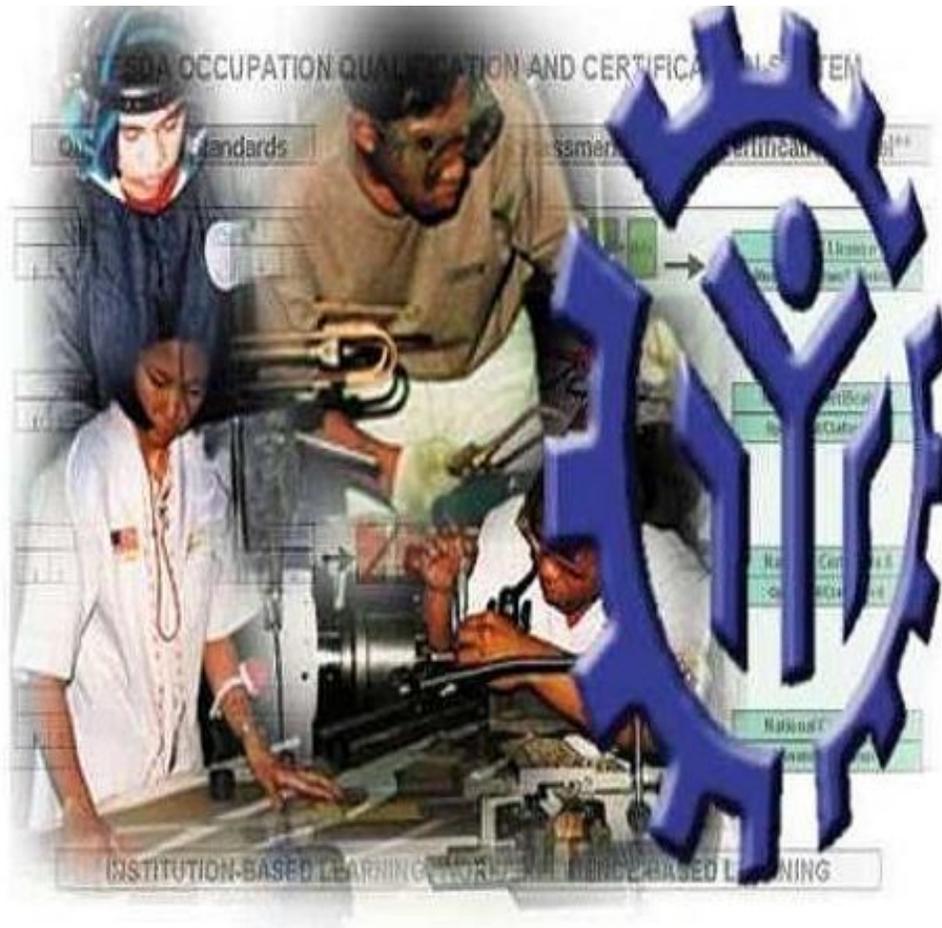


# TRAINING REGULATIONS



## FORGING NC II

**AUTOMOTIVE MANUFACTURING SECTOR**

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

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## TRAINING REGULATIONS FOR FORGING NC II

### SECTION 1 FORGING NC II QUALIFICATION

The FORGING NC II Qualification consists of competencies that a person must achieve to be able to perform hand and hammer forging of low to medium carbon and alloy up to steel carbon and alloy steels using a variety of techniques, tools, formers and heating devices. It also include basic incidental heat/quenching, tempering and annealing of ferrous and non-ferrous metals of various types and thicknesses.

**Forging** is the term for shaping metal by using localized compressive forces. Cold forging is done at room temperature or near room temperature. Hot forging is done at a high temperature, which makes metal easier to shape and less likely to fracture. Warm forging is done at intermediate temperature between room temperature and hot forging temperatures. Forged parts can range in weight from less than a kilogram to 170 metric tons. Forged parts usually require further processing to achieve a finished part.

The Units of Competency comprising this Qualification include the following:

<b>CODE NO.</b>	<b>BASIC COMPETENCIES</b>
500311105	Participate in workplace communication
500311106	Work in team environment
500311107	Practice career professionalism
500311108	Practice occupational health and safety procedures

<b>CODE NO.</b>	<b>COMMON COMPETENCIES</b>
ALT742201	Read & Interpret Engineering Drawings
ALT311202	Perform Mensuration and Calculation
ALT723203	Read, Interpret and Apply Specifications and Manuals
ALT723205	Perform Shop Maintenance

<b>CODE NO.</b>	<b>CORE COMPETENCIES</b>
ALT722301	Perform Hand Forging
ALT722302	Perform Hammer Forging
ALT722303	Perform Basic Incidental Heat/Quenching, Tempering and Annealing

