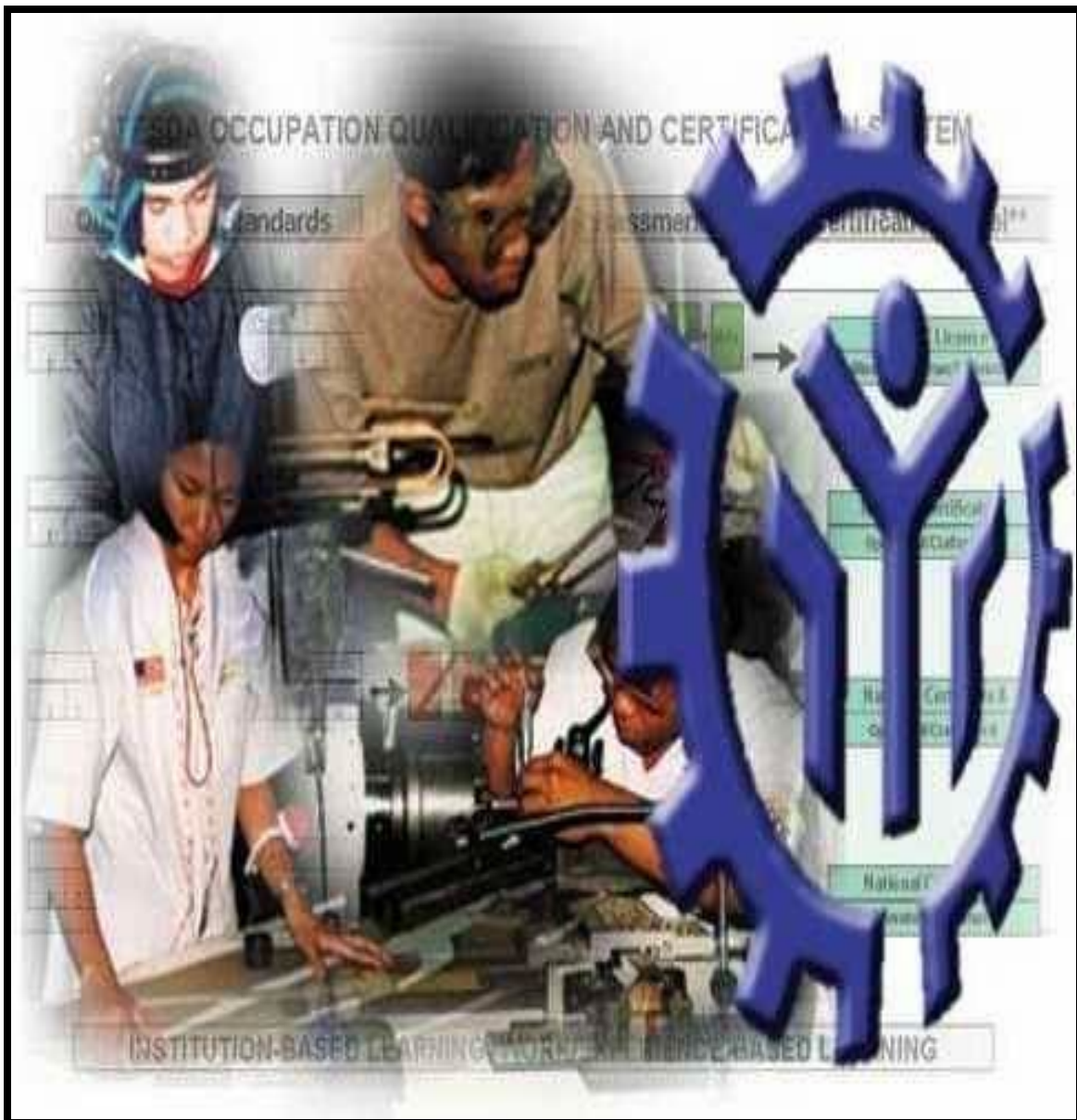


TRAINING REGULATIONS

LABORATORY AND METROLOGY/ CALIBRATION SERVICES NC II



AUTOMOTIVE (MANUFACTURING SUB-SECTOR)

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY

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

*Technical Education and Skills Development Act of 1994
(Republic Act No. 7796)*

Section 22, “Establishment and Administration of the National Trade Skills Standards” of the RA 7796 known as the TESDA Act mandates TESDA to establish national occupational skill standards. The Authority shall develop and implement a certification and accreditation program in which private industry group and trade associations are accredited to conduct approved trade tests, and the local government units to promote such trade testing activities in their respective areas in accordance with the guidelines to be set by the Authority.

The Training Regulations (TR) serves as basis for the:

1. Competency assessment and certification;
2. Registration and delivery of training programs; and
3. Development of curriculum and assessment instruments.

Each TR has four sections:

- Section 1 Definition of Qualification - refers to the group of competencies that describes the different functions of the qualification.
- Section 2 Competency Standards - gives the specifications of competencies required for effective work performance.
- Section 3 Training Standards - contains information and requirements in designing training program for certain Qualification. It includes curriculum design, training delivery; trainee entry requirements; tools equipment and materials; training facilities and trainer's qualification.
- Section 4 National Assessment and Certification Arrangements - describe the policies governing assessment and certification procedure.

TABLE OF CONTENTS
AUTOMOTIVE
(MANUFACTURING SUB-SECTOR)

LABORATORY AND METROLOGY/CALIBRATION
SERVICES NC II

	Page No.
SECTION 1	
LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II QUALIFICATION	1
SECTION 2	
COMPETENCY STANDARDS	
• Basic Competencies	2-13
• Common Competencies	14-25
• Core Competencies	26-35
SECTION 3	
TRAINING STANDARDS	
3.1	
Curriculum Design	
• Basic Competencies	36
• Common Competencies	37
• Core Competencies	37-38
3.2	
Training Delivery	38-39
3.3	
Trainee Entry Requirements	39
3.4	
List of Tools, Equipment and Materials	39-40
3.5	
Training Facilities	41
3.6	
Trainers' Qualifications	41
3.7	
Institutional Assessment	41
SECTION 4	
NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS	42
Annex A: COMPETENCY MAP	43
DEFINITION OF TERMS	44-45
ACKNOWLEDGEMENTS	46

TRAINING REGULATIONS FOR LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II

SECTION 1 LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II QUALIFICATION

The LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II Qualification consists of competencies that a person must achieve to perform laboratory and metrology/calibration services work. With the increasing demand for accuracy and reliability of dimensional measurement, laboratory and metrology/calibration services has become very important. The competence in this area requires the understanding and knowledge of a wide spectrum of dimensional mensuration processes that includes scientific planning, execution, assessment and calibration.

