

TRAINING REGULATIONS



INSTRUMENTATION AND CONTROL SERVICING NC II

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 II

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TRAINING REGULATIONS FOR INSTRUMENTATION AND CONTROL SERVICING NC II

SECTION 1: INSTRUMENTATION AND CONTROL SERVICING QUALIFICATIONS

The **INSTRUMENTATION AND CONTROL SERVICING NC II** Qualification consists of competencies that a person must achieve to enable him/her to install, calibrate, and configure 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 05	Participate in workplace communication
5 00 311 1 06	Work in team environment
5 00 311 1 07	Practice career professionalism
5 00 311 1 08	Practice occupational health and safety procedures

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
ELC724301	Install Instrumentation and Control Devices
ELC724302	Calibrate Instrumentation and Control Devices
ELC724303	Configure Instrumentation and Control Devices

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

- Instrumentation and Control Technician 2

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 II**.

BASIC COMPETENCIES

UNIT OF COMPETENCY : PARTICIPATE IN WORKPLACE COMMUNICATION

UNIT CODE : 500311105

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Obtain and convey workplace information	1.1 Specific and relevant information is accessed from appropriate sources 1.2 Effective questioning , active listening and speaking skills are used to gather and convey information 1.3 Appropriate medium is used to transfer information and ideas 1.4 Appropriate non- verbal communication is used 1.5 Appropriate lines of communication with supervisors and colleagues are identified and followed 1.6 Defined workplace procedures for the location and storage of information are used 1.7 Personal interaction is carried out clearly and concisely
2. Participate in workplace meetings and discussions	2.1 Team meetings are attended on time 2.2 Own opinions are clearly expressed and those of others are listened to without interruption 2.3 Meeting inputs are consistent with the meeting purpose and established protocols 2.4 Workplace interactions are conducted in a courteous manner 2.5 Questions about simple routine workplace procedures and matters concerning working conditions of employment are asked and responded to 2.6 Meeting outcomes are interpreted and implemented
3. Complete relevant work related documents	3.1 Range of forms relating to conditions of employment are completed accurately and legibly 3.2 Workplace data is recorded on standard workplace forms and documents 3.3 Basic mathematical processes are used for routine calculations 3.4 Errors in recording information on forms/ documents are identified and properly acted upon 3.5 Reporting requirements to supervisor are completed according to organizational guidelines

RANGE OF VARIABLES

VARIABLE	RANGE
1. Appropriate sources	1.1. Team members 1.2. Suppliers 1.3. Trade personnel 1.4. Local government 1.5. Industry bodies
2. Medium	2.1. Memorandum 2.2. Circular 2.3. Notice 2.4. Information discussion 2.5. Follow-up or verbal instructions 2.6. Face to face communication
3. Storage	3.1. Manual filing system 3.2. Computer-based filing system
4. Forms	4.1. Personnel forms, telephone message forms, safety reports
5. Workplace interactions	5.1. Face to face 5.2. Telephone 5.3. Electronic and two way radio 5.4. Written including electronic, memos, instruction and forms, non-verbal including gestures, signals, signs and diagrams
6. Protocols	6.1. Observing meeting 6.2. Compliance with meeting decisions 6.3. Obeying meeting instructions

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. Prepared written communication following standard format of the organization 1.2. Accessed information using communication equipment 1.3. Made use of relevant terms as an aid to transfer information effectively 1.4. Conveyed information effectively adopting the formal or informal communication
<p>2. Underpinning Knowledge</p>	<ul style="list-style-type: none"> 2.1. Effective communication 2.2. Different modes of communication 2.3. Written communication 2.4. Organizational policies 2.5. Communication procedures and systems 2.6. Technology relevant to the enterprise and the individual's work responsibilities
<p>3. Underpinning Skills</p>	<ul style="list-style-type: none"> 3.1. Follow simple spoken language 3.2. Perform routine workplace duties following simple written notices 3.3. Participate in workplace meetings and discussions 3.4. Complete work related documents 3.5. Estimate, calculate and record routine workplace measures 3.6. Basic mathematical processes of addition, subtraction, division and multiplication 3.7. Ability to relate to people of social range in the workplace 3.8. Gather and provide information in response to workplace Requirements
<p>4. Resource Implications</p>	<ul style="list-style-type: none"> 4.1. Fax machine 4.2. Telephone 4.3. Writing materials 4.4. Internet
<p>5. Methods of Assessment</p>	<ul style="list-style-type: none"> 5.1. Direct Observation 5.2. Oral interview and written test
<p>6. Context for Assessment</p>	<ul style="list-style-type: none"> 6.1. Assessment may be conducted in the workplace or in a simulated work environment.