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

- Blacksmith; or
- Hammer smith

## SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in **FORGING 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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <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 <b>appropriate sources</b> 1.2 Effective questioning , active listening and speaking skills are used to gather and convey information 1.3 Appropriate <b>medium</b> 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 <b>storage</b> 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 <b>protocols</b> 2.4 <b>Workplace interactions</b> 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 <b>forms</b> 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"> <li>1.1 Prepared written communication following standard format of the organization</li> <li>1.2 Accessed information using communication equipment</li> <li>1.3 Made use of relevant terms as an aid to transfer information effectively</li> <li>1.4 Conveyed information effectively adopting the formal or informal communication</li> </ul>
<p>2. Underpinning Knowledge and Attitudes</p>	<ul style="list-style-type: none"> <li>2.1 Effective communication</li> <li>2.2 Different modes of communication</li> <li>2.3 Written communication</li> <li>2.4 Organizational policies</li> <li>2.5 Communication procedures and systems</li> <li>2.6 Technology relevant to the enterprise and the individual's work responsibilities</li> </ul>
<p>3. Underpinning Skills</p>	<ul style="list-style-type: none"> <li>3.1 Follow simple spoken language</li> <li>3.2 Perform routine workplace duties following simple written notices</li> <li>3.3 Participate in workplace meetings and discussions</li> <li>3.4 Complete work related documents</li> <li>3.5 Estimate, calculate and record routine workplace measures</li> <li>3.6 Basic mathematical processes of addition, subtraction, division and multiplication</li> <li>3.7 Ability to relate to people of social range in the workplace</li> <li>3.8 Gather and provide information in response to workplace Requirements</li> </ul>
<p>4. Resource Implications</p>	<ul style="list-style-type: none"> <li>4.1 Fax machine</li> <li>4.2 Telephone</li> <li>4.3 Writing materials</li> <li>4.4 Internet</li> </ul>
<p>5. Method of Assessment</p>	<ul style="list-style-type: none"> <li>5.1 Direct Observation</li> <li>5.2 Oral interview and written test</li> </ul>
<p>6. Context of Assessment</p>	<ul style="list-style-type: none"> <li>6.1 Competency may be assessed individually in the actual workplace or through accredited institution</li> </ul>

**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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables
1. Describe team role and scope	1.1 The <b><i>role and objective of the team</i></b> is identified from available <b><i>sources of information</i></b> 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 <b><i>workplace context</i></b> 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> <ul style="list-style-type: none"> <li>1.1 Operated in a team to complete workplace activity</li> <li>1.2 Worked effectively with others</li> <li>1.3 Conveyed information in written or oral form</li> <li>1.4 Selected and used appropriate workplace language</li> <li>1.5 Followed designated work plan for the job</li> <li>1.6 Reported outcomes</li> </ul>
<p>2. Underpinning Knowledge and Attitude</p>	<ul style="list-style-type: none"> <li>2.1 Communication process</li> <li>2.2 Team structure</li> <li>2.3 Team roles</li> <li>2.4 Group planning and decision making</li> </ul>
<p>3. Underpinning Skills</p>	<ul style="list-style-type: none"> <li>3.1 Communicate appropriately, consistent with the culture of the workplace</li> </ul>
<p>4. Resource Implications</p>	<p>The following resources <b>MUST</b> be provided:</p> <ul style="list-style-type: none"> <li>4.1 Access to relevant workplace or appropriately simulated environment where assessment can take place</li> <li>4.2 Materials relevant to the proposed activity or tasks</li> </ul>
<p>5. Method of Assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Observation of the individual member in relation to the work activities of the group</li> <li>5.2 Observation of simulation and or role play involving the participation of individual member to the attainment of organizational goal</li> <li>5.3 Case studies and scenarios as a basis for discussion of issues and strategies in teamwork</li> </ul>
<p>6. Context of Assessment</p>	<ul style="list-style-type: none"> <li>6.1 Competency may be assessed in workplace or in a simulated workplace setting</li> <li>6.2 Assessment shall be observed while task are being undertaken whether individually or in group</li> </ul>

