

TRAINING REGULATIONS



INSTRUMENTATION AND CONTROL SERVICING NC III

ELECTRONICS SECTOR

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
East Service Road, South Superhighway, Taguig City, Metro Manila

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INSTRUMENTATION AND CONTROL SERVICING
NATIONAL CERTIFICATE LEVEL III

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TRAINING REGULATIONS FOR INSTRUMENTATION AND CONTROL SERVICING NC III

SECTION 1: INSTRUMENTATION AND CONTROL SERVICING QUALIFICATIONS

The **INSTRUMENTATION AND CONTROL SERVICING NC III** Qualification consists of competencies that a person must achieve to enable him/her to loop check, maintain, and repair various instrumentation & control devices and systems, as well as microcomputer hardware, operating systems, common user applications, network systems, and various common peripherals in a manufacturing or processing environment.

This Qualification is packaged from the competency map of the Electronics Industry (Service sector) as shown in Annex A.

The units of competency comprising this qualification include the following:

Code	BASIC COMPETENCIES
5 00 311 1 09	Lead workplace communication
5 00 311 1 10	Lead small teams
5 00 311 1 11	Develop and practice negotiation skills
5 00 311 1 12	Solve problems related to work activities
5 00 311 1 13	Use mathematical concepts and techniques
5 00 311 1 14	Use relevant technologies

Code	COMMON COMPETENCIES
ELC724201	Use Hand Tools
ELC311201	Perform Mensuration and Calculation
ELC311202	Prepare and Interpret Technical Drawing
ELC315202	Apply Quality Standards
ELC311203	Perform Computer Operations
ELC724202	Terminate and Connect Electrical Wiring and Electronic Circuits

Code	CORE COMPETENCIES
	All core units of competency in Instrumentation & Control Servicing NC II, plus
ELC724304	Loop Check Instrumentation and Control Devices
ELC724305	Maintain and Repair Instrumentation and Control Devices

A person who has achieved this Qualification is competent to be an:

- Instrumentation and Control Technician 3
- Process Automation Technician

SECTION 2: COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common, and core units of competency required for **INSTRUMENTATION AND CONTROL SERVICING NC III**.

BASIC COMPETENCIES

UNIT OF COMPETENCY : LEAD WORKPLACE COMMUNICATION

UNIT CODE : 500311109

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to lead in the dissemination and discussion of ideas, information and issues in the workplace.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Communicate information about workplace processes	1.1. Appropriate communication method is selected 1.2. Multiple operations involving several topics areas are communicated accordingly 1.3. Questions are used to gain extra information 1.4. Correct sources of information are identified 1.5. Information is selected and organized correctly 1.6. Verbal and written reporting is undertaken when required 1.7. Communication skills are maintained in all situations
2. Lead workplace discussions	2.1. Response to workplace issues are sought 2.2. Response to workplace issues are provided immediately 2.3. Constructive contributions are made to workplace discussions on such issues as production, quality and safety 2.4. Goals/objectives and action plan undertaken in the workplace are communicated
3. Identify and communicate issues arising in the workplace	3.1. Issues and problems are identified as they arise 3.2. Information regarding problems and issues are organized coherently to ensure clear and effective communication 3.3. Dialogue is initiated with appropriate personnel 3.4. Communication problems and issues are raised as they arise

RANGE OF VARIABLES

VARIABLE	RANGE
1. Methods of communication	1.1. Non-verbal gestures 1.2. Verbal 1.3. Face to face 1.4. Two-way radio 1.5. Speaking to groups 1.6. Using telephone 1.7. Written 1.8. Internet

EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1. Dealt with a range of communication/information at one time 1.2. Made constructive contributions in workplace issues 1.3. Sought workplace issues effectively 1.4. Responded to workplace issues promptly 1.5. Presented information clearly and effectively written form 1.6. Used appropriate sources of information 1.7. Asked appropriate questions 1.8. Provided accurate information
<p>2. Underpinning knowledge</p>	<ul style="list-style-type: none"> 2.1. Organization requirements for written and electronic communication methods 2.2. Effective verbal communication methods
<p>3. Underpinning Skills</p>	<ul style="list-style-type: none"> 3.1. Organize information 3.2. Understand and convey intended meaning 3.3. Participate in variety of workplace discussions 3.4. Comply with organization requirements for the use of written and electronic communication methods
<p>4. Resource Implications</p>	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 4.1. Variety of Information 4.2. Communication tools 4.3. Simulated workplace
<p>5. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> 5.1. Competency in this unit must be assessed through 5.2. Direct Observation 5.3. Interview
<p>6. Context for Assessment</p>	<ul style="list-style-type: none"> 6.1. Competency may be assessed in the workplace or in simulated workplace work environment

UNIT OF COMPETENCY : **LEAD SMALL TEAMS**
UNIT CODE : **500311110**
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes to lead small teams including setting and maintaining team and individual performance standards.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Provide team leadership	1.1. Work requirements are identified and presented to team members 1.2. Reasons for instructions and requirements are communicated to team members 1.3. Team members' queries and concerns are recognized, discussed and dealt with
2. Assign responsibilities	2.1. Duties, and responsibilities are allocated having regard to the skills, knowledge and aptitude required to properly undertake the assigned task and according to company policy 2.2. Duties are allocated having regard to individual preference, domestic and personal considerations, whenever possible
3. Set performance expectations for team members	3.1. Performance expectations are established based on client needs and according to assignment requirements 3.2. Performance expectations are based on individual team members duties and area of responsibility 3.3. Performance expectations are discussed and disseminated to individual team members
4. Supervised team performance	4.1. Monitoring of performance takes place against defined performance criteria and/or assignment instructions and corrective action taken if required 4.2. Team members are provided with feedback , positive support and advice on strategies to overcome any deficiencies 4.3. Performance issues which cannot be rectified or addressed within the team are referenced to appropriate personnel according to employer policy 4.4. Team members are kept informed of any changes in the priority allocated to assignments or tasks which might impact on client/customer needs and satisfaction 4.5. Team operations are monitored to ensure that employer/client needs and requirements are met 4.6. Follow-up communication is provided on all issues affecting the team 4.7. All relevant documentation is completed in accordance with company procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Work requirements	1.1. Client Profile 1.2. Assignment instructions
2. Team member's concerns	2.1. Roster/shift details
3. Monitor performance	3.1. Formal process 3.2. Informal process
4. Feedback	4.1. Formal process 4.2. Informal process
5. Performance issues	5.1. Work output 5.2. Work quality 5.3. Team participation 5.4. Compliance with workplace protocols 5.5. Safety 5.6. Customer service

EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1. Maintained or improved individuals and/or team performance given a variety of possible scenario 1.2. Assessed and monitored team and individual performance against set criteria 1.3. Represented concerns of a team and individual to next level of management or appropriate specialist and to negotiate on their behalf 1.4. Allocated duties and responsibilities, having regard to individual's knowledge, skills and aptitude and the needs of the tasks to be performed 1.5. Set and communicated performance expectations for a range of tasks and duties within the team and provided feedback to team members
<p>2. Underpinning Knowledge</p>	<ol style="list-style-type: none"> 2.1. Company policies and procedures 2.2. Relevant legal requirements 2.3. How performance expectations are set 2.4. Methods of Monitoring Performance 2.5. Client expectations 2.6. Team member's duties and responsibilities
<p>3. Underpinning Skills</p>	<ol style="list-style-type: none"> 3.1. Communication skills required for leading teams 3.2. Informal performance counseling skills 3.3. Team building skills 3.4. Negotiating skills
<p>4. Resource Implications</p>	<p>The following resources MUST be provided:</p> <ol style="list-style-type: none"> 4.1. Access to relevant workplace or appropriately simulated environment where assessment can take place 4.2. Materials relevant to the proposed activity or task
<p>5. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <ol style="list-style-type: none"> 5.1. Direct observations of work activities of the individual member in relation to the work activities of the group 5.2. Observation of simulation and/or role play involving the participation of individual member to the attainment of organizational goal 5.3. Case studies and scenarios as a basis for discussion of issues and strategies in teamwork
<p>6. Context for Assessment</p>	<ol style="list-style-type: none"> 6.1. Competency assessment may occur in workplace or any appropriately simulated environment 6.2. Assessment shall be observed while task are being undertaken whether individually or in-group

UNIT OF COMPETENCY: DEVELOP AND PRACTICE NEGOTIATION SKILLS

UNIT CODE : 500311111

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes required to collect information in order to negotiate to a desired outcome and participate in the negotiation.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Plan negotiations	1.1 Information on <i>preparing for negotiation</i> is identified and included in the plan 1.2 Information on creating <i>non verbal environments</i> for positive negotiating is identified and included in the plan 1.3 Information on <i>active listening</i> is identified and included in the plan 1.4 Information on different <i>questioning techniques</i> is identified and included in the plan 1.5 Information is checked to ensure it is correct and up-to- date
2. Participate in negotiations	2.1 Criteria for successful outcome are agreed upon by all parties 2.2 Desired outcome of all parties are considered 2.3 Appropriate language is used throughout the negotiation A variety of questioning techniques are used 2.4 The issues and processes are documented and agreed upon by all parties 2.5 Possible solutions are discussed and their viability assessed 2.6 Areas for agreement are confirmed and recorded Follow-up action is agreed upon by all parties

