

# TRAINING REGULATIONS



## HEAT TREATMENT NC II

**AUTOMOTIVE MANUFACTURING SECTOR**

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

**TABLE OF CONTENTS**  
**AUTOMOTIVE SECTOR**  
**(AUTOMOTIVE MANUFACTURING SUB SECTOR)**

**HEAT TREATMENT NC II**

	Page No.
<b>SECTION 1 HEAT TREATMENT NC II QUALIFICATION</b>	<b>1</b>
<b>SECTION 2 COMPETENCY STANDARDS</b>	
• Basic Competencies	2-14
• Common Competencies	15-26
• Core Competencies - HEAT TREATMENT NC II	27-33
<b>SECTION 3 TRAINING STANDARDS</b>	
3.1 Curriculum Design	34-36
3.2 Training Delivery	37
3.3 Trainee Entry Requirements	38
3.4 List of Tools, Equipment and Materials	38-39
3.5 Training Facilities	40
3.6 Trainers' Qualifications	40
3.7 Institutional Assessment	40
<b>SECTION 4 NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS</b>	<b>41</b>
<b>ANNEX A: COMPETENCY MAP</b>	<b>42</b>
<b>DEFINITION OF TERMS</b>	<b>43</b>
<b>ACKNOWLEDGEMENTS</b>	<b>44</b>

## TRAINING REGULATIONS FOR HEAT TREATMENT NC II

### SECTION 1 HEAT TREATMENT NC II QUALIFICATION

The HEAT TREATMENT NC II Qualification consists of competencies that a person must achieve to be able to select the appropriate process of heat treatment to achieve the desired result, recording and maintaining the heat treatment information in the manufacture of many other metals. It also covers heat treatment of ferrous and non-ferrous metals using a variety of equipment such as box type pit type, boggie type furnaces either gas, oil-fired or electrically heated. Heat treatment techniques include annealing, case hardening, precipitation strengthening, tempering and quenching.

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

The Units of Competency comprising this Qualification include the following:

<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 and Apply 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>
ALT812318	Select Heat Treatment Process
ALT812319	Perform Heat Treatment Process

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

- Heat Treater**

## SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in HEAT TREATMENT NC II.

### BASIC COMPETENCIES

**UNIT OF COMPETENCY :** PARTICIPATE IN WORKPLACE COMMUNICATION

**UNIT CODE :** 500311105

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

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Obtain and convey workplace information	1.1 Specific and relevant information is accessed from <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 <del>is</del> 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

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Attained job targets within key result areas (KRAs)</li> <li>1.2 Maintained intra - and interpersonal relationship in the course of managing oneself based on performance evaluation</li> <li>1.3 Completed trainings and career opportunities which are based on the requirements of the industries</li> <li>1.4 Acquired and maintained licenses and/or certifications according to the requirement of the qualification</li> </ul>
<p>2. Underpinning knowledge &amp; attitudes</p>	<ul style="list-style-type: none"> <li>2.1 Work values and ethics (Code of Conduct, Code of Ethics, etc.)</li> <li>2.2 Company policies</li> <li>2.3 Company-operations, procedures and standards</li> <li>2.4 Fundamental rights at work including gender sensitivity</li> <li>2.5 Personal hygiene practices</li> </ul>
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Appropriate practice of personal hygiene</li> <li>3.2 Intra and Interpersonal skills</li> <li>3.3 Communication skills</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 Workplace or assessment location</li> <li>4.2 Case studies/scenarios</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 Simulation/Role-plays</li> <li>5.4 Observation</li> <li>5.5 Third Party Reports</li> <li>5.6 Exams and Tests</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>

**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 Attitudes</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 <b>MUST</b> 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 <b>MUST</b> 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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
	<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	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 <b>MUST</b> 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 <b>MUST</b> 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.

