# TRAINING REGULATIONS

# FOUNDRY MOLDING NC III

## AUTOMOTIVE MANUFACTURING SECTOR

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

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## AUTOMOTIVE/LAND TRANSPORT SECTOR

# FOUNDRY MOLDING NC III

# TRAINING REGULATIONS FOR
# FOUNDRY MOLDING NC III

## SECTION 1 FOUNDRY MOLDING NC III QUALIFICATION

The FOUNDRY MOLDING NC III Qualification consists of competencies that a person must achieve to be able to prepare sand mixture and produce all types of molds manually to cast heavy casting (500 kgs. or more net weight) individually or as a team. It also include competency in pouring molten metal to heavy castings. The heavy casting are usually cast to make press die parts such as forming, blanking die and trimming dies, base plates for molding machine.

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

The Units of Competency comprising this Qualification include the following:

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

| CODE NO. | COMMON COMPETENCIES |
|---|---|
| ALT742201 | Read & interpret Engineering Drawings |
| ALT311202 | Perform Mensuration and Calculation |
| ALT723203 | Read, Interpret and Apply Specifications and Manuals |
| ALT723204 | Perform Shop Maintenance |

| CODE NO. | CORE COMPETENCIES |
|---|---|
| ALT812312 | Prepare Sand Mixture for Heavy Casting |
| ALT812313 | Perform Hand Molding To Produce Heavy Castings |
| ALT812314 | Pour Molten Metal to Heavy Castings |

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

- **Jobbing Foundry Molder**

## SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in FOUNDRY MOLDING 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<br>***Italicized terms*** are elaborated in the Range of Variables |
|---|---|
| 1. Communicate information about workplace processes | 1.1 Appropriate ***communication method*** is selected<br>1.2 Multiple operations involving several topics areas are communicated accordingly<br>1.3 Questions are used to gain extra information<br>1.4 Correct sources of information are identified<br>1.5 Information is selected and organized correctly<br>1.6 Verbal and written reporting is undertaken when required<br>1.7 Communication skills are maintained in all situations |
| 2. Lead workplace discussions | 2.1 Response to workplace issues are sought<br>2.2 Response to workplace issues are provided immediately<br>2.3 Constructive contributions are made to workplace discussions on such issues as production, quality and safety<br>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<br>3.2 Information regarding problems and issues are organized coherently to ensure clear and effective communication<br>3.3 Dialogue is initiated with appropriate personnel<br>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<br>1.2 Verbal<br>1.3 Face to face<br>1.4 Two-way radio<br>1.5 Speaking to groups<br>1.6 Using telephone<br>1.7 Written<br>1.8 Internet |

**EVIDENCE GUIDE**

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

**UNIT OF COMPETENCY : LEAD SMALL TEAMS**

**UNIT CODE : 500311110**

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

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

**RANGE OF VARIABLES**

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

**EVIDENCE GUIDE**

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

**UNIT OF COMPETENCY: DEVELOP AND PRACTICE NEGOTIATION SKILLS**

**UNIT CODE : 500311111**

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

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

**RANGE OF VARIABLES**

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

**EVIDENCE GUIDE**

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

**UNIT OF COMPETENCY : SOLVE PROBLEMS RELATED TO WORK ACTIVITIES**

**UNIT CODE : 500311112**

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

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

**RANGE OF VARIABLES**

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

**EVIDENCE GUIDE**

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

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

**UNIT OF COMPETENCY:** **USE MATHEMATICAL CONCEPTS AND TECHNIQUES**

**UNIT CODE** : **500311113**

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

| ELEMENT | Performance Criteria<br>***Italicized terms*** are elaborated in the Range of Variables |
|---|---|
| 1. Identify mathematical tools and techniques to solve problem | 1.1 Problem areas are identified based on given condition<br>1.2 ***Mathematical techniques*** are selected based on the given problem |
| 2. Apply mathematical procedure/solution | 2.1 Mathematical techniques are applied based on the problem identified<br>2.2 Mathematical computations are performed to the level of accuracy required for the problem<br>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<br>3.2 ***Appropriate action*** is applied in case of error |

**RANGE OF VARIABLES**

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

**EVIDENCE GUIDE**

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|---|---|
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:<br>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)<br>2.2 Measurement system<br>2.3 Precision and accuracy<br>2.4 Basic measuring tools/devices |
| 3. Underpinning skills | 3.1 Applying mathematical computations<br>3.2 Using calculator<br>3.3 Using different measuring tools |
| 4. Resource implications | The following resources **MUST** be provided:<br>4.1 Calculator<br>4.2 Basic measuring tools<br>4.3 Case Problems |
| 5. Method of assessment | Competency may be assessed through:<br>5.1 Authenticated portfolio<br>5.2 Written Test<br>5.3 Interview/Oral Questioning<br>5.4 Demonstration |
| 6. Context of assessment | 6.1 Competency may be assessed in the work place or in a simulated work place setting |

**UNIT OF COMPETENCY: USE RELEVANT TECHNOLOGIES**

**UNIT CODE : 500311114**

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

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

**RANGE OF VARIABLES**

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

**EVIDENCE GUIDE**

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

## COMMON COMPETENCIES

## AUTOMOTIVE MANUFACTURING

**UNIT TITLE** : **READ, INTERPRET AND APPLY ENGINEERING DRAWINGS**

**UNIT CODE** : **ALT742201**

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

| ELEMENT | PERFORMANCE CRITERIA<br>***Italicized*** terms are elaborated in the Range of Variables |
|---|---|
| 1. Identify and access engineering drawings/ specification | 1.1 Appropriate ***Engineering drawings*** are identified and accessed as per job requirements.<br>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<br>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<br>3.2 Work steps are correctly identified in accordance with the specifications in the drawings.<br>3.3 Dimensional ***data*** and shape are applied according to the given task |
| 4. Store drawings | 4.1 The drawings and specification are stored properly to ensure prevention of damage, ready access and updating of information when required in accordance with company requirements |

