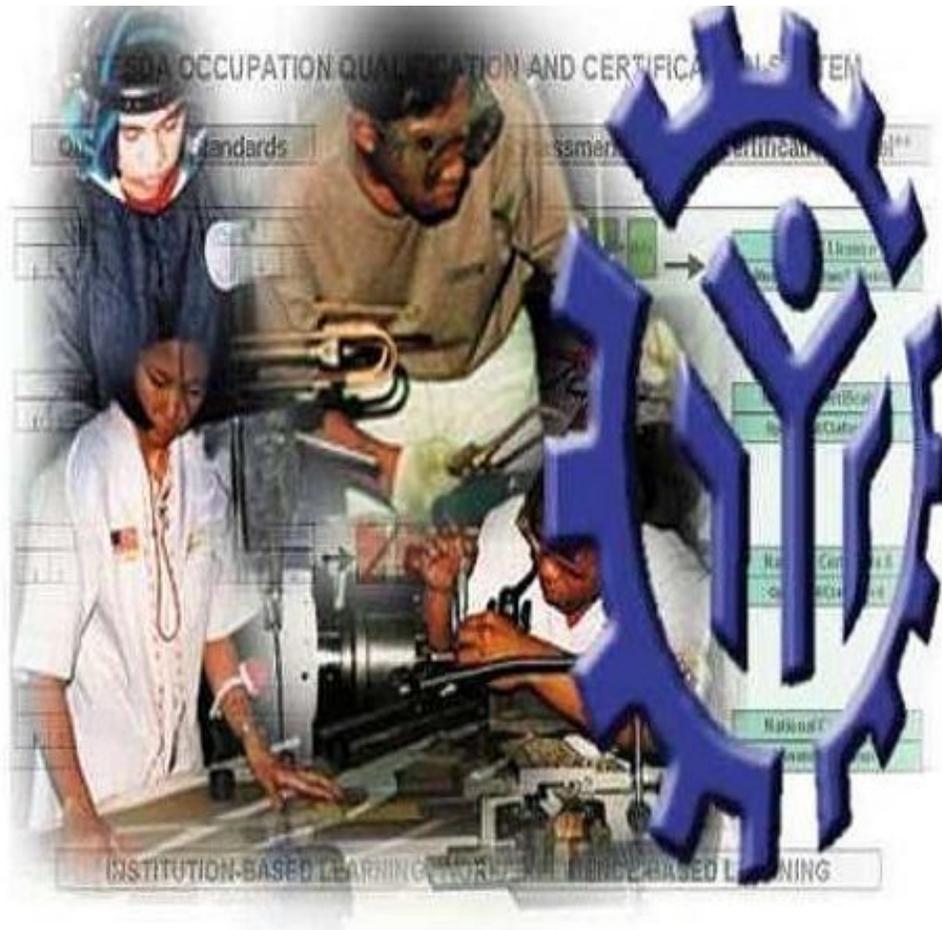


# TRAINING REGULATIONS



## FOUNDRY MELTING/CASTING NC III

**AUTOMOTIVE MANUFACTURING SECTOR**

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

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## TRAINING REGULATIONS FOR FOUNDRY MELTING/CASTING NC III

### SECTION 1 FOUNDRY MELTING/ CASTING NC III QUALIFICATION

The FOUNDRY MELTING/CASTING NC III Qualification consists of competencies that a person must achieve to melt aluminum-silicon alloys for safety tested castings; melt Metals using coreless induction furnace and melt automotive gray iron castings in cupola.

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>
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

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

<b>CODE NO.</b>	<b>CORE COMPETENCIES</b>
ALT812315	Melt Aluminum-Silicon Alloys for Safety Tested Castings
ALT812316	Melt Metals Using Coreless Induction Furnace
ALT812317	Melt Automotive Gray Iron Castings in Cupola

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

- **Foundry Alloy Melter**

## SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in **FOUNDRY MELTING/CASTING 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 <i>Italicized terms</i> are elaborated in the Range of Variables
1. Communicate information about workplace processes	1.1 Appropriate <b>communication method</b> 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

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Dealt with a range of communication/information at one time</li> <li>1.2 Made constructive contributions in workplace issues</li> <li>1.3 Sought workplace issues effectively</li> <li>1.4 Responded to workplace issues promptly</li> <li>1.5 Presented information clearly and effectively written form</li> <li>1.6 Used appropriate sources of information</li> <li>1.7 Asked appropriate questions</li> <li>1.8 Provided accurate information</li> </ul>
<p>2. Underpinning knowledge</p>	<ul style="list-style-type: none"> <li>2.1 Organization requirements for written and electronic communication methods</li> <li>2.2 Effective verbal communication methods</li> </ul>
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Organize information</li> <li>3.2 Understand and convey intended meaning</li> <li>3.3 Participate in variety of workplace discussions</li> <li>3.4 Comply with organization requirements for the use of written and electronic communication methods</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 Variety of Information</li> <li>4.2 Communication tools</li> <li>4.3 Simulated workplace</li> </ul>
<p>5. Method of assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Competency in this unit must be assessed through</li> <li>5.2 Direct Observation</li> <li>5.3 Interview</li> </ul>
<p>6. Context of assessment</p>	<ul style="list-style-type: none"> <li>6.1 Competency may be assessed in the workplace or in simulated workplace environment</li> </ul>

**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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Provide team leadership	1.1 <b>Work requirements</b> are identified and presented to team members 1.2 Reasons for instructions and requirements are communicated to team members 1.3 <b>Team members' queries and concerns</b> 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 <b>Monitoring of performance</b> takes place against defined performance criteria and/or assignment instructions and corrective action taken if required 4.2 Team members are provided with <b>feedback</b> , positive support and advice on strategies to overcome any deficiencies 4.3 <b>Performance issues</b> 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

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Maintained or improved individuals and/or team performance given a variety of possible scenario</li> <li>1.2 Assessed and monitored team and individual performance against set criteria</li> <li>1.3 Represented concerns of a team and individual to next level of management or appropriate specialist and to negotiate on their behalf</li> <li>1.4 Allocated duties and responsibilities, having regard to individual's knowledge, skills and aptitude and the needs of the tasks to be performed</li> <li>1.5 Set and communicated performance expectations for a range of tasks and duties within the team and provided feedback to team members</li> </ul>
<p>2. Underpinning knowledge</p>	<ul style="list-style-type: none"> <li>2.1 Company policies and procedures</li> <li>2.2 Relevant legal requirements</li> <li>2.3 How performance expectations are set</li> <li>2.4 Methods of Monitoring Performance</li> <li>2.5 Client expectations</li> <li>2.6 Team member's duties and responsibilities</li> </ul>
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Communication skills required for leading teams</li> <li>3.2 Informal performance counseling skills</li> <li>3.3 Team building skills</li> <li>3.4 Negotiating 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 Access to relevant workplace or appropriately simulated environment where assessment can take place</li> <li>4.2 Materials relevant to the proposed activity or task</li> </ul>
<p>5. Methods of assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Direct observations of work activities 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 assessment may occur in workplace or any appropriately simulated environment</li> <li>6.2 Assessment shall be observed while task are being undertaken whether individually or in-group</li> </ul>