<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 aspect of competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Selected measuring instruments</li> <li>1.2 Carried-out measurements and calculations.</li> <li>1.3 Maintained measuring instruments</li> </ul>
2. Underpinning knowledge and attitudes	<ul style="list-style-type: none"> <li>2.1 Types of Measuring instruments and its uses</li> <li>2.2 Safe handling procedures in using measuring instruments</li> <li>2.3 Four fundamental operation of mathematics</li> <li>2.4 Formula for Volume, Area, Perimeter and other geometric figures</li> </ul>
3. Underpinning skills	<ul style="list-style-type: none"> <li>3.1 Caring and Handling measuring instruments</li> <li>3.2 Calibrating and using measuring instruments</li> <li>3.3 Performing calculation by Addition, Subtraction, Multiplication and Division</li> <li>3.4 Visualizing objects and shapes</li> <li>3.5 Interpreting formula for volume, area, perimeter and other geometric figures</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 location</li> <li>4.2 Measuring instrument appropriate to servicing processes</li> <li>4.3 Instructional materials relevant to the propose 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 Observation with questioning</li> <li>5.2 Written or oral examination</li> <li>5.3 Interview</li> <li>5.4 Demonstration with questioning</li> </ul>
6. Context of assessment	<ul style="list-style-type: none"> <li>6.1 Competency elements must be assessed in a safe working environment</li> <li>6.2 Assessment may be conducted in a workplace or simulated environment</li> </ul>

**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 <b>manuals</b> 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: 2.1 Manufacturer's specification manual 2.2 Repair manual 2.3 Maintenance Procedure Manual 2.4 Periodic Maintenance Manual

## EVIDENCE GUIDE

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <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>
<p>2. Underpinning knowledge and attitudes</p>	<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>
<p>3. Underpinning skills</p>	<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>
<p>4 Resource Implications</p>	<p>The following resources must 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>
<p>5 Method of assessment</p>	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Observation with questioning</li> <li>5.2 Interview</li> </ul>
<p>6 Context of assessment</p>	<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 :**      **SELECT HEAT TREATMENT PROCESS**

**UNIT CODE**                    **:**      **ALT812318**

**UNIT DESCRIPTOR**         **:**      This unit covers selecting the appropriate process to achieve the desired result, recording and maintaining the heat treatment information.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables
1. Determine job requirements	<p>1.1 <b><i>Heat treatment process</i></b> to achieve specified result is determined using reference materials, metallurgist's report, consultation with technical specialists or other appropriate personnel.</p> <p>1.2 Knowledge of <b><i>metal composition</i></b> and effects of heat and cooling is applied to selection of appropriate process and <b><i>equipment</i></b>.</p>
2. Test materials and record and maintain heat treatment information	<p>2.1 Properties of <b><i>materials</i></b> is tested using appropriate <b><i>testing</i></b> equipment as required</p> <p>2.2 Heat treatment faults are identified and reported to concerned personnel</p> <p>2.3 <b><i>Heat treatment faults</i></b> are rectified according to standard operating procedure</p> <p>2.4 Information relating to equipment and processes is maintained as required</p>

## RANGE OF VARIABLE

VARIABLE	RANGE
1. Heat-treatment process	1.1 Preheating 1.2 Soaking 1.3 Quenching (air, water, oil) 1.4 Tempering 1.5 Annealing 1.6 Normalizing 1.7 Carburizing 1.8 sintering
2. Metal composition	2.1 High 2.2 Low carbon steel
3. Equipment	3.1 Salt baths 3.2 Vacuum furnace 3.3 Induction heating 3.4 Kilns 3.5 Gas-fired furnace
4. Material	4.1 Ferrous metals 4.2 Non-ferrous metals
5. Testing	5.1 Destructive tests 5.2 Non-destructive tests
6. Heat treatment faults	6.1 Thermal fractures 6.2 Distortion 6.3 Shrinkage 6.4 Oxidation, etc