Dimensional mensuration is composed of the standard procedures and processes to measure geometrically defined dimensions of parts and components. This will include using simple measuring tools such as vernier calipers, bore gages, micrometers, etc. This also includes the use of sophisticated computerized measuring machines and electronic or electrical equipment used for measurements.

This Qualification is packaged from the competency map of the Automotive Industry (Manufacturing sub-sector) as shown in Annex A.

The Units of Competency comprising this Qualification include the following:

CODE NO.	BASIC COMPETENCIES
500311105	Participate in Workplace Communication
500311106	Work in Team Environment
500311107	Practice Career Professionalism
500311108	Practice Occupational Health and Safety Procedures
CODE NO.	COMMON COMPETENCIES
ALT742201	Read, Interpret and Apply Engineering Drawings
ALT311202	Perform Mensuration and Calculation
ALT723203	Read, Interpret and Apply Specifications and Manuals
ALT723205	Perform Shop Maintenance
CODE NO.	CORE COMPETENCIES
ALT315305	Perform Engineering Measurement
ALT315306	Perform Precision Mechanical Measurement
ALT315307	Calibrate Measuring Equipment

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

- **Laboratory and Metrology/Calibration Technician**

SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in LABORATORY AND METROLOGY/CALIBRATION SERVICES 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 <i>appropriate sources</i> 1.2 Effective questioning, active listening and speaking skills are used to gather and convey information 1.3 Appropriate <i>medium</i> 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 <i>storage</i> 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 <i>protocols</i> 2.4 <i>Workplace interactions</i> 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 Meetings outcomes are interpreted and implemented
3. Complete relevant work related documents	3.1 Range of <i>forms</i> 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 and attitudes</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. Method of assessment</p>	<ul style="list-style-type: none"> 5.1. Direct observation 5.2. Oral interview and written test
<p>6. Context of assessment</p>	<ul style="list-style-type: none"> 6.1. Competency may be assessed individually in the actual workplace or through accredited institution

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 <i>role and objective of the team</i> is identified from available <i>sources of information</i> 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 used and interactions undertaken with team members who contribute to known team activities and objectives 3.2. Effective and appropriate contributions made to complement team activities and objectives, based on individual skills and competencies and <i>workplace context</i> 3.3. Observed protocols 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 judgment 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> <ol 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>	<ol 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>	<ol 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> <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 tasks
<p>5. Method of assessment</p>	<p>Competency may be assessed through:</p> <ol 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 of assessment</p>	<ol 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. Method 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 of 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 <ul style="list-style-type: none"> • Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles • 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 designated 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
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 and Attitudes</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>4. 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>5. Method of assessment</p>	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> 5.1 Portfolio assessment 5.2 Interview 5.3 Case study/situation
<p>6. Context of 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
(AUTOMOTIVE MANUFACTURING-PARTS MANUFACTURING)**

UNIT TITLE: READ, INTERPRET AND APPLY ENGINEERING DRAWINGS.

UNIT CODE: ALT742201

UNIT DESCRIPTOR: This unit deals with identifying, interpreting and applying specification from engineering blue prints or drawings that provides the measurements of the product and pattern that is to be produced.

ELEMENT	PERFORMANCE CRITERIA
	<i>Italicized</i> terms are elaborated in the Range of Variables
1. Identify and access engineering drawings/ specification	1.1 Appropriate engineering drawings are identified and accessed as per job requirements. 1.2 Version and date of drawing is checked to ensure correct specification and procedure are identified.
2. Interpret drawings	2.1 Relevant dimensions and sections of the drawings/ specifications are located in relation to the work to be conducted 2.2 Information in the manual are interpreted in accordance to industry practices
3 Apply information in the drawings & specifications	3.1 Engineering drawing is interpreted according to job requirements 3.2 Work steps are correctly identified in accordance with the specifications in the drawings. 3.3 Dimensional data and shape are applied according to the given task
4. Store drawings	4.1 The drawings and specification are stored properly to ensure prevention of damage, ready access and updating of information when required in accordance with company requirements

RANGE OF VARIABLES

VARIABLE	RANGE
1. Engineering drawings	Kinds of drawings: 1.1 Casting drawing 1.2 Machining drawing 1.3 Project plan 1.4 Technical drawing
2. Data	Data includes but not limited to 2.1 Material specifications 2.2 Process specifications 2.3 Special instructions 2.4 Machining locating points 2.5 Clamping points 2.6 Amount of draft 2.7 Surface finish

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 Identified and accessed drawings/specification 1.2 Interpreted drawings 1.3 Applied information in drawings 1.4 Stored drawings
<p>2. Underpinning knowledge and attitudes</p>	<ul style="list-style-type: none"> 2.1 Types of drawings used in automotive manufacturing industry 2.2 Identification of symbols used in the drawings 2.3 Identification of units of measurements 2.4 Unit conversion 2.5 Attention to details, Perseverance, Honesty
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> 3.1 Reading and comprehension skills required to identify and interpret engineering drawings and specifications 3.2 Accessing information and data
<p>4. Resource implications</p>	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 4.1 All drawings/engineering specifications relative to automotive manufacturing 4.2 Job order, requisitions 4.3 Product sample
<p>5 Method of assessment</p>	<p>Competency MUST be assessed through:</p> <ul style="list-style-type: none"> 5.1 Observation with questioning 5.2 Interview
<p>6 Context of assessment</p>	<ul style="list-style-type: none"> 6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines 6.2 Assessment may be conducted in the workplace or a simulated environment.