UNIT OF COMPETENCY: WORK IN TEAM ENVIRONMENT

UNIT CODE : 500311106

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes to identify role and responsibility as a member of a team.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Describe team role and scope	1.1. The role and objective of the team is identified from available sources of information 1.2. Team parameters, reporting relationships and responsibilities are identified from team discussions and appropriate external sources
2. Identify own role and responsibility within team	2.1. Individual role and responsibilities within the team environment are identified 2.2. Roles and responsibility of other team members are identified and recognized 2.3. Reporting relationships within team and external to team are identified
3. Work as a team member	3.1. Effective and appropriate forms of communications are used and interactions undertaken with team members who contribute to known team activities and objectives 3.2. Effective and appropriate contributions are made to complement team activities and objectives, based on individual skills and competencies and workplace context 3.3. Protocols are observed in reporting using standard operating procedures 3.4. Contribute to the development of team work plans based on an understanding of team's role and objectives and individual competencies of the members.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Role and objective of team	1.1. Work activities in a team environment with enterprise or specific sector 1.2. Limited discretion, initiative and judgement maybe demonstrated on the job, either individually or in a team environment
2. Sources of information	2.1. Standard operating and/or other workplace procedures 2.2. Job procedures 2.3. Machine/equipment manufacturer's specifications and instructions 2.4. Organizational or external personnel 2.5. Client/supplier instructions 2.6. Quality standards 2.7. OHS and environmental standards
3. Workplace context	3.1. Work procedures and practices 3.2. Conditions of work environments 3.3. Legislation and industrial agreements 3.4. Standard work practice including the storage, safe handling and disposal of chemicals 3.5. Safety, environmental, housekeeping and quality guidelines

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. Operated in a team to complete workplace activity 1.2. Worked effectively with others 1.3. Conveyed information in written or oral form 1.4. Selected and used appropriate workplace language 1.5. Followed designated work plan for the job 1.6. Reported outcomes
<p>2. Underpinning Knowledge and Attitude</p>	<ul style="list-style-type: none"> 2.1. Communication process 2.2. Team structure 2.3. Team roles 2.4. Group planning and decision making
<p>3. Underpinning Skills</p>	<ul style="list-style-type: none"> 3.1. Communicate appropriately, consistent with the culture of the workplace
<p>4. Resource Implications</p>	<p>The following resources MUST be provided:</p> <ul 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 tasks
<p>5. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> 5.1. Observation 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>	<ul style="list-style-type: none"> 6.1. Competency may be assessed in workplace or in a simulated workplace setting 6.2. Assessment shall be observed while task are being undertaken whether individually or in group

UNIT OF COMPETENCY: PRACTICE CAREER PROFESSIONALISM

UNIT CODE : 500311107

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in promoting career growth and advancement.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Integrate personal objectives with organizational goals	1.1. Personal growth and work plans are pursued towards improving the qualifications set for the profession 1.2. Intra- and interpersonal relationships is are maintained in the course of managing oneself based on performance evaluation 1.3. Commitment to the organization and its goal is demonstrated in the performance of duties
2. Set and meet work priorities	2.1. Competing demands are prioritized to achieve personal, team and organizational goals and objectives. 2.2. Resources are utilized efficiently and effectively to manage work priorities and commitments 2.3. Practices along economic use and maintenance of equipment and facilities are followed as per established procedures
3. Maintain professional growth and development	3.1. Trainings and career opportunities are identified and availed of based on job requirements 3.2. Recognitions are -sought/received and demonstrated as proof of career advancement 3.3. Licenses and/or certifications relevant to job and career are obtained and renewed