**RANGE OF VARIABLES**

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

**EVIDENCE GUIDE**

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|---|---|
| 1.Critical aspects of competency | Assessment requires evidence that the candidate:<br>1.1 Identified and accessed drawings/specification<br>1.2 Interpreted drawings<br>1.3 Applied information in drawings<br>1.4 Stored drawings |
| 2. Underpinning knowledge and attitudes | 2.1 Types of drawings used in automotive manufacturing industry<br>2.2 Identification of symbols used in the drawings<br>2.3 Identification of units of measurements<br>2.4 Unit conversion<br>2.5 Attention to details, Perseverance, Honesty |
| 1. Underpinning skills | 1.1 Reading and comprehension skills required to identify and interpret engineering drawings and specifications<br>1.2 Accessing information and data |
| 4. Resource implications | The following resources **MUST** be provided:<br>4.1 All drawings/engineering specifications relative to automotive manufacturing<br>4.2 Job order, requisitions<br>4.3 Product sample |
| 5 Method of assessment | Competency **MUST** be assessed through:<br>5.1 Observation with questioning<br>5.2 Interview |
| 6 Context of assessment | 6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines<br>6.2 Assessment may be conducted in the workplace or a simulated environment. |

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

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

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

| ELEMENT | PERFORMANCE CRITERIA<br>***Italicized*** terms are elaborated in the Range of Variables |
|---|---|
| 1. Select measuring instruments | 1.1 Object or component to be measured is identified<br>1.2 Correct specifications are obtained from relevant source<br>1.3 Appropriate ***measuring instrument*** is selected according to job requirements |
| 2. Carry out measurements and calculation | 2.1 Measuring tools are selected in line with job requirements<br>2.2 Accurate measurements are obtained to job<br>2.3 ***Calculation*** needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x) and division (/).<br>2.4 Calculations involving fractions, percentages and mixed numbers are used to complete workplace tasks.<br>2.5 Numerical computation is self-checked and corrected for accuracy<br>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<br>3.2 Measuring instruments are not dropped to avoid damage<br>3.3 Measuring instruments are cleaned before and after using. |

**RANGE OF VARIABLES**

| VARIABLE | RANGE |
|---|---|
| 1. Measuring instruments | Measuring instruments includes:<br>1.1 Multitester<br>1.2 Micrometer (In-out, depth)<br>1.3 Vernier caliper (Out, inside)<br>1.4 Dial Gauge with Mag. Std.<br>1.5 Straight Edge<br>Thickness gauge<br>1.6 Try square<br>1.7 Protractor<br>1.8 Height gauge<br>1.9 Steel rule<br>Shrink rule |
| 2. Calculation | Kinds of part mensuration include:<br>2.1 Volume<br>2.2 Area<br>2.3 Displacement<br>2.4 Inside diameter<br>2.5 Circumference<br>2.6 Length<br>2.7 Thickness<br>2.8 Outside diameter<br>2.9 Taper<br>2. 10 Out of roundness<br>2.11 Shrinkage allowance |

**EVIDENCE GUIDE**

| | |
|---|---|
| 1. Critical aspect of competency | Assessment requires evidence that the candidate:<br>1.1 Selected measuring instruments<br>1.2 Carried-out measurements and calculations.<br>1.3 Maintained measuring instruments |
| 2. Underpinning knowledge and attitudes | 2.1 Types of Measuring instruments and its uses<br>2.2 Safe handling procedures in using measuring instruments<br>2.3 Four fundamental operation of mathematics<br>2.4 Formula for Volume, Area, Perimeter and other geometric figures |
| 3. Underpinning skills | 3.1 Caring and Handling measuring instruments<br>3.2 Calibrating and using measuring instruments<br>3.3 Performing calculation by Addition, Subtraction, Multiplication and Division<br>3.4 Visualizing objects and shapes<br>3.5 Interpreting formula for volume, area, perimeter and other geometric figures |
| 4. Resource implications | The following resources **MUST** be provided:<br>4.1 Workplace location<br>4.2 Measuring instrument appropriate to servicing processes<br>4.3 Instructional materials relevant to the propose activity |
| 5. Method of assessment | Competency **MUST** be assessed through:<br>5.1 Observation with questioning<br>5.2 Written or oral examination<br>5.3 Interview<br>5.4 Demonstration with questioning |
| 6. Context of assessment | 6.1 Competency elements must be assessed in a safe working environment<br>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.

| ELEMENT | PERFORMANCE CRITERIA<br>***Italicized*** terms are elaborated in the Range of Variables |
|---|---|
| 1. Identify and access manual/ specification | 1.1 Appropriate ***manuals*** are identified and accessed as per job requirements.<br>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<br>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<br>3.2 Work steps are correctly identified in accordance with manufacturer specification<br>3.3 Manual data is applied according to the given task<br>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:<br>1.1 Manufacturer's specification manual<br>1.2 Repair manual<br>1.3 Maintenance Procedure Manual<br>1.4 Periodic Maintenance Manual |

**EVIDENCE GUIDE**

| | |
|---|---|
| 1.Critical aspects of competency | Assessment requires evidence that the candidate:<br>1.1 Identified and accessed manual/specification<br>1.2 Interpreted manuals<br>1.3 Applied information in manuals<br>1.4 Stored manuals |
| 2. Underpinning knowledge and attitudes | 2.1 Types of manuals used in automotive industry<br>2.2 Identification of symbols used in the manuals<br>2.3 Identification of units of measurements<br>2.4 Unit conversion |
| 3. Underpinning skills | 3.1 Reading and comprehension skills required to identify and interpret automotive manuals and specifications<br>3.2 Accessing information and data |
| 4 Resource Implications | The following resources must be provided:<br>4.1 All manuals/catalogues relative to Automotive<br>4.2 Job order, requisitions<br>4.3 Actual vehicle or simulator |
| 5 Method of assessment | Competency must be assessed through:<br>5.1 Observation with questioning<br>5.2 Interview |
| 6 Context of assessment | 6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines<br>6.2 Assessment may be conducted in the workplace or a simulated environment. |

