TRAINING REGULATIONS

FOUNDRY PATTERNMAKING NC II

AUTOMOTIVE MANUFACTURING SECTOR

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
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AUTOMOTIVE SECTOR
(AUTOMOTIVE MANUFACTURING SUB SECTOR)

FOUNDRY PATTERN MAKING NC II

TRAINING REGULATIONS FOR
FOUNDRY PATTERNMAKING NC II

SECTION 1 FOUNDRY PATTERN MAKING NC II QUALIFICATION

The FOUNDRY – PATTERN MAKING NC II Qualification consists of competencies that a person must achieve to be able to manufacture all types of solid, split and turned patterns and pattern component parts, including but is not limited to general engineering patterns, master patterns with multiple contraction, skeleton, frame and strickle, wheels, pulleys, chain sheaves, impellors, etc. It also include inspection, measurement and interpretation of drawings and repair procedures; setting up and operation of various specialized metalworking machines and utilization of precision measuring instrument in the operation and maintenance of melting equipment.

Patterns may be constructed by laminating timber and timber composites, stave and lag, box or frame construction or any alternative method that minimizes timber shrinkage, warp and achieves required strength. A full range of timber
and timber composites may be used. Solid patterns may be set up on a regular or irregular joint.

Turned patterns are manufactured using tools and machines appropriate for shaping wood. This unit covers all specifications interpreted from drawings, technical sketches
and/or customer requirements.

Tasks undertaken include utilizing appropriate wood pattern making principles and techniques, designated procedures, correct and appropriate tools and equipment.

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
500311105	Participate in Workplace Communication
500311106	Work in Team Environment
500311107	Practice Career Professionalism
500311108	Practice Occupational Health and Safety Procedures

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

CODE NO.	CORE COMPETENCIES
ALT742301	Develop and Manufacture Wood Patterns
ALT742302	Develop and Manufacture Polymer Patterns
ALT742303	Develop and Manufacture Assembled Plated Patterns
ALT742304	Develop and Manufacture Production Patterns
ALT742305	Performs General Woodworking Machine Operations
ALT821303	Use and Maintain Measuring Instrument

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

- **Foundry Patternmaker**

SECTION 2 COMPETENCY STANDARDS

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

BASIC COMPETENCIES

UNIT OF COMPETENCY : PARTICIPATE IN WORKPLACE COMMUNICATION
UNIT CODE : 500311105
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Obtain and convey workplace information	1.1 Specific and relevant information is accessed from ***appropriate sources*** 1.2 Effective questioning , active listening and speaking skills are used to gather and convey information 1.3 Appropriate ***medium*** is used to transfer information and ideas 1.4 Appropriate non- verbal communication is used 1.5 Appropriate lines of communication with supervisors and colleagues are identified and followed 1.6 Defined workplace procedures for the location and ***storage*** of information are used 1.7 Personal interaction is carried out clearly and concisely
2. Participate in workplace meetings and discussions	2.1 Team meetings are attended on time 2.2 Own opinions are clearly expressed and those of others are listened to without interruption 2.3 Meeting inputs are consistent with the meeting purpose and established ***protocols*** 2.4 ***Workplace interactions*** are conducted in a courteous manner 2.5 Questions about simple routine workplace procedures and maters concerning working conditions of employment are asked and responded to 2.6 Meetings outcomes are interpreted and implemented
3. Complete relevant work related documents	3.1 Range of ***forms*** relating to conditions of employment are completed accurately and legibly 3.2 Workplace data is recorded on standard workplace forms and documents 3.3 Basic mathematical processes are used for routine calculations 3.4 Errors in recording information on forms/ documents are identified and properly acted upon 3.5 Reporting requirements to supervisor are completed according to organizational guidelines

RANGE OF VARIABLES

VARIABLE	RANGE
1. Appropriate sources	1.1. Team members 1.2. Suppliers 1.3. Trade personnel 1.4. Local government 1.5. Industry bodies
2. Medium	2.1. Memorandum 2.2. Circular 2.3. Notice 2.4. Information discussion 2.5. Follow-up or verbal instructions 2.6. Face to face communication
3. Storage	3.1. Manual filing system 3.2. Computer-based filing system
4. Forms	4.1. Personnel forms, telephone message forms, safety reports
5. Workplace interactions	5.1. Face to face 5.2. Telephone 5.3. Electronic and two way radio 5.4. Written including electronic, memos, instruction and forms, non-verbal including gestures, signals, signs and diagrams
6. Protocols	6.1. Observing meeting 6.2. Compliance with meeting decisions 6.3. Obeying meeting instructions

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1. Prepared written communication following standard format of the organization 1.2. Accessed information using communication equipment 1.3. Made use of relevant terms as an aid to transfer information effectively 1.4. Conveyed information effectively adopting the formal or informal communication
2. Underpinning knowledge and attitudes	2.1. Effective communication 2.2. Different modes of communication 2.3. Written communication 2.4. Organizational policies 2.5. Communication procedures and systems 2.6. Technology relevant to the enterprise and the individual's work responsibilities
3. Underpinning skills	3.1. Follow simple spoken language 3.2. Perform routine workplace duties following simple written notices 3.3. Participate in workplace meetings and discussions 3.4. Complete work related documents 3.5. Estimate, calculate and record routine workplace measures 3.6. Basic mathematical processes of addition, subtraction, division and multiplication 3.7. Ability to relate to people of social range in the workplace 3.8. Gather and provide information in response to workplace Requirements
4. Resource implications	4.1. Fax machine 4.2. Telephone 4.3. Writing materials 4.4. Internet
5. Method of assessment	5.1. Direct Observation 5.2. Oral interview and written test
6. Context of assessment	6.1. Competency may be assessed individually in the actual workplace or through accredited institution