RANGE OF VARIABLES

VARIABLE	RANGE
1. Evaluation	1.1 Performance Appraisal 1.2 Psychological Profile 1.3 Aptitude Tests
2. Resources	2.1 Human 2.2 Financial 2.3 Technology 2.3.1 Hardware 2.3.2 Software
3. Trainings and career opportunities	3.1 Participation in training programs 3.1.1 Technical 3.1.2 Supervisory 3.1.3 Managerial 3.1.4 Continuing Education 3.2 Serving as Resource Persons in conferences and workshops
4. Recognitions	4.1 Recommendations 4.2 Citations 4.3 Certificate of Appreciations 4.4 Commendations 4.5 Awards 4.6 Tangible and Intangible Rewards
5. Licenses and/or certifications	5.1 National Certificates 5.2 Certificate of Competency 5.3 Support Level Licenses 5.4 Professional Licenses

EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Attained job targets within key result areas (KRAs) 1.2 Maintained intra - and interpersonal relationship in the course of managing oneself based on performance evaluation 1.3 Completed trainings and career opportunities which are based on the requirements of the industries 1.4 Acquired and maintained licenses and/or certifications according to the requirement of the qualification
2. Underpinning Knowledge	<ul style="list-style-type: none"> 2.1 Work values and ethics (Code of Conduct, Code of Ethics, etc.) 2.2 Company policies 2.3 Company-operations, procedures and standards 2.4 Fundamental rights at work including gender sensitivity 2.5 Personal hygiene practices
3. Underpinning Skills	<ul style="list-style-type: none"> 3.1 Appropriate practice of personal hygiene 3.2 Intra and Interpersonal skills 3.3 Communication skills
4. Resource Implications	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 4.1 Workplace or assessment location 4.2 Case studies/scenarios
5. Methods of Assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> 5.1 Portfolio Assessment 5.2 Interview 5.3 Simulation/Role-plays 5.4 Observation 5.5 Third Party Reports 5.6 Exams and Tests
6. Context for Assessment	<ul style="list-style-type: none"> 6.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY : PRACTICE OCCUPATIONAL HEALTH AND SAFETY PROCEDURES

UNIT CODE : 500311108

UNIT DESCRIPTOR : This unit covers the outcomes required to comply with regulatory and organizational requirements for occupational health and safety.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Identify hazards and risks	1.1 Safety regulations and workplace safety and hazard control practices and procedures are clarified and explained based on organization procedures 1.2 Hazards/risks in the workplace and their corresponding indicators are identified to minimize or eliminate risk to co-workers, workplace and environment in accordance with organization procedures 1.3 Contingency measures during workplace accidents, fire and other emergencies are recognized and established in accordance with organization procedures
2. Evaluate hazards and risks	2.1 Terms of maximum tolerable limits which when exceeded will result in harm or damage are identified based on threshold limit values (TLV) 2.2 Effects of the hazards are determined 2.3 OHS issues and/or concerns and identified safety hazards are reported to designated personnel in accordance with workplace requirements and relevant workplace OHS legislation
3. Control hazards and risks	3.1 Occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace are consistently followed 3.2 Procedures for dealing with workplace accidents, fire and emergencies are followed in accordance with organization OHS policies 3.3 Personal protective equipment (PPE) is correctly used in accordance with organization OHS procedures and practices 3.4 Appropriate assistance is provided in the event of a workplace emergency in accordance with established organization protocol
4. Maintain OHS awareness	4.1 Emergency-related drills and trainings are participated in as per established organization guidelines and procedures 4.2 OHS personal records are completed and updated in accordance with workplace requirements