UNIT OF COMPETENCY : **PERFORM SHOP MAINTENANCE**

UNIT CODE : **ALT723205**

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

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

**RANGE OF VARIABLES**

| VARIABLE | RANGE |
|---|---|
| 1. Work area | Work areas include:<br>1.1 Workshop areas for servicing/repairing light and/or heavy vehicle and/or plant transmissions and/or outdoor power equipment<br>1.2 Open workshop/garage and enclosed, ventilated office area<br>1.3 Other variables may include workshop with:<br>• Mess hall<br>• Wash room<br>• Comfort room |
| 2. Cleaning requirement | 2.1 Cleaning solvent<br>2.2 Inventory of supplies, tools, equipment, facilities<br>2.3 List of mechanics/technicians<br>2.4 Rags<br>2.5 Broom<br>2.6 Mop<br>2.7 Pail<br>2.8 Used oil container<br>2.9 Oiler<br>2.10 Dust/waste bin |
| 3. Manuals | 3.1 Vehicle/plant manufacturer specifications<br>3.2 Company operating procedures<br>3.3 Industry/Workplace Codes of Practice<br>3.4 Product manufacturer specifications<br>3.5 Customer requirements<br>3.6 Industry Occupational Health and Safety |
| 4. Company standard operating procedure | Wearing of Personal protective equipment include:<br>4.1 Gloves<br>4.2 Apron<br>4.3 Goggles<br>4.4 Safety shoes |

**EVIDENCE GUIDE**

| | |
|---|---|
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:<br>1.1 Cleaned workshop tools/facilities<br>1.2 Maintained equipment, tools and facilities<br>1.3 Disposed wastes and used lubricants/fluid as per required procedure |
| 2. Underpinning knowledge and attitudes | 2.1 5 S or TQM<br>2.2 Service procedures<br>2.3 Relevant technical information<br>2.4 Safe handling of equipment and tools<br>2.5 Vehicle safety requirements<br>2.6 Workshop policies<br>2.7 Personal safety procedures<br>2.8 Fire extinguishers and prevention<br>2.9 Storage/disposal of hazardous/flammable materials<br>2.10 Positive Work Values (Perseverance, Honesty, Patience, Attention to Details) |
| 3. Underpinning skills | 3.1 Handling/Storing of tools/equipment/supplies and material<br>3.2 Cleaning grease/lubricants<br>3.3 Disposing of wastes and fluid<br>3.4 Preparing inventory of s/m and tools and equipment<br>3.5 Monitoring of s/m and tools/equipment |
| 4. Resource implications | The following resources **MUST** be provided:<br>4.1 Workplace: Real or simulated work area<br>4.2 Appropriate Tools & equipment<br>4.3 Materials relevant to the activity |
| 5. Method of assessment | Competency **MUST** be assessed through:<br>5.1 Written/Oral Questioning<br>5.2 Demonstration |
| 6. Context of assessment | 6.1 Competency must be assessed on the job or in a simulated environment.<br>6.2 The assessment of practical skills must take place after a period of supervised practice and repetitive experience. |

# CORE COMPETENCIES

**UNIT OF COMPETENCY :** **PREPARE SAND MIXTURE FOR HEAVY CASTING**

**UNIT CODE :** **ALT812312**

**UNIT DESCRIPTOR :** This unit covers the preparation of a sand mixture for molding / core making of heavy casting (500 kgs. or more net weight). The mixture will be applied for facing, backing and core sand. The heavy castings are usually cast to make press die parts such as forming, blanking die and trimming dies, base plates for molding machine.

| ELEMENT | PERFORMANCE CRITERIA<br>***Italicized*** terms are elaborated in the Range of Variables |
|---|---|
| 1. Determine job requirement | 1.1 ***Job requirement*** are determined from job sheet and instruction sheet.<br>1.2 ***Type of sand mixture*** is selected in accordance with job requirements<br>1.3 Volume of sand mixture is prepared according to job requirements. |
| 2. Select materials | 2.1 Materials for ***sand mixture*** are calculated as per job requirements.<br>2.2 Requisition of materials is completed as per standard operating procedure. |
| 3. Select mixer | 3.1 Mixer selected applying knowledge of facing, backing, core sand mixer capacities.<br>3.2 Pre-operational equipment inspection is conducted as per standard operating procedures. |
| 4. Mixing of sand mixture | 4.1 Sand mixer / muller is operated according to manufacturing instruction<br>4.2 ***Loading sequence*** of sand, binder, additives is accomplished according to standard operating procedures.<br>4.3 ***Cycle time*** per loading / mixing is determined per volume of mixture.<br>4.4 Moldability of sand mixture is manually tested according to job requirements. |
| 5. Discharge / store sand | 5.1 Sand discharged to sand bin as per standard operating procedures.<br>5.2 Mixer / muller shut down as per standard operating procedures.<br>5.3 Conditioned sand transfer to molding / core making line according to procedure. |
| 6. Perform house keeping | 6.1 Mixer/Muller cleaned according to standard operating procedure.<br>6.2 Excess sand and other debris are disposed of according to ***occupational health and safety*** (OH & S) requirements.<br>6.3 Housekeeping around the work area is performed as per company procedure.. |