RANGE OF VARIABLES

VARIABLE	RANGE
1. Preparing for negotiation	1.1 Background information on other parties to the negotiation 1.2 Good understanding of topic to be negotiated 1.3 Clear understanding of desired outcome/s 1.4 Personal attributes 1.4.1 self awareness 1.4.2 self esteem 1.4.3 objectivity 1.4.4 empathy 1.4.5 respect for others 1.5 Interpersonal skills 1.5.1 listening/reflecting 1.5.2 non verbal communication 1.5.3 assertiveness 1.5.4 behavior labeling 1.5.5 testing understanding 1.5.6 seeking information 1.5.7 self disclosing 1.6 Analytic skills 1.6.1 observing differences between content and process 1.6.2 identifying bargaining information 1.6.3 applying strategies to manage process 1.6.4 applying steps in negotiating process 1.6.5 strategies to manage conflict 1.6.6 steps in negotiating process 1.6.7 options within organization and externally for resolving conflict
2. Non verbal environments	2.1 Friendly reception 2.2 Warm and welcoming room 2.3 Refreshments offered 2.4 Lead in conversation before negotiation begins
3. Active listening	3.1 Attentive 3.2 Don't interrupt 3.3 Good posture 3.4 Maintain eye contact 3.5 Reflective listening
4. Questioning techniques	4.1 Direct 4.2 Indirect 4.3 Open-ended

EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Demonstrated sufficient knowledge of the factors influencing negotiation to achieve agreed outcome 1.2 Participated in negotiation with at least one person to achieve an agreed outcome
2. Underpinning Knowledge and Attitude	<ul style="list-style-type: none"> 2.1 Codes of practice and guidelines for the organization 2.2 Organizations policy and procedures for negotiations 2.3 Decision making and conflict resolution strategies procedures 2.4 Problem solving strategies on how to deal with unexpected questions and attitudes during negotiation 2.5 Flexibility 2.6 Empathy
3. Underpinning Skills	<ul style="list-style-type: none"> 3.1 Interpersonal skills to develop rapport with other parties 3.2 Communication skills (verbal and listening) 3.3 Observation skills 3.1 Negotiation skills
4. Resource Implications	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 4.1 Room with facilities necessary for the negotiation process 4.2 Human resources (negotiators)
5. Methods of Assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> 5.1 Observation/demonstration and questioning 5.2 Portfolio assessment 5.3 Oral and written questioning 5.4 Third party report
6. Context for Assessment	<ul style="list-style-type: none"> 6.1 Competency to be assessed in real work environment or in a simulated workplace setting.

UNIT OF COMPETENCY : SOLVE PROBLEMS RELATED TO WORK ACTIVITIES

UNIT CODE : 500311112

UNIT DESCRIPTOR : This unit of covers the knowledge, skills and attitudes required to solve problems in the workplace including the application of problem solving techniques and to determine and resolve the root cause of problems.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Identify the problem	1.1. Variances are identified from normal operating parameters; and product quality 1.2. Extent, cause and nature are of the problem are defined through observation, investigation and analytical techniques 1.3. Problems are clearly stated and specified
2. Determine fundamental causes of the problem	2.1. Possible causes are identified based on experience and the use of problem solving tools / analytical techniques. 2.2. Possible cause statements are developed based on findings 2.3. Fundamental causes are identified per results of investigation conducted
3. Determine corrective action	3.1. All possible options are considered for resolution of the problem 3.2. Strengths and weaknesses of possible options are considered 3.3. Corrective actions are determined to resolve the problem and possible future causes 3.4. Action plans are developed identifying measurable objectives, resource needs and timelines in accordance with safety and operating procedures
4. Provide recommendation/s to manager	4.1. Report on recommendations are prepared 4.2. Recommendations are presented to appropriate personnel. 4.3. Recommendations are followed-up, if required

RANGE OF VARIABLES

VARIABLE	RANGE
1. Analytical techniques	1.1. Brainstorming 1.2. Intuitions/Logic 1.3. Cause and effect diagrams 1.4. Pareto analysis 1.5. SWOT analysis 1.6. Gant chart, Pert CPM and graphs 1.7. Scattergrams
2. Problem	2.1. Non – routine process and quality problems 2.2. Equipment selection, availability and failure 2.3. Teamwork and work allocation problem 2.4. Safety and emergency situations and incidents
3. Action plans	3.1. Priority requirements 3.2. Measurable objectives 3.3. Resource requirements 3.4. Timelines 3.5. Co-ordination and feedback requirements 3.6. Safety requirements 3.7. Risk assessment 3.8. Environmental requirements

EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1. Identified the problem 1.2. Determined the fundamental causes of the problem 1.3. Determined the correct / preventive action 1.4. Provided recommendation to manager <p>These aspects may be best assessed using a range of scenarios / case studies / what ifs as a stimulus with a walk through forming part of the response. These assessment activities should include a range of problems, including new, unusual and improbable situations that may have happened.</p>
<p>2. Underpinning Knowledge</p>	<ol style="list-style-type: none"> 2.1. Competence includes a thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations 2.2. Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause, determining the corrective action and provision of recommendations <ol style="list-style-type: none"> 2.2.1. Relevant equipment and operational processes 2.2.2. Enterprise goals, targets and measures 2.2.3. Enterprise quality, OHS and environmental requirement 2.2.4. Principles of decision making strategies and techniques 2.2.5. Enterprise information systems and data collation 2.2.6. Industry codes and standards
<p>3. Underpinning Skills</p>	<ol style="list-style-type: none"> 3.1. Using range of formal problem solving techniques 3.2. Identifying and clarifying the nature of the problem 3.3. Devising the best solution 3.4. Evaluating the solution 3.5. Implementation of a developed plan to rectify the problem
<p>4. Resource Implications</p>	<ol style="list-style-type: none"> 4.1. Assessment will require access to an operating plant over an extended period of time, or a suitable method of gathering evidence of operating ability over a range of situations. A bank of scenarios / case studies / what ifs will be required as well as bank of questions which will be used to probe the reason behind the observable action.

<p>5. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> 5.1. Case studies on solving problems in the workplace 5.2. Observation <p>The unit will be assessed in a holistic manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations, which will include disruptions to normal, smooth operation. Simulation may be required to allow for timely assessment of parts of this unit of competency. Simulation should be based on the actual workplace and will include walk through of the relevant competency components.</p>
<p>6. Context for Assessment</p>	<p>6.1. In all workplace, it may be appropriate to assess this unit concurrently with relevant teamwork or operation units.</p>

UNIT OF COMPETENCY: USE MATHEMATICAL CONCEPTS AND TECHNIQUES

UNIT CODE : 500311113

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required in the application of mathematical concepts and techniques.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Identify mathematical tools and techniques to solve problem	1.1 Problem areas are identified based on given condition 1.2 Mathematical techniques are selected based on the given problem
2. Apply mathematical procedure/solution	2.1 Mathematical techniques are applied based on the problem identified 2.2 Mathematical computations are performed to the level of accuracy required for the problem 2.3 Results of mathematical computation is determined and verified based on job requirements
3. Analyze results	3.1 Result of application is reviewed based on expected and required specifications and outcome 3.2 Appropriate action is applied in case of error

RANGE OF VARIABLES

VARIABLE	RANGE
1. Mathematical techniques	May include but are not limited to: 1.1 Four fundamental operations 1.2 Measurements 1.3 Use/Conversion of units of measurements 1.4 Use of standard formulas
2. Appropriate action	2.1 Review in the use of mathematical techniques (e.g. recalculation, re-modeling) 2.2 Report error to immediate superior for proper action

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified, applied and reviewed the use of mathematical concepts and techniques to workplace problems
2. Underpinning Knowledge	2.1 Fundamental operation (addition, subtraction, division, multiplication) 2.2 Measurement system 2.3 Precision and accuracy 2.4 Basic measuring tools/devices
3. Underpinning Skills	3.1 Applying mathematical computations 3.2 Using calculator 3.3 Using different measuring tools
4. Resource Implications	The following resources MUST be provided: 4.1 Calculator 4.2 Basic measuring tools 4.3 Case Problems
5. Methods of Assessment	Competency may be assessed through: 5.1 Authenticated portfolio 5.2 Written Test 5.3 Interview/Oral Questioning 5.4 Demonstration
6. Context for Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: USE RELEVANT TECHNOLOGIES

UNIT CODE : 500311114

UNIT DESCRIPTOR : This unit of competency covers the knowledge, skills, and attitude required in selecting, sourcing and applying appropriate and affordable technologies in the workplace.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Study/select appropriate technology	1.1 Usage of different technologies is determined based on job requirements 1.2 Appropriate technology is selected as per work specification
2. Apply relevant technology	2.1 Relevant technology is effectively used in carrying out function 2.2 Applicable software and hardware are used as per task requirement 2.3 Management concepts are observed and practiced as per established industry practices
3. Maintain/enhance of relevant technology	3.1 Maintenance of technology is applied in accordance with the industry standard operating procedure, manufacturer's operating guidelines and occupational health and safety procedure to ensure its operative ability 3.2 Updating of technology is maintained through continuing education or training in accordance with job requirement 3.3 Technology failure/ defect is immediately reported to the concern/responsible person or section for appropriate action

