TRAINING REGULATIONS

FORGING NC III

AUTOMOTIVE MANUFACTURING SECTOR

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

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AUTOMOTIVE/LAND TRANSPORT SECTOR

FORGING NC III

TRAINING REGULATIONS FOR
FORGING NC III

SECTION 1 FORGING NC III QUALIFICATION

The FORGING NC III Qualification consists of competencies that a person must achieve to be able to perform hand forging to complex shapes of different metals. It also covers hammer forging to complex shapes using power hammer which applies to open die forging of complex shapes such as forged bosses, heavy rings and bushes. Both competencies also cover specialized methods of holding, positioning and lifting complex forgings. Competency on performing drop and upset forging on a range of metals is also included.

The Units of Competency comprising this Qualification include the following:

CODE NO.	BASIC COMPETENCIES
500311109	Lead workplace communication
500311110	Lead small teams
500311111	Develop and practice negotiation skills
500311112	Solve problems related to work activities
500311113	Use mathematical concepts and techniques
500311114	Use relevant technologies

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

CODE NO.	CORE COMPETENCIES
ALT722304	Hand Forge Complex Shapes
ALT722305	Hammer Forge Complex Shapes
ALT722306	Perform Drop and Upset Forging

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

- **Forging Machine Operator**

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 III**.

BASIC COMPETENCIES

UNIT OF COMPETENCY : LEAD WORKPLACE COMMUNICATION

UNIT CODE : 500311109

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

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Dealt with a range of communication/information at one time 1.2 Made constructive contributions in workplace issues 1.3 Sought workplace issues effectively 1.4 Responded to workplace issues promptly 1.5 Presented information clearly and effectively written form 1.6 Used appropriate sources of information 1.7 Asked appropriate questions 1.8 Provided accurate information
2. Underpinning knowledge	2.1 Organization requirements for written and electronic communication methods 2.2 Effective verbal communication methods
3. Underpinning skills	3.1 Organize information 3.2 Understand and convey intended meaning 3.3 Participate in variety of workplace discussions 3.4 Comply with organization requirements for the use of written and electronic communication methods
4. Resource implications	The following resources **MUST** be provided: 4.1 Variety of Information 4.2 Communication tools 4.3 Simulated workplace
5. Method of assessment	Competency may be assessed through: 5.1 Competency in this unit must be assessed through 5.2 Direct Observation 5.3 Interview
6. Context of assessment	6.1 Competency may be assessed in the workplace or in simulated workplace environment

UNIT OF COMPETENCY : **LEAD SMALL TEAMS**

UNIT CODE : **500311110**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes to lead small teams including setting and maintaining team and individual performance standards.

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Maintained or improved individuals and/or team performance given a variety of possible scenario 1.2 Assessed and monitored team and individual performance against set criteria 1.3 Represented concerns of a team and individual to next level of management or appropriate specialist and to negotiate on their behalf 1.4 Allocated duties and responsibilities, having regard to individual's knowledge, skills and aptitude and the needs of the tasks to be performed 1.5 Set and communicated performance expectations for a range of tasks and duties within the team and provided feedback to team members
2. Underpinning knowledge	2.1 Company policies and procedures 2.2 Relevant legal requirements 2.3 How performance expectations are set 2.4 Methods of Monitoring Performance 2.5 Client expectations 2.6 Team member's duties and responsibilities
3. Underpinning skills	3.1 Communication skills required for leading teams 3.2 Informal performance counseling skills 3.3 Team building skills 3.4 Negotiating skills
4. Resource implications	The following resources **MUST** be provided: 4.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 4.2 Materials relevant to the proposed activity or task
5. Method of assessment	Competency may be assessed through: 5.1 Direct observations of work activities of the individual member in relation to the work activities of the group 5.2 Observation of simulation and/or role play involving the participation of individual member to the attainment of organizational goal 5.3 Case studies and scenarios as a basis for discussion of issues and strategies in teamwork
6. Context of assessment	6.1 Competency assessment may occur in workplace or any appropriately simulated environment 6.2 Assessment shall be observed while task are being undertaken whether individually or in-group