**RANGE OF VARIABLE**

| VARIABLE | RANGE |
|---|---|
| 1. Job requirement | 1.1 Type of metal to be poured.<br>1.2 Number of molds required. |
| 2. Type of sand mixture | 2.1 Chromite, silica with silicate binder and hardened by carbon dioxide process.<br>2.2 Chemically bonded sand with appropriate catalyst. |
| 3. Sand mixture | 3.1 Sand<br>3.2 Binder<br>3.3 Additives |
| 4. Loading sequence and cycle time | 4.1 Timing of addition.<br>4.2 Mixer capabilities (over-loading).<br>4.3 The dwell time that each binder / sand / additives is mixed before new addition is made. |
| 5. Occupational health and safety (OH & S) | Occupational health and safety (OH & S) may include:<br>5.1 Use of personal protective equipment<br>5.2 Storage and disposal of harmful substances<br>5.3 Provision of emission control devices |

**EVIDENCE GUIDE**

| | |
|---|---|
| 1. Critical aspect of competency | Assessment requires evidence that the candidate<br>1.1 Determined job requirements.<br>1.2 Selected materials.<br>1.3 Selected mixer.<br>1.4 Mixed sand mixture.<br>1.5 Discharged / stored sand.<br>1.6 Performed housekeeping. |
| 2. Underpinning knowledge and attitudes | 2.1 Characteristics, safe handling procedure and mixture applications of sand and binding agents.<br>2.2 Molding requirements.<br>2.3 Mixers, applications, loading, operating and unloading procedures.<br>2.4 Volumes, quantities, ratios and percentages.<br>2.5 Sampling, testing and acceptance criteria for mixed sand.<br>2.6 Procedures for cleaning and shutting down mixer.<br>2.7 Environmental requirements for the disposal of unwanted sand.<br>2.8 Use and application of personal protective equipment.<br>2.9 Safe work practices and procedures.<br>2.10 Hazards and control measures related to preparing and mixing sand for metal molding.<br>2.11 Sampling, testing and acceptance criteria for raw sand, binders, additives.<br>2.12 Properties / characteristics of molding sand.<br>2.13 Properties / characteristics of no-bake binders and its application.<br>2.14 Sand mixing equipment capabilities / capacities<br>2.15 Observant/Attentive to details<br>2.16 Patient<br>2.17 Honest |
| 3. Underpinning skills | 3.1 Reading and following written instructions and standard operating procedures.<br>3.2 Setting parameters for mixing.<br>3.3 Loading mixers.<br>3.4 Mixing sand and monitoring the process.<br>3.5 Sampling and testing mixed sand.<br>3.6 Discharging sand.<br>3.7 Closing down and cleaning.<br>3.8 Using measurement skills for preparing and mixing sand within the scope of this unit.<br>3.9 Routine maintenance of mixers / mullers.<br>3.10 Incoming test of raw materials.<br>3.11 Visual recognition of sand's type / binders.<br>3.12 Communicate orally. |

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

**UNIT OF COMPETENCY :** **PREPARE HAND MOLDING TO PRODUCE HEAVY CASTING**

**UNIT CODE :** **ALT812313**

**UNIT DESCRIPTOR :** This unit covers the production of mold manually to cast heavy casting (500 kgs. or more net weight) individually or as a team. Examples of application are castings used for stamping, forming, blanking and trimming dies, welding fixtures, skid rails.

| ELEMENT | PERFORMANCE CRITERIA<br>***Italicized*** terms are elaborated in the Range of Variables |
|---|---|
| 1. Determine job requirements | 1.1 ***Job requirement*** are determined from job sheet, instruction manual, and shop brainstorming meeting.<br>1.2 Pattern size (length, width and height) inspected and measured according to product drawing.<br>1.3 M***ethod of molding*** and ***rigging*** are determined and selected according to job requirements.<br>1.4 ***Type of sand mixture*** to be used is determined according to job requirements. |
| 2. Prepare pattern and accessories | 2.1 Pattern / corebox is cleaned and inspected according to standard operating procedures.<br>2.2 Molding box is selected including location of rigging according to job requirements<br>2.3 ***Molding allowances*** are determined according to job requirements |
| 3. Make mold | 3.1 Pattern is set up/positioned according to standard operating procedures<br>3.2 Mold making is performed according to standard operating procedures<br>3.3 Riser, gating system, vents, flow-off is located according to casting plan<br>3.4 Mold is inspected, repaired and finished according to standard operating procedures. |
| 4. Apply mold coating | 4.1 ***Mold coating*** is prepared / mixed according to standard operating procedures.<br>4.2 ***Mold pre-heated*** with LPG burner according to standard operating procedures.<br>4.3 Mold coating applied to appropriate mold surface including riser and gating system.<br>4.4 Mold secured prior to mold assembly and pouring according to standard operating procedures.<br>4.5 Tasks are completed in accordance with ***standard operating procedures and occupational health and safety*** (***OH & S) requirements***. |

**RANGE OF VARIABLE**

| VARIABLE | RANGE |
|---|---|
| 1. Job requirements | 1.1 Number of casting required<br>1.2 Priorities<br>1.3 Molding box to be used including sand clearance on mold edges. |
| 2. Method of molding | 2.1 Adapts to pattern construction. |
| 3. Sand mixture | Depends mostly on:<br>3.1 Type of metal<br>3.2 Pouring temperature<br>3.3 Casting weight. |
| 4. Rigging | 4.1 Cross bar<br>4.2 Guide pin/bushing<br>4.3 Molding board<br>4.4 Roll over cam<br>4.5 Anti-shift location |
| 5. Molding allowance | 5.1 Sand edge<br>5.2 Gating and risering system<br>5.3 Flow-off<br>5.4 Vents |
| 6. Mold coating | 6.1 Alcohol based graphite or non-carbonaceous coating.<br>6.2 Application can be brushing, swabbing, spraying.<br>6.3 Control of viscosity. |
| 7. Mold pre-heating | 7.1 Mold surface only or where mold coating is applied to remove excess moisture. |
| 8. Standard operating procedures (SOP) and occupational health and safety (OH & S) | Standard operating procedures (SOP) may include:<br>8.1 Use of production drawing and technical specification<br>8.2 Practice of quality handbook<br>8.3 Use Application of process handbook<br>8.4 Use of shop instruction<br>Occupational health and safety (OH & S) may include:<br>8.5 Use of personal protective equipment<br>8.6 Storage and disposal of harmful substances<br>8.7 Provision of emission control devices |