**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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <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 are maintained in the course of managing oneself based on performance <b>evaluation</b> 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 <b>Resources</b> 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 <b>Trainings and career opportunities</b> are identified and availed of based on job requirements 3.2 <b>Recognitions</b> are -sought/received and demonstrated as proof of career advancement 3.3 <b>Licenses and/or certifications</b> 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	Assessment requires evidence that the candidate: 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	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	3.1 Appropriate practice of personal hygiene 3.2 Intra and Interpersonal skills 3.3 Communication skills
4. Resource Implications	The following resources <b>MUST</b> be provided: 4.1 Workplace or assessment location 4.2 Case studies/scenarios
5. Method of Assessment	Competency may be assessed through: 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	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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables
1. Identify hazards and risks	1.1 <b>Safety regulations</b> and workplace safety and hazard control practices and procedures are clarified and explained based on organization procedures 1.2 <b>Hazards/risks</b> 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 <b>Contingency measures</b> 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 <b>Personal protective equipment (PPE)</b> 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 <b>Emergency-related drills and trainings</b> are participated in as per established organization guidelines and procedures 4.2 <b>OHS personal records</b> 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"> <li>• Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles</li> <li>• Physiological factors – monotony, personal relationship, work out cycle</li> </ul>
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"> <li>1.1 Explained clearly established workplace safety and hazard control practices and procedures</li> <li>1.2 Identified hazards/risks in the workplace and its corresponding indicators in accordance with company procedures</li> <li>1.3 Recognized contingency measures during workplace accidents, fire and other emergencies</li> <li>1.4 Identified terms of maximum tolerable limits based on threshold limit value- TLV.</li> <li>1.5 Followed Occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace</li> <li>1.6 Used Personal Protective Equipment (PPE) in accordance with company OHS procedures and practices</li> <li>1.7 Completed and updated OHS personal records in accordance with workplace requirements</li> </ul>
<p>2. Underpinning Knowledge and Attitude</p>	<ul style="list-style-type: none"> <li>2.1 OHS procedures and practices and regulations</li> <li>2.2 PPE types and uses</li> <li>2.3 Personal hygiene practices</li> <li>2.4 Hazards/risks identification and control</li> <li>2.5 Threshold Limit Value -TLV</li> <li>2.6 OHS indicators</li> <li>2.7 Organization safety and health protocol</li> <li>2.8 Safety consciousness</li> <li>2.9 Health consciousness</li> </ul>
<p>3. Underpinning Skills</p>	<ul style="list-style-type: none"> <li>3.1 Practice of personal hygiene</li> <li>3.2 Hazards/risks identification and control skills</li> <li>3.3 Interpersonal skills</li> <li>3.4 Communication skills</li> </ul>
<p>4. Resource Implications</p>	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> <li>4.1 Workplace or assessment location</li> <li>4.2 OHS personal records</li> <li>4.3 PPE</li> <li>4.4 Health records</li> </ul>
<p>5. Method of Assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Portfolio Assessment</li> <li>5.2 Interview</li> <li>5.3 Case Study/Situation</li> </ul>
<p>6. Context of Assessment</p>	<ul style="list-style-type: none"> <li>6.1 Competency may be assessed in the work place or in a simulated work place setting</li> </ul>

**COMMON COMPETENCIES**  
**AUTOMOTIVE 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 <b>Engineering drawings</b> 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 <b>data</b> 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

1. Critical aspects of competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Identified and accessed drawings/specification</li> <li>1.2 Interpreted drawings</li> <li>1.3 Applied information in drawings</li> <li>1.4 Stored drawings</li> </ul>
2. Underpinning knowledge and attitudes	<ul style="list-style-type: none"> <li>2.1 Types of drawings used in automotive manufacturing industry</li> <li>2.2 Identification of symbols used in the drawings</li> <li>2.3 Identification of units of measurements</li> <li>2.4 Unit conversion</li> <li>2.5 Attention to details, Perseverance, Honesty</li> </ul>
3. Underpinning skills	<ul style="list-style-type: none"> <li>3.1 Reading and comprehension skills required to identify and interpret engineering drawings and specifications</li> <li>3.2 Accessing information and data</li> </ul>
4. Resource implications	<p>The following resources <b>MUST</b> be provided:</p> <ul style="list-style-type: none"> <li>4.1 All drawings/engineering specifications relative to automotive manufacturing</li> <li>4.2 Job order, requisitions</li> <li>4.3 Product sample</li> </ul>
5. Method of assessment	<p>Competency <b>MUST</b> be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Observation with questioning</li> <li>5.2 Interview</li> </ul>
6. Context of assessment	<ul style="list-style-type: none"> <li>6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines</li> <li>6.2 Assessment may be conducted in the workplace or a simulated environment.</li> </ul>

**UNIT OF COMPETENCY :**      **PERFORM MENSURATION AND CALCULATION**

**UNIT CODE :**                      **ALT311202**

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

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <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 <b><i>measuring instrument</i></b> 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 <b><i>Calculation</i></b> 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 1.6 Thickness gauge 1.7 Try square 1.8 Protractor 1.9 Height gauge 1.10 Steel rule 1.11 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 aspects of competency	Assessment requires evidence that the candidate: 1.1 Selected measuring instruments 1.2 Carried-out measurements and calculations. 1.3 Maintained measuring instruments
2. Underpinning knowledge and attitudes	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	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	The following resources <b>MUST</b> be provided: 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	Competency <b>MUST</b> be assessed through: 5.1 Observation with questioning 5.2 Written or oral examination 5.3 Interview 5.4 Demonstration with questioning
6. Context of assessment	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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables
1. Identify and access manual/ specification	1.1 Appropriate <i>manuals</i> 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

1. Critical aspects of competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Identified and accessed manual/specification</li> <li>1.2 Interpreted manuals</li> <li>1.3 Applied information in manuals</li> <li>1.4 Stored manuals</li> </ul>
2. Underpinning knowledge	<ul style="list-style-type: none"> <li>2.1 Types of manuals used in automotive industry</li> <li>2.2 Identification of symbols used in the manuals</li> <li>2.3 Identification of units of measurements</li> <li>2.4 Unit conversion</li> </ul>
3. Underpinning skills	<ul style="list-style-type: none"> <li>3.1 Reading and comprehension skills required to identify and interpret automotive manuals and specifications</li> <li>3.2 Accessing information and data</li> </ul>
4 Resource Implications	<p>The following resources <b>MUST</b> be provided:</p> <ul style="list-style-type: none"> <li>4.1 All manuals/catalogues relative to Automotive</li> <li>4.2 Job order, requisitions</li> <li>4.3 Actual vehicle or simulator</li> </ul>
5 Method of assessment	<p>Competency <b>MUST</b> be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Observation with questioning</li> <li>5.2 Interview</li> </ul>
6 Context of assessment	<ul style="list-style-type: none"> <li>6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines</li> <li>6.2 Assessment may be conducted in the workplace or a simulated environment.</li> </ul>