RANGE OF VARIABLES

VARIABLE	RANGE
1. Safety regulations	May include but are not limited to: 1.1 Clean Air Act 1.2 Building code 1.3 National Electrical and Fire Safety Codes 1.4 Waste management statutes and rules 1.5 Philippine Occupational Safety and Health Standards 1.6 DOLE regulations on safety legal requirements 1.7 ECC regulations
2. Hazards/Risks	May include but are not limited to: 2.1 Physical hazards – impact, illumination, pressure, noise, vibration, temperature, radiation 2.2 Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects 2.3 Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors 2.4 Ergonomics 2.4.1 Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles 2.4.2 Physiological factors – monotony, personal relationship, work out cycle
3. Contingency measures	May include but are not limited to: 3.1 Evacuation 3.2 Isolation 3.3 Decontamination 3.4 (Calling designed) emergency personnel
4. PPE	May include but are not limited to: 4.1 Mask 4.2 Gloves 4.3 Goggles 4.4 Hair Net/cap/bonnet 4.5 Face mask/shield 4.6 Ear muffs 4.7 Apron/Gown/coverall/jump suit 4.8 Anti-static suits

VARIABLE	RANGE
5. Emergency-related drills and training	5.1 Fire drill 5.2 Earthquake drill 5.3 Basic life support/CPR 5.4 First aid 5.5 Spillage control 5.6 Decontamination of chemical and toxic 5.7 Disaster preparedness/management
6. OHS personal records	6.1 Medical/Health records 6.2 Incident reports 6.3 Accident reports 6.4 OHS-related training completed

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 Explained clearly established workplace safety and hazard control practices and procedures 1.2 Identified hazards/risks in the workplace and its corresponding indicators in accordance with company procedures 1.3 Recognized contingency measures during workplace accidents, fire and other emergencies 1.4 Identified terms of maximum tolerable limits based on threshold limit value- TLV. 1.5 Followed Occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace 1.6 Used Personal Protective Equipment (PPE) in accordance with company OHS procedures and practices 1.7 Completed and updated OHS personal records in accordance with workplace requirements
<p>2. Underpinning Knowledge</p>	<ul style="list-style-type: none"> 2.1 OHS procedures and practices and regulations 2.2 PPE types and uses 2.3 Personal hygiene practices 2.4 Hazards/risks identification and control 2.5 Threshold Limit Value -TLV 2.6 OHS indicators 2.7 Organization safety and health protocol 2.8 Safety consciousness 2.9 Health consciousness
<p>3. Underpinning Skills</p>	<ul style="list-style-type: none"> 3.1 Practice of personal hygiene 3.2 Hazards/risks identification and control skills 3.3 Interpersonal skills 3.4 Communication skills
<p>2. Resource Implications</p>	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 4.1 Workplace or assessment location 4.2 OHS personal records 4.3 PPE 4.4 Health records
<p>3. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> 5.1 Portfolio Assessment 5.2 Interview 5.3 Case Study/Situation
<p>4. Context for Assessment</p>	<ul style="list-style-type: none"> 6.1 Competency may be assessed in the work place or in a simulated work place setting

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
	<i>Italicized Bold</i> terms are elaborated in the Range of Variables
1. Plan and prepare for tasks to be undertaken	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 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	<ul style="list-style-type: none">1.1. Straight edge1.2. Torque gauge1.3. Try square1.4. Protractor1.5. Combination gauge1.6. Steel rule
2. Calculation	<p>Kinds of part mensuration includes the following but not limited to</p> <ul style="list-style-type: none">2.1. Volume2.2. Area2.3. Displacement2.4. Inside diameter2.5. Circumference2.6. Length2.7. Thickness2.8. Outside diameter2.9. Taper2.10. 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 include 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 electronic 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

1. Critical aspect of competency	<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
2. Underpinning knowledge	<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
3. Underpinning skills	<ul style="list-style-type: none"> 3.1. Reading skills required to interpret work instruction 3.2. Communication skills 3.3. Soldering techniques
4. Method of assessment	<ul style="list-style-type: none"> 4.1. The assessor may select two (2) of the following assessment methods to objectively assess the candidate: <ul style="list-style-type: none"> 4.1.1. Observation 4.1.2. Oral Questioning 4.1.3. Practical demonstration
5. Resource implication	<ul style="list-style-type: none"> 5.1. Tools for measuring, cutting, drilling, assembling/disassembling, connecting. Tool set includes the following but not limited to: <ul style="list-style-type: none"> 5.1.1. screw drivers 5.1.2. pliers 5.1.3. cutters
6. Context of Assessment	<ul style="list-style-type: none"> 6.1. Assessment may be conducted in the workplace or in a simulated work environment

CORE COMPETENCIES

UNIT TITLE : **INSTALL INSTRUMENTATION AND CONTROL DEVICES**
UNIT CODE : **ELC724301**
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes necessary to install instrumentation and control devices.