**EVIDENCE GUIDE**

| | |
|---|---|
| 1. Critical aspect of competency | Assessment requires evidence that the candidate<br>1.1 Determined job requirements.<br>1.2 Prepared pattern and accessories.<br>1.3 Made molds.<br>1.4 Applied Mold coating. |
| 2. Underpinning knowledge and attitudes | 2.1 Metal casting process.<br>2.2 Variety of pattern types and their application.<br>2.3 Pattern assembly techniques.<br>2.4 Selection of molding box.<br>2.5 How to select ancillary components.<br>2.6 Sand types and their bonding systems.<br>2.7 Compaction processes.<br>2.8 Parting and stripping systems.<br>2.9 Mold requirements.<br>2.10 Finishing and closing techniques.<br>2.11 Core placement.<br>2.12 Pouring requirements.<br>2.13 Securing systems.<br>2.14 Pattern care and storage. |
| 3. Underpinning skills | 3.1 Interpreting written instruction sketches and drawings.<br>3.2 Assembling and positioning pattern in the molding box.<br>3.3 Positioning ancillary methoding components.<br>3.4 Preparing molding media.<br>3.5 Filling and compacting the mold assembly.<br>3.6 Stripping the pattern.<br>3.7 Inspecting the mold.<br>3.8 Finishing the mold.<br>3.9 Positioning cores in prints.<br>3.10 Closing molds.<br>3.11 Placing pouring basin.<br>3.12 Securing mold.<br>3.13 Following oral instruction.<br>3.14 Entering routine and familiar information on proforma and standard workplace forms. |
| 4. Resource implications | The following resources **MUST** be provided:<br>4.1 All manuals/catalogues relative to Melting/Casting<br>4.2 Job order, requisitions slip for materials<br>4.3 Materials, tools and equipment relevant to the activity<br>4.4 Melting furnace |
| 5. Method of assessment | Competency **MUST** be assessed through:<br>5.1 Observation with questioning<br>5.2 Portfolio<br>5.3 Third party report |
| 6. Context of assessment | 6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines<br>6.2 Assessment may be conducted in the workplace or a simulated environment |

**UNIT OF COMPETENCY :** **POUR MOLTEN METAL TO HEAVY CASTINGS**

**UNIT CODE :** **ALT812314**

**UNIT DESCRIPTOR :** This unit covers the competency in manually pouring molten metal as part of metal casting and molding process with ladle capacities of 500Kgs or more using bull ladle, crane ladle a bottom poured ladle.

| ELEMENT | PERFORMANCE CRITERIA<br>***Italicized*** terms are elaborated in the Range of Variables |
|---|---|
| 1. Prepare for pouring molten metal | 1.1 ***Condition of the mold*** is checked according to standard operating procedures.<br>1.2 C***ondition of the ladle*** is checked and appropriate measures are undertaken to correct ladle defects according to standard operating procedures.<br>1.3 Temperature of molten metal is checked for conformance to specification and pouring method is sequenced to standard operating procedures.<br>1.4 The capacity of the required pour is identified against specification according to standard operating procedures.<br>1.5 Over-head cranes, wire-ropes, metal shield are checked according to standard operating procedures.<br>1.6 Ladle is ***pre-heated*** according to prescribed procedures. |
| 2. Transfer ladle to furnace | 2.1 Safety clips of the lifting hooks are checked according to standard operating procedures.<br>2.2 Ladle is filled with ***appropriate weight*** and transferred to the pouring area in accordance with standard operating procedures.<br>2.3 Required ***additives / ferro-alloys*** and metal cover determined from specification and added to molten metal as required.<br>2.4 Chill, wedge test is undertaken as required to standard operating procedures. |
| 3. Maintain quality of metal as required | 3.1 Slag or dross is removed as necessary.<br>3.2 The ***temperature*** is monitored by contact thermocouple as required.<br>3.3 Sample for chemical analysis is taken and submitted to laboratory according to standard operating procedures. |

| | |
|---|---|
| 4. Pour molten metal. | 4.1 Personnel in the immediate area of metal pour are informed that pouring is to take place and appropriate safety clothing and equipment is used as specified in standard operating procedures.<br>4.2 Metal is poured safely in accordance with ***standard operating procedures and occupational health and safety (OH & S)*** requirements.<br>4.3 Metal is poured at an appropriate and continuous rate without over-flowing or splashing.<br>4.4 Co-workers are instructed to assist in firing of the mold to ignite gasses escaping in the parting line, venting, risers and flow-off.<br>4.5 Test bar is poured in accordance with standard operating procedures. |
| 5. Empty excess metal for the ladle | 5.1 Pig-molds are poured and tagged.<br>5.2 Dross/slagged poured in tote boxes<br>5.3 The ladle is appropriately cleaned and maintained as per standard operating procedures. |