UNIT OF COMPETENCY: WORK IN TEAM ENVIRONMENT

UNIT CODE : 500311106

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes to identify role and responsibility as a member of a team.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Describe team role and scope	1.1. The ***role and objective of the team*** is identified from available ***sources of information*** 1.2. Team parameters, reporting relationships and responsibilities are identified from team discussions and appropriate external sources
2. Identify own role and responsibility within team	2.1. Individual role and responsibilities within the team environment are identified 2.2. Roles and responsibility of other team members are identified and recognized 2.3. Reporting relationships within team and external to team are identified
3. Work as a team member	3.1. Effective and appropriate forms of communications used and interactions undertaken with team members who contribute to known team activities and objectives 3.2. Effective and appropriate contributions made to complement team activities and objectives, based on individual skills and competencies and ***workplace context*** 3.3. Observed protocols in reporting using standard operating procedures 3.4. Contribute to the development of team work plans based on an understanding of team's role and objectives and individual competencies of the members.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Role and objective of team	1.1. Work activities in a team environment with enterprise or specific sector 1.2. Limited discretion, initiative and judgment maybe demonstrated on the job, either individually or in a team environment
2. Sources of information	2.1. Standard operating and/or other workplace procedures 2.2. Job procedures 2.3. Machine/equipment manufacturer's specifications and instructions 2.4. Organizational or external personnel 2.5. Client/supplier instructions 2.6. Quality standards 2.7. OHS and environmental standards
3. Workplace context	3.1. Work procedures and practices 3.2. Conditions of work environments 3.3. Legislation and industrial agreements 3.4. Standard work practice including the storage, safe handling and disposal of chemicals 3.5. Safety, environmental, housekeeping and quality guidelines

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1. Operated in a team to complete workplace activity 1.2. Worked effectively with others 1.3. Conveyed information in written or oral form 1.4. Selected and used appropriate workplace language 1.5. Followed designated work plan for the job 1.6. Reported outcomes
2. Underpinning knowledge and attitude	2.1. Communication process 2.2. Team structure 2.3. Team roles 2.4. Group planning and decision making
3. Underpinning skills	3.1. Communicate appropriately, consistent with the culture of the workplace
4. Resource implications	The following resources **MUST** be provided: 4.1. Access to relevant workplace or appropriately simulated environment where assessment can take place 4.2. Materials relevant to the proposed activity or tasks
5. Method of assessment	Competency may be assessed through: 5.1. Observation of the individual member in relation to the work activities of the group 5.2. Observation of simulation and or role play involving the participation of individual member to the attainment of organizational goal 5.3. Case studies and scenarios as a basis for discussion of issues and strategies in teamwork
6. Context of assessment	6.1. Competency may be assessed in workplace or in a simulated workplace setting 6.2. Assessment shall be observed while task are being undertaken whether individually or in group

UNIT OF COMPETENCY: PRACTICE CAREER PROFESSIONALISM

UNIT CODE : 500311107

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in promoting career growth and advancement.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Integrate personal objectives with organizational goals	1.1 Personal growth and work plans are pursued towards improving the qualifications set for the profession 1.2 Intra- and interpersonal relationships ~~is~~ are maintained in the course of managing oneself based on performance ***evaluation*** 1.3 Commitment to the organization and its goal is demonstrated in the performance of duties
2. Set and meet work priorities	2.1 Competing demands are prioritized to achieve personal, team and organizational goals and objectives. 2.2 ***Resources*** are utilized efficiently and effectively to manage work priorities and commitments 2.3 Practices along economic use and maintenance of equipment and facilities are followed as per established procedures
3. Maintain professional growth and development	3.1 ***Trainings and career opportunities*** are identified and availed of based on job requirements 3.2 ***Recognitions*** are -sought/received and demonstrated as proof of career advancement 3.3 ***Licenses and/or certifications*** relevant to job and career are obtained and renewed

RANGE OF VARIABLES

VARIABLE	RANGE
1. Evaluation	1.1 Performance Appraisal 1.2 Psychological Profile 1.3 Aptitude Tests
2. Resources	2.1 Human 2.2 Financial 2.3 Technology 2.3.1 Hardware 2.3.2 Software
3. Trainings and career opportunities	3.1 Participation in training programs 3.1.1 Technical 3.1.2 Supervisory 3.1.3 Managerial 3.1.4 Continuing Education 3.2 Serving as Resource Persons in conferences and workshops
4. Recognitions	4.1 Recommendations 4.2 Citations 4.3 Certificate of Appreciations 4.4 Commendations 4.5 Awards 4.6 Tangible and Intangible Rewards
5. Licenses and/or certifications	5.1 National Certificates 5.2 Certificate of Competency 5.3 Support Level Licenses 5.4 Professional Licenses