**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.

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

## CORE COMPETENCIES

**UNIT OF COMPETENCY :**      **PERFORM HAND FORGING**

**UNIT CODE :**                      **ALT722301**

**UNIT DESCRIPTOR :**            This unit covers using hand tools and formers, applying hand forging techniques and operating heat treatment equipment. The unit applies to hand forging low to medium carbon and alloy steels using a variety of techniques, tools, formers and heating devices.

ELEMENT	PERFORMANCE CRITERIA
	<i>Italicized</i> terms are elaborated in the Range of Variables
1. Select material	1.1 Job requirements are determined from engineering drawing, job sheet or verbal instructions 1.2 Material calculations are made using volumes and weights that include provision for oxidization and shrinkage. 1.3 Material is selected according to the requirements of the job.
2. Use hand tools and formers	2.1 <b>Hand tools and formers</b> are selected for specific forging techniques. 2.2 Hand tools and formers are used according to the <b>hand forging technique</b> selected.
3. Operate heating equipment	3.1 <b>Heating equipment</b> is set up and operated in accordance with company procedures and/or manufacturer's instruction. 3.2 Equipment is operated in a manner that minimizes oxidization. 3.3 Heat is controlled to specified areas.
4. Hand-forge articles	4.1 Hand forging technique is selected and applied according to the requirements of the job 4.2 Material is hand-forged to produce articles to specification. 4.3 Forging temperatures and heat specifications are adhered to for various <b>materials</b> . 4.4 Allowance is made for material shrinkage and oxidization based on the requirements of the job.

## RANGE OF VARIABLE

VARIABLE	RANGE
1. Hand tools and formers	1.1 Flatters 1.2 Set hammers 1.3 Hot/cold sets 1.4 Ball peen hammer 1.5 Swages
2. Hand forging techniques	2.1 Drawing 2.2 Swaging 2.3 Bending 2.4 Upsetting 2.5 Spreading 2.6 Punching 2.7 Drifting
3. Heating equipment	3.1 Diesel 3.2 Electric furnace 3.3 Gas furnaces 3.4 Coke fires 3.5 Gaseous oxygen/fuel equipment
4. Materials	4.1 Low to medium carbon 4.2 Alloy steels

## EVIDENCE GUIDE

1. Critical aspect of competency	<p>Assessment requires evidence that the candidate</p> <ul style="list-style-type: none"> <li>1.1 Selected materials</li> <li>1.2 Selected and used hand tools and formers</li> <li>1.3 Determined correct forging temperatures</li> <li>1.4 Set-up and operated heating equipment</li> <li>1.5 Hand-forged articles</li> </ul>
2. Underpinning knowledge and attitudes	<ul style="list-style-type: none"> <li>2.1 Types and properties of forging materials</li> <li>2.2 Different kinds of hand tools, formers used in hand forging</li> <li>2.3 Hand forging techniques (drawing, swaging, bending, upsetting, spreading, punching, drifting )</li> <li>2.4 How to calculate mean diameter, length, circumference</li> <li>2.5 Source of information on forging temperatures</li> <li>2.6 Heat specifications for various materials</li> <li>2.7 Effects of and allowances for material shrinkage and oxidization</li> <li>2.8 Application, set up, and means of adjustment of a range of heating equipment</li> <li>2.9 Use and application of personal protective equipment</li> <li>2.10 Safe work practices and procedures</li> <li>2.11 Hazards and control measures associated with hand forging, including housekeeping</li> <li>2.12 Use and application of personal protective equipment</li> <li>2.13 Safe work practices and procedures</li> <li>2.14 Honesty and perseverance</li> </ul>
3. Underpinning skills	<ul style="list-style-type: none"> <li>3.1 Using hand tools and formers</li> <li>3.2 Setting up and operating forging machines</li> <li>3.3 Following job instructions, drawings, specifications</li> <li>3.4 Detecting forging defects</li> <li>3.5 Rectifying forging techniques</li> <li>3.6 Safely handling hot metal</li> <li>3.7 Correctly heating material being forged</li> <li>3.8 Calculating volume and weight of material</li> </ul>
4. Resource implications	<p>The following resources <b>MUST</b> be provided:</p> <ul style="list-style-type: none"> <li>3.6 Tools, equipment, materials and documentation required relative to hand forging</li> <li>3.7 Job order, requisitions slip for materials</li> <li>3.8 Relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</li> </ul>
5. Method of assessment	<p>Competency <b>MUST</b> be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Observation with questioning</li> <li>5.2 Portfolio</li> <li>5.3 Third party report</li> </ul>
6. Context of assessment	<ul style="list-style-type: none"> <li>6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines</li> <li>6.2 Assessment may be conducted in the workplace or a simulated environment</li> </ul>