ELEMENTS	PERFORMANCE CRITERIA
1. Interpret work instructions	<p>1.1. Work instructions are read and interpreted to determine job requirements.</p> <p>1.2. Tools, equipment and testing devices needed to carry out the installation work are selected in accordance with established procedures and checked for correct operation and safety.</p> <p>1.3. Materials necessary to complete the work are obtained in accordance with job requirements.</p>
2. Install instrumentation and control devices	<p>2.1. Appropriate personal protective equipment is worn in line with standard operating procedures.</p> <p>2.2. OH & S policies and procedures for installation are followed in line with the requirements.</p> <p>2.3. Instrumentation and Control standards are followed in line with the job requirements.</p> <p>2.4. Devices are installed in accordance with manufacturer's instructions, requirements, and without damage to the surrounding place or environment</p> <p>2.5. Unplanned events or conditions are responded to in accordance with established procedures</p>
3. Test installed instrumentation and control devices	<p>3.1. Devices are tested in accordance with standard procedures.</p> <p>3.2. Final inspections are undertaken to ensure that the installed devices conforms to technical requirements.</p> <p>3.3. Work site is cleaned and cleared of all debris and left safe in accordance with the company requirements</p> <p>3.4. Report on installation and testing of equipment is prepared according to company's procedures/policies.</p>

RANGE OF VARIABLES

Variable	Range
1. Tools	Tools for: cutting, shaping, drilling, threading, tapping, finishing, dismantling/assembling. Tool set includes but not limited to: <ul style="list-style-type: none"> 1.1. Pliers (assorted) 1.2. Screw drivers (assorted) 1.3. Soldering iron/gun 1.4. Wrenches
2. Equipment/testing devices	2.1. Equipment includes but not limited to: <ul style="list-style-type: none"> 2.1.1. Communication equipment e.g., 2-way radio, cell phone 2.1.2. Lifting equipment 2.1.3. Fastening equipment 2.2. Testing devices includes but not limited to: <ul style="list-style-type: none"> 2.2.1. Multimeter 2.2.2. Calibrators
3. Materials	Include but not limited to: <ul style="list-style-type: none"> 3.1. Wires and cables 3.2. Pipes/tubes & fittings 3.3. Sealing materials 3.4. Fasteners
4. Personal protective equipment	Include but not limited to: <ul style="list-style-type: none"> 4.1. Ear muffs/plugs 4.2. Goggles/glasses/face shield 4.3. Safety hat 4.4. Safety apparel/suit 4.5. Safety belt/harness 4.6. Safety shoes 4.7. Mask 4.8. Gloves
5. OH & S policies and procedures	5.1. OH & S guidelines 5.2. Philippine environmental standards

<p>6. Instrumentation and Control Standards</p>	<p>Includes but not limited to:</p> <ul style="list-style-type: none"> 6.1. ISA (Instrumentation, Systems and Automation Society (formerly Instrument Society of America) 6.2. ANSI(American National Standards Institute) 6.3. ASME (American Society of Mechanical Engineers) 6.4. NEC (National Electrical Code) 6.5. IEC (International Electrotechnical Commission)
<p>7. Devices</p>	<p>Include but not limited to:</p> <ul style="list-style-type: none"> 7.1. Sensors/Transmitters/Transducers 7.2. Indicators 7.3. Controllers 7.4. Control valves 7.5. Actuators 7.6. Recorders 7.7. Annunciators 7.8. Process switches