## EVIDENCE GUIDE

<p>1. Critical aspect of Competency</p>	<p>Assessment requires evidence that the candidate</p> <ul style="list-style-type: none"> <li>1.1 Determined job requirements</li> <li>1.2 Identified and selected appropriate heat treatment process</li> <li>1.3 Tested materials and recorded and maintained heat treatment information</li> </ul>
<p>2. Underpinning Knowledge and attitudes</p>	<ul style="list-style-type: none"> <li>2.1 Metal chemical composition.</li> <li>2.2 Different heat-treatment processes, equipment and application.</li> <li>2.3 Heat-treatment faults and counter-measures.</li> <li>2.4 Destructive and non-destructive testing of metals.</li> <li>2.5 Mechanical / physical properties of metals.</li> <li>2.6 Time, temperature diagram of metals.</li> <li>2.7 Use of personal protective unit.</li> <li>2.8 Safe work practices and procedures.</li> </ul>
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Selecting appropriate heat-treatment equipment and process.</li> <li>3.2 Identifying and rectifying heat-treatment faults (equipment and process).</li> <li>3.3 Reading, interpreting and following information on written job instructions, specifications, standard operating procedures, manufacturers manual and instructions, chart, list, drawings and applicable reference documents.</li> <li>3.4 Accomplishing pro-forms and standard workplace form using routine and familiar information</li> <li>3.5 Perform standard metal hardness tests.</li> <li>3.6 Check and clarify tasks selected information.</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 Manuals/catalogues relative to heat treatment</li> <li>4.2 Job order, requisitions slip for materials</li> <li>4.3 Materials, tools and equipment relevant to the activity</li> </ul>
<p>5. Method of assessment</p>	<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>
<p>6. Context of assessment</p>	<p>Assessment may be conducted in the workplace or a simulated environment.</p>

**UNIT OF COMPETENCY :**      **PERFORM HEAT TREATMENT PROCESS**

**UNIT CODE :**                      **ALT812319**

**UNIT DESCRIPTOR :**            This unit covers heat treatment of ferrous and non-ferrous metals, selecting the appropriate process to achieve the desired result using a variety of equipment such as box type, pit type, boggie type furnaces either gas, oil-fired or electrically heated.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables
1. Determine job requirements and set up equipment	1.1 Job requirements are determined from engineering drawing, job sheet or verbal instruction from metallurgist and other concerned personnel. 1.2 <b>Heating equipment</b> is selected for the required <b>heat treatment process</b> . 1.3 Equipment is set up according to standard operating procedures and/or manufacturer's instructions 1.4 Personal protective equipment/devices are used in accordance with occupational health and safety (OH & S) requirements
2. Load/ arrange materials	2.1 <b>Material</b> is piece- or batch-loaded and unloaded in accordance with standard operating procedures. 2.2 Fixtures are used to avoid /minimize damage to the material during handling and heating or cooling. 2.3 Equipment appropriate to the situation is applied according to standard operating procedure.
3. Operate and monitor heating equipment	3.1 Furnace start-up is performed as per standard operating procedures and safety requirements. 3.2 Information related with equipment and process is recorded as per standard procedures. 3.3 Required heating temperature, soaking time and cooling time is applied and maintained according to standard operating procedure. 3.4 Hazards are identified and control measures are implemented to maintain a safe work environment. 3.5 Optimum furnace operation requirement is maintained as per standard operating procedures. 3.6 Furnace atmosphere is maintained as per standard operating procedures 3.7 Temperature distribution inside the furnace is monitored and adjusted, if necessary, in accordance with standard operating procedures.

4. Heat treat materials	<p>4.1 Quenching medium /tank is prepared as required by the process.</p> <p>4.2 Air blast for air cooling is prepared, if required by the process.</p> <p>4.3 Material is removed from the furnace as per standard operating procedures and safely requirements</p> <p>4.4 Materials is heat treated to achieve required result in accordance with standard operating procedures and customer requirements</p>
5. Shut down furnace	<p>5.1 Furnace is shut down as per standard operating procedures</p> <p>5.2 Routine maintenance is performed on thermo-couples and temperature meter as per standard operating procedures</p>

## RANGE OF VARIABLE

VARIABLE	RANGE
1. Heating Equipment	Heating equipment include gas, oil fired and electric furnaces, such as 1.1 pit furnace 1.2 box type furnace 1.3 boggie (car type) furnace or 1.4 muffle furnace.
2. Heat treatment process	2.1 Stress relieving 2.2 Annealing 2.3 Normalizing 2.4 Quenching (air, water, oil) 2.5 Tempering
3. Materials	3.1 Cast iron 3.2 Carbon steels 3.2 Alloy steels 3.4 Aluminum alloys.