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Attained job targets within key result areas (KRAs) 1.2 Maintained intra - and interpersonal relationship in the course of managing oneself based on performance evaluation 1.3 Completed trainings and career opportunities which are based on the requirements of the industries 1.4 Acquired and maintained licenses and/or certifications according to the requirement of the qualification
2. Underpinning knowledge & attitudes	2.1 Work values and ethics (Code of Conduct, Code of Ethics, etc.) 2.2 Company policies 2.3 Company-operations, procedures and standards 2.4 Fundamental rights at work including gender sensitivity 2.5 Personal hygiene practices
3. Underpinning skills	3.1 Appropriate practice of personal hygiene 3.2 Intra and Interpersonal skills 3.3 Communication skills
4. Resource implications	The following resources **MUST** be provided: 4.1 Workplace or assessment location 4.2 Case studies/scenarios
5. Method of assessment	Competency may be assessed through: 5.1 Portfolio Assessment 5.2 Interview 5.3 Simulation/Role-plays 5.4 Observation 5.5 Third Party Reports 5.6 Exams and Tests
6. Context of assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY : **PRACTICE OCCUPATIONAL HEALTH AND SAFETY PROCEDURES**

UNIT CODE : **500311108**

UNIT DESCRIPTOR : This unit covers the outcomes required to comply with regulatory and organizational requirements for occupational health and safety.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Identify hazards and risks	1.1 ***Safety regulations*** and workplace safety and hazard control practices and procedures are clarified and explained based on organization procedures 1.2 ***Hazards/risks*** in the workplace and their corresponding indicators are identified to minimize or eliminate risk to co-workers, workplace and environment in accordance with organization procedures 1.3 ***Contingency measures*** during workplace accidents, fire and other emergencies are recognized and established in accordance with organization procedures
2. Evaluate hazards and risks	2.1 Terms of maximum tolerable limits which when exceeded will result in harm or damage are identified based on threshold limit values (TLV) 2.2 Effects of the hazards are determined 2.3 OHS issues and/or concerns and identified safety hazards are reported to designated personnel in accordance with workplace requirements and relevant workplace OHS legislation
3. Control hazards and risks	3.1 Occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace are consistently followed 3.2 Procedures for dealing with workplace accidents, fire and emergencies are followed in accordance with organization OHS policies 3.3 ***Personal protective equipment (PPE)*** is correctly used in accordance with organization OHS procedures and practices 3.4 Appropriate assistance is provided in the event of a workplace emergency in accordance with established organization protocol
4. Maintain OHS awareness	4.1 ***Emergency-related drills and trainings*** are participated in as per established organization guidelines and procedures 4.2 ***OHS personal records*** are completed and updated in accordance with workplace requirements

RANGE OF VARIABLES

VARIABLE	RANGE
1. Safety regulations	May include but are not limited to: 1.1 Clean Air Act 1.2 Building code 1.3 National Electrical and Fire Safety Codes 1.4 Waste management statutes and rules 1.5 Philippine Occupational Safety and Health Standards 1.6 DOLE regulations on safety legal requirements 1.7 ECC regulations
2. Hazards/Risks	May include but are not limited to: 2.1 Physical hazards – impact, illumination, pressure, noise, vibration, temperature, radiation 2.2 Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects 2.3 Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors 2.4 Ergonomics • Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles • Physiological factors – monotony, personal relationship, work out cycle
3. Contingency measures	May include but are not limited to: 3.1 Evacuation 3.2 Isolation 3.3 Decontamination 3.4 (Calling designed) emergency personnel
4. PPE	May include but are not limited to: 4.1 Mask 4.2 Gloves 4.3 Goggles 4.4 Hair Net/cap/bonnet 4.5 Face mask/shield 4.6 Ear muffs 4.7 Apron/Gown/coverall/jump suit 4.8 Anti-static suits

VARIABLE	RANGE
5. Emergency-related drills and training	5.1 Fire drill 5.2 Earthquake drill 5.3 Basic life support/CPR 5.4 First aid 5.5 Spillage control 5.6 Decontamination of chemical and toxic 5.7 Disaster preparedness/management
6. OHS personal records	6.1 Medical/Health records 6.2 Incident reports 6.3 Accident reports 6.4 OHS-related training completed

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Explained clearly established workplace safety and hazard control practices and procedures 1.2 Identified hazards/risks in the workplace and its corresponding indicators in accordance with company procedures 1.3 Recognized contingency measures during workplace accidents, fire and other emergencies 1.4 Identified terms of maximum tolerable limits based on threshold limit value- TLV. 1.5 Followed Occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace 1.6 Used Personal Protective Equipment (PPE) in accordance with company OHS procedures and practices 1.7 Completed and updated OHS personal records in accordance with workplace requirements
2. Underpinning knowledge and Attitudes	2.1 OHS procedures and practices and regulations 2.2 PPE types and uses 2.3 Personal hygiene practices 2.4 Hazards/risks identification and control 2.5 Threshold Limit Value -TLV 2.6 OHS indicators 2.7 Organization safety and health protocol 2.8 Safety consciousness 2.9 Health consciousness
3. Underpinning skills	3.1 Practice of personal hygiene 3.2 Hazards/risks identification and control skills 3.3 Interpersonal skills 3.4 Communication skills
4. Resource implications	The following resources **MUST** be provided: 4.1 Workplace or assessment location 4.2 OHS personal records 4.3 PPE 4.4 Health records
5. Method of assessment	Competency **MUST** be assessed through: 5.1 Portfolio Assessment 5.2 Interview 5.3 Case Study/Situation
6. Context of assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