RANGE OF VARIABLES

VARIABLE	RANGE
1. Technology	May include but are not limited to: 1.1 Office technology 1.2 Industrial technology 1.3 System technology 1.4 Information technology 1.5 Training technology
2. Management concepts	May include but not limited to: 2.1 Real Time Management 2.2 KAIZEN or continuous improvement 2.3 5s 2.4 Total Quality Management 2.5 Other management/productivity tools
3. Industry standard operating procedure	3.1 Written guidelines relative to the usage of office technology/equipment 3.2 Verbal advise/instruction from the co-worker
4. Manufacturer's operating guidelines/ instructions	4.1 Written instruction/manuals of specific technology/ equipment 4.2 General instruction manual 4.3 Verbal advise from manufacturer relative to the operation of equipment
5. Occupational health and safety procedure	5.1 Relevant statutes on OHS 5.2 Company guidelines in using technology/equipment
6. Appropriate action	6.1 Implementing preventive maintenance schedule 6.2 Coordinating with manufacturer's technician

EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Studied and selected appropriate technology consistent with work requirements 1.2 Applied relevant technology 1.3 Maintained and enhanced operative ability of relevant technology
2. Underpinning Knowledge	<ul style="list-style-type: none"> 2.1 Awareness on technology and its function 2.2 Repair and maintenance procedure 2.3 Operating instructions 2.4 Applicable software 2.5 Communication techniques 2.6 Health and safety procedure 2.7 Company policy in relation to relevant technology 2.8 Different management concepts 2.9 Technology adaptability
3. Underpinning Skills	<ul style="list-style-type: none"> 3.1 Relevant technology application/implementation 3.2 Basic communication skills 3.3 Software applications skills 3.4 Basic troubleshooting skills
4. Resource Implications	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 4.1 Relevant technology 4.2 Interview and demonstration questionnaires 4.3 Assessment packages
5. Methods of Assessment	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> 5.1 Interview 5.2 Actual demonstration 5.3 Authenticated portfolio (related certificates of training/seminar)
6. Context for Assessment	<ul style="list-style-type: none"> 6.1 Competency may be assessed in actual workplace or simulated environment

COMMON COMPETENCIES

UNIT TITLE : **USE HAND TOOLS**
UNIT CODE : **ELC724201**
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes on the safe use, handling and maintenance of tools.

ELEMENT	PERFORMANCE CRITERIA
1. Plan and prepare for tasks to be undertaken	<i>Italicized Bold</i> terms are elaborated in the Range of Variables 1.1. Tasks to be undertaken are properly identified 1.2. Appropriate hand tools are identified and selected according to the task requirements
2. Prepare hand tools	2.1. Appropriate hand tools are checked for proper operation and safety 2.2. Unsafe or faulty tools are identified and marked for repair according to standard company procedure
3. Use appropriate hand tools and test equipment	3.1. Tools are used according to tasks undertaken 3.2. All safety procedures in using tools are observed at all times and appropriate personal protective equipment (PPE) are used 3.3. Malfunctions, unplanned or unusual events are reported to the supervisor
4. Maintain hand tools	4.1. Tools are not dropped to avoid damage 4.2. Routine maintenance of tools undertaken according to standard operational procedures, principles and techniques 4.3. Tools are stored safely in appropriate locations in accordance with manufacturer's specifications or standard operating procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Hand tools	1.1. Hand tools for adjusting, dismantling, assembling, finishing, cutting. Tool set includes the following but not limited to: screw drivers, pliers, punches, wrenches, files
2. Personal Protective Equipment (PPE)	2.1. Gloves 2.2. Protective eyewear 2.3. Apron/overall
3. Maintenance	3.1. Cleaning 3.2. Lubricating 3.3. Tightening 3.4. Simple tool repairs 3.5. Hand sharpening 3.6. Adjustment using correct procedures

EVIDENCE GUIDE

<p>1. Critical aspect of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1. Demonstrated safe working practices at all times 1.2. Communicated information about processes, events or tasks being undertaken to ensure a safe and efficient working environment 1.3. Planned tasks in all situations and reviewed task requirements as appropriate 1.4. Performed all tasks to specification 1.5. Maintained and stored tools in appropriate location
<p>2. Underpinning knowledge</p>	<ul style="list-style-type: none"> 2.1. Safety <ul style="list-style-type: none"> 2.1.1. Safety requirements in handling tools 2.2. Tools : <ul style="list-style-type: none"> 2.2.1. Function, Operation, Common faults 2.3. Processes, Operations, Systems <ul style="list-style-type: none"> 2.3.1. Maintenance of tools 2.3.2. Storage of Tools
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> 3.1. Reading skills required to interpret work instruction and numerical skills 3.2. Communication skills 3.3. Problem solving in emergency situation
<p>4. Method of assessment</p>	<p>Competency in this unit must be assessed through:</p> <ul style="list-style-type: none"> 4.1. Observation 4.2. Oral questioning
<p>5. Resource Implication</p>	<ul style="list-style-type: none"> 5.1. Tools may include the following but not limited to: <ul style="list-style-type: none"> 5.1.1. screw drivers 5.1.2. pliers 5.1.3. punches 5.1.4. wrenches, files
<p>6. Context of Assessment</p>	<ul style="list-style-type: none"> 6.1. Assessment may be conducted in the workplace or in a simulated work environment

UNIT TITLE : **PERFORM MENSURATION AND CALCULATION**
UNIT CODE : **ELC311201**
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes and values needed identify, care, handle and use measuring instruments

ELEMENT	PERFORMANCE CRITERIA <i>Italicized Bold</i> terms are elaborated in the Range of Variables
1. Select measuring instruments	1.1. Object or component to be measured is identified 1.2. Correct specifications are obtained from relevant source 1.3. Measuring tools are selected in line with job requirements
2. Carry out measurements and calculation	2.1. Appropriate measuring instrument is selected to achieve required outcome 2.2. Accurate measurements are obtained for job 2.3. Calculation needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x), and division (/) 2.4. Calculation involving fractions, percentages and mixed numbers are used to complete workplace tasks. 2.5. Numerical computation is self-checked and corrected for accuracy 2.6. Instruments are read to the limit of accuracy of the tool.
3. Maintain measuring instruments	3.1. Measuring instruments are not dropped to avoid damage 3.2. Measuring instruments are cleaned before and after using. 3.3. Proper storage of instruments undertaken according to manufacturer's specifications and standard operating procedures.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Measuring instruments	1.1. Straight edge 1.2. Torque gauge 1.3. Try square 1.4. Protractor 1.5. Combination gauge 1.6. Steel rule
2. Calculation	Kinds of part mensuration includes the following but not limited to 2.1. Volume 2.2. Area 2.3. Displacement 2.4. Inside diameter 2.5. Circumference 2.6. Length 2.7. Thickness 2.8. Outside diameter 2.9. Taper 2.10. Out of roundness

EVIDENCE GUIDE

1. Critical aspect of competency	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1. selected proper measuring instruments according to tasks 1.2. carried out measurement and calculations 1.3. maintained and stores instruments
2. Underpinning knowledge	<ol style="list-style-type: none"> 2.1. Types of measuring instruments and their uses 2.2. Safe handling procedures in using measuring instruments 2.3. Four fundamental operation of mathematics 2.4. Formula for volume, area, perimeter and other geometric figures
3. Underpinning skills	<ol style="list-style-type: none"> 3.1. Reading skills required to interpret work instruction 3.2. Communication skills 3.3. Handling measuring instruments 3.4. Performing mathematical calculations using the four fundamental operations 3.5. Visualizing objects and shapes 3.6. Interpreting formulae
4. Method of assessment	<p>Competency in this unit must be assessed through:</p> <ol style="list-style-type: none"> 4.1. Observation 4.2. Oral questioning
5. Resource implication	<ol style="list-style-type: none"> 5.1. Place of assessment 5.2. Measuring instruments 5.3. Straight edge 5.4. Torque gauge 5.5. Try square 5.6. Protractor 5.7. Combination gauge 5.8. Steel rule
6. Context of Assessment	<ol style="list-style-type: none"> 6.1. Assessment may be conducted in the workplace or in a simulated work environment

UNIT TITLE : **PREPARE AND INTERPRET TECHNICAL DRAWING**
UNIT CODE : **ELC311202**
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes and values needed to prepare/interpret diagrams, engineering abbreviation and drawings, symbols, dimension.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized Bold</i> terms are elaborated in the Range of Variables
1. Identify different kinds of technical drawings	1.1. Correct technical drawing is selected according to job requirements. 1.2. Technical drawings are segregated in accordance with the types and kinds of drawings
2. Interpret technical drawing	2.1. Components, assemblies or objects are recognized as required. 2.2. Dimensions of the key features of the objects depicted in the drawing are correctly identified. 2.3. Symbols used in the drawing are identified and interpreted correctly. 2.4. Drawing is checked and validated against job requirements or equipment in accordance with standard operating procedures.
3. Prepare/make changes to electrical/electronic schematics and drawings	3.1. Electrical/electronic schematic is drawn and correctly identified. 3.2. Correct drawing is identified, equipment are selected and used in accordance with job requirements.
4. Store technical drawings and equipment /instruments	4.1. Care and maintenance of drawings are undertaken according to company procedures. 4.2. Technical drawings are recorded and inventory is prepared in accordance with company procedures. 4.3. Proper storage of instruments is undertaken according to company procedures.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Technical drawings	<p>Technical drawings include the following but not limited to:</p> <ul style="list-style-type: none"> 1.1. Schematic diagrams 1.2. Charts 1.3. Block diagrams 1.4. Lay-out plans 1.5. Location plans 1.6. Process and instrumentation diagrams 1.7. Loop diagrams 1.8. System Control Diagrams
2. Dimensions	<p>Dimensions may include but not limited to:</p> <ul style="list-style-type: none"> 2.1. Length 2.2. Width 2.3. Height 2.4. Diameter 2.5. Angles
3. Symbols	<p>May include but not limited to:</p> <ul style="list-style-type: none"> 3.1. NEC- National Electric Code 3.2. IEC -International Electrotechnical Commission 3.3. ASME - American Society of Mechanical Engineers 3.4. IEEE - Institute of Electrical and Electronics Engineers 3.5. ISA - Instrumentation System and Automation Society
4. Instruments/Equipment	<ul style="list-style-type: none"> 4.1. Components/dividers 4.2. Drawing boards 4.3. Rulers 4.4. T-square 4.5. Calculator