## EVIDENCE GUIDE

<p>1. Critical aspect of Competency</p>	<p>Assessment requires evidence that the candidate</p> <ul style="list-style-type: none"> <li>1.1 Determined job requirements</li> <li>1.2 Set-up heat treatment equipment</li> <li>1.3 Loaded / arranged the materials</li> <li>1.4 Operated and monitored heating equipment</li> <li>1.5 Heat treated materials</li> <li>1.6 Shut down furnace</li> </ul>
<p>2. Underpinning Knowledge and attitudes</p>	<ul style="list-style-type: none"> <li>2.1 Metal chemical composition.</li> <li>2.2 Different heat-treatment processes, equipment and application.</li> <li>2.3 Heat-treatment faults and counter-measures.</li> <li>2.4 Destructive and non-destructive testing of metals.</li> <li>2.5 Mechanical / physical properties of metals.</li> <li>2.6 Time, temperature diagram of metals.</li> <li>2.7 Use of personal protective unit.</li> <li>2.9 Safe work practices and procedures.</li> </ul>
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Selecting appropriate heat-treatment equipment and process.</li> <li>3.6 Identifying and rectifying heat-treatment faults (equipment and process).</li> <li>3.7 Reading, interpreting and following information on written job instructions, specifications, standard operating procedures, manufacturers manual and instructions, chart, list, drawings and applicable reference documents.</li> <li>3.8 Entering routine and familiar information into pro-forms and standard workplace form.</li> <li>3.9 Perform standard metal hardness tests.</li> <li>3.6 Check and clarify tasks selected information.</li> </ul>
<p>4. Resource implications</p>	<p>The following resources <b>MUST</b> be provided:</p> <ul style="list-style-type: none"> <li>6.1 Manuals/catalogues relative to heat treatment</li> <li>6.2 Job order, requisitions slip for materials</li> <li>6.3 Materials, tools and equipment relevant to the activity</li> </ul>
<p>7. Method of assessment</p>	<p>Competency <b>MUST</b> be assessed through:</p> <ul style="list-style-type: none"> <li>7.1 Observation with questioning</li> <li>7.2 Portfolio</li> <li>7.3 Third Party Report</li> </ul>
<p>8. Context of assessment</p>	<p>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 Heat Treatment NC II.

### 3.1 CURRICULUM DESIGN

Course Title: **Heat Treatment**

NC Level: **NC II**

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

Course Description:

This course is designed to enhance the knowledge, skills and attitudes of an individual in the field of HEAT TREATMENT. This course consists of competencies that a person must achieve to be able to select the appropriate process of heat treatment to achieve the desired result, recording and maintaining the heat treatment information in the manufacture of many other metals. It also covers heat treatment of ferrous and non-ferrous metals using a variety of equipment such as box type pit type, boggie type furnaces either gas, oil-fired or electrically heated. Heat treatment techniques include annealing, case hardening, precipitation strengthening, tempering and quenching.

This course is also designed to enhance the basic and common knowledge, skills and attitudes of an individual in the field of foundry-pattern making.

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

#### BASIC COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Participate in workplace communication	1.1 Obtain and convey workplace information. 1.2 Complete relevant work related documents. 1.3 Participate in workplace meeting and discussion.	<ul style="list-style-type: none"> <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 / Interaction</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.	<ul style="list-style-type: none"> <li>• Group Discussion</li> <li>• Interaction</li> <li>• Simulation</li> </ul>	<ul style="list-style-type: none"> <li>• Role play</li> <li>• Interview</li> <li>• Written examination</li> </ul>