COMMON COMPETENCIES

AUTOMOTIVE MANUFACTURING

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

UNIT CODE: ALT742201

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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Identify and access engineering drawings/ specification	1.1 Appropriate ***engineering drawings*** are identified and accessed as per job requirements. 1.2 Version and date of drawing is checked to ensure correct specification and procedure are identified.
2. Interpret drawings	2.1 Relevant dimensions and sections of the drawings/ specifications are located in relation to the work to be conducted 2.2 Information in the manual are interpreted in accordance to industry practices
3 Apply information in the drawings & specifications	3.1 Engineering drawing is interpreted according to job requirements 3.2 Work steps are correctly identified in accordance with the specifications in the drawings. 3.3 Dimensional ***data*** and shape are applied according to the given task
4. Store drawings	4.1 The drawings and specification are stored properly to ensure prevention of damage, ready access and updating of information when required in accordance with company requirements

RANGE OF VARIABLES

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

EVIDENCE GUIDE

1.Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Identified and accessed drawings/specification 1.2 Interpreted drawings 1.3 Applied information in drawings 1.4 Stored drawings
2. Underpinning knowledge and attitudes	2.1 Types of drawings used in automotive manufacturing industry 2.2 Identification of symbols used in the drawings 2.3 Identification of units of measurements 2.4 Unit conversion 2.5 Attention to details, Perseverance, Honesty
3. Underpinning skills	3.1 Reading and comprehension skills required to identify and interpret engineering drawings and specifications 3.2 Accessing information and data
4. Resource implications	The following resources **MUST** be provided: 4.1 All drawings/engineering specifications relative to automotive manufacturing 4.2 Job order, requisitions 4.3 Product sample
5 Method of assessment	Competency **MUST** be assessed through: 5.1 Observation with questioning 5.2 Interview
6 Context of assessment	6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines 6.2 Assessment may be conducted in the workplace or a simulated environment.

UNIT OF COMPETENCY: PERFORM MENSURATION AND CALCULATION

UNIT CODE: ALT311202

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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Select measuring instruments	1.1 Object or component to be measured is identified 1.2 Correct specifications are obtained from relevant source 1.3 Appropriate ***measuring instrument*** is selected according to job requirements
2. Carry out measurements and calculation	2.1 Measuring tools are selected in line with job requirements 2.2 Accurate measurements are obtained to job 2.3 ***Calculation*** needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x) and division (/). 2.4 Calculations involving fractions, percentages and mixed numbers are used to complete workplace tasks. 2.5 Numerical computation is self-checked and corrected for accuracy 2.6 Instruments are read to the limit of accuracy of the tool.
3. Maintain measuring instruments	3.1 Measuring instruments are kept free from corrosion 3.2 Measuring instruments are not dropped to avoid damage 3.3 Measuring instruments are cleaned before and after using.

RANGE OF VARIABLES

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

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate: 1.1 Selected measuring instruments 1.2 Carried-out measurements and calculations. 1.3 Maintained measuring instruments
2. Underpinning knowledge and attitudes	2.1 Types of Measuring instruments and its uses 2.2 Safe handling procedures in using measuring instruments 2.3 Four fundamental operation of mathematics 2.4 Formula for Volume, Area, Perimeter and other geometric figures
3. Underpinning skills	3.1 Caring and Handling measuring instruments 3.2 Calibrating and using measuring instruments 3.3 Performing calculation by Addition, Subtraction, Multiplication and Division 3.4 Visualizing objects and shapes 3.5 Interpreting formula for volume, area, perimeter and other geometric figures
4. Resource implications	The following resources **MUST** be provided: 4.1 Workplace location 4.2 Measuring instrument appropriate to servicing processes 4.3 Instructional materials relevant to the propose activity
5. Method of assessment	Competency **MUST** be assessed through: 5.1 Observation with questioning 5.2 Written or oral examination 5.3 Interview 5.4 Demonstration with questioning
6. Context of assessment	6.1 Competency elements must be assessed in a safe working environment 6.2 Assessment may be conducted in a workplace or simulated environment

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

UNIT CODE: ALT723203

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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Identify and access manual/ specification	1.1 Appropriate ***manuals*** are identified and accessed as per job requirements. 1.2 Version and date of manual is checked to ensure correct specification and procedure are identified.
2. Interpret manuals	2.1 Relevant sections, chapters of manuals/specifications are located in relations to the work to be conducted 2.2 Information and procedure in the manual are interpreted in accordance to industry practices
3 Apply information in manual	3.1 Manual is interpreted according to job requirements 3.2 Work steps are correctly identified in accordance with manufacturer specification 3.3 Manual data is applied according to the given task 3.4 All correct sequencing and adjustments are interpreted in accordance with information contained on the manual or specifications
4. Store manuals	4.1 Manual or specification are stored appropriately to ensure prevention of damage, ready access and updating of information when required in accordance with company requirements