UNIT OF COMPETENCY: DEVELOP AND PRACTICE NEGOTIATION SKILLS

UNIT CODE : 500311111

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

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Plan negotiations	1.1 Information on ***preparing for negotiation*** is identified and included in the plan 1.2 Information on creating ***non verbal environments*** for positive negotiating is identified and included in the plan 1.3 Information on ***active listening*** is identified and included in the plan 1.4 Information on different ***questioning techniques*** is identified and included in the plan 1.5 Information is checked to ensure it is correct and up-to- date
2. Participate in negotiations	2.1 Criteria for successful outcome are agreed upon by all parties 2.2 Desired outcome of all parties are considered 2.3 Appropriate language is used throughout the negotiation 2.4 A variety of questioning techniques are used 2.5 The issues and processes are documented and agreed upon by all parties 2.6 Possible solutions are discussed and their viability assessed 2.7 Areas for agreement are confirmed and recorded 2.8 Follow-up action is agreed upon by all parties

RANGE OF VARIABLES

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

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Demonstrated sufficient knowledge of the factors influencing negotiation to achieve agreed outcome 1.2 Participated in negotiation with at least one person to achieve an agreed outcome
2. Underpinning knowledge and Attitude	2.1 Codes of practice and guidelines for the organization 2.2 Organizations policy and procedures for negotiations 2.3 Decision making and conflict resolution strategies procedures 2.4 Problem solving strategies on how to deal with unexpected questions and attitudes during negotiation 2.5 Flexibility 2.6 Empathy
3. Underpinning skills	3.1 Interpersonal skills to develop rapport with other parties 3.2 Communication skills (verbal and listening) 3.3 Observation skills 3.4 Negotiation skills
4. Resource implications	The following resources **MUST** be provided: 4.1 Room with facilities necessary for the negotiation process 4.2 Human resources (negotiators)
5. Method of assessment	Competency may be assessed through: 5.1 Observation/demonstration and questioning 5.2 Portfolio assessment 5.3 Oral and written questioning 5.4 Third party report
6. Context of assessment	6.1 Competency to be assessed in real work environment or in a simulated workplace setting.

UNIT OF COMPETENCY : SOLVE PROBLEMS RELATED TO WORK ACTIVITIES

UNIT CODE : 500311112

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

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Identified the problem 1.2 Determined the fundamental causes of the problem 1.3 Determined the correct / preventive action 1.4 Provided recommendation to manager These aspects may be best assessed using a range of scenarios / case studies / what ifs as a stimulus with a walk through forming part of the response. These assessment activities should include a range of problems, including new, unusual and improbable situations that may have happened.
2. Underpinning knowledge	2.1 Competence includes a thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations 2.2 Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause, determining the corrective action and provision of recommendations 2.2.1 Relevant equipment and operational processes 2.2.2 Enterprise goals, targets and measures 2.2.3 Enterprise quality, OHS and environmental requirement 2.2.4 Principles of decision making strategies and techniques 2.2.5 Enterprise information systems and data collation 2.2.6 Industry codes and standards
3. Underpinning skills	3.1 Using range of formal problem solving techniques 3.2 Identifying and clarifying the nature of the problem 3.3 Devising the best solution 3.4 Evaluating the solution 3.5 Implementation of a developed plan to rectify the problem

4. Resource implications	4.1 Assessment will require access to an operating plant over an extended period of time, or a suitable method of gathering evidence of operating ability over a range of situations. A bank of scenarios / case studies / what ifs will be required as well as bank of questions which will be used to probe the reason behind the observable action.
5. Method of assessment	Competency may be assessed through: 5.1 Case studies on solving problems in the workplace 5.2 Observation The unit will be assessed in a holistic manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations, which will include disruptions to normal, smooth operation. Simulation may be required to allow for timely assessment of parts of this unit of competency. Simulation should be based on the actual workplace and will include walk through of the relevant competency components.
6. Context of assessment	6.1 In all workplace, it may be appropriate to assess this unit concurrently with relevant teamwork or operation units.