UNIT OF COMPETENCY: PERFORM MENSURATION AND CALCULATION

UNIT CODE: ALT311202

UNIT DESCRIPTOR: This unit includes identifying, caring for, handling, using and maintaining measuring instruments.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</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 Appropriate <i>measuring instrument</i> is selected according to job requirements
2. Carry out measurements and calculation	2.1 Measuring tools are selected in line with job requirements 2.2 Accurate measurements are obtained to job 2.3 <i>Calculation</i> needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x) and division (/). 2.4 Calculations 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 kept free from corrosion 3.2 Measuring instruments are not dropped to avoid damage 3.3 Measuring instruments are cleaned before and after using.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Measuring instruments	Measuring instruments includes: 1.1 Multitester 1.2 Micrometer (In-out, depth) 1.3 Vernier caliper (Out, inside) 1.4 Dial Gauge with Mag. Std. 1.5 Straight Edge Thickness gauge 1.6 Try square 1.7 Protractor 1.8 Height gauge 1.9 Steel rule Shrink rule
2. Calculation	Kinds of part mensuration include: 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 2.11 Shrinkage allowance

EVIDENCE GUIDE

1. Critical aspect of competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Selected measuring instruments 1.2 Carried-out measurements and calculations. 1.3 Maintained measuring instruments
2. Underpinning knowledge and attitudes	<ul style="list-style-type: none"> 2.1 Types of Measuring instruments and its 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	<ul style="list-style-type: none"> 3.1 Caring and Handling measuring instruments 3.2 Calibrating and using measuring instruments 3.3 Performing calculation by Addition, Subtraction, Multiplication and Division 3.4 Visualizing objects and shapes 3.5 Interpreting formula for volume, area, perimeter and other geometric figures
4. Resource implications	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 4.1 Workplace location 4.2 Measuring instrument appropriate to servicing processes 4.3 Instructional materials relevant to the propose activity
5. Method of assessment	<p>Competency MUST be assessed through:</p> <ul style="list-style-type: none"> 5.1 Observation with questioning 5.2 Written or oral examination 5.3 Interview 5.4 Demonstration with questioning
6. Context of assessment	<ul style="list-style-type: none"> 6.1 Competency elements must be assessed in a safe working environment 6.2 Assessment may be conducted in a workplace or simulated environment

UNIT TITLE: READ, INTERPRET AND APPLY SPECIFICATION AND MANUALS.

UNIT CODE: ALT723203

UNIT DESCRIPTOR: This unit deals with identifying, interpreting and applying service specification manuals, maintenance procedure manuals and periodic maintenance manual

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Identify and access manual/ specification	1.1 Appropriate manuals are identified and accessed as per job requirements. 1.2 Version and date of manual is checked to ensure correct specification and procedure are identified.
2. Interpret manuals	2.1 Relevant sections, chapters of manuals/specifications are located in relations to the work to be conducted 2.2 Information and procedure in the manual are interpreted in accordance to industry practices
3 Apply information in manual	3.1 Manual is interpreted according to job requirements 3.2 Work steps are correctly identified in accordance with manufacturer specification 3.3 Manual data is applied according to the given task 3.4 All correct sequencing and adjustments are interpreted in accordance with information contained on the manual or specifications
4. Store manuals	4.1 Manual or specification are stored appropriately to ensure prevention of damage, ready access and updating of information when required in accordance with company requirements

RANGE OF VARIABLES

VARIABLE	RANGE
1. Manuals	Kinds of manuals: 1.1 Manufacturer's specification manual 1.2 Repair manual 1.3 Maintenance Procedure Manual 1.4 Periodic Maintenance Manual

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 Identified and accessed manual/specification 1.2 Interpreted manuals 1.3 Applied information in manuals 1.4 Stored manuals
<p>2. Underpinning knowledge and attitudes</p>	<ul style="list-style-type: none"> 2.1 Types of manuals used in automotive industry 2.2 Identification of symbols used in the manuals 2.3 Identification of units of measurements 2.4 Unit conversion
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> 3.1. Reading and comprehension skills required to identify and interpret automotive manuals and specifications 3.2. Accessing information and data
<p>4 Resource Implications</p>	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 4.1 All manuals/catalogues relative to Automotive 4.2 Job order, requisitions 4.3 Actual vehicle or simulator
<p>5 Method of assessment</p>	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> 5.1 Observation with questioning 5.2 Interview
<p>6 Context of assessment</p>	<ul style="list-style-type: none"> 6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines 6.2 Assessment may be conducted in the workplace or a simulated environment.

UNIT OF COMPETENCY : PERFORM SHOP MAINTENANCE

UNIT CODE : ALT723205

UNIT DESCRIPTOR : This unit deals with inspecting and cleaning of work area including tools, equipment and facilities. Storage and checking of tools/equipment and disposal of used supplies/materials are also incorporated in this competency.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables
1. Inspect/clean tools and work area	1.1 Cleaning solvent used as per workshop/tools <i>cleaning requirement</i> 1.2 <i>Work area</i> is checked and cleaned 1.3 Wet surface/spot in work area is wiped and dried
2. Store/arrange tools and shop equipment	2.1 Tools/equipment are checked and stored in their respective shelves/location 2.2 Corresponding labels are posted and visible 2.3 Tools are safely secured and logged in the records
3. Dispose wastes/used lubricants	3.1 Containers for used lubricants are visibly labeled 3.2 Wastes/used lubricants are disposed as per workshop SOP
4. Report damaged tools/equipment	4.1 Complete inventory of tools/equipment is maintained 4.2 Damaged tools/equipment/facilities are identified and repair recommendation is given 4.3 Reports prepared has no error/discrepancy

RANGE OF VARIABLES

VARIABLE	RANGE
1. Work area	Work areas include: <ol style="list-style-type: none"> 1.1 Workshop areas for servicing/repairing light and/or heavy vehicle and/or plant transmissions and/or outdoor power equipment 1.2 Open workshop/garage and enclosed, ventilated office area 1.3 Other variables may include workshop with: <ul style="list-style-type: none"> • Mess hall • Wash room • Comfort room
2. Cleaning requirement	<ol style="list-style-type: none"> 2.1 Cleaning solvent 2.2 Inventory of supplies, tools, equipment, facilities 2.3 List of mechanics/technicians 2.4 Rags 2.5 Broom 2.6 Mop 2.7 Pail 2.8 Used oil container 2.9 Oiler 2.10 Dust/waste bin
3. Manuals	<ol style="list-style-type: none"> 3.1 Vehicle/plant manufacturer specifications 3.2 Company operating procedures 3.3 Industry/Workplace Codes of Practice 3.4 Product manufacturer specifications 3.5 Customer requirements 3.6 Industry Occupational Health and Safety
4. Company standard operating procedure	Wearing of Personal protective equipment include: <ol style="list-style-type: none"> 4.1 Gloves 4.2 Apron 4.3 Goggles 4.4 Safety shoes