**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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Plan negotiations	1.1 Information on <b><i>preparing for negotiation</i></b> is identified and included in the plan 1.2 Information on creating <b><i>non verbal environments</i></b> for positive negotiating is identified and included in the plan 1.3 Information on <b><i>active listening</i></b> is identified and included in the plan 1.4 Information on different <b><i>questioning techniques</i></b> 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 A variety of questioning techniques are used 2.4 The issues and processes are documented and agreed upon by all parties 2.5 Possible solutions are discussed and their viability assessed 2.6 Areas for agreement are confirmed and recorded 2.7 Follow-up action is agreed upon by all parties 2.8

## 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	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Demonstrated sufficient knowledge of the factors influencing negotiation to achieve agreed outcome</li> <li>1.2 Participated in negotiation with at least one person to achieve an agreed outcome</li> </ul>
2. Underpinning knowledge and Attitude	<ul style="list-style-type: none"> <li>2.1 Codes of practice and guidelines for the organization</li> <li>2.2 Organizations policy and procedures for negotiations</li> <li>2.3 Decision making and conflict resolution strategies procedures</li> <li>2.4 Problem solving strategies on how to deal with unexpected questions and attitudes during negotiation</li> <li>2.5 Flexibility</li> <li>2.6 Empathy</li> </ul>
3. Underpinning skills	<ul style="list-style-type: none"> <li>3.1 Interpersonal skills to develop rapport with other parties</li> <li>3.2 Communication skills (verbal and listening)</li> <li>3.3 Observation skills</li> <li>3.1 Negotiation skills</li> </ul>
4. Resource implications	<p>The following resources <b>MUST</b> be provided:</p> <ul style="list-style-type: none"> <li>4.1 Room with facilities necessary for the negotiation process</li> <li>4.2 Human resources (negotiators)</li> </ul>
5. Method of assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Observation/demonstration and questioning</li> <li>5.2 Portfolio assessment</li> <li>5.3 Oral and written questioning</li> <li>5.4 Third party report</li> </ul>
6. Context of assessment	<ul style="list-style-type: none"> <li>6.1 Competency to be assessed in real work environment or in a simulated workplace setting.</li> </ul>

**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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> 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 <b>analytical techniques</b> 1.3 <b>Problems</b> 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 <b>Action plans</b> 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

<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 the problem</li> <li>1.2 Determined the fundamental causes of the problem</li> <li>1.3 Determined the correct / preventive action</li> <li>1.4 Provided recommendation to manager</li> </ul> <p>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.</p>
<p>2. Underpinning knowledge</p>	<ul style="list-style-type: none"> <li>2.1 Competence includes a thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations</li> <li>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 <ul style="list-style-type: none"> <li>2.2.1 Relevant equipment and operational processes</li> <li>2.2.2 Enterprise goals, targets and measures</li> <li>2.2.3 Enterprise quality, OHS and environmental requirement</li> <li>2.2.4 Principles of decision making strategies and techniques</li> <li>2.2.5 Enterprise information systems and data collation</li> <li>2.2.6 Industry codes and standards</li> </ul> </li> </ul>
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Using range of formal problem solving techniques</li> <li>3.2 Identifying and clarifying the nature of the problem</li> <li>3.3 Devising the best solution</li> <li>3.4 Evaluating the solution</li> <li>3.5 Implementation of a developed plan to rectify the problem</li> </ul>

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	<p>Competency may be assessed through:</p> <p>5.1 Case studies on solving problems in the workplace</p> <p>5.2 Observation</p> <p>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.</p>
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.

<b>ELEMENT</b>	<b>Performance Criteria</b> <i>Italicized terms</i> 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 <b>Mathematical techniques</b> 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 <b>Appropriate action</b> 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 <b>MUST</b> 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.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Study/select appropriate technology	1.1 Usage of different <b>technologies</b> 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 <b>Management concepts</b> 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 <b>industry standard operating procedure</b> , <b>manufacturer's operating guidelines</b> and <b>occupational health and safety procedure</b> 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 <b>appropriate action</b>

## 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 <b>MUST</b> 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.

<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 aspects of competency	Assessment requires evidence that the candidate: 1.1 Selected measuring instruments 1.2 Carried-out measurements and calculations. 1.3 Maintained measuring instruments
2. Underpinning knowledge and attitudes	2.1 Types of Measuring instruments and its uses 2.2 Safe handling procedures in using measuring instruments 2.3 Four fundamental operation of mathematics 2.4 Formula for Volume, Area, Perimeter and other geometric figures
3. Underpinning Skills	3.1 Caring and Handling measuring instruments 3.2 Calibrating and using measuring instruments 3.3 Performing calculation by Addition, Subtraction, Multiplication and Division 3.4 Visualizing objects and shapes 3.5 Interpreting formula for volume, area, perimeter and other geometric figures
4. Resource Implications	The following resources <b>MUST</b> be provided: 4.1 Workplace location 4.2 Measuring instrument appropriate to servicing processes 4.3 Instructional materials relevant to the propose activity
5. Method of assessment	Competency <b>MUST</b> be assessed through: 5.1 Observation with questioning 5.2 Written or oral examination 5.3 Interview 5.4 Demonstration with questioning
6. Context of assessment	6.1 Competency elements must be assessed in a safe working environment 6.1 Assessment may be conducted in a workplace or simulated environment

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

**UNIT CODE: ALT723203**

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

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables
1. Identify and access manual/ specification	1.1 Appropriate <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: 1.1 Manufacturer's specification manual 1.2 Repair manual 1.3 Maintenance Procedure Manual 1.4 Periodic Maintenance Manual

## EVIDENCE GUIDE

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

UNIT OF COMPETENCY : **PERFORM SHOP MAINTENANCE**

UNIT CODE : **ALT723205**

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

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

## RANGE OF VARIABLES

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

## EVIDENCE GUIDE

1. Critical aspects of competency	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 <b>MUST</b> 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 <b>MUST</b> 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 :**      **MELT ALUMINUM-SILICON ALLOYS FOR SAFETY TESTED CASTINGS**

**UNIT CODE :**                      **ALT812315**

**UNIT DESCRIPTOR :**         This unit covers melting of appropriate aluminum silicon alloys for safety tested casting melted in a gas or oil fired furnace, using gravity die casting or low-pressure die casting method except aviation parts.