EVIDENCE GUIDE

<p>1. Critical aspect of competency</p>	<p>Assessment require evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1. interpreted work instructions according to job requirements. 1.2. installed Instrumentation & Control devices in accordance with technical requirements. 1.3. conducted tests accurately on the devices using standard procedures 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
<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. Installation skills 3.5. Problem solving in unplanned events

<p>4. Method of assessment</p>	<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
<p>5. Resource Implication</p>	<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 and calibrators 5.4. Materials 5.5. PPE 5.6. Technical manuals 5.7. Instrumentation & Control drawings
<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 : **CALIBRATE INSTRUMENTATION AND CONTROL DEVICES**

UNIT CODE : **ELC724302**

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

ELEMENTS	PERFORMANCE CRITERIA <i>Italicized Bold</i> items are elaborated in the range of Variables
1. Plan and prepare for calibration	1.1. Calibration 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 the job requirements. 1.4. Instrumentation and control devices for calibration 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 calibration are obtained and checked for correct operation and safety 1.7. Instrumentation and control devices calibrated are identified based on Job/Service Order or instructions
2. Calibrate instrumentation and control devices	2.1. Appropriate personal protective equipment is used based on OHS policies and procedures. 2.2. Normal functions of devices are checked in accordance with manufacturer's instructions & standard procedures. 2.3. Fault/s or problem/s in the device is/are diagnosed in line with the standard operating procedures. 2.4. Instrumentation and control devices are calibrated in line with the standard operating procedures. 2.5. Unplanned events or conditions are responded to in accordance with established procedures
3. Inspect and test calibrated instrumentation and control devices	3.1. Final inspections are undertaken to ensure that the calibration done on the device conforms with the manufacturer's instruction/manual 3.2. Instrumentation and control devices are checked and tested based on safety procedures. 3.3. Report is prepared/completed according to company requirements

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 Electric 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	Tool set for dismantling/assembling 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. Calibration bench 5.1.2. Instrument air supply equipment 5.1.3. Power supply equipment 5.2. Testing devices include but not limited to: 5.2.1. Multimeter 5.2.2. Calibrators, configurator or programmer 5.2.3. Signal generator 5.2.4. Oscilloscope	
6. Materials	Include but not limited to: 6.1. Wires and cables 6.2. Sealing materials 6.3. Pipes/tubes & fittings	
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> <ul style="list-style-type: none"> 1.1. Interpreted work instructions according to job requirements. 1.2. Diagnosed faults or problems on the devices 1.3. Calibrated identified devices 1.4. Checked calibrated devices to ensure safety 1.5. Documented the tasks undertaken
<p>2. Underpinning knowledge</p>	<p>Include but not limited to:</p> <ul 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
<p>3. Underpinning skills</p>	<ul 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. Calibration skills 3.5. Problem solving in unplanned events
<p>4. Method of assessment</p>	<ul style="list-style-type: none"> 4.1. The assessor may select at least three of the following assessment methods to objectively assess the candidate: <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

<p>5. Resource Implication</p>	<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 and calibrators 5.4. Materials 5.5. PPE 5.6. Technical manuals 5.7. Instrumentation & Control drawings
<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 : **CONFIGURE INSTRUMENTATION AND CONTROL DEVICES**

UNIT CODE : **ELC724303**

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

ELEMENTS	PERFORMANCE CRITERIA <i>Italicized Bold</i> items are elaborated in the range of Variables
1. Plan and prepare for configuration	1.1. Configuration 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 the job requirements 1.4. Instrumentation and control devices for configuration 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 configuration of the instrumentation and control devices are obtained and checked for correct operation and safety 1.7. Instrumentation and control devices configured are identified based on the Job/Service Order or instructions
2. Configure instrumentation and control devices	2.1. Appropriate personal protective equipment is used and OHS policies and procedures are followed 2.2. Normal function of systems and components is checked in accordance with manufacturer's instructions 2.3. Fault/s or problem/s in the device are diagnosed in line with the standard operating procedures. 2.4. Instrumentation and control devices are configured in line with the standard operating procedures. 2.5. Unplanned events or conditions are responded to in accordance with established procedures
3. Inspect and test configured instrumentation and control devices	3.1. Final inspections are undertaken to ensure that the configuration done on the devices conforms with the manufacturer's instruction/manual 3.2. Instrumentation and control devices are checked to ensure safe operation. 3.3. Report is prepared/completed according to company requirements.