EVIDENCE GUIDE

<p>1. Critical aspect of competencies</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1. selected correct technical drawing in line with job requirements 1.2. correctly identified the objects represented in the drawing 1.3. identified and interpreted symbols used in the drawing correctly 1.4. prepared/produced electrical/electronic drawings including all relevant specifications 1.5. stored diagrams/equipment
<p>2. Underpinning knowledge</p>	<ol style="list-style-type: none"> 2.1. Drawing conventions 2.2. Symbols 2.3. Dimensioning Conventions 2.4. Mark up/Notation of Drawings 2.5. Mathematics <ol style="list-style-type: none"> 2.5.1. Four fundamental operations 2.5.2. Percentage 2.5.3. Fraction 2.5.4. Trigonometric Functions 2.5.5. Algebra 2.5.6. Geometry
<p>3. Underpinning skills</p>	<ol style="list-style-type: none"> 3.1. Reading skills required to interpret work instruction 3.2. Communication skills 3.3. Interpreting electrical/electronic signs and symbols
<p>4. Method of assessment</p>	<p>Competency in this unit must be assessed through:</p> <ol style="list-style-type: none"> 4.1. Practical tasks involving interpretation of a range of technical drawings 4.2. Oral questioning
<p>5. Resource implication</p>	<ol style="list-style-type: none"> 5.1. Drawings 5.2. Diagrams 5.3. Charts 5.4. Plans
<p>6. Context of Assessment</p>	<p>Assessment may be conducted in the workplace or in a simulated work environment</p>

UNIT TITLE : **APPLY QUALITY STANDARDS**
UNIT CODE : **ELC315202**
UNIT DESCRIPTOR : This unit covers the knowledge, skills, (and) attitudes and values needed to apply quality standards in the workplace. The unit also includes the application of relevant safety procedures and regulations, organization procedures and customer requirements

ELEMENT	PERFORMANCE CRITERIA <i>Italicized Bold</i> terms are elaborated in the Range of Variables
1. Assess quality of received materials or components	1.1. Work instructions are obtained and work is carried out in accordance with standard operating procedures 1.2. Received materials or component parts are checked against workplace standards and specifications 1.3. Faulty material or components related to work are identified and isolated 1.4. Faults and any identified causes are recorded and/or reported to the supervisor concerned in accordance with workplace procedures 1.5. Faulty materials or components are replaced in accordance with workplace procedures
2. Assess own work	2.1. Documentation relative to quality within the company is identified and used 2.2. Completed work is checked against workplace standards relevant to the task undertaken 2.3. Faulty pieces are identified and isolated 2.4. Information on the quality and other indicators of production performance is recorded in accordance with workplace procedures 2.5. In cases of deviations from specified quality standards , causes are documented and reported in accordance with the workplace' standards operating procedures
3. Engage in quality improvement	3.1. Process improvement procedures are participated in relation to workplace assignment 3.2. Work is carried out in accordance with process improvement procedures 3.3. Performance of operation or quality of product or service to ensure customer satisfaction is monitored

RANGE OF VARIABLES

VARIABLE	RANGE
1. Materials/components	1.1. Materials may include but not limited to: 1.1.1. wires 1.1.2. cables, soldering lead 1.1.3. electrical tape 1.2. Components may include but not limited to: 1.2.1. ICs 1.2.2. Diodes
2. Faults	Faults may include but not limited to: 2.1. Components/materials not according to specification 2.2. Components/materials contain manufacturing defects 2.3. Components/materials do not conform with government regulation i.e., PEC, environmental code 2.4. Components/materials have safety defect
3. Documentation	3.1. Organization work procedures 3.2. Manufacturer's instruction manual 3.3. Customer requirements 3.4. Forms
4. Quality standards	4.1. Quality standards may relate but not limited to the following: 4.1.1. materials 4.1.2. component parts 4.1.3. final product 4.1.4. production processes
5. Customer	5.1. Co-worker 5.2. Supplier 5.3. Client 5.4. Organization receiving the product or service

EVIDENCE GUIDE

1. Critical aspect of competency	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1. Carried out work in accordance with the company's standard operating procedures 1.2. Performed task according to specifications 1.3. Reported defects detected in accordance with standard operating procedures 1.4. Carried out work in accordance with the process improvement procedures
2. Underpinning knowledge	<ol style="list-style-type: none"> 2.1. Relevant production processes, materials and products 2.2. Characteristics of materials/component parts used in electronic production processes 2.3. Quality checking procedures 2.4. Workplace procedures 2.5. Safety and environmental aspects of production processes 2.6. Fault identification and reporting 2.7. Quality improvement process
3. Underpinning skills	<ol style="list-style-type: none"> 3.1. Reading skills required to interpret work instruction 3.2. Communication skills needed to interpret and apply defined work procedures 3.3. Carry out work in accordance with OHS policies and procedures
4. Method of assessment	<ol style="list-style-type: none"> 4.1. The assessor may select two (2) of the following assessment methods to objectively assess the candidate: <ol style="list-style-type: none"> 4.1.1. Observation 4.1.2. Questioning 4.1.3. Practical demonstration
5. Resource implication	<ol style="list-style-type: none"> 5.1. Materials and component parts and equipment to be used in a real or simulated electronic production situation
6. Context of Assessment	<ol style="list-style-type: none"> 6.1. Assessment may be conducted in the workplace or in a simulated work environment.

UNIT TITLE : **PERFORM COMPUTER OPERATIONS**
UNIT CODE : **ELC311203**
UNIT DESCRIPTOR : This unit covers the knowledge, skills, (and) attitudes and values needed to perform computer operations which include inputting, accessing, producing and transferring data using the appropriate hardware and software

ELEMENT	PERFORMANCE CRITERIA <i>Italicized Bold</i> terms are elaborated in the Range of Variables
1. Plan and prepare for task to be undertaken	1.1. Requirements of task are determined 1.2. Appropriate hardware and software are selected according to task assigned and required outcome 1.3. Task is planned to ensure OH & S guidelines and procedures are followed
2. Input data into computer	2.1. Data are entered into the computer using appropriate program/application in accordance with company procedures 2.2. Accuracy of information is checked and information is saved in accordance with standard operating procedures 2.3. Inputted data are stored in storage media according to requirements 2.4. Work is performed within ergonomic guidelines
3. Access information using computer	3.1. Correct program/application is selected based on job requirements 3.2. Program/application containing the information required is accessed according to company procedures 3.3. Desktop icons are correctly selected, opened and closed for navigation purposes 3.4. Keyboard techniques are carried out in line with OH & S requirements for safe use of keyboards
4. Produce/output data using computer system	4.1. Entered data are processed using appropriate software commands 4.2. Data printed out as required using computer hardware/peripheral devices in accordance with standard operating procedures 4.3. Files, data are transferred between compatible systems using computer software, hardware/ peripheral devices in accordance with standard operating procedures
5. Maintain computer equipment and systems	5.1. Systems for cleaning, minor maintenance and replacement of consumables are implemented 5.2. Procedures for ensuring security of data, including regular back-ups and virus checks are implemented in accordance with standard operating procedures 5.3. Basic file maintenance procedures are implemented in line with the standard operating procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Hardware and peripheral devices	1.1. Personal computers 1.2. Networked systems 1.3. Communication equipment 1.4. Printers 1.5. Scanners 1.6. Keyboard 1.7. Mouse
2. Software	Software includes the following but not limited to: 2.1. Word processing packages 2.2. Data base packages 2.3. Internet 2.4. Spreadsheets
3. OH & S guidelines	3.1. OHS guidelines 3.2. Enterprise procedures
4. Storage media	Storage media include the following but not limited to: 4.1. diskettes 4.2. CDs 4.3. zip disks 4.4. hard disk drives, local and remote
5. Ergonomic guidelines	5.1. Types of equipment used 5.2. Appropriate furniture 5.3. Seating posture 5.4. Lifting posture 5.5. Visual display unit screen brightness
6. Desktop icons	Icons include the following but not limited to: 6.1. directories/folders 6.2. files 6.3. network devices 6.4. recycle bin
7. Maintenance	7.1. Creating more space in the hard disk 7.2. Reviewing programs 7.3. Deleting unwanted files 7.4. Backing up files 7.5. Checking hard drive for errors 7.6. Using up to date anti-virus programs 7.7. Cleaning dust from internal and external surfaces