ELEMENT	PERFORMANCE CRITERIA
1. Identify job requirement	<p><i>Italicized</i> terms are elaborated in the Range of Variables</p> <p>1.1 <b>Casting alloy requirements</b> identified as per manufacturers / suppliers catalogue, drawings, instruction sheets.</p> <p>1.2 Required specifications are cross checked with corresponding <b>international specification</b></p> <p>1.3 Casting method is determined by available die or mold (gravity or low-pressure die casting).</p> <p>1.4 <b>Metal treatment</b> is determined based on available product bulletin.</p> <p>1.5 Appropriate melting furnace selected as per required metal treatment and type of crucible (stationary / dip-out or tilting).</p>
2. Establish melting and melt treatment process.	<p>2.1 Metal charges are fed as per standard operating procedures.</p> <p>2.2 Appropriate fluxing technique is performed based on composition of metal charges (virgin ingot and recycled scrap).</p> <p>2.3 Furnace is started up as per standard operating procedures.</p> <p>2.4 Appropriate degassing technique is applied as per standard operating procedures.</p> <p>2.5 Melt refining agent of the alloy is added as per standard operating procedures.</p> <p>2.6 Structured modification of the alloy is applied as per standard operating procedures.</p> <p>2.7 Speed of melting is monitored to avoid oxidation.</p> <p>2.8 Pouring temperature is determined corresponding to the alloy and casting section thickness.</p> <p>2.9 Filtration method and location is decided on corresponding to the alloy</p> <p>2.10 Metal is tapped from crucible with minimum turbulence to avoid oxide formations.</p> <p>2.11 Pouring is accomplished in accordance with OH &amp; S requirements</p>

<p>3. Identify casting quality requirement.</p>	<p>3.1 Casting quality requirements is identified based on job requirements</p> <p>3.2 Content of <b>contaminants</b> which will affect integrity of the casting is identified in accordance with procedures.</p> <p>3.3 Structural modification is applied in accordance with procedures,</p> <p>3.4 Availability of chemical analysis results is coordinated with other section such as process control</p> <p>3.5 Written procedures to be followed during castings is established as per quality Handbook.</p>
<p>4. Identify casting defects cause by unsound melting technique.</p>	<p>4.1 Nature of <b>casting defects</b>, its causes and the appropriate remedial actions is identified in accordance with standard operating procedures.</p> <p>4.2 Cause / effect analysis of the defect and other tools of quality control is presented in coordination with the process engineer.</p> <p>4.3 Defective castings which showed up in machining and painting section are coordinated with the respective sections in accordance with company procedures</p> <p>4.4 Action plan to resolve the persistent casting defect is formulated and implemented (vital few / trivial many) in accordance with company procedures.</p> <p>4.5 Personnel involved in melting are re-oriented on correct melting and treatment of aluminum-silicon alloy.</p> <p>4.6 Result of quality inspection is analyzed and measures are recommended to quality</p>
<p>5. Recycle scraps / turnings.</p>	<p>5.1 Re-melting is accomplished in accordance with company standard operating procedures</p> <p>5.2 Dross is completely removed from the melt before pouring into pig ingot molds.</p> <p>5.3 Ingot type is labeled as per standard operating procedures</p> <p>5.4 Melt contamination is avoided by coating all tools which comes into contact with the melt.</p> <p>5.5 <b>Production</b> reports are entered in pro-form with some comment / recommendation for future production reference.</p>

## RANGE OF VARIABLE

VARIABLE	RANGE
1. Casting alloy requirement.	1.1 Aluminum Silicon Alloy (AlSi) 12 1.2 AlSi 12 Magnesium (Mg) 1.3 AlSi 10 1.4 AlSi 9 Mg 1.5 AlSi 7 Mg 1.6 AlSi 5 Mg.
2. International specification	2.1 Society of Automotive Engineer (SAE) 2.2 Japanese Industrial Standard (JIS) 2.3 American Society Testing Materials (ASTM) 2.4 German Standard (DIN) 2.5 British Standard (BS) 2.6 Australian Standard (AS) 2.7 American Aluminum (AA)
3. Metal treatment.	3.1 Structural modifications. 3.2 Refining agent-metallic sodium, permanently refined with strontium. 3.3 Titanium diboride. 3.4 Flux 3.5 Degasser 3.6 Solution heat treatment / aging as necessary.
4. Contaminants	4.1 Iron content – max 0.15%. 4.2 Manganese content – max 0.02% 4.3 Copper content – less than 0.01%
5. Casting defects	5.1 Shrinkage. 5.2 Blow-holes. 5.3 Metal inclusions 5.4 Oxide inclusions
6. Production	Safety tested castings produced include 6.1 car wheels 6.2 motor bike wheels 6.3 brake pedals, 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 Identified job requirements.</li> <li>1.2 Established melting and melt treatment process.</li> <li>1.3 Identified casting quality requirement.</li> <li>1.4 Identified casting defects cause by un-sound melting technique.</li> <li>1.5 Recycled of scraps / turnings.</li> <li>1.6 Prepared reports</li> </ul>
<p>2. Underpinning knowledge and attitudes</p>	<ul style="list-style-type: none"> <li>2.1 Aluminum-silicon alloy specification</li> <li>2.2 Melting control of aluminum silicon alloy procedures</li> <li>2.3 Melt treatment of aluminum-silicon alloy procedures</li> <li>2.4 Casting chemical composition limits and subversive Elements (contaminants)</li> <li>2.5 Effects of chemical composition on integrity of the casting (strengths, ductility, surface finish)</li> <li>2.6 Charging sequence of metallic charges and melt treatment</li> <li>2.7 Pouring temperature range limits.</li> <li>2.8 Nature of casting defects attributable to melting and melt treatment of aluminum-silicon alloy.</li> <li>2.9 Countermeasures to eliminate / minimize casting defects.</li> <li>2.10 Safety test applied to casting.</li> <li>2.11 Operation of emission spectrometer analyzer</li> <li>2.12 Safe work practice and procedures.</li> <li>2.13 Use and application of personal protective equipments.</li> <li>2.14 Operational hazards and control measures associated with melting aluminum-silicon alloys.</li> <li>2.15 Applicable industry standards for aluminum-silicon alloy such as: AA, JIS, SAE, ASTM, DIN, BS and other published standard by aluminum ingots supplier.</li> </ul>
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Reading and interpreting information on written job instructions, specifications, standard operating procedures relevant test data sheets and other standard workplace forms. May include drawings for furnace operation.</li> <li>3.2 Following oral instructions.</li> <li>3.3 Decide on raw materials.</li> <li>3.4 Weighing charge materials.</li> <li>3.5 Feeding materials into furnace.</li> <li>3.6 Measuring metal temperature and adjusting if necessary.</li> <li>3.7 Sampling for chemical analysis and for gas content analysis.</li> <li>3.8 Applying de-slagging, degassing, refining and modifying melting techniques.</li> </ul>