**UNIT OF COMPETENCY :**      **PERFORM HAMMER FORGING**

**UNIT CODE :**                      **ALT722302**

**UNIT DESCRIPTOR :**            This unit covers using hammer tools and formers, selecting material, and applying hammer forging techniques. The unit applies to the use of hammer forging techniques on carbon and alloy steels using various techniques, tools, formers, power hammers and heating devices. Equipment range does not include drop and upset machinery, vacuum furnaces or rolling and extruding mill machinery.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables
1. Select material	1.1 Job requirements are determined from engineering drawing, job sheet or verbal instructions 1.2 <b>Material calculations</b> are made using volumes and weights that include provision for oxidization and shrinkage. 1.3 Material is correctly selected for use with specific tools and formers.
2. Use hammer tools and formers	2.1 <b>Hammer tools and formers</b> are selected for specific forging technique. 2.2 Hammer tools and formers are used in accordance with the forging technique selected. 2.3 Forging machine is set up and operated in accordance with company procedures and/or manufacturer's instruction.
3. Hammer-forge articles	3.1 Hammer forging technique is selected and applied according to the requirements of the job. 3.2 Material is hammer-forged to produce articles to specification 3.3 <b>Defects</b> are recognized and appropriate rectification action is taken. 3.4 Correct techniques are applied to the handling of hot metal with regard to balancing and pivoting. 3.5 <b>Heating process</b> is applied based on the <b>material</b> and/ or requirements of the job.

## RANGE OF VARIABLE

VARIABLE	RANGE
1 Material calculations	1.1 Thermal expansion/contraction 1.2 Material wastage
2 Hammer tools and formers	2.1 Flatters 2.2 Set hammers 2.3 Hot/cold sets 2.4 Ball peen hammer 2.5 Swages
3 Defects	3.1 Galls 3.2 Fins 3.3 Shrinkage 3.4 Oxidization
4 Heating process	4.1 Diesel furnace 4.2 Electric furnace 4.3 Gas furnaces 4.4 Coke-fired 4.5 Gaseous oxygen-fuel equipment
5 Material	5.1 Low/high carbon steels 5.2 Alloys 5.3 Stainless steel 5.4 Lead

## EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate 1.1 Applied hammer forging techniques to carbon and alloy steels using various techniques, tools, formers, power hammers and heating devices.
2. Underpinning knowledge and attitudes	2.1 Hammer forging techniques 2.2 The set up and operation of forging machines 2.3 Techniques for handling hot metal 2.4 Oxidization/shrinkage allowances 2.5 Numerical operations and formulae for determining the volume and weight of material 2.6 Material specifications 2.7 Hazards and control measures associated with hammer forging, including housekeeping 2.8 Use and application of personal protective equipment 2.9 Safe work practices and procedures 2.10 Honesty and perseverance
3. Underpinning skills	3.1 Using hammer tools and formers 3.2 Setting up and operating forging machines 3.3 Following job instructions, drawings, specifications 3.4 Detecting forging defects 3.5 Rectifying forging techniques 3.6 Safely handling hot metal 3.7 Correctly heating material being forged 3.8 Calculating volume and weight of material
4. Resource implications	The following resources <b>MUST</b> be provided: 4.1 Tools, equipment, materials and documentation required relative to hammer forging 4.2 Job order, requisitions slip for materials 4.3 Relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
5. Method of assessment	Competency <b>MUST</b> be assessed through: 5.4 Observation with questioning 5.5 Portfolio 5.6 Third party report
6. Context of assessment	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 BASIC INCIDENTAL HEAT/QUENCHING, TEMPERING AND ANNEALING**

**UNIT CODE :**                      **ALT722303**

**UNIT DESCRIPTOR :**            This unit covers performing straightforward heating/ quenching, tempering and annealing of ferrous and non-ferrous metals.

This unit applies to the heat treatment of ferrous and non-ferrous metals of various types and thicknesses by a range of methods. These may include oxy acetylene, LPG gas equipment, forge etc. used to heat/quench, temper and anneal materials to specifications.

Work would normally cover one-off processes or processes undertaken as incidental to trade work (e.g. tool making, metal spinning etc.)

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables
1. Determine job requirements	1.1 Job requirements are determined from engineering drawing, job sheet or verbal instructions
2. Set up equipment for heat/quenching, tempering and annealing	2.1 Appropriate <b>heating process</b> and/or procedure are selected for the given job. 2.2 Equipment is set up according to standard operating procedures and manufacturers' instructions.
3. Operate heating equipment	3.1 Safety procedures are observed in accordance with OH & S requirements. 3.2 <b>Heating equipment</b> is operated following standard operating procedures and/or manufacturer's instructions. 3.3 Equipment adjustments are made in accordance with standard operating procedures and/or manufacturer's instructions. 3.4 <b>Material</b> is heat-treated to achieve required result.