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. Materials	Include but not limited to: 4.1. Connectors 4.2. Adaptors 4.3. Wires and cables 4.4. Appropriate softwares 4.5. Computer storage media	
5. Tools	Tool set dismantling/assembling include but not limited to: 5.1. Pliers (assorted) 5.2. Screw drivers (assorted) 5.3. Soldering iron/gun 5.4. Wrenches	
6. Equipment/testing devices	6.1. Equipment include but not limited to: 6.1.1. Configurator or programmer 6.1.2. Computer 6.2. Testing devices includes but not limited to: 6.2.1. Multimeter 6.2.2. Calibrators 6.2.3. Signal generator 6.2.4. Oscilloscope	
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. Diagnosed faults or problems on the devices 1.3. Configured the identified devices 1.4. Checked configured devices to ensure safety 1.5. 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
<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. Configuration skills 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: 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 work environment

SECTION 3 TRAINING STANDARDS

3.1 CURRICULUM DESIGN

Course Title: Instrumentation & Control Servicing

NC Level: NC II

Nominal Training Duration: 18 hrs – Basic Competencies
 60 hrs – Common Competencies
 160 hrs – Core Competencies

 238 hrs

Course Description:

This course is designed to develop & enhance the knowledge, skills, & attitudes of an instrumentation and control technician in accordance with industry standards. It covers the basic & common competencies in addition to the core competencies such as installing, calibrating & configuring instrumentation & control devices.

BASIC COMPETENCIES

18 hrs

1. Participate in workplace communication	1.1 Obtain and convey workplace information. 1.2 Complete relevant work related documents. 1.3 Participate in workplace meeting and discussion	<ul style="list-style-type: none"> • Group discussion • Interaction 	<ul style="list-style-type: none"> • Demonstration • Observation • Interviews/questioning
2. Work in a team environment	2.1 Describe and identify team role and responsibility in a team. 2.2 Describe work as a team member.	<ul style="list-style-type: none"> • Discussion • Interaction 	<ul style="list-style-type: none"> • Demonstration • Observation • Interviews/questioning
3. Practice career professionalism	3.1 Integrate personal objectives with organizational goals. 3.2 Set and meet work priorities. 3.3 Maintain professional growth and development.	<ul style="list-style-type: none"> • Discussion • Interaction 	<ul style="list-style-type: none"> • Demonstration • Observation • Interviews/questioning
4. Practice occupational health and safety	4.1 Evaluate hazard and risks 4.2 Control hazards and risks 4.3 Maintain occupational health and safety awareness	<ul style="list-style-type: none"> • Discussion • Plant tour • Symposium 	<ul style="list-style-type: none"> • Observation • Interview

COMMON COMPETENCIES

60 hrs

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
3. Use Hand Tools	3.1 Identify, explain and apply the use of different types of hand tools 3.2 Perform basic maintenance and proper storage of hand tools according to the standard operating procedures 3.3 Document and record the sequence of events in safe keeping hand tools.	<ul style="list-style-type: none"> ▪ Lecture / Demonstration ▪ Distance education ▪ Film Showing 	<ul style="list-style-type: none"> ▪ Written/Oral examination ▪ Practical demonstration
4. Perform Mensurations and Calculation	4.1 Select measuring instruments; 4.2 Carry-out measurements and calculations;	<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 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 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

160 hrs

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Install 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
	1.2 Identify the tools, equipment, testing devices, & materials needed for installation.		
	1.3 Identify the PPE & OHS policies & procedures required for the installation job.		
	1.4 Install Instrumentation & control devices according to technical requirements & standards		
	1.5 Conduct functional test procedure of the installed Instrumentation & Control devices		
	1.6 Prepare an installation & testing report		
2. Calibrate Instrumentation & Control Devices	2.1 Read & interpret work instructions according to the calibration 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
	2.2 Identify the tools, equipment, testing devices, & materials needed for calibration.		
	2.3 Identify the PPE & OHS policies & procedures required for the calibration job.		
	2.4 Calibrate Instrumentation & control devices according to technical requirements & standards		
	2.5 Conduct tests to determine normal functionality & to insure safe operation.		
	2.5 Prepare a calibration & testing report		