4. Resource implications	<p>The following resources <b>MUST</b> be provided:</p> <p>4.1 All manuals/catalogues relative to Melting/Casting of Aluminum-silicon alloys.</p> <p>4.2 Job order, requisitions slip for materials</p> <p>4.3 Materials, tools and equipment relevant to the activity</p> <p>4.4 Crucible furnace</p> <p>4.5 Spectrometer</p>
5. Method of assessment	<p>Competency <b>MUST</b> be assessed through:</p> <p>5.1 Observation with questioning</p> <p>5.2 Portfolio</p> <p>5.3 Third party report</p>
6. Context of assessment	<p>6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines</p> <p>6.2 Assessment may be conducted in the workplace or a simulated environment</p>

**UNIT OF COMPETENCY :**      **MELT METALS USING CORELESS INDUCTION FURNACE**

**UNIT CODE :**                      **ALT812316**

**UNIT DESCRIPTOR :**            This unit covers implementation of Quality Assurance and Control in Induction Furnace Melting, which would include low frequency, medium frequency and high frequency furnaces, melting a wide range of metals and the operational maintenance of the furnace crucible.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized</i> terms are elaborated in the Range of Variables
1. Identify job requirements.	1.1 Melting and casting requirements identified as per manufacturers/ suppliers catalogue, drawings, customer requirements and instruction sheet 1.2 <b>Metal</b> composition and casting properties is determined in accordance with standard operating procedures. 1.3 <b>Charge materials</b> / ferro-alloys requirement are determined based cast metal requirements. 1.4 Melting / pouring temperature range are determined based <b>cast metal</b> requirements.
2. Establish melting procedure	2.1 Melting <b>procedure</b> is written down as per standard operating procedure. 2.2 Raw materials, ferro-alloys and additives are specified as per procedures 2.3 Incoming materials are inspected as per standard operating procedure.
3. Perform material inspection.	3.1 Material inspection is performed in accordance with the <b>checklist</b> provided 3.2 Retention is recorded (furnace log-book or record file per material) as per company procedure.
4. Control melting process.	4.1 Furnace is prepared and started up as per standard operating procedures. 4.2 Furnace is charged as per standard operating procedures. 4.3 Chemical composition is analyzed either by emission spectrometric method or thermal analysis and corrective measures are undertaken to attain required composition. 4.4 Required alloying element and deoxidant is added to the melt as per standard operating procedures 4.5 Inoculation is performed to improve metal properties in accordance with recommended inoculation procedures and

	<p>techniques.</p> <p>4.6 Melt change-over procedure is undertaken in accordance with standard operating procedures</p> <p>4.7 Molten metal is performed applying the recommended pouring technique.</p> <p>4.8 <b>Production data</b> is recorded in accordance with company requirements</p>
<p>5. Maintain furnace crucible</p>	<p>5.1 Crucible lining is inspected and <b>findings</b> are noted, in logbook in accordance with company requirements</p> <p>5.2 Corrective measures are undertaken to restore the crucible lining to working condition</p> <p>5.3 Task is accomplished in accordance with OH &amp; S requirements</p>

## RANGE OF VARIABLE

VARIABLE	RANGE
1. Charge materials.	1.1 steel scrap 1.2 pig iron 1.3 return scrap 1.4 purchased scrap 1.5 ferro-alloys 1.6 additives
2. Cast metal	2.1 gray cast iron and its alloy 2.2 low, medium and high carbon steel and their alloys 2.3 stainless steel
3. Procedure	Procedure should specify- 3.1 What procedures are to be followed? 3.2 What are the raw materials, ferro-alloys, additives 3.3 What is to be measured? 3.4 How is it measured? 3.5 Instrument/tools? 3.6 What is to be recorded?
4. Checklist	4.1 Characteristics of melting material (e.g. size). 4.2 Contaminants as per chemical analysis. 4.3 Checking frequency (once per shipment / 0.5kilo per ton). 4.4 Quality checked (sample size). 4.5 Checking method (visual, spectro, weigh scale). 4.6 Personnel responsible (operation/process inspector).
5. Production data	5.1 Furnace charge weight 5.2 Energy consumption, total cold charge material, amount of heel, tapping quantities, number of ladles. 5.3 Type of casting poured, number of molds poured.
6. Findings	Findings in inspection of crucible lining include but not limited to: 6.1 Lining wear data and wear pattern. 6.2 Thickness of the lining. 6.3 Number of heats made or through-put of the lining. 6.4 Lining condition.

## 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 Identified job requirements.</li> <li>1.2 Established melting procedure.</li> <li>1.3 Performed material inspection.</li> <li>1.4 Controlled the melting process.</li> <li>1.5 Maintained furnace crucible</li> </ul>
<p>2. Underpinning Knowledge and attitudes</p>	<ul style="list-style-type: none"> <li>2.1 Foundry melting production process (from material selection to fettling and trimming).</li> <li>2.2 Procedure of quality assurance and control system including inspection and testing.</li> <li>2.3 Crucible conditions, faults and repair limits.</li> <li>2.4 Metallic charge materials, ferro-alloys, additives, ladle additions.</li> <li>2.5 Weighing procedure and scale types.</li> <li>2.6 Thermocouple condition monitoring and adjustment mechanism.</li> <li>2.7 Interpretation of carbon equivalent (thermal analysis) and wedge chill test result.</li> <li>2.8 Coagulant agents, application and removal procedures.</li> <li>2.9 Applicable industry standard, JIS, ASTM, SAE, DIN, BS, AS etc.</li> <li>2.10 Metallic charge materials and its characteristics.</li> <li>2.11 Metal composition and its effects on the mechanical physical properties of the metal.</li> <li>2.12 Pouring temperature and its effect on the casting integrity.</li> <li>2.13 Proper pouring techniques.</li> <li>2.14 Effect of charge material on the mechanical / physical properties of the metal.</li> <li>2.15 Effect of inoculation, ductile treatment, fade time or molten metal.</li> <li>2.16 Use and application of personal protective equipments.</li> <li>2.17 Safe work practice and procedures.</li> <li>2.18 Hazard and control measure associated with operating melting furnace.</li> </ul>
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Reading and interpreting information on written job instructions, specifications, standard operating procedures relevant test data sheets and other standard workplace forms. May include drawings for furnace operation.</li> <li>3.2 Following oral instructions.</li> <li>3.3 Deciding on charge materials.</li> <li>3.4 Weighing charge materials.</li> <li>3.5 Feeding materials into furnace.</li> <li>3.6 Measuring metal temperature and correcting as necessary.</li> </ul>