## RANGE OF VARIABLE

VARIABLE	RANGE
1. Heating process	1.1 Heating/quenching 1.2 Tempering 1.3 Annealing
2. Heating Equipment	2.1 Oxy acetylene 2.2 LPG gas equipment 2.3 Forge
3. Materials	3.1 Ferrous metals of various types and thicknesses 3.2 non-ferrous metals of various types and thicknesses

## EVIDENCE GUIDE

<p>1. Critical aspect of competency</p>	<p>Assessment requires evidence that the candidate: Performed basic incidental heat/quenching, tempering and annealing of ferrous and non-ferrous metals by a range of methods, which may include oxy acetylene, LPG gas equipment, forge, and use to heat/quench temper and anneal materials to specifications.</p>
<p>2. Underpinning knowledge and attitudes</p>	<p>2.1 Characteristics and applications of heating/quenching, tempering, annealing processes 2.2 Specifications for heating, quenching, tempering, and annealing 2.3 Process for heating/quenching, tempering, annealing, different materials 2.4 Operating/adjusting heating equipment 2.5 Hazards and control measures associated with heating/quenching, tempering, annealing, including housekeeping 2.6 Use and application of personal protective equipment 2.7 Safe work practices and procedures 2.8 Honesty and perseverance</p>
<p>3. Underpinning skills</p>	<p>3.1 Reading, interpreting and following information on written job instructions, specifications, standard operating procedures, manufacturer instructions, charts, lists, drawings and other applicable reference documents 3.2 Checking and clarifying task-related information 3.3 Following verbal instructions 3.4 Orally reporting routine information 3.5 Selecting appropriate processes for heating/quenching, tempering, annealing 3.6 Setting up, adjusting and operating equipment</p>
<p>4 Resource implications</p>	<p>The following resources <b>MUST</b> be provided: 4.1 All tools, equipment, materials and documentation required relative to the Performance of basic incidental heat/quenching, tempering and annealing of ferrous and non-ferrous metals 4.2 Job order, requisitions slip for materials 4.3 Relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<p>5 Method of assessment</p>	<p>Competency <b>MUST</b> be assessed through: 5.1 Observation with questioning 5.2 Portfolio 5.3 Third party report</p>
<p>6 Context of assessment</p>	<p>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</p>

## 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 Forging NC II

### 3.1 CURRICULUM DESIGN

Course Title: **FORGING**

NC Level: **NC II**

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

Course Description:

This course is designed to enhance the knowledge, skills and attitudes of an individual in the field of FORGING NC II Qualification. It consists of competencies that a person must achieve to be able to perform hand and hammer forging of low to medium carbon and alloy up to steel carbon and alloy steels using a variety of techniques, tools, formers and heating devices. It also include basic incidental heat/quenching, tempering and annealing of ferrous and non-ferrous metals of various types and thicknesses.

Basic competencies such as: Participate in workplace communication; Work in a team environment; Practice career professionalism; and Practice occupational health and safety are included.

It also includes common competencies such as: Read, Interpret and Apply Engineering Drawings; Perform Mensuration and Calculation Read; Interpret and Apply Specifications and Manuals and; Perform Shop Maintenance.

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 Participate in workplace meeting and discussion. 1.3 Complete relevant work-related documents	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Interaction</li> <li>• Lecture</li> <li>• Reportorial</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Practical/ performance test</li> <li>• Interview</li> </ul>
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"> <li>• Group discussion</li> <li>• Case studies</li> <li>• Simulation</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Observation</li> <li>• Simulation</li> <li>• Role playing</li> <li>• Case studies</li> </ul>

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"> <li>• Group Discussion</li> <li>• Interaction</li> <li>• Simulation</li> <li>• Demonstration</li> <li>• Self-paced instruction</li> <li>• Structured activity</li> <li>• Film viewing</li> </ul>	<ul style="list-style-type: none"> <li>• Role play</li> <li>• Interview</li> <li>• Written examination</li> <li>• Portfolio assessment</li> </ul>
4. Practice occupational health and safety	4.1 Identify hazards and risks. 4.2 Evaluate hazard and risks 4.3 Control hazards and risks 4.4 Maintain occupational health and safety awareness	<ul style="list-style-type: none"> <li>• Interactive-lecture</li> <li>• Simulation</li> <li>• Symposium</li> <li>• Group dynamics</li> <li>• Film viewing</li> <li>• Situation analysis</li> <li>• Self-paced instruction</li> </ul>	<ul style="list-style-type: none"> <li>• Situational analysis</li> <li>• Interview</li> <li>• Practical examination</li> <li>• Written exam</li> <li>• Portfolio assessment</li> </ul>