EVIDENCE GUIDE

<p>1. Critical aspect of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1. Selected and used hardware components correctly and according to the task requirement 1.2. Identified and explain the functions of both hardware and software used, their general features and capabilities 1.3. Produced accurate and complete data in accordance with the requirements 1.4. Used appropriate devices and procedures to transfer files/data accurately 1.5. Maintained computer system
<p>2. Underpinning knowledge</p>	<ul style="list-style-type: none"> 2.1. Basic ergonomics of keyboard and computer use 2.2. Main types of computers and basic features of different operating systems 2.3. Main parts of a computer 2.4. Storage devices and basic categories of memory 2.5. Relevant types of software 2.6. General security 2.7. Viruses 2.8. OH & S principles and responsibilities 2.9. Calculating computer capacity
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> 3.1. Reading skills required to interpret work instruction 3.2. Communication skills
<p>4. Method of assessment</p>	<p>4.1. The assessor may select two of the following assessment methods to objectively assess the candidate:</p> <ul style="list-style-type: none"> 4.1.1. Observation 4.1.2. Questioning 4.1.3. Practical demonstration
<p>5. Resource implication</p>	<ul style="list-style-type: none"> 5.1. Computer hardware with peripherals 5.2. Appropriate software
<p>6. Context of Assessment</p>	<p>6.1. Assessment may be conducted in the workplace or in a simulated work environment</p>

UNIT TITLE : **TERMINATE AND CONNECT ELECTRICAL WIRING AND ELECTRONICS CIRCUIT**
UNIT CODE : **ELC724202**
UNIT DESCRIPTOR : This unit covers the knowledge, skills, (and) attitudes and values needed to terminate and connect electrical wiring and electronics circuits

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Plan and prepare for termination/connection of electrical wiring/electronics circuits	1.1. Materials are checked according to specifications and tasks 1.2. Appropriate tools and equipment are selected according to tasks requirements 1.3. Task is planned to ensure OH & S guidelines and procedures are followed 1.4. Electrical wiring/electronic circuits are correctly prepared for connecting/termination in accordance with instructions and work site procedures
2. Terminate/connect electrical wiring/electronic circuits	2.1. Safety procedures in using tools are observed at all times and appropriate personal protective equipment are used 2.2. All work undertaken safely in accordance with the workplace and standard procedures 2.3. Appropriate range of methods in termination/connection are used according to specifications, manufacturer's requirements and safety 2.4. Correct sequence of operation is followed 2.5. Accessories used are adjusted, if necessary 2.6. Confirm termination/connection undertaken successfully in accordance with job specification
3. Test termination/connections of electrical wiring/electronics circuits	3.1. Testing of all completed termination/ connections of electric wiring/electronic circuits is conducted for compliance with specifications and regulations using appropriate procedures and equipment 3.2. Wiring and circuits are checked using specified testing procedures 3.3. Unplanned events or conditions are responded to in accordance with established procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Materials	1.1 Materials include the following but not limited to: 1.1.1 Soldering lead 1.1.2 Cables 1.1.3 Wires
2. Tools and equipment	2.1 Tools for measuring, cutting, drilling, assembling/disassembling. Tool set includes the following but not limited to: 2.1.1 Pliers 2.1.2 Cutters 2.1.3 Screw drivers 2.2 Equipment 2.2.1 Soldering gun 2.2.2 Multi-tester
3. Personal protective equipment	3.1 goggles 3.2 gloves 3.3 apron/overall
4. Methods	4.1 Clamping 4.2 Pin connection 4.3 Soldered joints 4.4 Plugs
5. Accessories	5.1 Accessories may include the following but not limited to: 5.1.1 brackets 5.1.2 clamps

EVIDENCE GUIDE

<p>1. Critical aspect of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1. Undertook work safely and according to workplace and standard procedures 1.2. used appropriate termination/ connection methods 1.3. followed correct sequence in termination / connection process 1.4. conducted testing of terminated connected electrical wiring/electronic circuits using appropriate procedures and standards
<p>2. Underpinning knowledge</p>	<ul style="list-style-type: none"> 2.1. Use of tools 2.2. Use of test instruments/equipment 2.3. Electrical theory 2.4. Single phase AC principles 2.5. Wiring techniques 2.6. DC power supplies 2.7. Soldering
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> 3.1. Reading skills required to interpret work instruction 3.2. Communication skills 3.3. Soldering techniques
<p>4. Method of assessment</p>	<p>4.1. The assessor may select two (2) of the following assessment methods to objectively assess the candidate:</p> <ul style="list-style-type: none"> 4.1.1. Observation 4.1.2. Oral Questioning 4.1.3. Practical demonstration
<p>5. Resource implication</p>	<p>5.1. Tools for measuring, cutting, drilling, assembling/disassembling, connecting. Tool set includes the following but not limited to:</p> <ul style="list-style-type: none"> 5.1.1. screw drivers 5.1.2. pliers 5.1.3. cutters
<p>6. Context of Assessment</p>	<p>6.1. Assessment may be conducted in the workplace or in a simulated work environment</p>

CORE COMPETENCIES

UNIT TITLE : LOOP-CHECK INSTRUMENTATION AND CONTROL LOOPS

UNIT CODE : ELC724304

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes needed to loop-check instrumentation and control loops

ELEMENT	PERFORMANCE CRITERIA
1. Plan and prepare for loop checking	<p>1.1. Loop checking is planned and prepared in line with the job requirements.</p> <p>1.2. OHS policies and procedures are followed in line with job requirements.</p> <p>1.3. Instrumentation and Control standards are followed in line with the job requirements</p> <p>1.4. Appropriate personnel are consulted to ensure that the work is effectively coordinated</p> <p>1.5. Loop checking parameters are identified from appropriate documentation and/or requirements</p> <p>1.6. Tools, equipment and testing devices needed for loop checking are obtained and checked for correct operation and safety</p> <p>1.7. Instrumentation and control loops to be loop-checked are identified from the Job/Service Order or instructions</p>
2. Conduct loop checking	<p>2.1. Appropriate personal protective clothing is used in line with standard operating procedures.</p> <p>2.2. Devices' defects are diagnosed using specified testing procedures from manufacturer's manual.</p> <p>2.3. Defect/s and fault/s on the devices & loops are identified and reported in line with standard operating procedures.</p> <p>2.4. Contingency measures are managed and implemented in accordance with established procedures</p>
3. Test the loops that were checked	<p>3.1. Instrumentation & control loops are tested to ensure safe operation.</p> <p>3.2. Unplanned events or conditions are responded to in accordance with established procedures</p> <p>3.3. Report is prepared/completed according to company procedures.</p>

RANGE OF VARIABLES

VARIABLE	RANGE	
1. OH & S policies and procedures	1.1. OH & S guidelines 1.2. Philippine environmental standards	
2. Instrumentation and Control Standards	Include but not limited to: 2.1. ISA (Instrumentation, Systems and Automation) Society (formerly Instrument Society of America) 2.2. ANSI(American National Standards Institute) 2.3. ASME (American Society of Mechanical Engineers) 2.4. NEC (National Electrical Code) 2.5. IEC (International Electrotechnical Commission)	
3. Tools	Tools for: dismantling/assembling. Tool set include but not limited to: 3.1. Pliers (assorted) 3.2. Screw drivers (assorted) 3.3. Soldering iron/gun 3.4. Wrenches	
4. Equipment/testing devices	4.1. Equipment include but not limited to: 4.1.1. Communication equipment (e.g. 2-way radio, cell phone) 4.1.2. Configurator or programmer 4.2. Testing devices include but not limited to: 4.2.1. Multimeter 4.2.2. Calibrators 4.2.3. Signal simulators	
5. Instrumentation & Control loops	Include a combination of the following but not limited to: 5.1. Sensors, transmitters & other measuring elements 5.2. Indicators, Recorders, Controllers, Annunciators, computer-based systems & other receiving elements 5.3. Final control elements (control valves, dampers) 5.4. Process & machineries	
6. Personal protective equipment	Include but not limited to: 6.1. Ear muffs/plugs 6.2. Goggles/glasses/face shield 6.3. Safety hat 6.4. Safety apparel/suit	6.5. Safety belt/harness 6.6. Safety shoes 6.7. Mask 6.8. Gloves
7. Defect/s or fault/s	7.1. mechanical 7.2. electrical	7.3. electronics 7.4. computer-based

EVIDENCE GUIDE

<p>1. Critical aspect of competency</p>	<p>Assessment requires evidence that the candidate :</p> <ol style="list-style-type: none"> 1.1. Interpreted work instructions according to job requirements. 1.2. Conducted loop-checks accurately on the system using standard procedures 1.3. Tested the loop-checked system to insure safety 1.4. Documented the tasks undertaken
<p>2. Underpinning knowledge</p>	<p>Include but not limited to:</p> <ol style="list-style-type: none"> 2.1. Occupational health and safety 2.2. Instrumentation & Control standards 2.3. Use of tools 2.4. Mathematical calculations 2.5. Electrical theory 2.6. Electronics theory 2.7. Use of test equipment and calibrators 2.8. Wiring techniques 2.9. Drawing interpretation 2.10. Soldering techniques 2.11. Principles of Instrumentation 2.12. Process variable measurements (pressure, level, flow, temperature, analysis, etc.) 2.13. Process Control Theory 2.14. Process Control System (single-loop & multi-loop controllers, DCS, DAS, SCADA, etc) 2.15. Sensors, transmitters, transducers & converters 2.16. Programmable logic controllers 2.17. Control valves and final control elements 2.18. Computer operations 2.19. Process and Machinery operation
<p>3. Underpinning skills</p>	<ol style="list-style-type: none"> 3.1. Reading skills required to interpret work instructions 3.2. Communication skills needed to interpret and define work procedures 3.3. Selection & use of proper tools & equipment 3.4. Loop-checking skills 3.5. Problem solving in unplanned events