3. Configure Instrumentation & Control Devices	2.1 Read & interpret work instructions according to the configuration 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
	2.2 Identify the tools, equipment, testing devices, & materials needed for configuration.		
	2.3 Identify the PPE & OHS policies & procedures required for the configuration job.		
	2.4 Configure Instrumentation & control devices according to technical requirements & standards		
	2.5 Conduct tests to determine normal functionality & to insure safe operation.		
	2.6 Prepare a configuration & testing 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 communicate orally & in writing
- Can perform basic mathematical computations
- Can recognize abstract and 3-dimensional figures
- Must be mentally fit to undergo training
- With good moral character

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS (Institution-based)

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

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	1 lot	Calibration stickers
5 sets	Combination wrench, English	5 pcs	Process controllers		
		1 pc.	Control valve w/ positioner		
		1 pc.	I/P Converter		
		5 pcs	Desktop PC		
		1 pc.	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 II Trainer's Qualification TQ II

- Must be a holder of Instrumentation & Control Certificate NCII or 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 II**, the candidate must demonstrate in all the units listed in Section 1. Successful candidates shall be awarded a **National Certificate II** signed by the TESDA Director General.
- 4.2 The qualification of **Instrumentation and Control Servicing NC II** 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

Successful candidates shall be awarded a **Certificate of Competency (COC)** in each of the core units.
 - 4.2.2 Demonstration of competence through project-type assessment covering all the units required in the qualification.
- 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) **HMI:** Human Machine Interface (HMI) is a software application (typically a Graphical User Interface or GUI) that present information to the operator about the state of a process, and to accept and implement the operators control instructions. It may also interpret the plant information and guide the interaction of the operator with the system. Also known as Man Machine Interface (MMI).

- 38) **PID control:** Proportional plus Integral plus Derivative control is used in processes where the controlled variable is affected by long downtimes.
- 39) **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.
- 40) **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.
- 41) **Process control:** Automatic monitoring and control of a process by an instrument or computer programmed to respond appropriately to feedback from the process.
- 42) **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.
- 43) **Sensor:** A transducer whose input is a physical phenomenon and whose output is a quantitative measure of the phenomenon.
- 44) **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.
- 45) **Software:** The entire set of programs, procedures, and related documentation associated with a computer.
- 46) **Static Calibration:** A calibration recording pressure versus output at fixed points at room temperature.
- 47) **Systems integration:** The ability of computers, instrumentation, and equipment to share data or applications with other components in the same or other functional areas.
- 48) **Transducer:** A device that converts signals from one physical form to another.

ANNEX A - COMPETENCY MAP

BAISC 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 Mechatronic 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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- **THE TECHNICAL EXPERT COMMITTEE**

- **MR. ERNIE O. DIMALANTA**

- President, PICS Foundation, Inc.
President, PhilAsia School of Instrumentation
and Automation

- **ENGR. CHUCK L.G. EBALO**

- VP-Academic Affairs, PhilAsia School
Of Instrumentation and Automation

- **MS. MA. ZENAIDA S. VILLALVA**

- Professor, Rizal Technological University
Treasurer, PICS Foundation, Inc.

- **ENGR. RAINNEL R. MACLANG**

- Engineering Service Manager
Instrumentation & Control Specialist, Inc.

- **PHILIPPINE INSTRUMENTATION AND CONTROL SOCIETY FOUNDATION, INC.**

- **INSTRUMENTATION & CONTROL SPECIALIST, INC.**

- **PHILASIA SCHOOL OF INSTRUMENTATION & AUTOMATION**

- **THE TESDA BOARD - STANDARDS SETTING AND SYSTEMS DEVELOPMENT COMMITTEE**

- **THE MANAGEMENT AND STAFF OF TESDA SECRETARIAT**

- Qualifications and Standards Office
(QSO)