### 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"> <li>• Lecture/ Demonstration</li> <li>• Dual training</li> </ul>	<ul style="list-style-type: none"> <li>• Direct observation</li> <li>• Interview</li> </ul>
2. Perform Mensuration and Calculation	2.1 Select measuring instrument and 2.2 Carry out measurement and calculations. 2.3 Maintain measuring instruments	<ul style="list-style-type: none"> <li>• Lecture/ Demonstration</li> <li>• Simulation</li> <li>• Exercises</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Oral questioning</li> <li>• Direct observation</li> </ul>
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"> <li>• Lecture/ Demonstration</li> <li>• Dual training</li> <li>• Distance Learning</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Direct observation</li> <li>• Project method</li> <li>• Interview</li> </ul>
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"> <li>• Lecture/ Demonstration</li> <li>• Dual training</li> <li>• Self paced (modular)</li> <li>• Simulation</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Direct observation</li> <li>• Demonstration</li> <li>• Interview</li> </ul>

## CORE COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Perform hand forging	1.1 Select material 1.2 Use hand tools and formers 1.3 Operate heating equipment 1.4 Hand forge articles	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Demonstration</li> <li>• Dualized training</li> <li>• Distance learning</li> </ul>	<ul style="list-style-type: none"> <li>• Observation with questioning</li> <li>• Portfolio</li> <li>• Third party report</li> </ul>
2. Perform hammer forging	2.1 Select material 2.2 Use hammer tools and formers 2.3 Hammer-forged articles	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Demonstration</li> <li>• Dualized training</li> <li>• Distance learning</li> </ul>	<ul style="list-style-type: none"> <li>• Observation with questioning</li> <li>• Portfolio</li> <li>• Third party report</li> </ul>
3. Perform Basic Incidental Heat/Quenching Tempering and Annealing	3.1 Determine job requirements 3.2 Set up equipment for heat/quenching, tempering and annealing 3.3 Operate heating equipment	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Demonstration</li> <li>• Dualized training</li> <li>• Distance learning</li> </ul>	<ul style="list-style-type: none"> <li>• Observation with questioning</li> <li>• Portfolio</li> <li>• Third party report</li> </ul>

### 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 2 year experience in basic foundry melting
- Ability to communicate both orally and in writing; and
- Physically and mentally fit

### 3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS FORGING NC II

Recommended list of tools, equipment and materials for the training of 12 trainees for FORGING NC II

TOOLS		EQUIPMENT		MATERIALS	
QTY		QTY		QTY	
4 pairs	Gloves		Forklift 2Tons capacity	4 gallon	Lubricant
2 pairs	Safety shoes		Portable Lifter 500Kgs capacity	100Kgs	Low/medium carbon steel
2 sets	Colored glass	1 unit	Drop hammer	20Kgs	Aluminum rods
1 Lot	Flatters	1 unit	Upset machine	40Kgs	Copper Rods
1 Lot	Tongs	1 unit	Mechanical press	50Kgs	Alloy Steel Bars
1 Lot	Swaging dies	1 unit	Hydraulic press	3 tank	Oxygen
1 Lot	Set hammers	1 set	Oxy-acetylene cutting outfit	2 tank	Acetylene
1 Lot	Assorted inserts	1 unit	Gas Heating Furnace	3 tank	LPG
4 pcs	Ball pein hammers	1 unit	Electric heating furnace	200 liter	Diesel fuel
4 pcs	Board hammer	1 lot	Assorted Dies	10Kgs	Graphite
2 pcs	Anvil	1 Lot	Die block	50Kgs	Silica sand
1 Lot	Splitters	1 lot	Benders	2 Kgs	Grease
1 Lot	Bolster	1 unit	Air compressor	2 Kgs	Wax
1 Lot	Trimmers	1 lot	Trimming dies		
1 Lot	Wood cushions	1 unit	Power shear machine		
2 sets	Lubricant dispenser				
1 Lot	Punch				
1 Lot	Draw dies				
3 units	Hand power tools				
2 units	Grease gun				
4 pcs	Steel brush				
4 pcs	Sledge hammer				

6 pcs	Clamps				
1 Lot	Assorted keys				
1 Lot	Spanners				
3 pcs	Screw driver				
2 pcs	Steel Tape / Meter				
2 pcs	Pipe Wrench				
3 pcs	Adjustable wrench				
2 sets	Vernier caliper				
2 pairs	Apron				
2 pairs	Arm band				

### 3.5 TRAINING FACILITIES FORGING NC II

Based on a class size of 12 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	3.50 x 3.50 per student / trainee	12.25 per student	147
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**	-	-	302.00

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

### **3.6 TRAINER'S QUALIFICATIONS FOR AUTOMOTIVE MANUFACTURING SUB SECTOR**

#### **FORGING NC II**

##### **TRAINER QUALIFICATION (TQ II)**

- Must be a holder of FORGING NC II
- Must have undergone training on Training Methodology II (TM II) <sup>1</sup>
- Must be computer literate
- Must be physically and mentally fit
- Must have at least 2 years job/industry experience<sup>2</sup>
- Must be a civil-service eligible or holder of appropriate professional license issued by the Professional Regulatory Commission (for government positions)

<sup>1</sup> This shall be changed to “:Must be a holder of Trainer Qualification Level II (TQII) or equivalent” upon promulgation by the TESDA Board of the TQ/AQ training regulations