EVIDENCE GUIDE

1. Critical aspects of competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Cleaned workshop tools/facilities 1.2 Maintained equipment, tools and facilities 1.3 Disposed wastes and used lubricants/fluid as per required procedure
2. Underpinning knowledge and attitudes	<ul style="list-style-type: none"> 2.1 5 S or TQM 2.2 Service procedures 2.3 Relevant technical information 2.4 Safe handling of equipment and tools 2.5 Vehicle safety requirements 2.6 Workshop policies 2.7 Personal safety procedures 2.8 Fire extinguishers and prevention 2.9 Storage/disposal of hazardous/flammable materials 2.10 Positive Work Values (Perseverance, Honesty, Patience, Attention to Details)
3. Underpinning skills	<ul style="list-style-type: none"> 3.1 Handling/Storing of tools/equipment/supplies and material 3.2 Cleaning grease/lubricants 3.3 Disposing of wastes and fluid 3.4 Preparing inventory of s/m and tools and equipment 3.5 Monitoring of s/m and tools/equipment
4. Resource implications	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 4.1 Workplace: Real or simulated work area 4.2 Appropriate Tools & equipment 4.3 Materials relevant to the activity
5. Method of assessment	<p>Competency MUST be assessed through:</p> <ul style="list-style-type: none"> 5.1 Written/Oral Questioning 5.2 Demonstration
6. Context of assessment	<ul style="list-style-type: none"> 6.1 Competency must be assessed on the job or in a simulated environment. 6.2 The assessment of practical skills must take place after a period of supervised practice and repetitive experience.

CORE COMPETENCIES

UNIT OF COMPETENCY : **PERFORM ENGINEERING MEASUREMENTS**

UNIT CODE : **ALT315305**

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes required in measuring parts and components (with more than 0.01mm/0.025 inch tolerance) using mechanical measuring devices and associated calculations.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variable (All inspections methods are carried out according to <i>industry regulations/guidelines</i> , occupational health and safety and company procedures)
1. Select appropriate device or equipment	1.1 Measurement requirements are determined from specifications . 1.2 Appropriate device or equipment is selected according to standard operating procedures, to achieve required outcome.
2. Obtain measurements using a range of measuring devices	2.1 Correct and appropriate measuring technique is used. 2.2 Measurements are accurately obtained using a range of measuring devices . 2.3 Dimensions are determined or verified using basic calculations , where required.
3. Maintain measuring devices	3.1 Routine care and storage of devices is undertaken to manufacturers' specifications or standard operating procedures. 3.2 Routine adjustments to devices are made and checked.
4. Communicate measurements as required	4.1 Measurements are accurately recorded, where required. 4.2 Freehand sketch which depicts required information is prepared, as required.

RANGE OF VARIABLES

VARIABLE	RANGE										
1. Industry regulations/ guidelines	1.1 Strict adherence to automotive manufacturing standards such as: <ul style="list-style-type: none"> 1.1.1 Japanese industrial standards (JIS) 1.1.2 Society of Automotive Engineers (SAE) 1.1.3 American Society of Testing Materials (ASTM) 1.2 Compliance to Local Government Unit (LGU) or Department of Environment and Natural Resources (DENR) regulations <ul style="list-style-type: none"> 1.2.1 Handling, storing and disposal of chemical and other wastes 1.2.2 Pollution control 1.3 Provision of safety devices to equipment e.g. safety or limit switches, guards or railings 1.4 Use of personal protective equipment (cap, safety shoes, face shield/safety goggles, shop uniform)										
2. Specifications	2.1 Drawings 2.2 Sketches 2.3 Job instructions 2.4 Schematics 2.5 Diagrams 2.6 Technical manual										
3. Measuring devices	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">3.1 Protractors</td> <td style="width: 50%;">3.6 Tapes</td> </tr> <tr> <td>3.2 Combination squares</td> <td>3.7 Rules</td> </tr> <tr> <td>3.3 Jet squares</td> <td>3.8 Micrometers</td> </tr> <tr> <td>3.4 Dial indicators</td> <td>3.9 Vernier scaled measuring equipment</td> </tr> <tr> <td>3.5 Height gauges</td> <td></td> </tr> </table>	3.1 Protractors	3.6 Tapes	3.2 Combination squares	3.7 Rules	3.3 Jet squares	3.8 Micrometers	3.4 Dial indicators	3.9 Vernier scaled measuring equipment	3.5 Height gauges	
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3.2 Combination squares	3.7 Rules										
3.3 Jet squares	3.8 Micrometers										
3.4 Dial indicators	3.9 Vernier scaled measuring equipment										
3.5 Height gauges											
4. Basic calculations	Calculations needed to assist in determining measurements where a reading of the graduated device is not sufficient, for example subtracting one measurement from another to give a third measurement. Examples of calculations needed are: <ul style="list-style-type: none"> 3.1 Addition 3.2 Subtraction 3.3 Multiplication 3.4 Division 3.5 Fractions 3.6 Decimals Calculations may be made using a calculator or if applicable can be manual calculation										
5. Routine adjustments	Validating the device using <ul style="list-style-type: none"> 5.1 simple zeroing 5.2 scale adjustment 										
6. Measurements	<ul style="list-style-type: none"> 5.1 Measuring length 5.2 Squareness 5.3 Flatness 5.4 Angle 5.5 Roundness 5.6 Clearances or any other measurements that can be read off 5.7 analog measuring device 										
7. Information	<ul style="list-style-type: none"> 6.1 Dimensions 6.2 Instructions 6.3 Base line or datum points 										