UNIT OF COMPETENCY: USE MATHEMATICAL CONCEPTS AND TECHNIQUES

UNIT CODE : 500311113

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

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

UNIT OF COMPETENCY: USE RELEVANT TECHNOLOGIES

UNIT CODE : 500311114

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

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Studied and selected appropriate technology consistent with work requirements 1.2 Applied relevant technology 1.3 Maintained and enhanced operative ability of relevant technology
2. Underpinning knowledge	2.1 Awareness on technology and its function 2.2 Repair and maintenance procedure 2.3 Operating instructions 2.4 Applicable software 2.5 Communication techniques 2.6 Health and safety procedure 2.7 Company policy in relation to relevant technology 2.8 Different management concepts 2.9 Technology adaptability
3. Underpinning skills	3.1 Relevant technology application/implementation 3.2 Basic communication skills 3.3 Software applications skills 3.4 Basic troubleshooting skills
4. Resource implications	The following resources **MUST** be provided: 4.1 Relevant technology 4.2 Interview and demonstration questionnaires 4.3 Assessment packages
5. Method of assessment	Competency must be assessed through: 5.1 Interview 5.2 Actual demonstration 5.3 Authenticated portfolio (related certificates of training/seminar)
6. Context of assessment	6.1 Competency may be assessed in actual workplace or simulated environment

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 ***Italicized*** 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

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Identified and accessed drawings/specification 1.2 Interpreted drawings 1.3 Applied information in drawings 1.4 Stored drawings
2. Underpinning knowledge and attitudes	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
3. Underpinning skills	3.1 Reading and comprehension skills required to identify and interpret engineering drawings and specifications 3.2 Accessing information and data
4. Resource implications	The following resources **MUST** be provided: 4.1 All drawings/engineering specifications relative to automotive manufacturing 4.2 Job order, requisitions 4.3 Product sample
5. Method of assessment	Competency **MUST** be assessed through: 5.1 Observation with questioning 5.2 Interview
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 MENSURATION AND CALCULATION

UNIT CODE: ALT311202

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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** 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 ***measuring instrument*** 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 ***Calculation*** 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 **MUST** 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 **MUST** 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.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** 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

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Identified and accessed manual/specification 1.2 Interpreted manuals 1.3 Applied information in manuals 1.4 Stored manuals
2. Underpinning knowledge	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
3. Underpinning skills	3.1 Reading and comprehension skills required to identify and interpret automotive manuals and specifications 3.2 Accessing information and data
4. Resource Implications	The following resources **MUST** be provided: 4.1 All manuals/catalogues relative to Automotive 4.2 Job order, requisitions 4.3 Actual vehicle or simulator
5. Method of assessment	Competency **MUST** be assessed through: 5.1 Observation with questioning 5.2 Interview
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 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 ***Italicized terms*** are elaborated in the Range of Variables
1. Inspect/clean tools and work area	1.1 Cleaning solvent used as per workshop/tools ***cleaning requirement***
	1.2 **W*ork area*** 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: • Mess hall • Wash room • Comfort room
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	Assessment requires evidence that the candidate: 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	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	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	The following resources **MUST** be provided: 4.1 Workplace: Real or simulated work area 4.2 Appropriate Tools & equipment 4.3 Materials relevant to the activity
5. Method of assessment	Competency **MUST** be assessed through: 5.1 Written/Oral Questioning 5.2 Demonstration
6. Context of assessment	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 : **HAND-FORGE COMPLEX SHAPES**