RANGE OF VARIABLES

VARIABLE	RANGE
1. Manuals	Kinds of manuals: 2.1 Manufacturer's specification manual 2.2 Repair manual 2.3 Maintenance Procedure Manual 2.4 Periodic Maintenance Manual

EVIDENCE GUIDE

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

UNIT OF COMPETENCY : **PERFORM SHOP MAINTENANCE**

UNIT CODE : **ALT723205**

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

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

CORE COMPETENCIES

UNIT OF COMPETENCY: DEVELOP AND MANUFACTURE WOOD PATTERN

UNIT CODE: ALT742301

UNIT DESCRIPTOR: This unit covers developing and manufacturing wood patterns, both regular shaped and split patterns, based on an understanding of casting and molding principles.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1.Determine job requirements	1.1 Job instructions and specifications are interpreted correctly. 1.2 Type of wood pattern required is determined through application of ***molding/casting techniques*** and foundry processes. 1.3 Appropriate ***timber/timber composites*** are selected to meet specification.
2. Develop and lay out wood patterns	2.1 Pattern parameters are ***calculated*** to specification e.g. angles, tapers, clearances, contractions etc. 2.2 Pattern is laid out showing tapers, machining allowances, core prints and method of construction to specification. 2.3 Jigs and fixtures are developed and manufactured to aid wood pattern manufacture as required.
3.Manufacture wood patterns	3.1 Materials are marked out and construction is developed to meet specification. 3.2 Pattern or pattern component parts are produced to size and shape and checked for conformance to specifications using acceptable wood pattern making techniques and procedures and utilizing appropriate hand and handheld power tools. 3.3 Pattern component parts are ***joined or fixed*** as required and checked for conformance to specification. using acceptable wood pattern making techniques and procedures 3.4 Pattern is correctly marked, color-coded or tagged according to specifications or standard operating procedures.

RANGE OF VARIABLE

VARIABLE	RANGE
1.Molding/casting techniques	1.1 The variety of sand molding techniques and sand mediums
2.Timber/timber composites	2.1 Hardwood 2.2 Softwood 2.3 Laminates 2.4 Plywood 2.5 Veneers and bonded fiberboard
3. Calculations	Calculations include the determination of: 3.1 Contraction rates, 3.2 General engineering calculations
4. Joining and fixing	Joining and fixing may include: 4.1 Glued 4.2 Screwed 4.3 Nailed 4.4 Stapled

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Determined job requirements 1.2 Developed and lay out wood patterns 1.3 Manufactured wood patterns
2. Underpinning knowledge and attitudes	2.1 Kinds of timber products including features, characteristics and applications 2.2 Molding and casting techniques 2.3 Tools required for casting/molding 2.4 Jigs and fixtures methods of construction 2.5 Formulas and mathematical techniques required for necessary manufacturing of patterns/core boxes i.e. contraction, taper, clearances, machining allowances etc. 2.6 Identification of coding and numbering 2.7 Pattern checking techniques 2.8 Moldability i.e. surface finish, face taper, convex or concave perspectives, undercuts, etc. 2.9 Types of personal protective equipment 2.10 Safe work practices and procedures
3. Underpinning skills	3.1 Reading/interpreting/following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other documents 3.2 Performing computation on different numerical operations, geometry and formulas within the scope of this unit 3.3 Selecting appropriate timber to suit the molding/ casting techniques and foundry process 3.4 Laying out the pattern/core boxes 3.5 Constructing patterns/core boxes 3.6 Joining and fixing component parts
4. Resource Implications	The following resources **MUST** be provided: 4.1 All manuals/catalogues relative to Automotive 4.2 Job order, requisitions
5. Method of assessment	Competency **MUST** be assessed through: 5.1 Observation with questioning 5.2 Demonstration with questioning 5.3 Interview 5.4 Portfolio
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: DEVELOP AND MANUFACTURE POLYMER PATTERNS

UNIT CODE: ALT742302

UNIT DESCRIPTOR: This unit covers designing, manufacturing and finishing the polymer patterns.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Determine job requirements.	1.1 Job instructions and specifications are correctly interpreted and followed.
2. Inspect and prepare pattern	2.1 Patterns or cores are inspected for appropriate ***surface finish*** and set up on joint line or flat board to specification. 2.2 Appropriate ***parting agent*** is selected and applied to polymer specifications
3. Manufacture molds	3.1 Appropriate ***polymer materials*** are selected to specification. 3.2 Polymer and hardener are mixed to correct ratios and specifications using standard safety and operating procedures. 3.3 Polymer is applied to specification following predetermined methods such as ensuring air is not entrapped in application, excessive heat is not generated and de-lamination does not occur in final use. 3.4 Pattern/core box is stripped, inspected, cleaned and repaired as required. 3.5 Faces of polymer pattern are machined and finished to specifications. 3.6 Appropriate ***method of location*** is applied to patterns and core boxes. 3.7 Polymer tooling is checked for conformance to specifications as required.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Surface finish	1.1 Texture 1.2 Gel coat 1.3 Aluminum fill
2. Parting agent	2.1 PVA 2.2 Wax
3. Polymer materials	3.1 Epoxy resins 3.2 Urethane
4. Method of location	4.1 Male joint 4.2 Female joint 4.3 Pin 4.4 Bush