	<p>3.7 Sampling for chemical, carbon equivalent and wedge tests.</p> <p>3.8 Tapping the metal.</p> <p>3.9 Implement relevant check / test required procedures of Quality Handbook.</p> <p>3.10 Coordination skill with process inspector, pourer, furnace operator.</p> <p>3.11 Can accomplish chemical analysis using emission spectrometer, thermal analysis.</p> <p>3.12 Review, comprehend entries on melting section log-book.</p> <p>3.13 Good analysis technique of the limits of foundry melting process, analysis of melt and metal composition.</p>
4. Resource implications	<p>The following resources <b>MUST</b> be provided:</p> <p>4.1 Manuals/catalogues relative to Melting/Casting</p> <p>4.2 Job order, requisitions slip for materials</p> <p>4.3 Materials, tools and equipment relevant to the activity</p> <p>4.4 Incoming material receiving effort.</p> <p>4.5 Quality handbook procedure for melting.</p>
5. Method of assessment	<p>Competency <b>MUST</b> be assessed through:</p> <p>5.1 Observation with questioning</p> <p>5.2 Portfolio</p> <p>5.3 Third Party Report</p>
6. Context of assessment	<p>6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines</p> <p>6.2 Assessment may be conducted in the workplace or a simulated environment.</p>

**UNIT OF COMPETENCY :** MELT AUTOMOTIVE GRAY IRON CASTINGS IN CUPOLA

**UNIT CODE :** ALT812317

**UNIT DESCRIPTOR :** This unit covers melting of automotive truck, tractor, and allied industries gray iron casting using cupola as a basic melter in conjunction with a holding furnace or induction furnace as refiner. This unit applies to melting of automotive grades gray iron castings used in the production of automobile, trucks, tractors and allied industries as covered by **ASTM-A159**.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables
1. Identify casting requirement	1.1 <b>Mechanical and physical properties</b> of gray cast iron casting are determined from product drawing, industrial standards, instruction sheet and technical bulletins or specific standards such as ASTM-A159, ASTM-247 and E-10. 1.2 Base metal is selected based on ASTM-159 specifications 1.3 Specific location of hardness and micro-structure tests identified based on customer requirements. 1.4 <b>Other relevant requirement</b> is determined according to customer requirements i.e. heat-treatment, metal processing.
2. Select melting materials.	2.1 High-grade <b>raw materials</b> are selected must be, consistent with <b>automotive grade casting</b> . 2.2 Charge analysis is undertaken and converted to appropriate furnace charge. 2.3 Requisitions are completed as required according to standard operating procedures. 2.4 Furnace charge is weighed according to standard operating procedures.
3. Melt base iron	3.1 Cupola furnace is prepared as per standard operating procedures. 3.2 Cupola furnace is charged as per standard operating procedures. 3.3 Cupola melt is monitored including testing of <b>chemical composition</b> and melt temperature as per standard operating procedures. 3.4 Adapt corrective measures are undertaken to attain required chemical composition. 3.5 Wedge chill testing is conducted and rectification measures are undertaken to attain desired results. 3.6 Molten metal is transferred to cupola fore-hearth as per standard operating procedures.

<p>4. Perform duplexing and control activities.</p>	<p>4.1 Molten metal is transferred to an <b>induction furnace duplexing</b> furnace in accordance with standard operating procedures and OH &amp; S requirements.</p> <p>4.2 Metal is desulfurized (0.02% MAX) if making nodular (Ductile) cast iron, before transferring to the induction furnace as per standard operating procedures.</p> <p>4.3 Required alloying element is added to the melt as per standard operating procedures.</p> <p>4.4 Chemical composition analysis is undertaken and adjusted, if required, as per standard operating procedures.</p> <p>4.5 Metal temperature is raised to tapping value and wedge chill test undertaken as per standard operating procedures.</p> <p>4.6 Molten metal is transferred to pouring ladle for inoculation and pouring as per standard operating procedures.</p>
<p>5. Perform inoculation procedures</p>	<p>5.1 Appropriate <b>inoculants</b> is selected compatible with type of casting, its size and section thickness.</p> <p>5.2 Inoculation is performed to improve metal properties in accordance with recommended inoculation procedures and techniques.</p> <p>5.3 Wedge chill value is taken before and after inoculation as per standard operating procedures.</p> <p>5.4 “Dead melt” time and pouring time is control as per standard operating procedures.</p>
<p>6. Conduct gray iron casting testing and inspection.</p>	<p>6.1 Agreement is secured from the customer regarding what to test, where to test which will correspond with ASTM standards or JIS standards, as the case maybe.</p> <p>6.2 Visual inspection is conducted using “color check” or dye penetrants.</p> <p>6.3 Dimensional inspection is performed as per standard operating procedures.</p> <p>6.4 File test is performed to determine chills on casting edges.</p> <p>6.5 Other standard method of inspection is implemented assume casting integrity.</p> <p>6.6 Repair agreement is secured from the customer as to location of defect and its extent.</p> <p>6.7 Scrap diagnosis is spearheaded and coordinated with machine shop and process engineering personnel.</p>

## RANGE OF VARIABLE

VARIABLE	RANGE
1. Mechanical and physical properties	1.1 Brinell Hardness 1.2 Tensile strength 1.3 Graphite distribution 1.4 Form 1.5 Size and 1.6 Matrix.
2. Other relevant requirements	2.1 Heat treatment 2.2 Metal processing
3. Raw materials	3.1 Pig iron 3.2 Steel scrap 3.3 Return scrap 3.4 Carburizer 3.5 Siliconizing 3.6 Limestone 3.7 Inoculants
4. Automotive grade casting	4.1 Chemistry 4.2 Size 4.3 Purity
5. Chemical composition	5.1 Carbon 5.2 Silicon 5.3 Manganese 5.4 Sulphur 5.5 Phosphorous.
6. Induction furnace duplexing	6.1 Good temperature control (holding / tapping). 6.2 Addition of alloying element is very simple. 6.3 Good control for chemical composition and analysis. 6.4 Flexibility is good.
7. Inoculants	7.1. Graphitizer. 7.2. Stabilizer 7.3. Special inoculants 7.4. Size / fineness compatible with volume of treated metal