UNIT CODE : **ALT722304**

UNIT DESCRIPTOR : This unit covers production of intricate solid forged shapes by hand-forging of different metals, using specialized techniques, tools and jigs. This unit applies to hand-forging of complex shapes commonly forged in the forging and fabrication areas of industry. Specialized methods of holding, positioning and lifting complex forgings are covered. Equipment may include diesel, electric and gas furnaces, coke fires and gaseous oxygen/fuel equipment.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Forge complex shapes using hand tools on an anvil	1.1 Task requirements for ***complex hand forging*** are identified and clarified as required. 1.2 Material volume is calculated based on task requirements. 1.3 Allowances for bending, material shrinkage and oxidization are made as required. 1.4 Hand tools and formers are selected and used in accordance with standard operating procedures. 1.5 Safe hand forging procedures are followed. 1.6 Techniques and principles for producing complex shapes are applied correctly. 1.7 Forging is checked to ensure conformance to tolerances and specifications.
2. Perform splitting and bundling on anvil	2.1 Tools and equipment are selected and used in accordance with standard operating procedures. 2.2 ***Hand forging techniques*** and procedures are applied to forging and opening bundled and split sections. 2.3 Allowance is made for material shrinkage, distortion and oxidization. 2.4 Heat is applied and controlled in specified areas of the material to be forged in accordance with standard operating procedures. 2.5 Forgings are handled safely and correctly according to workplace procedures. 2.6 Forgings are checked to ensure conformance to tolerances and specifications.
3. Produce jigs and tools for complex shapes	3.1 Tools and equipment required to taper and bend materials are selected appropriate to task requirements. 3.2 Techniques for producing jigs and tools are applied correctly. 3.3 Jigs and patterns are bent and shaped to specifications. 3.4 Hand held tools are forged to cut pattern, in accordance with specifications. 3.5 Final shaping, heat treatment and sharpening is performed to specifications

RANGE OF VARIABLE

VARIABLE	RANGE
1. Complex hand forging	1.1 Shaping 1.2 Reverse tapering 1.3 Jump up section for bends
2. Hand forging techniques	2.1 Spreading 2.2 Surface chasing 2.3 Hot splitting

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate demonstrated hand forging of complex shapes.
2. Underpinning knowledge and attitudes	2.1 Hand tools and their applications 2.2 Techniques and procedures for hand forging complex shapes 2.3 Numerical operations and calculations/formulae within the scope of this unit 2.4 Procedures for measuring forged articles 2.5 Forging temperatures and heat specifications for multiple pieces 2.6 Tools, techniques and equipment required to taper and bend materials 2.7 Effects of material shrinkage and oxidization on the dimensions of the forged article 2.8 Methods of overcoming/allowing for the effects of shrinkage and oxidization when hand forging articles 2.9 Procedures for handling forgings 2.10 Heating equipment and applications 2.11 Heat treatment processes for forging 2.12 Heat treatment requirements for given materials 2.13 Perseverance and Honesty in the Workplace 2.14 Safety Practices and Personal Protective Equipment Used in Forging
3. Underpinning skills	3.1 Selecting and using measuring guides 3.2 Calculating allowance for material volume, bending, shrinkage and oxidization 3.3 Selecting tools and equipment 3.4 Forging and splitting sections 3.5 Forging bundled sections and opening bundled sections 3.6 Positioning material 3.7 Handling materials 3.8 Selecting and setting up heating equipment 3.9 Performing heat treatment process(es) for forging 3.10 Applying and controlling heat
4. Resource implications	The following resources **MUST** be provided: 4.1 Tools, equipment, materials and documentation required relative to hand-forging of complex shapes 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 **MUST** be assessed through: 5.1 Observation with questioning 5.2 Portfolio 5.3 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 : **HAMMER FORGE COMPLEX SHAPES**