	3.2 Set and meet work priorities. 3.3 Maintain professional growth and development.	<ul style="list-style-type: none"> <li>• Demonstration</li> <li>• Self-paced instruction</li> <li>• Structured activity</li> <li>• Film viewing</li> </ul>	<ul style="list-style-type: none"> <li>• Portfolio assessment</li> </ul>
4. Practice occupational health and safety	4.1 Identify hazardous 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>• Situation analysis</li> <li>• Interview</li> <li>• Practical examination</li> <li>• Written examination</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	4.1. Identify/accessed manuals and interpret data and specification 4.2 Apply information accessed in manual 4.3 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. Select Heat Treatment Process	1.1 Determine job requirements 1.2 Identify and select appropriate heat treatment process 1.3 Test materials, record and maintain heat treatment information	<ul style="list-style-type: none"> <li>• Lecture</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 Heat Treatment Process	2.1 Determine job requirements 2.2 Select appropriate equipment and accessories 2.3 Conduct appropriate material loading 2.4 Operate the furnace 2.5 Inspect / test the product	<ul style="list-style-type: none"> <li>• Lecture</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 experience in basic machining
- Can communicate both orally and in writing; and
- Physically and mentally fit

### 3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS HEAT TREATMENT NC II

Recommended list of tools, equipment and materials for the training of 25 trainees for Heat Treatment NC II

TOOLS		EQUIPMENT		MATERIALS	
QTY		QTY		QTY	
2 sets	Wire rope ½ harness, 12mm dia rope x 10meters long	1 unit	Box type furnace	2 pcs	Cold rolled steel – 25 dia SAE 1030 200mm long
4 sets	Tongs	1 unit	Bogie type furnace	2 pcs	Cold rolled steel – 50 dia SAE 1030 200mm long
1 set	Socket wrench	1 unit	Muffle type furnace	4 pcs	Mild steel plate (200mm long x 100mm wide) 12mm thick
1 set	Open wrench	1 unit	Over-head crane	4 pcs	Mild steel plate (200mm long x 100mm wide) 20mm thick
2 pcs	Ball pein hammer 300mm long	1 unit	A-crane	4 pcs	Mild steel plate (200mm long x 100mm wide) 6mm thick
10 sets	Toogle clamp	1 unit	Quenching tank	5 gallon	Quenching oil
10 sets	Bolt	4 units	Blower fan	2 pcs	Cold rolled steel SAE-1040/4140 100mm long – 25dia
2 pcs	Mechanical plier	1 unit	Fork lift 2 tons	2 pcs	Cold rolled steel SAE-1040/4140 100mm long – 50dia
1 pc	Electrical plier	4 units	Basket		LPG fuel
1 set	Hack saw	1 set	Thermocouple		Diesel fuel
2 pcs	Hack saw blade	2 sets	Thermocouple tips		
2 sets	Pipe wrench 2 inches	1 set	Temperature meter –		

			1200°C		
2 rolls	Teflon tape	1 set	Temperature reorder		
1 pc	Triangular file medium	1 set	Welding machine – 300 amp		
1 pc	Flat file medium	1 set	Hardness tester (BUN)		
2 sets	Screw driver (plus / minus)	1 set	Electric angular grinder – 100mm		
20 meters long	Steel bars – 12mm dia	1 pc	Hard hat		
2 pcs	Adjustable wrench – 300mm	1 pair	Safety shoes		
3 pcs	Pentel pen marker	2 sets	Eye goggles		
2 pcs	Ball pen	1 pair	Leather gloves		
1 pc	Clip board	1 set	Apron		
1 set	Letter punch	1 pair	Arm band		
1 set	Number punch				
5 sets	Water container 5 gallon capacity				
1 pc	Vernier caliper – 300mm				
1 pc	Steel tape 3 meters				

### 3.5 TRAINING FACILITIES HEAT TREATMENT NC II

Based on a class size of 25 students/trainees

SPACE REQUIREMENT	SIZE IN METERS	AREA IN SQ. METERS	TOTAL AREA IN SQ. METERS
• Building (permanent)	26.00 x 28.00	728.00	728.00
• Trainee Working Space	3.50 x 3.50 per student / trainee	10.25 per student	123
• 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	-	-	291.75

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

#### HEAT TREATMENT NC II TRAINER QUALIFICATION (TQ II)

- Must be a holder of HEAT TREATMENT 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 HEAT TREATMENT 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 The qualification of HEAT TREATMENT NC II may be attained through demonstration of competence through project-type assessment covering all required units of competency of the qualification.