## 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 Identified casting requirements.</li> <li>1.2 Selected melting materials.</li> <li>1.3 Melted base iron.</li> <li>1.4 Performed duplexing and control activities.</li> <li>1.5 Performed Inoculation procedures.</li> <li>1.6 Conducted gray iron casting testing and inspection.</li> </ul>
<p>2. Underpinning knowledge and attitudes</p>	<ul style="list-style-type: none"> <li>2.1 Foundry melting production process (from material selection to fettling and trimming).</li> <li>2.2 Procedure of quality assurance and control system including inspection and testing.</li> <li>2.3 Crucible conditions, faults and repair limits.</li> <li>2.4 Metallic charge materials, ferro-alloys, additives, ladle additions.</li> <li>2.5 Weighing procedure and scale types.</li> <li>2.6 Thermocouple condition monitoring and adjustment mechanism.</li> <li>2.7 Interpretation of carbon equivalent (thermal analysis) and wedge chill test result.</li> <li>2.8 Coagulant agents, application and removal procedures.</li> <li>2.9 Applicable industry standard, JIS, ASTM, SAE, DIN, BS, AS etc.</li> <li>2.10 Metallic charge materials and its characteristics.</li> <li>2.11 Metal composition and its effects on the mechanical physical properties of the metal.</li> <li>2.12 Pouring temperature and its effect on the casting integrity.</li> <li>2.13 Proper pouring techniques.</li> <li>2.14 Effect of charge material on the mechanical / physical properties of the metal.</li> <li>2.15 Effect of inoculation, ductile treatment, fade time or molten metal.</li> <li>2.16 Use and application of personal protective equipments.</li> <li>2.17 Safe work practice and procedures.</li> <li>2.18 Hazard and control measure associated with operating melting furnace.</li> </ul>

<p>3. Underpinning skills</p>	<p>3.1 Reading and interpreting information on written job instructions, specifications, standard operating procedures relevant test data sheets and other standard workplace forms and drawings for furnace operation.</p> <p>3.2 Following oral instructions</p> <p>3.3 Deciding on charge materials</p> <p>3.4 Weighing charge materials</p> <p>3.5 Feeding materials into furnace</p> <p>3.6 Measuring metal temperature and correcting as necessary</p> <p>3.7 Sampling for chemical, carbon equivalent and wedge tests</p> <p>3.8 Tapping the metal.</p> <p>3.9 Implement relevant check / test required procedures of Quality Handbook.</p> <p>3.10 Coordination skill with process inspector, pourer, furnace operator</p> <p>3.11 Can accomplish chemical analysis using emission spectrometer, thermal analysis.</p> <p>3.12 Review, comprehend entries on melting section log-book.</p> <p>3.13 Good analysis technique of the limits of foundry melting process, analysis of melt and metal composition.</p>
<p>4. Resource implications</p>	<p>The following resources <b>MUST</b> be provided:</p> <p>4.1 All manuals/catalogues relative to Melting/Casting</p> <p>4.2 Job order, requisitions slip for materials</p> <p>4.3 Materials, tools and equipment relevant to the activity</p> <p>4.4 Incoming material receiving effort.</p> <p>4.5 Quality handbook procedure for melting.</p>
<p>5. Method of assessment</p>	<p>Competency <b>MUST</b> be assessed through:</p> <p>5.1 Observation with questioning</p> <p>5.2 Portfolio</p> <p>5.3 Third party report</p>
<p>6. Context of assessment</p>	<p>6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines</p> <p>6.2 Assessment may be conducted in the workplace or a simulated environment</p>

## SECTION 3 TRAINING STANDARDS

These guidelines are set to provide the Technical and Vocational Education and Training (TVET) providers with information and other important requirements to consider when designing training programs for Foundry Melting/Casting NC III

### 3.1 CURRICULUM DESIGN

Course Title: **Foundry-Melting/Casting**

NC Level: **NC III**

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

Course Description:

This course is designed to equip individual the competencies that a person must achieve to be able to melt aluminum-silicon alloys for safety tested castings; melt Metals using coreless induction furnace and melt automotive gray iron castings in cupola.

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	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Role Play</li> <li>• Brainstorming</li> </ul>	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Interviews</li> </ul>
2. Lead small teams	2.1 Provide team leadership. 2.2 Assign responsibilities among members. 2.3 Set performance expectation for team members. 1.3 Supervise team performance	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Demonstration</li> <li>• Self-paced (modular)</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration</li> <li>• Case studies</li> </ul>
3. Develop and practice negotiation skills	1.1 Identify relevant information in planning negotiations 1.2 Participate in negotiations 1.3 Document areas for agreement	<ul style="list-style-type: none"> <li>• Direct observation</li> <li>• Simulation/role playing</li> <li>• Case studies</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Practical/ performance test</li> </ul>

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.	<ul style="list-style-type: none"> <li>• Direct observation</li> <li>• Simulation/role playing</li> <li>• Case studies</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Practical/ performance test</li> </ul>
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	<ul style="list-style-type: none"> <li>• Direct observation</li> <li>• Simulation/ role playing</li> <li>• Case studies</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Practical/ performance test</li> </ul>
6. Use relevant technologies	6.1 Identify appropriate technology 6.2 Apply relevant technology 6.3 Maintain/enhance relevant technology	<ul style="list-style-type: none"> <li>• Direct observation</li> <li>• Simulation/role playing</li> <li>• Case studies</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Practical/ performance test</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.. 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>
5. Perform Shop Maintenance	5.1 Inspect/clean tools and work area 5.2 Store/arrange tools and shop equipment 5.3 Dispose wastes/used lubricants 5.4 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. Melt Aluminum-Silicon Alloys for Safety Tested Casting	1.1 Identify job requirement 1.2 Establish melting and melt treatment process 1.3 Identify casting quality requirement 1.4 Identify casting defects cause by unsound melting technique 1.5 Recycle scraps/turnings	<ul style="list-style-type: none"> <li>• Lecture/ Demonstration</li> <li>• Dual training</li> </ul>	<ul style="list-style-type: none"> <li>• Observation with Questioning</li> <li>• Demonstration of practical skills</li> <li>• Interview</li> <li>• Portfolio</li> </ul>
2. Melt Metals Using Coreless Induction Furnace	2.1 Identify job requirements 2.2 Establish melting procedures 2.3 Perform material inspection 2.4 Control melting process 2.5 Maintain furnace crucible	<ul style="list-style-type: none"> <li>• Lecture/ Demonstration</li> <li>• Dual training</li> </ul>	<ul style="list-style-type: none"> <li>• Observation with Questioning</li> <li>• Demonstration of practical skills</li> <li>• Interview</li> <li>• Portfolio</li> </ul>
3. Melt Automotive Gray Iron Casting in Cupola	3.1 Identify casting requirements 3.2 Select melting materials 3.3 Melt base iron 3.4 Perform duplexing and control activities 3.5 Perform inoculation procedures 3.6 Conduct gray iron casting testing and inspection	<ul style="list-style-type: none"> <li>• Lecture/ Demonstration</li> <li>• Dual training</li> </ul>	<ul style="list-style-type: none"> <li>• Observation with Questioning</li> <li>• Demonstration of practical skills</li> <li>• Interview</li> <li>• Portfolio</li> </ul>

### 3.2 TRAINING DELIVERY

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

- The training is based on curriculum developed from the competency standards;
- Learning is modular in its structure;
- Training delivery is learner-centered and should accommodate individualized and self-paced learning strategies;
- Training is based on work that must be performed;
- Training materials are directly related to the competency standards and the curriculum modules;
- Assessment is based in the collection of evidence of the performance of work to the industry required standard;
- Training is based on and off-the-job components;
- Allows for recognition of prior learning (RPL) or current competencies;
- Training allows for multiple entry and exit; and
- Approved training programs are nationally accredited.