UNIT CODE : **ALT722305**

UNIT DESCRIPTOR : This unit covers forging complex shapes using a power hammer. This unit applies to open die forging of complex shapes commonly forged in the forging and fabrication areas of industry including forged bosses, heavy rings and bushes. Specialized methods of holding, and positioning and lifting complex forgings are covered. Equipment may include forging plant, diesel and gas furnaces.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Set up and operate forging machine	1.1 Forging machine is set up and operated in accordance with standard operating procedures and specifications. 1.2 Complex open-die tooling is selected and used according to workplace procedures. 1.3 Safe operating procedures are followed.
2. Forge complex shapes and heavy parts	2.1 The material to be ***forged*** is safely and correctly positioned in the forming equipment in accordance with standard operating procedures. 2.2 Hot forgings are marked and measured as required. 2.3 Allowance is made for material shrinkage and oxidization. 2.4 Hammer tools and fixtures attached to power hammer are used according to workplace procedures. 2.5 Forging is checked to ensure conformance to tolerances and specifications. 2.6 Forgings are handled safely and correctly according to workplace procedures.
3. Heat complex forgings	3.1 Heating plant and equipment is selected appropriate to work undertaken. 3.2 Techniques used to heat heavy complex forgings are applied correctly 3.3 Post-forging heating is performed correctly and safely. 3.4 Hot forgings are handled safely and according to workplace procedures.

RANGE OF VARIABLE

VARIABLE	RANGE
1. Forged	1.1 Forging on and against cold mandrels 1.2 Hammer punching and opening of large diameter holes

EVIDENCE GUIDE

1. Critical aspect of Competency	Assessment requires evidence that the candidate hammer-forged complex shapes.
2. Underpinning Knowledge and attitudes	2.1 Hammer tools and formers and their applications 2.2 Hammer forging techniques 2.3 Numerical operations and calculations/formulae for data analysis within the scope of this unit 2.4 Tools, formers and techniques to produce a range of hammer-forged articles 2.5 Procedures for measuring forged articles 2.6 Effects of material shrinkage and oxidization on the dimensions of the forged article 2.7 Methods of overcoming/allowing for the effects of shrinkage and oxidization when hammer forging articles 2.8 Hammer punching techniques 2.9 Procedures for handling material to be hammer forged 2.10 Heating equipment and applications 2.11 Heat treatment processes for forging 2.12 Heat treatment requirements for given materials 2.15 Perseverance and Honesty in the Workplace 2.13 Safety Practices and Personal Protective Equipment Used in Forging
3. Underpinning skills	3.1 Selecting and using measuring guides 3.2 Calculating allowance for material shrinkage and oxidization 3.3 Setting up and operating forging machine 3.4 Selecting forming tools and equipment 3.5 Positioning material 3.6 Handling materials 3.7 Selecting and setting up heating equipment 3.8 Performing heat treatment process(es) for forging
4. Resource implications	The following resources **MUST** be provided: 4.4 Tools, equipment, materials and documentation required relative to hammer forging of complex shapes 4.5 Job order, requisitions slip for materials 4.6 Relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
5. Method of assessment	Competency **MUST** be assessed through: 5.1 Observation with questioning 5.2 Portfolio 5.3 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 DROP AND UPSET FORGING**

UNIT CODE : **ALT722306**

UNIT DESCRIPTOR : This unit covers selecting, setting up, and operating drop and upset forging equipment. This unit includes the preparation and forging of material using drop and upset methods on a range of metals, and a range of drop forging and upset forging equipment including cold upset forging equipment. The material forged is to specified dimensional accuracy and finish.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Identify and select drop and upset forging equipment and tools for specific operation	1.1 Appropriate ***equipment*** is selected which accounts for size of material and procedures. 1.2 Dies and punches are selected for specific operations and equipment. 1.3 Die replacement is determined with regard to relief allowances, cracking, dimensions, etc.
2. Set up and operate drop and upset forging equipment	2.1 Equipment is correctly and safely set up, adjusted and operated according to workplace procedures. 2.2 Correct die setting techniques are applied in setting correct die and punch alignment. 2.3 Die preheating procedures are applied according to workplace procedures. 2.4 Heating process is applied according to workplace procedures.
3. Prepare material	3.1 ***Materials*** are prepared and heated in accordance with job requirements and/or specifications.
4. Drop and upset forge material	4.1 Material is drop forged using the correct procedures and techniques. 4.2 ***Lubricant*** is applied for die wear and forging release according to workplace procedures. 4.3 Correct grain flow is determined. 4.4 Galls, folds and cracks are identified and corrected according to workplace procedures. 4.5 ***Removal of flash or fin*** is carried out according to procedure. 4.6 Material amounts are calculated with allowance for heat wastage and flash or fin.