4. Method of assessment	<p>4.1. The assessor may select at least three of the following assessment methods to objectively assess the candidate:</p> <ul style="list-style-type: none"> 4.1.1. Observation 4.1.2. Demonstration 4.1.3. Questioning 4.1.4. Third Party 4.1.5. Portfolio
5. Resource Implication	<p>Include but not limited to:</p> <ul style="list-style-type: none"> 5.1. Instrumentation & control devices 5.2. Tools 5.3. Test equipment, calibrators, configurators or programmers 5.4. Materials 5.5. PPE 5.6. Technical manuals 5.7. Instrumentation & Control drawings
6. Context of Assessment	<p>6.1. Assessment may be conducted in the workplace or in a simulated work environment</p>

UNIT TITLE : MAINTAIN AND REPAIR INSTRUMENTATION AND CONTROL DEVICES

UNIT CODE : ELC724305

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes needed to maintain and repair instrumentation and control devices.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized Bold</i> items are elaborated in the range of Variables
1. Plan and prepare for maintenance/repair	1.1. Maintenance or repair is planned and prepared in line with job requirements. 1.2. OHS policies and procedures are followed in line with job requirements. 1.3. Instrumentation and Control standards are followed in line with job requirements 1.4. Instrumentation and control devices for maintenance or repair are checked against specifications and requirements. 1.5. Materials necessary to complete the work are obtained in accordance with established procedures and checked against job requirements. 1.6. Tools, equipment and testing devices needed for the maintenance/repair are obtained and checked for correct operation and safety 1.7. Instrumentation and control devices maintained or repaired are identified based on Job/Service Order or instructions
2. Maintain instrumentation and control devices	2.1. Appropriate personal protective equipment is used as per OH&S procedure. 2.2. Normal function of instrumentation and control devices is checked in accordance with manufacturer's instructions & standard procedures. 2.3. Scheduled/periodic maintenance is performed in accordance with manufacturer's requirements. 2.4. Unplanned events or conditions are responded to in accordance with established procedures
3. Repair instrumentation and control devices	3.1. Appropriate personal protective equipment is used in line with standard procedures. 3.2. Normal function of instrumentation and control devices is checked in accordance with manufacturer's instructions. 3.3. Fault/s or problem/s in system or component is/are diagnosed in line with the standard operating procedures. 3.4. Unplanned events or conditions are responded to in accordance with established procedures

<p>4. Inspect and test the repaired instrumentation and control devices</p>	<p>4.1. Final inspections are undertaken to ensure that the testing conducted on the device conforms with the manufacturer's instruction/manual</p> <p>4.2. Instrumentation and control devices are checked to ensure safe operation.</p> <p>4.3. Work site is cleaned and cleared of all debris and left in safe condition in accordance with company procedures</p> <p>4.4. Report is prepared and completed according to company requirements</p>
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RANGE OF VARIABLES

VARIABLE	RANGE	
1. OH & S policies and procedures	1.1. OH & S guidelines 1.2. Philippine environmental standards	
2. Instrumentation and Control Standards	Include but not limited to: 2.1. ISA (Instrumentation, Systems and Automation Society (formerly Instrument Society of America) 2.2. ANSI (American National Standards Institute) 2.3. ASME (American Society of Mechanical Engineers) 2.4. NEC (National Electrical Code) 2.5. IEC (International Electrotechnical Commission)	
3. Instrumentation and Control Devices	Include but not limited to: 3.1. Sensors/Transmitters/ Transducers 3.2. Indicators 3.3. Controllers 3.4. Control valves	3.5. Actuators 3.6. Recorders 3.7. Annunciators 3.8. Process switches
4. Tools	Tools for: cutting, shaping, drilling, threading, tapping, finishing, dismantling/assembling. Tool set include but not limited to: 4.1. Pliers (assorted) 4.2. Screw drivers (assorted) 4.3. Soldering iron/gun 4.4. Wrenches	
5. Equipment/testing devices	5.1. Equipment include but not limited to: 5.1.1. Maintenance bench 5.1.2. Instrument air supply equipment 5.1.3. Power supply equipment 5.2. Testing devices includes but not limited to: 5.2.1. Multimeter 5.2.2. Calibrators	
6. Materials	Include but not limited to: 6.1. Sealing materials 6.2. Pipes/tubes & fittings 6.3. Wires and cables	6.4. Cleaning materials 6.5. Lubricating materials
7. Personal protective equipment	Include but not limited to: 7.1. Ear muffs/plugs 7.2. Goggles/glasses/face shield 7.3. Safety hat 7.4. Safety apparel/suit	7.5. Safety belt/harness 7.6. Safety shoes 7.7. Mask 7.8. Gloves
8. Fault/s or problem/s	8.1. mechanical 8.2. electrical	8.3. electronics 8.4. computer-based

EVIDENCE GUIDE

<p>1. Critical aspect of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1. Interpreted work instructions according to job requirements. 1.2. Conducted maintenance properly on the devices using standard procedures 1.3. Diagnosed faults in the devices 1.4. Repaired or replaced defective devices 1.5. Checked the maintained/repaired devices to ensure safety 1.6. Documented the tasks undertaken
<p>2. Underpinning knowledge</p>	<p>Include but not limited to:</p> <ol style="list-style-type: none"> 2.1. Occupational health and safety 2.2. Instrumentation & Control standards 2.3. Use of tools 2.4. Mathematical calculations 2.5. Electrical theory 2.6. Electronics theory 2.7. Use of test equipment and calibrators 2.8. Wiring techniques 2.9. Drawing interpretation 2.10. Soldering techniques 2.11. Principles of Instrumentation 2.12. Process variable measurements (pressure, level, flow, temperature, analysis, etc.) 2.13. Process Control Theory 2.14. Process Control System (single-loop & multi-loop controllers, DCS, DAS, SCADA, etc) 2.15. Sensors, transmitters, transducers & converters 2.16. Programmable logic controllers 2.17. Control valves and final control elements 2.18. Computer operations 2.19. Corrective & preventive maintenance procedures
<p>3. Underpinning skills</p>	<ol style="list-style-type: none"> 3.1. Reading skills required to interpret work instructions 3.2. Communication skills needed to interpret and define work procedures 3.3. Selection & use of proper tools & equipment 3.4. Troubleshooting skills on device level 3.5. Problem solving in unplanned events
<p>4. Method of assessment</p>	<ol style="list-style-type: none"> 4.1. The assessor may select at least three of the following assessment methods to objectively assess the candidate: <ol style="list-style-type: none"> 4.1.1. Observation 4.1.2. Demonstration 4.1.3. Questioning 4.1.4. Third Party 4.1.5. Portfolio

5. Resource Implication	Include but not limited to: <ul style="list-style-type: none"> 5.1. Instrumentation & Control devices 5.2. Tools 5.3. Test equipment and calibrators 5.4. Materials 5.5. PPE 5.6. Technical manuals 5.7. Instrumentation & Control drawings
6. Context of Assessment	6.1. Assessment may be conducted in the workplace or in a simulated environment

SECTION 3 TRAINING STANDARDS

3.1 CURRICULUM DESIGN

Course Title: Instrumentation & Control Servicing

NC Level: NC III

Nominal Training Duration:

36 hrs – Basic Competencies
60 hrs – Common Competencies
80 hrs – Core Competencies
176 hrs

Course Description:

This course is designed to develop & enhance the knowledge, skills, & attitudes of an Instrumentation & Control Technician, in accordance with industry standards. It covers the basic & common competencies in addition to the core competencies such as loop checking, maintaining and repairing Instrumentation & control devices. *The nominal duration of 176 hr covers only the basic, common and core units at Instrumentation & Control Servicing NC III. TVET providers can however, offer a longer, ladderized course covering both NC II and NC III basic, common and core units.*

BASIC COMPETENCIES

36 hrs

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Lead workplace communication	1.1 Communicate information about workplace processes. 1.2 Lead workplace discussions. 1.3 Identify and communicate issues arising in the workplace	<ul style="list-style-type: none"> • Group discussion • Role Play • Brainstorming 	<ul style="list-style-type: none"> • Observation • Interviews
2. Lead small teams	2.1 Provide team leadership. 2.2 Assign responsibilities among members. 2.3 Set performance expectation for team members. 2.4 Supervise team performance	<ul style="list-style-type: none"> • Lecture • Demonstration • Self-paced (modular) 	<ul style="list-style-type: none"> • Demonstration • Case studies
3. Develop and practice negotiation skills	3.1 Identify relevant information in planning negotiations 3.2 Participate in negotiations 3.3 Document areas for agreement	<ul style="list-style-type: none"> • Direct observation • Simulation/role playing • Case studies 	<ul style="list-style-type: none"> • Written test • Practical/ performance test

4. Solve workplace problem related to work activities	4.1 Explain the analytical techniques. 4.2 Identify the problem. 4.3 Determine the possible cause/s of the problem.	<ul style="list-style-type: none"> • Direct observation • Simulation/role playing • Case studies 	<ul style="list-style-type: none"> • Written test • Practical/ performance test
5. Use mathematical concepts and techniques	5.1 Identify mathematical tools and techniques to solve problem 5.2 Apply mathematical procedures/solution 5.3 Analyze results	<ul style="list-style-type: none"> • Direct observation • Simulation/role playing • Case studies 	<ul style="list-style-type: none"> • Written test • Practical/ performance test
6. Use relevant technologies	2.1 Identify appropriate technology 2.2 Apply relevant technology 2.3 Maintain/enhance relevant technology	<ul style="list-style-type: none"> • Direct observation • Simulation/role playing • Case studies 	<ul style="list-style-type: none"> • Written test • Practical/ performance test