EVIDENCE GUIDE

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <p>1.1 Selected the appropriate measuring instrument 1.2 Computed/Obtained measurement using the required measuring instrument 1.3 Maintained measuring instruments 1.4 Prepared the necessary reports or computation as required.</p>
<p>2. Underpinning knowledge and attitudes</p>	<p>2.1 Correct application of a range of measuring devices 2.2 Correct and appropriate measuring technique for a range of measuring devices 2.3 Addition, subtraction, multiplication, division, fractions, decimals to the scope required by this unit 2.4 Procedures for handling and storing a range of measuring devices 2.5 Procedures for adjusting and zeroing a range of measuring devices 2.6 Methods of communicating measurements by drawings as required 2.7 Safe work practices and procedures</p>
<p>3. Underpinning skills</p>	<p>3.1 Reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents 3.2 Planning and sequencing operations 3.3 Checking and clarifying task related information 3.4 Checking for conformance to specifications 3.5 Undertaking numerical operations involving addition, subtraction, multiplication, division, fractions and decimals 3.6 Preparing drawings as required 3.7 Selecting the appropriate measuring device for given measuring tasks 3.8 Using appropriate measuring technique 3.8 Reading all measurements taken accurately to the finest graduation of the selected measuring device 3.10 Handling and storing measuring devices in accordance with manufacturers' specifications or standard operating procedures 3.11 Verifying all measuring devices before use 3.12 Making routine adjustments to measuring devices</p>
<p>4. Resource implications</p>	<p>The following resources MUST be provided:</p> <p>4.1 Workplace: Real or simulated work area 4.2 Access to all tools & equipment materials and documentations required 4.3 Relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials</p>
<p>5. Method of assessment</p>	<p>Candidate MUST be assessed through:</p> <p>Observation with questioning Portfolio Third party report</p>
<p>6. Context of assessment</p>	<p>6.1 This unit may be assessed on the job, off the job or a combination of both on and off the job. 6.2 Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. 6.3 The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p>

UNIT OF COMPETENCY : **PERFORM PRECISION MECHANICAL MEASUREMENT**

UNIT CODE : **ALT315306**

UNIT DESCRIPTOR : This unit covers performing precision mechanical measurement (with less than 0.01mm/0.025 inch tolerance) by using precision measuring equipment, setting comparison measuring devices and maintaining precision equipment.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables (All inspections methods are carried out according to <i>industry regulations/guidelines</i> , occupational health and safety and company procedures)
1. Use precision measurement equipment	1.1 Appropriate <i>precision mechanical equipment</i> is selected to achieve specified outcome. 1.2 Correct and <i>appropriate measuring techniques</i> are used for the measurement task. 1.3 <i>Measurements</i> are taken accurately to the finest graduation of instrument. 1.4 Readings and measurements are interpreted correctly and accurately.
2. Set comparative measuring devices	2.1 Statistical analyses of previous measurements are conducted in accordance with standard operating procedures. 2.2 Comparative measuring equipment is set to specifications using manufacturer guidelines or standard operating procedures and techniques.
3. Maintain precision equipment	3.1 Measuring equipment is adjusted and maintained to required accuracy, using manufacturer or standard operating procedures and techniques. 3.2 Equipment is stored to manufacturer specifications or standard operating procedures.

RANGE OF VARIABLES

VARIABLE	RANGE																		
1. Industry regulations/ guidelines	Strict adherence to automotive manufacturing standards such as: <ul style="list-style-type: none"> 1.1.1 Japanese industrial standards (JIS) 1.1.2 Society of Automotive Engineers (SAE) 1.1.3 American Society of Testing Materials (ASTM) 1.2 Compliance to Local Government Unit (LGU) or Department of Environment and Natural Resources (DENR) regulations <ul style="list-style-type: none"> 1.2.1 Handling, storing and disposal of chemical and other wastes 1.2.2 Pollution control 1.3 Provision of safety devices to equipment e.g. safety or limit switches, guards or railings 1.4 Use of personal protective equipment (cap, safety shoes, face shield/safety goggles, shop uniform) 																		
2. Precision mechanical equipment	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">2.1 Strip gauges</td> <td style="width: 50%;">2.9 Rotary tables</td> </tr> <tr> <td>2.2 Engineering squares</td> <td>2.10 Precision levels</td> </tr> <tr> <td>2.3 Gauge blocks</td> <td>2.11 Vernier calipers</td> </tr> <tr> <td>2.4 Sine bars</td> <td>2.12 Micrometers</td> </tr> <tr> <td>2.5 Angle gauges</td> <td>2.13 Height gauges</td> </tr> <tr> <td>2.6 Polygons</td> <td>2.14 Hardness testers</td> </tr> <tr> <td>2.7 Dividing heads</td> <td>2.15 Texture measuring equipment</td> </tr> <tr> <td>2.8 Bore gauge</td> <td>2.16 Surface plate (Granite)</td> </tr> <tr> <td></td> <td>2.17 Air gauge</td> </tr> </table>	2.1 Strip gauges	2.9 Rotary tables	2.2 Engineering squares	2.10 Precision levels	2.3 Gauge blocks	2.11 Vernier calipers	2.4 Sine bars	2.12 Micrometers	2.5 Angle gauges	2.13 Height gauges	2.6 Polygons	2.14 Hardness testers	2.7 Dividing heads	2.15 Texture measuring equipment	2.8 Bore gauge	2.16 Surface plate (Granite)		2.17 Air gauge
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2.7 Dividing heads	2.15 Texture measuring equipment																		
2.8 Bore gauge	2.16 Surface plate (Granite)																		
	2.17 Air gauge																		
3. Appropriate measuring techniques	Includes considerations of the suitability of the environmental conditions for measurements being taken such as <ul style="list-style-type: none"> 3.1 set up of parts/components to be measured 3.2 temperature 3.3 relative humidity 3.4 barometric pressure 3.5 surface stability 																		
4. Measurements	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">4.1 Length</td> <td style="width: 50%;">4.7 Finishes</td> </tr> <tr> <td>4.2 Circular</td> <td>4.8 Textures</td> </tr> <tr> <td>4.3 Straightness</td> <td>4.9 Roundness</td> </tr> <tr> <td>4.4 Flatness</td> <td>4.10 Squareness</td> </tr> <tr> <td>4.5 Hardness</td> <td>4.11 Alignment</td> </tr> <tr> <td>4.6 Angles</td> <td>4.12 Coordinate measurement etc. on components or equipment</td> </tr> </table>	4.1 Length	4.7 Finishes	4.2 Circular	4.8 Textures	4.3 Straightness	4.9 Roundness	4.4 Flatness	4.10 Squareness	4.5 Hardness	4.11 Alignment	4.6 Angles	4.12 Coordinate measurement etc. on components or equipment						
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4.6 Angles	4.12 Coordinate measurement etc. on components or equipment																		