RANGE OF VARIABLE

VARIABLE	RANGE
1. Equipment	May include: 1.1 Drop forging hammer/press 1.2 Open die forging hammer using closed loose die 1.3 Horizontal upsetting machine (heading machine)
2. Materials	May include: 2.1 Ferrous materials (steel) 2.2 Non-ferrous material (copper, aluminum, bronze)
3. Lubricants	3.1 Graphite bearing oils/greases 3.2 Cellulose granules 3.3 Waxes
4. Removal of flash or fin	4.1 Ejector pins 4.2 Drafts in die (angle)

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate made preparation and forged material using drop and upset methods on a range of metals, using a range of drop forging and upset forging equipment including cold upset forging equipment.
2. Underpinning knowledge and attitudes	2.1 Drop or upset forging techniques 2.2 Characteristics of forging equipment 2.3 Safety work practices and procedures 2.4 Hazards and control measures associated with drop and upset forging, including housekeeping 2.5 Incorrect/correct alignment of dies, punches 2.6 Perseverance and Honesty in the Workplace 2.7 Safety Practices and Personal Protective Equipment Used in Forging
3. Underpinning skills	3.1 Inspecting dies and preparing dies and materials 3.2 Aligning dies and punches 3.3 Replacing dies 3.4 Operating drop/upset forging equipment 3.5 Die preparation 3.6 Material preparation 3.7 Detecting and correcting defects 3.8 Removing flash or fins 3.9 Calculating material volume, weight, allowances, heat wastage, flash, fin
4. Resource implications	The following resources **MUST** be provided: 4.1 Tools, equipment, materials and documentation required relative to drop and upset 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 **MUST** be assessed through: 5.1 Observation with questioning 5.2 Portfolio 5.3 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

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 III

3.1 CURRICULUM DESIGN

Course Title: **FORGING** NC Level: **NC III**

Nominal Training Duration: **20 Hours** (Basic Competencies)
20 Hours (Common Competencies)
72 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 III Qualification. It consists of competencies that a person must achieve to be able to perform hand forging to complex shapes of different metals. It also covers hammer forging to complex shapes using power hammer which applies to open die forging of complex shapes such as forged bosses, heavy rings and bushes. Both competencies also cover specialized methods of holding, and positioning and lifting complex forgings. Competency on performing drop and upset forging on a range of metals is also included.

Basic competencies such as: Lead workplace communication; Lead small teams; Develop and practice negotiation skills; Solve problems related to work activities; Use mathematical concepts and techniques and Use relevant technologies 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. Lead workplace communication	1.1 Communicate information about workplace processes. 1.2 Lead workplace discussions. 1.3 Identify and communicate issues arising in the workplace	• Group discussion • Role Play • Brainstorming	• Observation • Interviews
2. Lead small teams	2.1 Provide team leadership. 2.2 Assign responsibilities among members. 2.3 Set performance expectation for team members. 2.4 Supervise team performance	• Lecture • Demonstration • Self-paced (modular)	• Demonstration • Case studies