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Determined job requirements. 1.2 Inspected and prepared pattern 1.3 Manufactured molds
2. Underpinning knowledge and attitudes	2.1 Methods of locating patterns and core boxes 2.2 Range of surface finishes 2.3 Range of polymers and their applications 2.4 Mixing ratios and calculations 2.5 Characteristics of polymer under exothermic reaction 2.6 Exothermic control procedures 2.7 Methods of stripping 2.8 Pattern checking techniques 2.9 Kinds, use and application of personal protective equipment 2.10 Safe work practices and procedures 2.11 Hazards and control measures associated with producing polymer patterns
3. Underpinning skills	3.1 Reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents 3.2 Undertaking numerical operations, geometry and calculations / formulae within the scope of this unit, including determination of contraction rates 3.3 Measuring polymer materials 3.4 Interpreting written instructions, sketches and drawings 3.5 Making master patterns 3.6 Machining patterns/core boxes and tooling aids 3.7 Sealing the patterns or cores with appropriate surface finish 3.8 Alignment of pattern to core box 3.9 Setting up with necessary locations 3.10 Applying the parting agents 3.11 Selecting polymers 3.12 Preparing polymer and hardener 3.13 Applying polymer coating 3.14 Releasing patterns and molds
4. Resource Implications	The following resources **MUST** be provided: 4.1 All manuals/catalogues relative to this unit 4.2 Job order, requisitions 4.3 Materials, tools, equipment and facilities relevant to the unit.
5. Method of assessment	Competency **MUST** be assessed through: 5.1 Observation with questioning 5.2 Demonstration with questioning 5.3 Interview 5.4 Portfolio 5.5 Third Party Report
6. Context of assessment	6.1 Assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines 6.2 Assessment may be conducted in the workplace or a simulated environment.

UNIT OF COMPETENCY: DEVELOP AND MANUFACTURE ASSEMBLED PLATED PATTERNS

UNIT CODE: ALT742303

UNIT DESCRIPTOR: This unit covers assembling plated patterns.

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ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Determine job requirement	1.1 Job instructions and specifications are correctly interpreted and followed.
2. Inspect and layout patterns	2.1 Pattern(s) are inspected to ensure dimensions and surface finish conforms to specifications. 2.2 Pattern and runner system is laid out to specifications from drawings, sketches or verbal instructions. 2.3 ***Pattern(s) alignment*** is correctly laid-out.
3. Mount pattern on plates	3.1 Cope and drag patterns/double-sided match plate patterns are attached to pattern plate/s according to specification. 3.2 Cope and drag patterns/double-sided match plate patterns are inspected for security and alignment.
4. Mount runner system	4.1 Volume of runner system conforms to specification. 4.2 All ***calculations*** are performed without error. 4.2 Runner components are attached to pattern plates using appropriate fixing and joining techniques using dowels and other fixing attachments to specification.
5. Inspect plated pattern assembly	5.1 Surface and moldability of plated pattern assembly are inspected and measured for compliance with specification

RANGE OF VARIABLES

VARIABLE	RANGE
1. Pattern	1.1 Metal 1.2 Wood
2. Match Plate	2.1 Plane 2.2 Offset
3. Alignment	3.1 Measurement (X Y Plane) 3.2 Dowels

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate: 1.1 Determined job requirements. 1.2 Inspected and laid-out patterns 1.3 Mounted pattern on plates 1.4 Mounted runner system 1.5 Inspected plated pattern assembly
2. Underpinning knowledge and attitudes	2.1 Determining job requirements from written instructions, specifications, sketches and drawings 2.2 Planning and sequencing tasks 2.3 Checking and clarifying task-related information 2.4 Performing relevant calculations 2.5 Following verbal instructions 2.6 Applying surface finishes for the molding process 2.7 Laying out patterns and runner systems 2.8 Attaching pattern and runner components 2.9 Locating and aligning patterns 2.10 Types of pattern plates 2.11Techniques for avoiding cross jointing or mismatch of the pattern and their relationship to the pin-centre 2.12 Methoding systems 2.13 Moldability of materials i.e. surface finish, face taper, convex or concave perspectives, undercuts, etc. 2.14 Molding and casting techniques 2.15 Kinds, use and application of personal protective equipment 2.16 Safe work practices and procedures 2.17 Hazards and control measures associated with assembling plated patterns
3. Underpinning skills	3.1 Checking patterns for compliance 3.2 Perform measurement, numerical operations and calculations associated with assembling plated patterns 3.3 Fixing and drilling techniques 3.4 Following safety, quality, communication, materials handling techniques 3.5 Recording and reporting associated with assembling plated patterns or other units requiring the exercise of the skills and knowledge covered by this unit.
4. Resource Implications	The following resources **MUST** be provided: 4.4 All manuals/catalogues relative to this unit 4.5 Job order, requisitions 4.6 Materials, tools, equipment and facilities relevant to the unit.
5. Method of assessment	Competency **MUST** be assessed through: 5.1 Observation with questioning 5.2 Demonstration with questioning 5.3 Portfolio
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: DEVELOP AND MANUFACTURE PRODUCTION PATTERNS