EVIDENCE GUIDE

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <p>1.1 Used precision measuring instrument 1.2 Had set comparative measuring devices 1.3 Maintained precision measuring instrument.</p>
<p>2. Underpinning knowledge and attitudes</p>	<p>2.1 Precision mechanical measuring device for given measurement 2.2 Procedures to verify equipment being used has been calibrated 2.3 Environmental conditions for the measurements being carried out 2.4 Procedures/techniques for obtaining a range of mechanical measurements 2.5 Accuracy to which a range of precision mechanical measuring devices can be read 2.6 Procedures for reading graduated mechanical measuring devices 2.7 Units of measurement and numerical operations 2.8 Procedures for setting precision mechanical measuring devices 2.9 Specifications of the equipment to be set 2.10 Tools and equipment for setting mechanical measuring devices 2.11 Adjustments that can be made to a range of precision mechanical measuring devices 2.12 Procedures for adjusting and maintaining precision mechanical measuring devices 2.13 Procedures for storing precision mechanical measuring devices 2.14 Hazards and control measures associated with precision mechanical measurement, including housekeeping 2.15 Safe work practices and procedures</p>
<p>3. Underpinning skills</p>	<p>3.1 Reading and interpreting text and numerical information on manufacturer specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents 3.2 Selecting/using precision mechanical measuring devices 3.3 Setting measuring devices to specification 3.4 Obtaining specified mechanical measurements to the finest graduation of the device 3.5 Measuring components to specified tolerances 3.6 Reading and interpreting measurements 3.7 Maintaining and adjusting precision mechanical measuring devices storing precision mechanical measuring devices 3.8 Undertaking calculations and numerical operations for measurement using precision mechanical measuring equipment</p>
<p>4. Resource implications</p>	<p>The following resources MUST be provided:</p> <p>4.1 Workplace: Real or simulated work area 4.2 Access to all tools & equipment materials and documentations 4.3 Relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials</p>
<p>5. Method of assessment</p>	<p>Candidate MUST be assessed through:</p> <p>5.1 Observation with questioning 5.2 Portfolio 5.3 Third party report</p>
<p>6. Context of assessment</p>	<p>6.1 This unit may be assessed on the job, off the job or a combination of both on and off the job. 6.2 Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</p>

UNIT OF COMPETENCY : CALIBRATE MEASURING EQUIPMENT

UNIT CODE : ALT315307

UNIT DESCRIPTOR : This unit covers checking engineering and precision measuring equipment for correct operation, and validating/calibrating precision measuring equipment in accordance with predetermined procedures.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables (All inspections methods are carried out according to <i>industry regulations/guidelines</i> , occupational health and safety and company procedures)
1. Check equipment for correct operation	Statistical analyses of previous measurements are conducted in accordance with standard operating procedures. Physical conditions of measuring equipment are checked in accordance with standard operating procedures.
2. Validate/calibrate precision measuring equipment	2.1 Calibration of precision measuring equipment is assessed to manufacturers' specifications and/or standard operating procedures. 2.2 Equipment is calibrated against appropriate physical standards using correct calibration devices , equipment, techniques using predetermined procedures. 2.3 Equipment is recommissioned in accordance with standard operating procedures. 2.4 Calibration activity is recorded, updated and stored.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Physical condition	Components are checked for wear loose connections other faults
2. Physical standards	Reference standards of: 2.1 Mass length 2.2 Time 2.3 Temperature 2.4 Pressure 2.5 Volume 2.6 Process characteristics etc.
3. Calibration devices, equipment	3.1 Micrometer 3.2 All types of calipers 3.3 Gauge blocks (bores, squares, micrometer blocks, etc.) 3.4 Voltmeter 3.5 Oscilloscope 3.6 All types of comparators 3.7 Jigs and fixtures 3.8 Templates, protractors, patterns etc. 3.9 Ultrasonics
4. Recommissioned	5.1 Sealing 5.2 Tagging 5.3 Recommendation for usage/application 5.4 Identification or storage in accordance with standard operating procedures

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 checked equipment for correct operation 1.2 validated/calibrated precision measuring equipment
<p>2. Underpinning knowledge and attitudes</p>	<ul style="list-style-type: none"> 2.1 Precision mechanical measuring device for given measurement 2.2 Procedures to verify equipment being used has been calibrated 2.3 Environmental conditions for the measurements being carried out 2.4 Procedures/techniques for obtaining a range of mechanical measurements 2.5 Accuracy to which a range of precision mechanical measuring devices can be read 2.6 Measuring equipment specifications, operation, wearing 2.7 parts, connections and components 2.8 Procedures for reading graduated mechanical measuring devices 2.9 Units of measurement and numerical operations 2.10 Procedures for setting precision mechanical measuring devices 2.11 Specifications of the equipment to be set 2.12 Tools and equipment for setting mechanical measuring devices 2.13 Adjustments that can be made to a range of precision mechanical measuring devices 2.14 Common fault(s) that may be found in the measuring equipment 2.15 Effects of faults on the performance/accuracy of the measuring equipment 2.16 General knowledge of standards, legislative or regulatory requirements applicable to the measuring equipment and/or its calibration 2.17 standard operating procedures for calibrating the measuring equipment and the tools and equipment required to do so 2.18 Standard operating procedures for commissioning the measuring equipment 2.19 Calibration records to be kept/maintained in accordance with standard operating procedures 2.20 Procedures for adjusting and maintaining precision mechanical measuring devices 2.21 Procedures for storing precision mechanical measuring devices 2.22 Hazards and control measures associated with precision mechanical measurement, including housekeeping 2.23 Safe work practices and procedures
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> 3.1 Interpreting work requirements 3.2 Using appropriate tools and equipment to check measuring equipment for faults 3.3 Using appropriate techniques to check the calibration of the measuring equipment for conformance to specifications 3.4 Calibrating the measuring equipment against the appropriate physical standard 3.5 Recommissioning the measuring equipment 3.6 Using literacy and numeracy skills to enable correct completion of calibration records 3.7 Checks that are to be made of the measuring equipment and the tools and equipment to be used when checking the measuring equipment

4 Resource implications	The following resources MUST be provided: 4.1 Workplace: Real or simulated work area 4.2 Access to all tools & equipment materials and documentations 4.3 Relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials
5 Method of assessment	Candidate MUST be assessed through: 5.1 Observation with questioning 5.2 Portfolio 5.3 Third party report
6 Context of assessment	6.1 This unit may be assessed on the job, off the job or a combination of both on and off the job. 6.2 Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.