3. Develop and practice negotiation skills	3.1 Identify relevant information in planning negotiations 3.2 Participate in negotiations 3.3 Document areas for agreement	• Direct observation • Simulation/ role playing • Case studies	• Written test • Practical/ performance test
4. Solve workplace problem related to work activities	4.1 Explain the analytical techniques. 4.2 Identify the problem. 4.3 Determine the possible cause/s of the problem.	• Direct observation • Simulation/role playing • Case studies	• Written test • Practical/ performance test
5. Use mathematical concepts and techniques	5.1 Identify mathematical tools and techniques to solve problem 5.2 Apply mathematical procedures/solution 5.3 Analyze results	• Lecture • Self-paced instruction • Group discussion • Practical work approach • Research study	• Written test • Practical/ performance test
6. Use relevant technologies	6.1 Identify appropriate technology 6.2 Apply relevant technology 6.3 Maintain/enhance relevant technology	• Lecture • Self-paced instruction • Group discussion • Film showing	• Written test • Practical/ performance test

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	• Lecture/ Demonstration • Dual training	• Direct observation • Interview
2. Perform Mensuration and Calculation	2.1 Select measuring instrument 2.2 Carry out measurement and calculations. 2.3 Maintain measuring instruments	• Lecture/ Demonstration • Simulation • Exercises	• Written test • Oral questioning • Direct observation
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	• Lecture/ Demonstration • Dual training • Distance Learning	• Written test • 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	• Lecture/ Demonstration • Dual training • Self paced (modular) • Simulation	• Written test • Direct observation • Demonstration • Interview

CORE COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Hand Forge Complex Shapes	1.1 Forge complex shapes using hand tools on an anvil 1.2 Perform splitting and bundling on anvil 1.3 Produce jigs and tools for complex shapes	• Lecture/ Demonstration • Dual training • Discussion	• Observation with Questioning • Third party report • Portfolio
2. Hammer Forge Complex Shapes	2.1 Set up and operate forging machine 2.2 Forge complex shapes and heavy parts 2.3 Heat complex forgings	• Lecture/ Demonstration • Dual training • Discussion	• Observation with Questioning • Portfolio • Third party report
3. Perform Drop and Upset Forging	3.1 Identify and select drop and upset forging equipment and tools for specific operation 3.2 Set up and operate drop and upset forging equipment 3.3 Prepare material 3.4 Drop and upset forge material	• Lecture/ Demonstration • Dual training • Discussion	• Observation with Questioning • Portfolio • Third party report

3.2 TRAINING DELIVERY

The delivery of training should adhere to the design of the curriculum. Delivery should be guided by the 10 basic principles of 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;
- Physically and mentally fit; and
- Must possess the FORGING National Certificate NC II or equivalent qualification in forging

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS FORGING NC III

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

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 III

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	147.00
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**	-	-	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 III

TRAINER QUALIFICATION (TQ II)

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

[1] 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

[2] 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 III, 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 III 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 Complex Shapes and Perform Drop and Upset Forging

- Hand Forge Complex Shapes
- Hammer Forge Complex Shapes
- Perform Drop and Upset Forging

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 Holder of FORGING NC II or equivalent qualification; or