<sup>2</sup> 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 FORGING 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 FORGING NC II must demonstrate competency in all the following core units of the Qualification through a single project-type assessment. Candidates may apply for assessment in any accredited assessment center.
- 4.2.1 Forge Basic Shapes**
- Perform Hand Forging
  - Perform Hammer Forging
  - Perform Basic Incidental Heat/Quenching Tempering and Annealing
- 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**

**ANNEX A**

<b>CORE COMPETENCIES</b>	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	Machine Parts	Perform Precision Assembly	
	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	Prepare Sand Mixture for Heavy Casting	Produce Blow Molded Products	Change Equipment Dies
	Operate Melting Furnaces (non-electric)	Operate Cupola Melting Furnace	Operate Electric Induction Melting Furnace	Fettle & Trim Metal Castings/Forgings	Perform Refractory Installation & Repair	Perform Hand Molding to Produce Heavy Casting	Pour Molten Metal to Heavy Castings	Produce Injection Molded Products	Prepare and Start Equipment for Production
	Melt Aluminum-Silicon Alloys for Safety Tested Castings	Melt Metals Using Coreless Induction Furnace	Melt Automotive Gray Iron Castings in Cupola	Manufacture and develop corebox for Shell Core Box	Develop and Manufacture Gear, Conveyor Screw and	Develop Gravity Die Casting Mold	Perform Press Machine Setting	Perform Mechanical Shearing Operation	
	Use Comparison and Basic Measuring Devices	Measure Components Using Coordinate Measuring Machines	Use Graphical Techniques and Perform Simple Statistical Computations	Apply Quality Systems	Conduct Product and/or Process Capability Studies	Maintain/Supervise the Application of Quality Procedures	Perform Mechanical Press Forming Operation		
	Perform Hand Forging	Perform Hammer Forging	Perform Basic Incidental Heat/Quenching, Tempering and Annealing	Hand Forge Complex Shapes	Hammer Forge Complex Shapes	Perform Drop and Upset Forging	Select Heat Treatment Process	Perform Heat Treatment Process	
	Perform Engineering Measurement	Perform Precision Mechanical Measurement	Calibrate Measuring Equipment	Select and Control Inspection Processes and Procedures	Perform 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		
<b>COMMON COMPETENCIES</b>	Read & Interpret Engineering Drawings	Perform Mensuration and Calculation	Read, Interpret and Apply Specifications and Manuals	Perform Shop Maintenance					
<b>BASIC COMPETENCIES</b>	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							



## DEFINITION OF TERMS (FORGING)

1. **Forging** **Forging** is the term for shaping metal by using localized compressive forces
2. **Cold forging** **Cold forging** is done at room temperature or near room temperature.
3. **Hot forging** **Hot forging** is done at a high temperature, which makes metal easier to shape and less likely to fracture.
4. **Warm forging** **Warm forging** is done at intermediate temperature between room temperature and hot forging temperatures.
5. **Hammer forging** In modern times, industrial forging is done either with presses or with hammers powered by compressed air, electricity, hydraulics or steam. These hammers are large, having reciprocating weights in the thousands of pounds. Smaller power hammers, 500 lb (230 kg) or less reciprocating weight, and hydraulic presses are common in art smithies as well. Steam hammers are becoming obsolete.
6. **Open-die forging** Open-die forging is also known as smith forging. In open-die forging a hammer comes down and deforms the workpiece, which is placed on a stationary anvil. Open-die forging gets its name from the fact that the dies (the working surfaces of the forge that contract the workpiece) do not enclose the workpiece, allowing it to flow except where contacted by the dies. Therefore the operator needs to orient and position the workpiece to get the desired shape. The dies are usually flat in shape, but some have a specially shaped surface for specialized operations. For instance, the die may have a round, concave, or convex surface or be a tool to form holes or be a cut-off tool.
7. **Impression-die forging** Impression-die forging is also called closed-die forging. In impression-die work metal is placed in a die resembling a mold, which is attached to the anvil. Usually the hammer die is shaped as well. The hammer is then dropped on the workpiece, causing the metal to flow and fill the die cavities. The hammer is generally in contact with the workpiece on the scale of milliseconds. Depending on the size and complexity of the part the hammer may be dropped multiple times in quick succession.
8. **Flash** Excess metal is squeezed out of the die cavities; this is called **flash**. The flash cools more rapidly than the rest of the material; this cool metal is stronger than the metal in the

die so it helps prevent more flash from forming. This also forces the metal to completely fill the die cavity. After forging the flash is trimmed off

### **9. Press forging**

Press forging is variation of drop-hammer forging. Unlike drop-hammer forging, press forges work slowly by applying continuous pressure or force. The amount of time the dies are in contact with the workpiece is measured in seconds (as compared to the milliseconds of drop-hammer forges). The press forging operation can be done either cold or hot.

### **10. Upset forging**

Upset forging increases the diameter of the workpiece by compressing its length.<sup>1</sup> Based on number of pieces produced this is the most widely used forging process. A few examples of common parts produced using the upset forging process are engine valves, couplings, bolts, screws, and other fasteners.

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