SECTION 3 TRAINING STANDARDS

These guidelines are set to provide the Technical and Vocational Education and Training (TVET) providers with information and other important requirements to consider when designing training programs for LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II.

3.1 CURRICULUM DESIGN

Course Title: **LABORATORY AND METROLOGY/CALIBRATION SERVICES**

Level: **NC II**

Nominal Training Duration: **18 Hours** (Basic Competencies)
 20 Hours (Common Competencies)
 56 Hours (Core Competencies)

Course Description:

This course is designed to equip individual with competency to perform Laboratory and Metrology/Calibration Services work including mensuration of engineering prototypes, automotive parts, geometric shapes and similar components. Measurements may be taken using ordinary manual equipment..

It also includes competencies on interpreting specifications, drawings, technical sketches and/or customer requirements. Tasks undertaken would also include utilizing appropriate standards, calibrating tools and proper machineries using principles and techniques; designated procedures, correct and appropriate inspection methods, measure and repair procedures; sets up and operates variety of specialized coordinate measuring machines needed for precision measurements and calibration.

This course is also designed to provide basic and common skills to equip individual with operational skills in Laboratory and Metrology/Calibration Services.

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

BASIC COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
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

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
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

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Read, Interpret and Apply Engineering Drawings	1.1 Identify and access engineering drawings/ specification 1.2 Interpret drawings 1.3 Apply information in the drawings & specifications 1.4 Store drawings	<ul style="list-style-type: none"> • Lecture/ Demonstration • Dual training • Self paced (modular) • Distance Learning 	<ul style="list-style-type: none"> • Written test • Oral questioning • Direct observation • Project method • Interview
2. Perform Mensuration and Calculation	2.1 Select measuring instrument and carry out measurement and calculations. 2.2 Maintain measuring instruments	<ul style="list-style-type: none"> • Lecture/ Demonstration • Dual training • Self paced (modular) • Distance Learning 	<ul style="list-style-type: none"> • Written test • Oral questioning • Direct observation • Project method • Interview
3. Read, Interpret and Apply Specifications and Manual	3.1 Identify/accessed manuals and interpret data and specification 3.2 Apply information accessed in manual 3.3 Store manual	<ul style="list-style-type: none"> • Lecture/ Demonstration • Dual training • Self paced (modular) • Distance Learning 	<ul style="list-style-type: none"> • Written test • Oral questioning • Direct observation • Project method • Interview
4. Perform Shop Maintenance	4.1 Inspect/clean tools and work area 4.2 Store/arrange tools and shop equipment 4.3 Dispose wastes/used lubricants 4.4 Report damaged tools/equipment	<ul style="list-style-type: none"> • Lecture/ Demonstration • Dual training • Self paced (modular) • Distance Learning 	<ul style="list-style-type: none"> • Written test • Oral questioning • Direct observation • Project method • Interview

CORE COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Perform Engineering measurement	1.1 Select measuring instruments 1.2. Carry out engineering measurement 1.3 Maintain measuring tools, devices and instruments	<ul style="list-style-type: none"> • Demonstration • Discussion 	<ul style="list-style-type: none"> • Written examination • Demonstration of practical skills • Practical Test

2. Perform precision mechanical measurement	2.1 Select measuring instruments 2.2. Carry out measurements/ calculations 2.3 Maintain measuring instruments	• Demonstration • Discussion	• Interview • Practical test • Direct Observation
3. Calibrate measuring equipment	3.1 Check equipment for correct operation 3.2. Validate / Calibrate precision measuring equipment	• Demonstration • Discussion	• Practical test

3.2 TRAINING DELIVERY

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

- The training is based on curriculum developed from the competency standards;
- Learning is modular in its structure;
- Training delivery is learner-centered and should accommodate individualized and self-paced learning strategies;
- 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 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 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 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 instructor are not in the same place. Distance learning may employ correspondence study, or audio, video or computer technologies.
- Project-Based Instruction is an authentic instructional model or strategy in which students plan, implement and evaluate projects that have real world applications.

3.3 TRAINEE ENTRY REQUIREMENTS

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

- With background in basic mensuration
- With good moral character;
- Ability to communicate both oral and written; and
- Physically and mentally fit

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II

Recommended list of tools, equipment and materials for the training of 25 trainees for LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II

TOOLS		EQUIPMENT		MATERIALS	
QTY		QTY		QTY	
25 units	Line graduated rules	2 units	Oil Free Compressor		
25 units	Line graduated Bar standard	1 unit	Air Conditioner		
25 units	Vernier caliper	2 units	Air Handling Equipment		
6 units	Outside Micrometer	3 units	Surface Plate		
5 units	Inside micrometer	1 set	Dial indicator with gage stand or comparator base		
6 pcs.	Bore gauges	3 units			
2 units	Master setting gages	1 set			
1 unit	Gage block standard for square, rectangular and round	3 units		20 L.	Solvent Naptha
2 units	Height gage	1 unit			
4 units	Sine bar	1 unit			
2 units	Depth indicator gage	5 units			
15 pcs.	Rubber glove	10 units			
15 pcs.	Cotton glove	3 units			
15 pcs.	Nylon glove	2 units			
15 pcs.	Goggle				
15 pcs.	Gas mask				
15 pcs.	Safety shoe				
15 pcs.	Apron				

1 yard	Filter Cloth (200 mesh)				
				30 pcs.	Sandpaper (Asstd. Grit) Grit# 1200 Grit# 600 Grit# 400 Grit# 360 Grit# 280 Grit# 180
				2 kls.	White rag (De Hilo)

3.5 TRAINING FACILITIES LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II

Based on a class size of 25 students/trainees

SPACE REQUIREMENT	SIZE IN METERS	AREA IN SQ. METERS	TOTAL AREA IN SQ. METERS
• Building (permanent)	26.00 x 28.00	728.00	728.00
• Trainee Working Space	2.0 x 1.5 per student/trainee	3.0 per student	75.00
• Lecture Room	9.00 x 10.00	90.00	90.00
• Learning Resource Center	5.00 x 8.00	40.00	40.00
• Facilities/ Equipment/ Circulation Area	-	-	523.00

3.6 TRAINER'S QUALIFICATIONS FOR AUTOMOTIVE SECTOR MANUFACTURING SUB-SECTOR

LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II TRAINER QUALIFICATION (TQ II)

- Must be a holder of an Engineering or similar course
- Must have undergone training on Training Methodology II (TM II)
- Must be computer literate
- Must be physically and mentally fit
- *Must have at least 4 years job/industry experience
- Must be a civil service eligible (for government position or appropriate professional license issued by the Professional Regulatory Commission)

* Optional. Only when required by the hiring institution.
Reference: TESDA Board Resolution No. 2004 03

3.7 INSTITUTIONAL ASSESSMENT

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

SECTION 4 NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS

- 4.1 To attain the National Qualification of LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II, the candidate must demonstrate competence in all the units listed in Section 1.