**RANGE OF VARIABLE**

| VARIABLE | RANGE |
|---|---|
| 1. Condition of the mold | 1.1 Mold clamping<br>1.2 Weighing<br>1.3 Bolting<br>1.4 Positioning of the sprue<br>1.5 Pouring basin<br>1.6 Riser type and position<br>1.7 Flame igniter<br>1.8 Platform for pourer<br>1.9 Fire wall for pourer<br>1.10 Vent-off and flow-off. |
| 2. Condition of ladle | 2.1 Lining condition<br>2.2 Wheel mechanism<br>2.3 Stopper rod<br>2.4 Ladle lips. |
| 3. Ladle defect | 3.1 Cracks<br>3.2 Erosion (localized)<br>3.3 Tilting mechanism malfunction |
| 4. Pre-heated | 5.1 Thorough drying of lining finally at a “red-heat” condition. |
| 5. Appropriate weight | 6.1 Measured by crane scale or a photo-cell in the furnace which indicates the amount of metal taken out |
| 6. Additives | 6.1 Alloys<br>6.2 Inoculants<br>6.3 Spheroidizer<br>6.4 Deoxidizers |
| 7. Temperature monitoring | 7.1 Measurement by immersion thermocouple (platinum / rhodium) couple.<br>7.2 Optical pyrometer is not accurate since it is influenced by slag, dross and smoke. |
| 8. Standard operating procedures (SOP) and occupational health and safety (OH & S) | Standard operating procedures (SOP) may include:<br>8.1 Use of production drawing and technical specification<br>8.2 Practice of quality handbook<br>8.3e Application of process handbook<br>8.4 Use of shop instruction<br>Occupational health and safety (OH & S) may include:<br>8.5 Use of personal protective equipment<br>8.6 Storage and disposal of harmful substances<br>8.7 Provision of emission control devices |
| 9. Firing of the mold | 9.1 To ignite gasses developed inside the mold during pouring. |

**EVIDENCE GUIDE**

| | |
|---|---|
| 1. Critical aspect of competency | Assessment requires evidence that the candidate<br>1.1 Prepared for pouring molten metal.<br>1.2 Transferred ladle to furnace.<br>1.3 Maintained quality of metal as required.<br>1.4 Poured molten metal.<br>1.5 Emptied excess metal for the ladle. |
| 2. Underpinning knowledge and attitudes | 2.1 Types and pouring characteristics of metals.<br>2.2 Types and characteristics of ladles.<br>2.3 Procedures for maintaining condition and integrity of ladle.<br>2.4 Procedures for safe handling and transference of molten metal.<br>2.5 Metal treatments, applications and procedures for making additions to molten metal.<br>2.6 Slag and dross removing procedures.<br>2.7 Techniques for sampling and testing molten metal.<br>2.8 Pouring procedures.<br>2.9 Metal identification and tagging procedures.<br>2.10 Use and application of personal protective equipment.<br>2.11 Safe work practices and procedures.<br>2.12 Hazards and control measures associated with pouring molten metal.<br>2.13 Type of ladle refractories, application and pre-heating requirement.<br>2.14 Lining mixtures for different ladles and lining procedures<br>2.15 Observant/Attentive to details<br>2.16 Patient<br>2.17 Honest |
| 3. Underpinning skills | 3.1 Reading and following written instructions, standard operating procedures, specifications and standard test data sheets.<br>3.2 Selecting and checking ladle.<br>3.3 Preparing ladle for pouring.<br>3.4 Transferring metal to ladle.<br>3.5 Treating metal.<br>3.6 Removing slag and dross.<br>3.7 Sampling and testing molten metal.<br>3.8 Pouring molten metal into moulds and pigs.<br>3.9 Tagging pig metal.<br>3.10 Using communication skills to effectively transfer skills and knowledge to employees.<br>3.11 Lining mixture for pouring ladles, shanks, and crane or bull ladles.<br>3.12 Lining and coating of ladle.<br>3.13 Repair / maintenance of ladle.<br>3.14 Temperature measurement by optical pyrometer or immersion type thermocouple.<br>3.15 Control of ladle wheel mechanism. |

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

## SECTION 3 TRAINING STANDARDS

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

### 3.1 CURRICULUM DESIGN

Course Title: **FOUNDRY MOULDING** NC Level: **NC III**

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

Course Description:

This course is designed to equip individual with competency to to prepare sand mixture and produce all types of molds manually to cast heavy casting ( 500 kgs or more net weight) individually or as a team. It also include competency in pouring molten metal to heavy castings. The heavy casting are usually cast to make press die parts such as forming, blanking die and trimming dies, base plates for molding machine.

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.<br>1.2 Lead workplace discussions.<br>1.3 Identify and communicate issues arising in the workplace | • Group discussion<br>• Role Play<br>• Brainstorming | • Observation<br>• Interviews |
| 2. Lead small teams | 2.1 Provide team leadership.<br>2.2 Assign responsibilities among members.<br>2.3 Set performance expectation for team members.<br>2.4 Supervise team performance | • Lecture<br>• Demonstration<br>• Self-paced (modular) | • Demonstration<br>• Case studies |

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

**COMMON COMPETENCIES**

| Unit of Competency | Learning Outcomes | Methodology | Assessment Approach |
|---|---|---|---|
| 1. Read, Interpret and Apply Engineering Drawings | 1.1 Identify and access engineering drawings/ specification<br>1.2.Interpret drawings<br>1.3.Apply information in the drawings & specifications<br>1.4 Store drawings | • Lecture/ Demonstration<br>• Dual training | • Direct observation<br>• Interview |
| 2. Perform Mensuration and Calculation | 2.1 Select measuring instrument and carry out measurement and calculations.<br>2.2 Maintain measuring instruments | • Lecture/ Demonstration<br>• Simulation<br>• Exercises | • Written test<br>• Oral questioning<br>• Direct observation |
| 3. Read, Interpret and Apply Specifications and Manual | 3.1 Identify/accessed manuals and interpret data and specification<br>3.2 Apply information accessed in manual<br>3.3 Store manual | • Lecture/ Demonstration<br>• Dual training<br>• Distance Learning | • Written test<br>• Direct observation<br>• Project method<br>• Interview |
| 4. Perform Shop Maintenance | 4.1 Inspect/clean tools and work area<br>4.2 Store/arrange tools and shop equipment<br>4.3 Dispose wastes/used lubricants<br>4.4 Report damaged tools / equipt | • Lecture/ Demonstration<br>• Dual training<br>• Self paced (modular)<br>• Simulation | • Written test<br>• Direct observation<br>• Demonstration<br>• Interview |