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

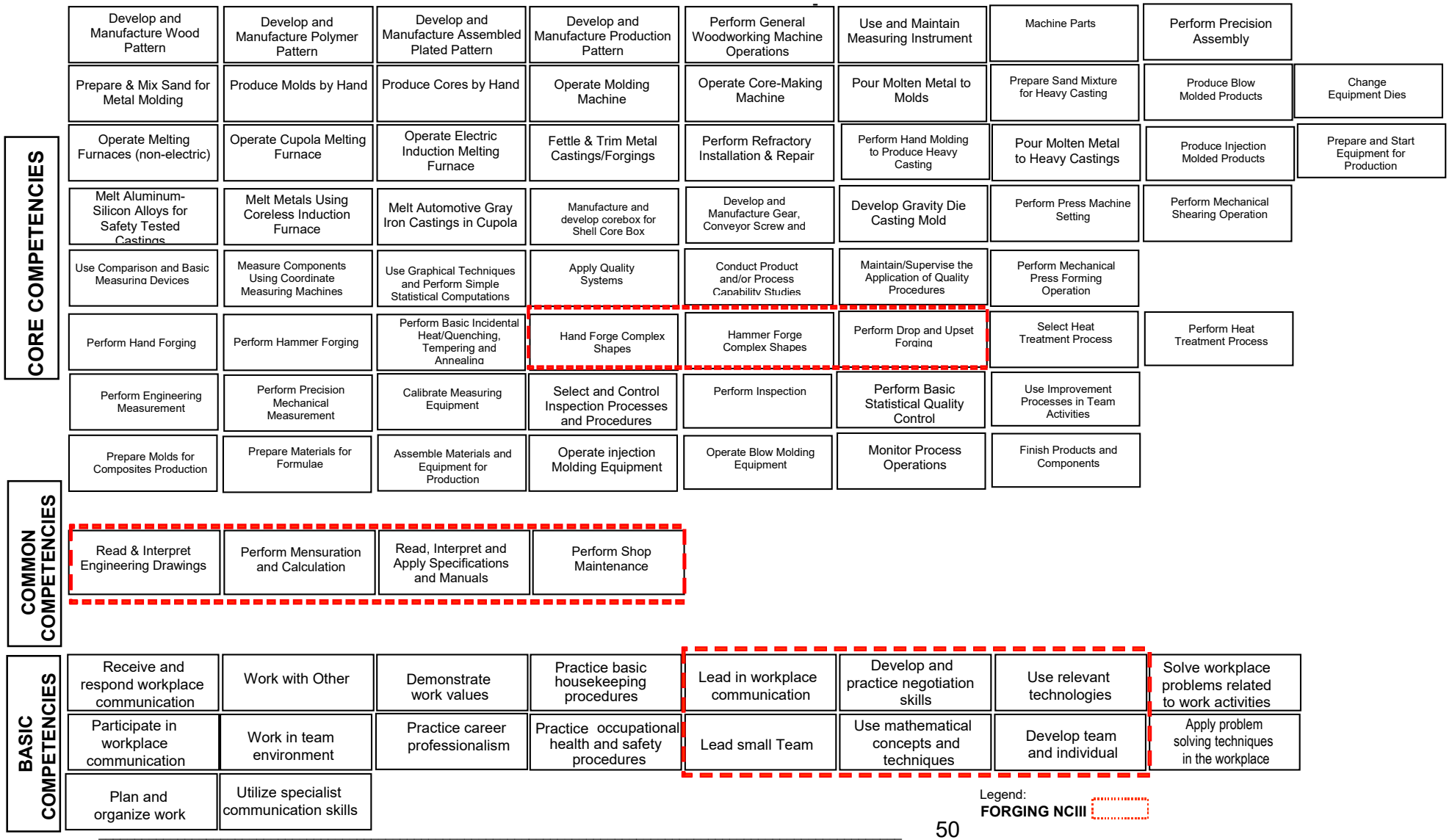
4.4.3 Experienced workers (wage employed or self-employed)

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



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 workpieces, 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.[1] 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.

ACKNOWLEDGEMENT

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THE TECHNICAL AND INDUSTRY EXPERT PANEL

FORGING

Antonio A. Gimenez	**Cesar R. Leal**	**Elmo N. Serbito**
Philippine Automotive Federation, Inc. (PAFI)	Philippine Automotive Federation, Inc. (PAFI)	PAFI (Samahan ng mga Manggagawang Supercast)

Carina J. Bondad

(Administrative Staff)

The PARTICIPANTS in the National Validation of this Training Regulation

- **(Supercast Foundry & Machinery Corp. SFMC)**
- **Philippine Aluminum Wheels Inc. (PAWI)**
- **Toyota Auto Parts Phils. Inc.**

Members of the TESDA Board

The MANAGEMENT and STAFF of the TESDA Secretariat

TESDA EXCOM

Qualification and Standards Office

Florante P. Inoturan

Agnes P. Panem

Abel B. Elpedes