COMMON COMPETENCIES

60 hrs

Note: *Those who have completed the course on Instrumentation and Control Servicing NC II or have acquired the Instrumentation and Control Servicing NC II qualification can skip this portion on common competencies.*

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Apply Quality Standards	1.1 Asses quality of received materials 1.2 Assess own work 1.3 Engage in quality improvement	<ul style="list-style-type: none"> ▪ Field trip ▪ Symposium ▪ Film showing ▪ Simulation ▪ On the job training 	<ul style="list-style-type: none"> ▪ Demonstration & questioning ▪ Observation & questioning ▪ Third party report
2. Perform Computer Operation	2.1 Set-up workstation 2.2 Prepare storage media 2.3 Work with files and objects 2.4 Manipulate word processing software 2.5 Manipulate spreadsheet software 2.6 Manipulate customize and database applications 2.7 Utilize the internet 2.8 Maintain computer hardware and software	<ul style="list-style-type: none"> ▪ Modular ▪ Film showing ▪ Computer based training (e-learning) ▪ Project method ▪ On the job training 	<ul style="list-style-type: none"> ▪ Demonstration & questioning ▪ Observation & questioning ▪ Third party report ▪ Assessment of output product ▪ Portfolio ▪ Computer-based assessment

<p>3. Use Hand Tools</p>	<p>3.1 Identify, explain and apply the use of different types of hand tools</p> <p>3.2 Perform basic maintenance and proper storage of hand tools according to the standard operating procedures</p> <p>3.3 Document and record the sequence of events in safe keeping hand tools.</p>	<ul style="list-style-type: none"> ▪ Lecture / Demonstration ▪ Distance education ▪ Film Showing 	<ul style="list-style-type: none"> ▪ Written/Oral examination ▪ Practical demonstration
<p>4. Perform Mensurations and Calculation</p>	<p>4.1 Select measuring instruments;</p> <p>4.2 Carry-out measurements and calculations;</p>	<ul style="list-style-type: none"> ▪ Self- paced/ modular ▪ Demonstration ▪ Small group discussion ▪ Distance education 	<ul style="list-style-type: none"> ▪ Written/Oral examination ▪ Practical demonstration
<p>5. Interpret Technical Drawings And Plans</p>	<p>5.1 Select and interpret technical drawing</p> <p>5.2 Perform freehand sketching</p>	<ul style="list-style-type: none"> ▪ Lecture/ demonstration ▪ Dualized ▪ Distance learning 	<ul style="list-style-type: none"> ▪ Written /oral examinations ▪ Direct observation ▪ Project method ▪ interview
<p>6. Terminate and Connect Electrical wiring and Electronic Circuit</p>	<p>6.1 Terminate or join non-soldered connections</p> <p>6.2 Terminate or join soldered connections</p>	<ul style="list-style-type: none"> ▪ Film Viewing ▪ Individualized Learning ▪ Direct Student Laboratory Experience ▪ On the Job Training ▪ Project ▪ Method 	<ul style="list-style-type: none"> ▪ Demonstration and Questioning ▪ Assessment of Output Product

CORE COMPETENCIES

80 hrs

Note: *This course design covers only Instrumentation & Control Servicing NC III level core units. The trainee attending this course must have completed first the units for Instrumentation and Control Servicing NC II.*

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Loop-Check Instrumentation & Control Devices	1.1 Read & interpret work instructions according to job requirements.	<ul style="list-style-type: none"> • Lecture • Discussion • Demonstration • Viewing multimedia 	<ul style="list-style-type: none"> • Written exam • Practical exam • Observation in workplace • Interviews/questioning
	1.2 Identify the tools, equipment, testing devices, & materials needed for loop checking.		
	1.3 Identify the PPE & OHS policies & procedures required for the loop checking job.		
	1.4 Loop check Instrumentation & control devices according to technical requirements & standards		
	1.5 Conduct functional test procedure of the loop checked Instrumentation & Control devices		
	1.6 Prepare a loop check & testing report		
2. Maintain and Repair Instrumentation & Control Devices	2.1 Read & interpret work instructions according to the maintenance & repair job.	<ul style="list-style-type: none"> • Lecture • Discussion • Demonstration • Viewing multimedia 	<ul style="list-style-type: none"> • Written exam • Practical exam • Observation in workplace • Interviews/questioning
	2.2 Identify the tools, equipment, testing devices, & materials needed for maintenance & repair.		
	2.3 Identify the PPE & OHS policies & procedures required for the maintenance & repair job.		
	2.4 Maintain Instrumentation & control devices according to technical requirements & standards		
	2.5 Diagnose & repair faults or problems in instrumentation & control devices		
	2.6 Conduct tests & inspection to determine normal functionality & to insure safe operation.		
	2.7 Prepare a maintenance & repair report		

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 the 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 the 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 components;
- Allows for 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 or 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 only facilitates the training delivery.
- Peer teaching/mentoring is a training modality wherein fast learners are given the opportunity to assist the slow learners.
- Supervised industry training or on-the-job training is an approach in training designed to enhance the knowledge and skills of the trainee through actual experience in the workplace to acquire a specific competencies prescribed in the training regulations.
- Distance learning is a formal education process in which majority of the instruction occurs when the students and instructors are not in the same place. Distance learning may employ correspondence study, or audio, video or computer technologies.

3.3 TRAINEE ENTRY REQUIREMENTS

The trainees who wish to enter the course should possess the following requirements:

- Can recognize abstract and 3-dimensional figures
- Must be physically and mentally fit to undergo training
- With good moral character
- Must have completed training in Instrumentation & Control Servicing NC II or equivalent in experience

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS

Recommended list of tools, equipment and materials for the training of 25 trainees for Instrumentation and Control Servicing NC III.

TOOLS		EQUIPMENT		MATERIAL	
Qty.	Description	Qty.	Description	Qty.	Description
25 pcs	Long-nosed pliers	25 pcs	Multimeters	1 spool	Solder lead
25 pcs	Diagonal cutters	5 pcs	Signal simulators	1 spool	Shielded instrumentation cable
25 pcs	Standard screwdrivers	5 pcs	Multifunction Calibrators	1 lot	Terminal lugs
25 pcs	Phillips screwdrivers	5 pcs	Pressure transmitters	1 lot	Terminal strips/blocks
25 pcs	Electrical pliers	5 pcs	Pressure gages	25 pcs	Cotton gloves
25 pcs	Soldering iron	1 pc.	Air compressor	1 lot	Copper tubing
25 pcs	Adjustable wrench	5 pcs	Thermocouple sensors	1 lot	Plastic tubing
5 pcs	Wire stripper	5 pcs	RTD sensors	1 lot	Compression fittings
5 pcs	Crimping tool	5 pcs	Temperature transmitters, Universal input	25 rolls	Electrical tape
5 sets	Allen wrench	5 pcs	Loop power supplies	25 rolls	Teflon sealant tape
5 sets	Jeweller's screwdrivers	5 pcs	Instrument stanchions	1 lot	Cable ties
5 sets	Combination wrench, metric	5 pcs	Process indicators		
5 sets	Combination wrench, English	5 pcs	Process controllers		

		1 pc.	Control valve w/positioner		
		1 pc.	I/P Converter		
		5 pcs	Desktop PC		
		2 pcs	Oscilloscope		
		5 sets	Communication equipment		
		1 pc.	Safety helmet		
		1 pc.	Safety shoes		
		1 pc.	Safety harness		
		1 pc.	Safety glasses/goggles		
		1 pc.	Ear plugs/ear muffs		
		1 pc.	Gas mask		
		1 pc.	Face shield		

3.5 TRAINING FACILITIES

Based on class size of 25 students/trainees the space requirements for the teaching/learning and circulation areas are as follows:

TEACHING/LEARNING AREAS	SIZE IN METERS	AREA IN SQ. METERS	QTY	TOTAL AREA IN SQ. METERS
Lecture Area	5 x 8	40	1	40
Laboratory Area	5 x 8	40	1	40
Learning Resource Area	4 x 5	20	1	20
Tool Room / Storage Area	4 x 5	20	1	20
Wash ,Toilet & Locker Room	1 x 2	2	1	2
Total				122
Facilities / Equipment / Circulation**				36
Total Area				158

**** Area requirement is equivalent to 30% of the total teaching/learning areas**

3.6 TRAINERS QUALIFICATIONS

Instrumentation & Control Technician NC III Trainer's Qualification TQ III

- Must be a holder of Instrumentation & Control NCIII or equivalent qualification
- Must have completed a Trainor's Training course or equivalent years of experience
- * Must have at least 2-years relevant industry experience.
- Must be physically & mentally fit.

* Optional: Only when required by the hiring institution.