4.2.1 **Perform Heat Treatment for Ferrous Metals**

- Select Heat Treatment Process
- Perform Heat Treatment Process

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 PARTS MANUFACTURING

<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	Use and maintain measuring instrument	Prepare Sand Mixture for Heavy Casting
	Operate melting furnaces (non-electric)	Operate cupola melting furnace	Operate electric induction melting furnace	Fettle & trim metal castings/forgings	Perform refractory installation & repair	Use & maintain measuring instrument	Perform Hand Molding to produce Heavy Casting	Pour Molten metal to Heavy Castings
	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 Propeller Patterns	Develop Gravity Die Casting Mold	Select Heat Treatment Process	Perform Heat Treatment Process
<b>COMMON COMPETENCIES</b>	<div style="border: 2px dashed green; padding: 5px;">                 Read &amp; Interpret Engineering Drawings    Perform Mensuration and Calculation    Read, Interpret and Apply Specifications and Manuals    Perform Shop Maintenance             </div>							
<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						

Legend:  
HEAT TREATMENT NC II

## DEFINITION OF TERMS (HEAT TREATMENT)

- 1. Heat Treatment** A process in which metal in the solid state is subjected to one or more temperature cycles to attain certain desired properties.
- 2. Annealing** Heating to and holding above the critical range followed by controlled slow-cooling in the furnace.
- 3. Quenching** Is a hardening process. It involves heating to a temperature within a critical temperature range followed by quenching in a medium which are liquid or air medium. Quenching is a distinct operation carried out external to the furnace.
- 4. Thermal critical range** Metals have its own distinct chemical composition. The thermal critical range depends on the chemical composition of the metal. Heating above and below the critical temperature range changes in a solid state constitution. While major constitutional change cannot occur below the lower limits some changes in microstructure are do so.
- 5. Precipitation hardening metals** Hardening in metals caused by the precipitation of a constituent from a supersaturated solid solution. This occurs after quenching of alloys especially the maraging steel groups and stainless steels.
- 6. Differential hardening** Some techniques allow different areas of a single object to receive different heat treatments. This is called differential hardening. It is common in high quality knives and swords. The Chinese jian is one of the earliest known examples of this, and the Japanese katana the most widely known. The Nepalese Khukuri is another example.
- 7. Ferrous metals** The term "ferrous" is derived from the latin word meaning "containing iron". This can include pure iron, such as wrought iron, or an alloy such as steel. Ferrous metals are often magnetic, but not exclusively.
- 8. Alloy** An alloy is a mixture of two or more elements in solid solution in which the major component is a metal. Combining different ratios of metals as alloys modifies the properties of pure metals to produce desirable characteristics. The aim of making alloys is generally to make them less brittle, harder, resistant to corrosion, or have a more desirable color and luster. Examples of alloys are steel (iron and carbon), brass (copper and zinc), bronze (copper and tin), and duralumin (aluminium and copper). Alloys specially designed for highly demanding applications, such as jet engines, may contain more than ten elements.
- 9. Metal** In chemistry, a **metal** (Greek: Metallo, *Μέταλλο*) is a chemical element whose atoms readily lose electrons to form positive ions (cations), and form metallic bonds between other metal atoms and ionic bonds between nonmetal atoms.

## ACKNOWLEDGEMENT

The Technical Education and Skills Development Authority (TESDA) wishes to extend thanks and appreciation to the many representatives of business, industry, academe and government agencies who rendered their time and expertise to the development and validation of this Training Regulation.

### THE TECHNICAL AND INDUSTRY EXPERT PANEL

#### HEAT TREATMENT

**Antonio A. Gimenez**

Philippine Automotive  
Federation, Inc. (PAFI)

**Cesar R. Leal**

Philippine Automotive  
Federation, Inc. (PAFI)

**Elmo N. Serbito**

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**