CODE: ALT742304

UNIT DESCRIPTOR: This unit covers developing pattern and manufacturing metal production patterns and core boxes.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Determine job requirements	1.1 Drawings, instructions and specifications are interpreted and understood. 1.2 Pattern type and design is conceptualized and planned with reference to customer's specification (written or verbal) for number, layout, runner system and core box design. 1.3 Pattern design is interpreted and visualized from drawings, prints or plans and checked against customer requirements. 1.4 A plan is developed for sequence of manufacture for either a high or low volume foundry production pattern.
2. Manufacture production patterns and core boxes	2.1 Appropriate ***materials*** are selected and obtained to meet requirements of strength, durability and component finish etc. 2.2 ***Calculations*** appropriate to establishing pattern parameters are performed, including angles, tapers, contraction, etc. where applicable. 2.3 Appropriate ***machines*** and machining process are selected to shape/produce production patterns and core boxes to specification. 2.4 A range of hand and hand held power tools are selected to fashion/manufacture production patterns and core boxes to specification. 2.5 Production ***patterns*** and core boxes are checked to specification and surface finish and are checked for moldability.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Appropriate materials	1.1 Ferrous 1.2 Non-ferrous 1.3 Alloy materials
2. Calculations	2.1 The determination of contraction rates 2.2 General engineering calculation such as: 2.2.1 Volume 2.2.2 Area 2.2.3 Length 2.2.4 Width, etc.
3. Appropriate machines	3.3 Lathe machine 3.4 Milling machine 3.5 Grinders 3.6 Pedestal drills 3.7 Pantographs, and other machines as needed
4. Patterns	Pattern types 4.1 One-piece, loose piece (unlimited size) 4.2 Split, loose piece pattern (unlimited size) 4.3 One piece match plate (depending on molding machine) 4.4 Split match plate (depending on molding machine) 4.5 Multi cavity patterns

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate 1.1 Determined job requirement. 1.2 Developed pattern equipment 1.3 Manufactured production patterns and core boxes
2. Underpinning knowledge and attitudes	2.1 Determining job requirements from written instructions, sketches and drawings 2.2 Planning and sequencing manufacturing operations 2.3 Characteristics of metals and alloys and their application in the development/manufacture of production patterns 2.4 Tolerances and contraction rates in the manufacture of production patterns 2.5 Production molding and casting techniques 2.6 Tooling required for casting/molding 2.7 Methoding techniques 2.8 The use and application of jigs and fixtures 2.9 Methods of construction including machining provision and clamping arrangements 2.10 Techniques, tools and equipment to measure, mark out and produce production patterns 2.11 Formulae and mathematical techniques required for manufacturing production patterns/core boxes i.e. contraction, taper, clearances, machining allowances etc. 2.12 Identification coding and numbering 2.13 Pattern checking techniques 2.14 Moldability i.e. surface finish, face taper, convex or concave perspectives, undercuts, etc. 2.15 Use and application of personal protective equipment 2.16 Safe work practices and procedures 2.17 Hazards and control measures associated with developing and manufacturing production patterns
3. Underpinning skills	3.1 Checking and clarifying task-related information 3.2 Selecting appropriate metals to suit the molding/casting techniques and foundry process 3.3 Laying out/constructing production pattern/core boxes 3.4 Joining and fixing component parts 3.5 Checking pattern for conformance to specifications 3.6 Measuring components to specified tolerances 3.7 Calculating contraction rates
4. Resource implications	The following resources **MUST** be provided: 4.1 Workplace: Real or simulated work area 4.2 Access to all tools & equipment, materials and documentation
5.Method of assessment	Competency **MUST** be assessed through: 5.1 Observation with questioning 5.2 Third party reports 5.3 Portfolio
6. Context of assessment	6.1 Competency must be assessed on the job or simulated environment. 6.2 The assessment of practical skills must take place after a period of supervised practice and repetitive experience.

UNIT OF COMPETENCY: PERFORM GENERAL WOODWORKING MACHINE OPERATIONS

UNIT CODE: ALT742305

UNIT DESCRIPTOR: This unit covers setting up and operating wood working machines used by engineering pattern makers and fabricators.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables (***All*** inspections methods ***are carried out according to industry regulations/guidelines,*** occupational health and safety and company procedures)
1. Determine job requirements	1.1 ***Job requirements***, instructions and specifications are interpreted and understood. 1.2 Appropriate ***woodworking machine*** is selected to meet specifications.
2. Set up woodworking machines	2.1 Tools/cutters are selected appropriate to task requirements. 2.2 ***Cutting tools*** are sharpened and/or shaped to specification. 2.3 Tools/cutters are correctly installed using standard operating procedures. 2.4 ***Guards/stops*** are set and adjusted as required. 2.5 Woodworking machines are ***set-up*** in accordance with company standard operating procedures and safety requirements
3. Operate woodworking machines	3.1 Material to be machined is positioned and secured effectively. 3.2 Materials are machined to specification using standard operating procedures. 3.3 Material use is optimized and waste is minimized.
4. Check finished component	4.1 Machined component is checked against specifications and predetermined finish.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Job requirements	1.1 Sizing 1.2 Appearance in terms of figure, grain or surface finish 1.3 Allowance of imperfections such as twist, bow, bend, sloping grain, knots, shakes, gum veins etc.
2. Woodworking machines	2.1 Band saws 2.2 Buzzers 2.3 Thicknesses 2.4 Disk sander 2.5 Bobbin sander 2.6 Pattern mill 2.7 Wood lathe 2.8 Pedestal router and drill
3 Cutting tools	3.1 Blades 3.2 Router bits
4 Guards/stops	4.1 Fixed guards and stops 4.2 Variable guards and stops
5 Set up	5.1 Installation of the blades and cutters 5.2 Settings for the job 5.3 Adjustments for sizing and speed