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 **Instrumentation and Control Servicing NC III**, the candidate must demonstrate competence in all the units listed in Section 1. Successful candidates shall be awarded a **National Certificate III** signed by the TESDA Director General.
- 4.2 The qualification of **Instrumentation and Control Servicing NC III** may be attained through:
 - 4.2.1. Accumulation of Certificates of Competency (COCs) in all the following units of competencies:
 - 4.2.1.1 Install Instrumentation and Control Devices
 - 4.2.1.2 Calibrate Instrumentation and Control Devices
 - 4.2.1.3 Configure Instrumentation and Control Devices
 - 4.2.1.4 Loop Check Instrumentation and Control Devices
 - 4.2.1.5 Maintain and Repair Instrumentation and Control Devices
- 4.3 Successful candidates shall be awarded a **Certificate of Competency (COC)** in each of the core units.
- 4.3 Accumulation and submission of all COCs acquired for the relevant units of competency comprising a qualification, an individual shall be issued the corresponding National Certificate.
- 4.4 Assessment shall focus on the core units of competency. The basic and common units shall be integrated or assessed concurrently with the core units.
- 4.5 The following are qualified to apply for assessment and certification:
 - 4.5.1. Graduate of formal, non-formal, and informal including enterprise-based training programs.
 - 4.5.2. Experienced workers (wage employed or self employed)
- 4.6 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 (PTQCS)”.

DEFINITION OF TERMS

GENERAL

- 1) **Certification** - is the process of verifying and validating the competencies of a person through assessment
- 2) **Certificate of Competency (COC)** – is a certification issued to individuals who pass the assessment for a single unit or cluster of units of competency
- 3) **Common Competencies** - are the skills and knowledge needed by all people working in a particular industry
- 4) **Competency** - is the possession and application of knowledge, skills and attitudes to perform work activities to the standard expected in the workplace
- 5) **Competency Assessment** - is the process of collecting evidence and making judgments on whether competency has been achieved
- 6) **Competency Standard (CS)** - is the industry-determined specification of competencies required for effective work performance
- 7) **Context of Assessment** - refers to the place where assessment is to be conducted or carried out
- 8) **Core Competencies** - are the specific skills and knowledge needed in a particular area of work - industry sector/occupation/job role
- 9) **Critical aspects of competency** - refers to the evidence that is essential for successful performance of the unit of competency
- 10) **Elective Competencies** - are the additional skills and knowledge required by the individual or enterprise for work
- 11) **Elements** - are the building blocks of a unit of competency. They describe in outcome terms the functions that a person performs in the workplace.
- 12) **Evidence Guide** - is a component of the unit of competency that defines or identifies the evidences required to determine the competence of the individual. It provides information on critical aspects of competency, underpinning knowledge, underpinning skills, resource implications, assessment method and context of assessment
- 13) **Level** - refers to the category of skills and knowledge required to do a job
- 14) **Method of Assessment** - refers to the ways of collecting evidence and when, evidence should be collected

- 15) **National Certificate (NC)** – is a certification issued to individuals who achieve all the required units of competency for a national qualification defined under the Training Regulations. NCs are aligned to specific levels within the PTQF
- 16) **Performance Criteria** - are evaluative statements that specify what is to be assessed and the required level of performance
- 17) **Qualification** - is a cluster of units of competencies that meets job roles and is significant in the workplace. It is also a certification awarded to a person on successful completion of a course in recognition of having demonstrated competencies in an industry sector
- 18) **Range of Variables** - describes the circumstances or context in which the work is to be performed
- 19) **Recognition of Prior Learning (RPL)** – is the acknowledgement of an individual's skills, knowledge and attitudes gained from life and work experiences outside registered training programs
- 19) **Resource Implication** - refer to the resources needed for the successful performance of the work activity described in the unit of competency. It includes work environment and conditions, materials, tools and equipment
- 20) **Basic Competencies** - are the skills and knowledge that everyone needs for work
- 21) **Training Regulations (TR)** – refers to the document promulgated and issued by TESDA consisting of competency standards, national qualifications and training guidelines for specific sectors/occupations. The TR serves as basis for establishment of qualification and certification under the PTQF. It also serves as guide for development of competency-based curricula and instructional materials including registration of TVET programs offered by TVET providers
- 22) **Underpinning Knowledge** - refers to the competency that involves in applying knowledge to perform work activities. It includes specific knowledge that is essential to the performance of the competency
- 23) **Underpinning Skills** - refers to the list of the skills needed to achieve the elements and performance criteria in the unit of competency. It includes generic and industry specific skills
- 24) **Unit of Competency** – is a component of the competency standards stating a specific key function or role in a particular job or occupation; it is the smallest component of achievement that can be assessed and certified under the PTQF

SECTOR SPECIFIC

- 25) **Actuator:** In a closed-loop control system, that part of the final control element that translates the control signal into action by the control device.
- 26) **ANSI:** American National Standards Institute.
- 27) **ASME:** American Society of Mechanical Engineers.
- 28) **Assembler:** A program that translates assembly language instructions into machine language instructions.
- 29) **Assembly Language:** A machine oriented language in which mnemonics are used to represent each machine language instruction. Each CPU has its own specific assembly language.
- 30) **Automation:** (1) The conversion to and implementation of procedures, processes, or equipment by automated means. (2) Industrial open- or closed-loop control systems in which the manual operation of controls is replaced by servo operation.
- 31) **Calibration:** The process of adjusting an instrument or compiling a deviation chart so that its reading can be correlated to the actual value being measured.
- 32) **Control system:** The deliberate guidance or manipulation of the elements in a system in order to achieve a prescribed value or performance of a system to complete a defined process.
- 33) **Conveyor:** A horizontal, inclined or vertical device for moving or transporting bulk materials, packages, or objects in a path predetermined by the design of the device and having points of loading and discharge fixed, or selective.
- 34) **DAS:** Also known as Data Acquisition System, DAQ is a system of one or more sensors, devices and communication links used to scan or collect and forward data to a central location for further processing, display, or archiving.
- 35) **DCS:** Distributed Control System (DCS) is a big Programmable Logic Controller (PLC) that is typically networked to other controllers, PLCs or field devices. It typically has a workstation to interface with the controller and can be very expensive due to built-in security and fail-over features.
- 36) **Ergonomics** --"The systematic application of knowledge about the psychological, physical, and social attributes of human beings in the design and use of all things which affect a person's working conditions: equipment and machinery, the work environment and layout, the job itself, training and the organization of work."
(Humansystems Inc).
- 37) **PID control:** Proportional plus Integral plus Derivative control is used in processes where the controlled variable is affected by long downtimes.
- 38) **PLC (Programmable Logic Controller) :** A class of industrially hardened devices that provides hardware interface for input sensors and output actuators. PLCs can be programmed using relay ladder logic to control the outputs based on input conditions and / or algorithms contained in the memory of the PLC.

- 39) **Process automation:** Includes objectives of control and also those of enterprise management. This requires an integrated approach to plant operations and enables a variety of applications such as production scheduling, inventory control, performance monitoring, statistical process control, maintenance management and environmental audit.
- 40) **Process control:** Automatic monitoring and control of a process by an instrument or computer programmed to respond appropriately to feedback from the process.
- 41) **SCADA:** Supervisory Control and Data Acquisition (SCADA) is a common process control application that collects data from sensors on the shop floor or in remote locations and sends them to a central computer for management and control.
- 42) **Sensor:** A transducer whose input is a physical phenomenon and whose output is a quantitative measure of the phenomenon.
- 43) **Sequence control:** The control of a series of machine movements, with the completion of one movement initiating the next. The extent of movements is typically not specified by numerical input data.
- 44) **Software:** The entire set of programs, procedures, and related documentation associated with a computer.
- 45) **Static Calibration:** A calibration recording pressure versus output at fixed points at room temperature.
- 46) **Systems integration:** The ability of computers, instrumentation, and equipment to share data or applications with other components in the same or other functional areas.
- 47) **Transducer:** A device that converts signals from one physical form to another.

ANNEX A - COMPETENCY MAP

BASIC COMPETENCIES

Receive and Respond to Workplace Communication	Work with Others	Demonstrate work values	Practice basic housekeeping procedures	Participate in Workplace Communication
Work in a Team Environment	Practice career professionalism	Practice occupational health and safety procedures	Lead Workplace Communication	Lead Small Team
Develop and practice negotiation skills	Solve Problems Related to Work Activities	Use mathematical concepts and techniques	Use relevant technologies	Utilize Specialist Communication Skills
Develop Team and Individuals	Apply Problem Solving Techniques in the Workplace	Collect, analyze and organize information	Plan and Organize Work	Promote environmental protection

COMMON COMPETENCIES

Use Hand Tools	Perform Mensuration and Calculation	Prepare and Interpret Technical Drawing	Apply Quality Standards	Perform Computer Operations
Terminate and Connect Electrical Wiring and Electronic Circuits				

CORE COMPETENCIES

Install Instrumentation and Control Devices	Calibrate Instrumentation and Control Devices	Configure Instrumentation and Control Devices	Loop Check Instrumentation and Control Devices	Maintain and Repair Instrumentation & Control Devices
Start-up Instrumentation and Control Systems	Diagnose and Troubleshoot Instrumentation and Control Systems	Install Mechatronic Devices	Configure and Test Mechatronics Devices	Develop Mechatronics Control Circuits and Software Application Programs
Maintain and Repair Mechatronic Systems	Commission Mechatronic Systems	Diagnose and Troubleshoot Mechatronic Systems	Service and Repair Audio Systems and Products	Service and Repair Video Systems and Products
Service and Repair Business Machines	Assemble and Disassemble Consumer Electronic Products	Maintain and Repair Electronically Controlled Domestic Appliances	Maintain and Repair Audio-Video Products and Systems	Maintain and Repair Cellular Phones
Commission Consumer Electronic Products and Systems	Develop Servicing Systems for Consumer Electronic Products	Train service technician	Manage Servicing Systems for Consumer Electronics Products and Systems	Train service technician supervisors

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