Successful candidates shall be awarded a National Certificate signed by the TESDA Director General.

- 4.2 Individual aspiring to be awarded the qualification of of LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II must acquire Certificates of Competency in all the following core units of the Qualification. Candidates may apply for assessment in any accredited assessment center.

4.2.1 Perform Engineering Measurement

4.2.2 Perform Precision Mechanical Measurement

4.2.3 Calibrate Measuring Equipment

- 4.3 Assessment shall focus on the core units of competency. The basic and common units shall be integrated or assessed concurrently with the core units.

- 4.4 The following are qualified to apply for assessment and certification:

4.4.1 Graduates of formal, non-formal and informal including enterprise-based training programs.

4.4.2 Experienced workers (wage employed or self-employed)

- 4.5 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).

**COMPETENCY MAP- AUTOMOTIVE SECTOR
MANUFACTURING SUB-SECTOR
(Parts Manufacturing)**

ANNEX A

LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II

CORE COMPETENCIES	Develop and Manufacture Wood Pattern	Develop and Manufacture Polymer Pattern	Develop and Manufacture Assembled Plated Pattern	Develop and Manufacture Production Pattern	Perform General woodworking Machine Operations	Use and Maintain Measuring Instrument	
	Prepare & mix sand for metal molding	Produce Molds by Hand	Produce Cores by Hand	Operate Molding Machine	Operate Core-Making Machine	Pour Molten Metal to Molds	Use and Maintain Measuring Instrument
	Operate melting furnaces (non-electric)	Operate Cupola Melting Furnace	Operate Electric Induction Melting Furnace	Fettle & Trim Metal Castings/Forgings	Perform Refractory Installation & Repair	Use & Maintain Measuring Instrument	
	Perform Engineering Measurement	Perform Precision Mechanical Measurement	Calibrate Measuring Equipment	Select and Control Inspection Processes and Procedure	Perform Product Inspection	Perform Basic Statistical Quality Control	Use Improvement Processes in Team Activities
	Prepare Molds for Composites Production	Prepare Materials for Formulae	Assemble Materials and Equipment for Production	Operate Injection Molding Equipment	Operate Blow Molding Equipment	Monitor Process Operations	Finish Products and Components

COMMON COMPETENCIES	Read & Interpret Engineering Drawings	Perform Mensuration and Calculation	Read, Interpret and Apply Specifications and Manuals	Perform Shop Maintenance
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BASIC COMPETENCIES	Receive and respond workplace communication	Work with Other	Demonstrate work values	Practice basic housekeeping procedures	Lead in workplace communication	Develop and practice negotiation skills	Use relevant technologies	Solve workplace problems related to work activities
	Participate in workplace communication	Work in team environment	Practice career professionalism	Practice occupational health and safety procedures	Lead small Team	Use mathematical concepts and techniques	Develop team and individual	Apply problem solving techniques in the workplace
	Plan and organize work	Utilize specialist communication skills						

Legend:
LABORATORY AND METROLOGY/CALIBRATION SERVICES NC II 

DEFINITION OF TERMS

1. **Accuracy** **Accuracy** designates the degree of agreement of the measured size with its true magnitude as expressed in standard units of measurement.
2. **Caliper gauges** **Caliper gauges** are measuring device with jaws establish the length to be measured by positive contact. One of the jaws is integral with the graduated beam, the other has markings to indicate the corresponding scale position.
3. **Dial indicators** **Dial indicators** are instruments used to accurately measure a small distance. These may be used to check the variation in tolerance during the inspection process of a machined part, measure the deflection of a beam or ring under laboratory conditions, as well as many other situations where a small measurement needs to be registered or indicated.
4. **Diffraction gratings** **Diffraction gratings** are transparent plates, usually made of glass, having a large number of equally spaced parallel lines.
5. **DMC (Dimensional Mark-up Language)** **DMC (Dimensional Mark-up Language)** is the release and ongoing development and testing a global language for metrology systems interfaces.
6. **Gauge blocks** **Gauge blocks** are precision ground and lapped measuring standards. They are used as references for the setting of measuring equipment such as micrometers, sine bars, dial indicators (when used in an inspection role).
7. **Line graduated master scales** **Line graduated master scales** is the basis for the operation of optical instruments for absolute length measurements.
8. **Line graduated rules** **Line graduated rules** are available in widely different degrees of accuracy to suit diverse requirements for plain length measuring tools.
9. **Metrology** **Metrology** designates the science of all measurements that are made by comparing the dimensionally measurable conditions of solids, or of diverse physical phenomena to generally accepted units of measurement. It is a branch of technology concerned with the measurement of geometrically defined dimensions of technical parts.
10. **Micrometer** **Micrometer** is a measuring device using rotation of the threaded spindle causes controlled advance of the spindle's contact face relative to an integral reference face.
11. **Precision** **Precision** expresses the degree of repeatability of the measuring process. It designates how closely identical values are obtained when repeating the same measurement at various intervals, or duplicating them by means of different instruments.
12. **Random errors** **Random errors** are statistical fluctuations (in either direction) in the measured data due to the precision limitations of the measurement device.

13. Sine bar

Sine bar is a hardened, precision ground body with two precision ground cylinders fixed at the ends. The distance between the centers of the cylinders is precisely controlled, and the top of the bar is parallel to a line through the centers of the two rollers.

14. Standard deviation

Standard deviation is the measure of the dispersion of a set of data from its mean. The more spread apart the data is, the higher the deviation.

15. Tolerance

Tolerance is the allowable variance from a nominal value established by design engineers that is deemed non harmful to the functioning of the product.

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