The competency-based TVET system recognizes various types of delivery modes, both on and off-the-job as long as the learning is driven by the competency standards specified by the industry. The following training modalities may be adopted when designing training programs:

- The dualized mode of training delivery is preferred and recommended. Thus programs would contain both in-school and in-industry training or fieldwork components. Details can be referred to the Dual Training System (DTS) Implementing Rules and Regulations.
- Modular/self-paced learning is a competency-based training modality wherein the trainee is allowed to progress at his own pace. The trainer facilitates the training delivery
- Peer teaching/mentoring is a training modality wherein fast learners are given the opportunity to assist the slow learners.
- Supervised industry training or on-the-job training is an approach in training designed to enhance the knowledge and skills of the trainee through actual experience in the workplace to acquire specific competencies prescribed in the training regulations.
- Distance learning is a formal education process in which majority of the instruction occurs when the students and instructor are not in the same place. Distance learning may employ correspondence study, or audio, video or computer technologies.
- Project-Based Instruction is an authentic instructional model or strategy in which students plan, implement and evaluate projects that have real world applications.

### 3.3 TRAINEE ENTRY REQUIREMENTS

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

- With 2 year experience in basic foundry melting
- Ability to communicate both orally and in written; and
- Physically and mentally fit
- Must possess the Foundry-Melting/ Casting National Certificate NC II or equivalent qualification in foundry molding and/or maintenance

### 3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS FOUNDRY MELTING/CASTING NC III

Recommended list of tools, equipment and materials for the training of 12 trainees for Foundry Melting/Casting NC III

TOOLS		EQUIPMENT		MATERIALS	
QTY		QTY		QTY	
2 sets	Box wrench	1 unit	Melting furnace (non-electric)	200 Kgs	Aluminum-Silicon Alloy
2 sets	Open end wrench	1 unit	Cupola melting furnace	50 Kgs	Copper
2 sets	Socket wrench	1 unit	Induction melting furnace	50 Kgs	Nickel
2 pcs	Adjustable wrench	1 unit	Shot hanger blast machine	50Kgs	Zinc
2 sets	Screwdriver (+)	1 unit	Table blast machine	50Kgs	Tin
2 sets	Screwdriver (-)	1 unit	Thumb blast machine	50Kgs	Ferro-Molybdenum
2 pcs	Plier (side cutting)	1 unit	Pedestal grinder (double head)	2 tons	Pig Iron
2 pcs	Plier (long nose)	1 unit	Shake out machine	2 tons	Return scrap
2 pcs	Mechanical plier	1 unit	Swing grinder	2 tons	Steel scrap
2 pcs	Ballpein hammer	1 set	Refractory ramming tools	100Kgs	Carburizer
4 pcs	Wood mallet	1 unit	Immersion type Thermo-couple (1300 C° min.)	30Kgs	Ferro silicone
4 pcs	Claw hammer	5 sets	Transfer ladle	30Kgs	Ferro manganese
1 set	Feeler gauge	1 unit each	Weighing scale (10, 50, 100, 500, 1000 Kgs capacity)	50Kgs	Ferro chrome
2 pcs	Hammer (plastic faced)	1 unit	Charging hoist (1 ton capacity)	20 Kgs	Slag coagelants
1 set	Number punch	2 units	Charging box (200Kgs capacity)	500Kgs	Acid lining

1 set	Alphabet punch	1 unit	Optical Pyro-meter (for ferrous metals)	500Kgs	Neutral lining
1 set	Straight drill	1 unit	Cooling curve analyzer (with sample pedestal)	2 sheets	Mica 4"x8"
2 pcs	Ballpein hammer (5lbs)	1 unit	Forehearth (1 ton capacity)	2 sheets	Asbestos board 4"x8"
12 pcs	Goggles	1 unit	Chill mold (wedge)	200Kgs	Mortar clay
12 pcs	Helmet	1 unit	Chill mold (ASTN 2C)	200Kgs	Fire clay
12 pcs	Safety Shoes	1 unit	Angle grinder (6 inches)	10 tablets	De-gasser
1 pc	Straight edge (1000 mm long)	2 units	Portable grinder (pencil type)	10 tablets	Silicone modifier
1 pc	Tri-square (300mm long)	1 set	A-crane (500Kgs capacity)	10 Kgs	Titanium boron grain refiner
1 pc	Adjustable protractor	2 sets	MS plate (2.3mm thick)	2 Kgs	Melt cover
2 sets	Colored goggles	2 lengths	BI pipe (1 1/2 " dia)	500Kgs	Foundry coke
1 pc	Sledge hammer	2 lengths	CRS shafting 16 dia	50Kgs	Limestone
		20 meters	Wire rope (1/2 dia)	10 Kgs	Inoculant (graphitizer)
2 pcs	File (coarse) half round	10 Kgs	Degasser	20Kgs	Ferro silicon magnesium
2 pcs	File (fine) half round	20 Kgs	Modifier	50pcs	Cooling curve analyzer mold
1 set	Vernier caliper (300)	20 Kgs	Grain Refiner	10 ton	Steel shots (SB-1417)
1 set	Vernier height gage (1000mm)	2 pcs	Colored glass #10-12	2pcs	Grinding wheel 50x50x300
		2 Kgs	Coating for metal handling tools	5pcs	Wheel grinder 180x20x6 dia
1 set	Vernier height gage (500mm)			10 pcs	Mounted wheel 6x25x40
1 pc	Divider (300mm)			3 cans	Color check
2 pcs	Trammel point			1 length	Hexagonal bar 25x3 meters long
1 pc	Divider (200mm)			1 length	Steel wire 5mm dia x 3 meters long
1 pc	Straight edge (510mm)			2 cans	Layout-blue
4 pcs	Chisel 1 1/2" wide			24 sets	Cotton gloves
4 pcs	Chisel 1" wide			24 sets	Maong gloves
4 pcs	Chisel 1/2 " wide			10 Kgs	Inoculant (stabilizer)
4 pcs	Chisel 1/4" wide				
1 set	Tong				