**CORE COMPETENCIES**

| Unit of Competency | Learning Outcomes | Methodology | Assessment Approach |
|---|---|---|---|
| 1. Prepare Sand Mixture for Heavy Casting | 1.1 Determine job requirement.<br>1.2 Select materials<br>1.3 Select mixer<br>1.4 Mixing sand mixture<br>1.5 Discharge/store sand | • Lecture/ Demonstration<br>• Discussion<br>• Dual training | • Observation w/ questioning<br>• Demonstration of practical skills<br>• Portfolio<br>• Third party report |
| 2. Perform Molding to Produce Heavy Casting | 2.Determine job requirement<br>2.2 Prepare pattern and accessories<br>2.3 Make mold<br>2.4 Apply mold coating | • Lecture/ Demonstration<br>• Discussion<br>• Dual training | • Observation w/ questioning<br>• Demonstration of practical skills<br>• Portfolio<br>• Third party report |
| 3. Pour molten metal to heavy casting | 3.1 Prepare for pouring molten metal<br>3.2 Transfer ladle to furnace<br>3.3 Maintain quality of metal as required<br>3.4 Pour molten metal<br>3.5 Empty excess metal for the ladle | • Lecture/ Demonstration<br>• Discussion<br>• Dual training | • Observation w/ questioning<br>• Demonstration of practical skills<br>• Portfolio<br>Third party report |

## 3.2 TRAINING DELIVERY

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

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

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

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

## 3.3 TRAINEE ENTRY REQUIREMENTS

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

- With background in basic machining
- Ability to communicate both oral and written; and
- Physically and mentally fit
- Must possess the Foundry Molding National Certificate (NC) II

## 3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS FOUNDRY MOLDING NC III

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

| TOOLS | | EQUIPMENT | | MATERIALS | |
|---|---|---|---|---|---|
| QTY | | QTY | | QTY | |
| 2 sets | Box wrench | 1 set | Sand muller (500Kgs capacity) | 5 tons | Silica sand (minimum 96% silica) |
| 2 sets | Open wrench | 1 set | Sand mixer (250Kgs capacity) | 5 tons | Chromite sand |
| 2 sets | Socket wrench | 1 set | 1-AS or 3-DS shell core | 2 tons | Resin bonded shell core sand |
| 2 pcs | Adjustable wrench (300mm) | 1 set | Air compressor (50hp) | 500Kgs | Bentonite (Volclay) |
| 2 pcs | Screwdriver (Minus 200mm) | 1 set | $CO_2$ gas regulator | 400Kgs | Sodium silicate (ratio 2.5 - 3) |
| 2 pcs | Screwdriver (Philips 200mm) | 1 set | LPG burner | 50Kgs | Sea coal |
| 2 pcs | Electrical pliers | 1 set | Weighing scale 1000Kgs capacity | 100Kgs | Molasses |
| 2 sets | Stopwatch with lap time | 2 sets | Working bench (1m x 2m x 1m) | 5Kgs | Parting compound (Dry) |
| 3 pcs | Shovel | 1 set | Weighing scale 100Kgs capacity | 10Kgs | Graphite coating |
| 2 sets | Spray gun | 2 sets | Weighing scale 15Kgs capacity | 10Kgs | Magnesia based coating |
| 4 pcs | Wood mallet | 4 sets | Molding box (30”x40”x6”) | 5 cylinder | LPG 50Kgs capacity |
| 2 pcs | Hack saw Blade | 4 sets | Molding box (30”x40”x8”) | 1 sheet | Styropore (3 feet x 8 feet x 4”) |
| 10 pcs | Paint brush (1”) | 1 set | Spirit based leveling device | 2Kgs | Grease |
| 10 pcs | Paint brush (2”) | 1 set | A-crane (1 ton capacity) | 50m | Wire rope (1/2” dia, 6 strand) |

| TOOLS | | EQUIPMENT | | MATERIALS | |
|---|---|---|---|---|---|
| **QTY** | | **QTY** | | **QTY** | |
| 4 sets | Blow gun | 1 set | Hoist (1 ton capacity) | 50m | Air hose (1/4 dia) |
| 12 pcs | Calculator (regular) | 1 set | F-D2 molding machine | 10sqm | Wire screen (mesh #2 / #4) |
| 2 pcs | Water container (60 liters capacity) | 2 pcs | Tooth box with wheel | 4 sets | Molding tools |
| 5m | Shafting (5mm dia) | 1 sets | Oil dispenser | 20 Liters | Methanol |
| 5m | Shafting (20mm dia) | 1 set | Pattern (Cope and drag) | 2m | Copper tube (10mm OD) |
| 6 pcs | Eye bolt (12mm dia) | 2 sets | Molding corebox | 36pairs | Cotton gloves |
| 4 pcs | Claw hammer | 2 pcs | White board (1m x 2m each) | 24 pcs | Broom (ting-ting) |
| 4 pcs | Ballpein hammer | 2 sets | Storage cabinet | 20 pcs | Broom (tambo) |
| 2 pcs | Long nose pliers | 2 pcs | Open shelf | 4 pcs | Push broom |
| 2 sets | Steel rule (1m long) | 1 set | Shell corebox for 1-AS or 3-DS with ejector plate, burner plate, ejector pin | 50Kgs | Cleaning rags |
| 2 sets | Hack saw with blade | 1 set | Loose piece pattern | 24 sets | Goggles |
| 2 sets | Vernier caliper (300mm) | | Oxyacetylene regulator with hose and cutter / welding tip | 12 sets | Hard hat |
| 6 pcs | Steel brush | 4 cylinder | Oxygen gas | 12 sets | Safety shoes |
| 1 set | Oil dispenser | 2 cylinder | Acetylene gas | 24 sets | T-shirt |
| 1 set | Grease gun | 1 set | Welding machine (200-300amperes) | 200Liters | Ecolotic Resin binder |
| | Training materials | 2 units | Hand rammer | 2 pcs | Angular bar (2”x2”x36”) |
| | Reference book | | | 10 pcs | Wire rope clamp (½” dia) |
| | Machine manuals | | | | |
| | Foundry supplies catalogues / brochures | | | | |
| | CD / Video tapes | | | | |
| | Notebook | | | | |
| | Ballpen | | | | |
| | Pencil | | | | |
| | Pentel pen | | | | |

## 3.5 TRAINING FACILITIES
### FOUNDRY MOLDING 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***

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

**FOUNDRY MOLDING NC III**

TRAINER QUALIFICATION (TQ II)

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

[1] This shall be changed to ":Must be a holder of Trainer Qualification Level II (TQII) or equivalent" upon promulgation by the TESDA Board of the TQ/AQ training regulations

[2] Optional. Only when required by the hiring institution

Reference: TESDA Board Resolution No. 2004 03

## 3.7 INSTITUTIONAL ASSESSMENT

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

## SECTION 4 NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS

4.1 To attain the National Qualification of FOUNDRY MOLDING 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 The qualification of Foundry Molding NC III may be attained through demonstration of competence through project-type assessment covering all required units of competency of the qualification.

4.2.1 **Perform Hand Molding to Produce Heavy Casting**

- Prepare Sand Mixture for Heavy Casting
- Perform Hand Molding to Produce Heavy Castings
- Pour Molten Metal to Heavy Casting

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 Molding NC II or equivalent qualification; or

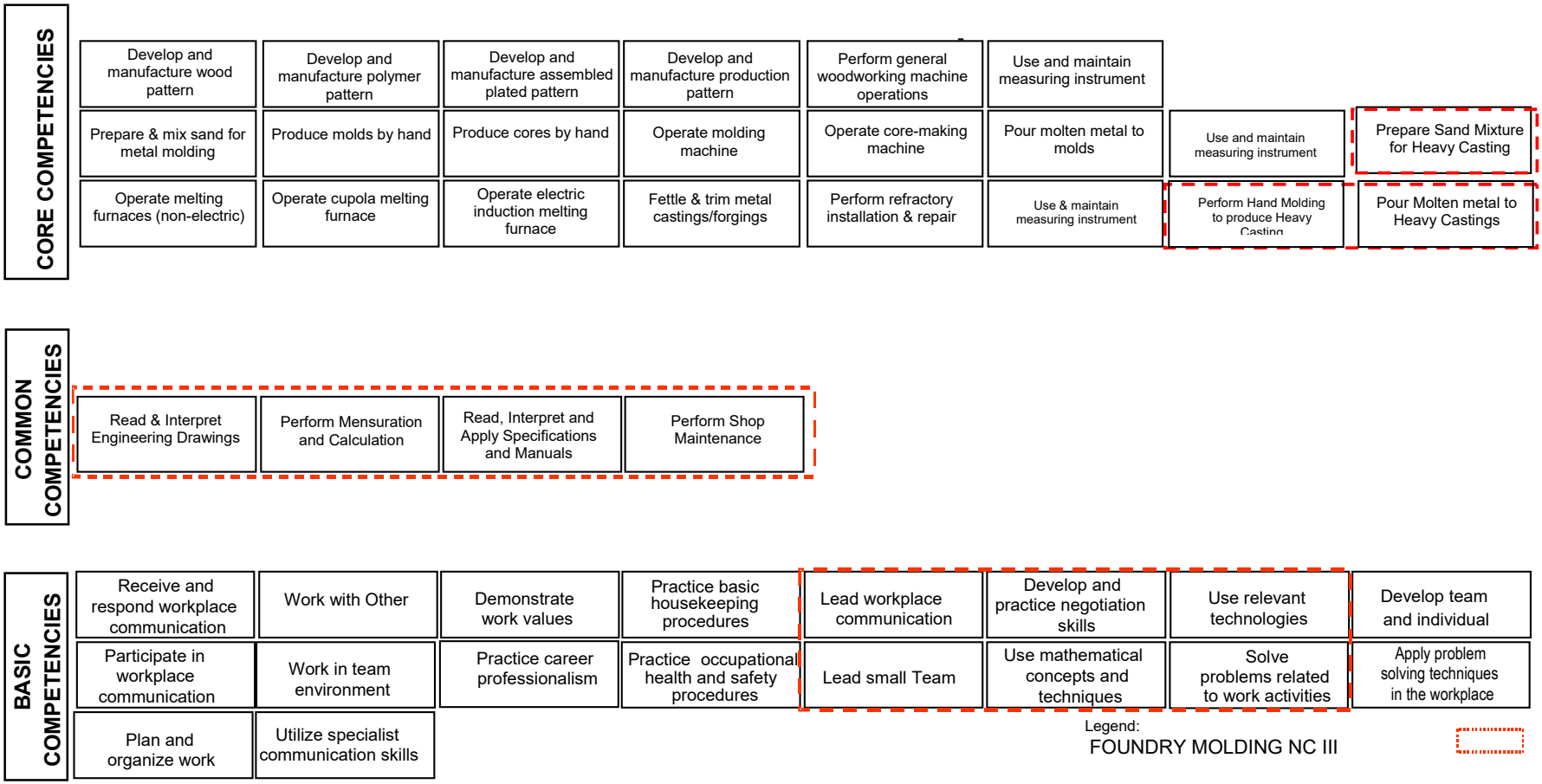
4.4.2 Graduates of formal, non-formal and informal including enterprise-based training programs.

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).*

**ANNEX A**

# COMPETENCY MAP- AUTOMOTIVE SECTOR
# MANUFACTURING SUB-SECTOR



## 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 as metallic properties. |
| **2. Carbon Dioxide Process** | **Carbon Dioxide Process** consist 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$^{o}$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** | Are by-product of melting metals. They are composed of metal oxides and sulfides. The 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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