### 3.5 TRAINING FACILITIES

#### FOUNDRY METAL/CASTING 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 with toilet & Locker room)	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**	-	-	300.00

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

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

#### FOUNDRY MELTING/CASTING NC III

##### TRAINER QUALIFICATION (TQ II)

- Must be a holder of Foundry Melting/Casting NC III
- 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 only)

<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 FOUNDRY MELTING/CASTING 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 FOUNDRY MELTING/CASTING 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 Melt Foundry Alloys**
- Melt Aluminum-Silicon Alloys for Safety Tested Castings
  - Melt Metals Using Coreless Induction Furnace
  - Melt Automotive Gray Iron Castings in Cupola
- 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 Foundry Melting/Casting 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**

**FOUNDRY- MELTING/CASTING NC III**

<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		
	Prepare & mix sand for metal molding	Produce molds by hand	Produce cores by hand	Operate molding machine	Operate core-making machine	Pour molten metal to molds	Use and maintain measuring instrument	
	Operate melting furnaces (non-electric)	Operate cupola melting furnace	Operate electric induction melting furnace	Fettle & trim metal castings/forgings	Perform refractory installation & repair	Use & maintain measuring instrument		
	Melt Aluminum- Silicon Alloys for Safety Tested Castings	Melt Metals Using Coreless Induction Furnace	Melt Automotive Gray Iron Castings in Cupola					
<b>COMMON COMPETENCIES</b>	Read & Interpret Engineering Drawings	Perform Mensuration and Calculation	Read, Interpret and Apply Specifications and Manuals	Perform Shop Maintenance				
<b>BASIC COMPETENCIES</b>	Receive and respond workplace communication	Work with Other	Demonstrate work values	Practice basic housekeeping procedures	Lead in workplace communication	Develop and practice negotiation skills	Use relevant technologies	Solve workplace problems related to work activities
	Participate in workplace communication	Work in team environment	Practice career professionalism	Practice occupational health and safety procedures	Lead small Team	Use mathematical concepts and techniques	Develop team and individual	Apply problem solving techniques in the workplace
	Plan and organize work	Utilize specialist communication skills						

Legend:  
**FOUNDRY-MELTING/CASTING NC III**



## DEFINITION OF TERMS (FOUNDRY)

1. **Alloy** An **alloy** is a homogeneous blend of two or more elements at least one of which is a metal, and where the resulting material has metallic properties.
2. **Carbon Dioxide Process** **Carbon Dioxide Process** consists of mixing a clean dry silica sand with a silicate binder, compacting the mixture to shape and hardening it by passing carbon dioxide gas.
3. **Casting** **Casting** is the term used to describe both the process and the product when molten metal is poured and solidified in a mold.
4. **Chemical Analysis** **Analytical chemistry** is the science that seeks ever improved means of measuring the chemical composition of natural and artificial materials.
5. **Cope** In a two-part mold, the **cope** is the name given to the top half of the pattern, flask, mold, or core.
6. **Core** The **core** is a sand shape that is inserted into the mold to produce the internal features of a casting, such as, holes or passages for water-cooling.
7. **Core Box** A **core box** is the mold or die used to produce casting cores.
8. **Core Print** The **core print** is the region added to the pattern, core, or mold that is used to locate and support the core within the mold.
9. **Draft** **Draft** is the taper on a pattern or casting that permits it to be withdrawn from the mold.
10. **Drag** The **drag** is the bottom part of the two-part mold.
11. **Dross** **Dross** is a mass of solid impurities floating on a molten metal bath. It appears usually on the melting of low melting point metals or alloys such as aluminum, copper, magnesium or each alloys.
12. **Fettle / Finishing** The process of cleaning the casting, removal of excess metal, grinding and inspection operation which may be required for some casting process.

- 13. Flask** The **flask** is the box that contains the molding aggregate.
- 14. Foundry** A **Foundry** is a factory which produces metal castings from either ferrous or non-ferrous alloys.
- 15. Furnace** **Furnaces** are refractory lined vessels that contain the material to be melted and provide the energy to melt it.
- 16. Gate** **Gate** is controlled entrances to the mold cavity.
- 17. Gating System** **Gating system** is the network of channels used to deliver the molten metal to the mold cavity.
- 18. Green Sand** The term **Green Sand** refers to that molded sand mixture which is allowed to remain moist and is used in casting ferrous and non-ferrous metals.
- 19. Melting** The process includes melting the charge, refining the melt, adjusting the melt chemistry and tapping into a transport vessel. Refining is done to remove deleterious gasses and elements from the molten metal. Material is added during the melting process to bring the final chemistry within a specific range specified by industry and/or internal standards. During the tap, final chemistry adjustments are made.
- 20. Molding** Is the process of making the mold cavity with a necessary allowances such as shrinkage, machining, taper, and surface finish. Usually it is done with green sand as the molding medium.
- 21. Mold Cavity** The **mold cavity** is the shaped hole into which the molten metal is poured and solidified to produce the desired casting.
- 22. Parting Line** **Parting Line** or Parting Surface is the interface that separates the cope and drag halves of a mold, flask, or pattern. The same part can also be found in some core making processes.
- 23. Pattern** The **pattern** is the approximate copy of the final casting. The molding material (sand for sand molds) is then packed around the pattern and the pattern is removed to produce the mold cavity.

- 24. Pattern Shrinkage Allowance** Dimensions added to the pattern to compensate for the solid shrinkage or contraction occurs in the solidified casting as it cools to room / ambient temperature.
- 25. Pouring Cup** A **Pouring Cup** or Pouring Basin is the portion of the gating system that initially receives the molten metal from the pouring vessel and controls its delivery to rest of the mold.
- 26. Refractories** Refers to materials that are used to make crucibles, linings for furnaces, kilns, ovens and incinerators. A practical requirement is the ability of the material to withstand temperatures above 1100°C without softening.
- 27. Riser** A **riser** is an extra void created in the mold that will also fill with molten metal. It provides a reservoir of molten metal that flow into the mold cavity to compensate for any shrinkage during solidification.
- 28. Runners** **Runners** are the horizontal part of the gating system that is connected to the gate.
- 29. Slag** By-product of melting metals. They are composed of metal oxides and sulfides. They assist in melt temperature control and minimize oxidation of the liquid metal before casting.
- 30. Sprue** From the pouring cup, the molten metal travels down the **sprue** the vertical part of the gating system that connects with the runners.
- 31. Vents** **Vents** are additional channels providing an escape for the gasses that are generated within the mold.
- 32. Wedge Chill Test** Indicates the chilling tendencies of cast iron melt which is related to melting conditions, chemical composition and casting section thickness.

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