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidences that the candidate: 1.1 Determined job requirements. 1.2 Had set up woodworking machines. 1.3 Operated woodworking machines. 1.4 Checked finished component.
2. Underpinning knowledge and attitudes	2.1 Knowledge of application and use of general wood working machines 2.2 Procedure in interpreting instructions, drawings or sketches 2.3 Numerical operations and calculations within the scope of this unit 2.4 Consequences of selecting inappropriate materials 2.5 Various processes requiring models calculus, engineering calculations and formulae relating to developing and manufacturing precision models 2. 6 Different machines and machining processes and their operations 2.7 Various checking procedures and devices including coordinate measuring and machine checking 2.8 Procedures for recording deviation or modification to original drawings or specifications 2.9 Hazards and control measures associated with developing and manufacturing precision models
3. Underpinning skills	3.1 Determining job requirements from job instructions, specifications, standard operating procedures and other applicable reference documents 3.2 Checking and clarifying task-related information 3.3 Selecting and setting machines 3.4 Setting guards and stops 3.5 Handling, machining and storing timber and wood 3.6 Measuring materials and components to specified sizes/tolerances 3.7 Checking for conformance to specifications
4. Resource implications	The following resources **MUST** be provided: 4.1 Workplace: Real or simulated work area 4.2 Access to all tools & equipment, materials and documentation 4.3 The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
5. Method of assessment	Competency **MUST** be assessed through: 5.1 Observation with Questioning 5.2 Demonstration with questioning 5.3 Portfolio
6. Context of assessment	6.1 Competency must be assessed on the job or simulated environment. 6.2 The assessment of practical skills must take place after a period of supervised practice and repetitive experience.

UNIT OF COMPETENCY: USE AND MAINTAIN MEASURING INSTRUMENT

UNIT CODE: ALT821303

UNIT DESCRIPTOR: This unit identifies the competence required to measure components or sections using non-specialist instrument and maintain the measuring instrument.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Measure dimensions or variables using appropriate instrument	1.1 ***Measurement of dimensions and variables*** are completed without causing damage to any instrument or components 1.2 Appropriate ***measuring instrument*** is selected 1.3 Relevant ***measuring techniques*** are used and results appropriately recorded 1.4 All measuring activities are carried out according to industry regulations/guidelines ***OHS & requirements*** and enterprise/procedures policies
2. Maintain measuring instrument	2.1 Maintenance of measuring instrument is achieved without causing damage to any instrument or component 2.2 ***Routine care and storage of measuring instrument*** is undertaken according to manufacture specifications 2.3 Checking and calibrating of measuring devices is done prior to use. 2.4 All maintenance activities of measuring instruments are carried out according to industry regulations/guidelines OHS legislation, and enterprise procedures policies

RANGE OF VARIABLES

VARIABLE	RANGE
1. Dimension and variables measurement	1.1 Measuring Tape • Diameter of Furnace components • External Dimensions 1.2 Steel Rule • Straightness • Alignment 1.3 Leveling Gauge • Warpage • Level and angle 1.4 Pyrometer
2. Measuring instrument and tools	2.1 Handtools 2.2 Depth gage 2.3 Vernier Caliper 2.4 Straight edge 2.5 Feeler gage 2.6 Inside Caliper 2.7 T-squares 2.8 Flat edges 2.9 Dividers 2.10 Protractors
3. Measuring technique	3.1 Correct usage of the above mentioned measuring instrument and tools. 3.2 Out of round or ovality 3.3 Cylindricity or taper conicity
4. OHS Requirements	4.1 Wearing of personal protective instrument such as apron, goggles, gloves, safety shoes 4.2 Disposal of wastes materials 4.3 Workshop housekeeping
5. Routine care and storage of measuring instrument	5.1 Periodic check up of pyrometer with standard bars 5.2 Storage in box separated from hand tools 5.3 Proper handling 5.4 Not to exposed to liquid such as water.

EVIDENCE GUIDE

1. Critical aspects competency	Assessment requires evidence that the candidate: 1.1 Measured components or section using correct instrument. 1.2 Maintained measuring instrument.
2. Underpinning knowledge and attitudes	2.1 Personal and instrument safety requirements 2.2 Measuring instrument types and their application 2.3 Measuring procedures 2.4 Measuring instrument graduation 2.5 Measuring instrument maintenance procedures 2.6 Positive Work values (Perseverance, Patience, Honesty, Attention to Details)
3. Underpinning skills	3.1 Accessing, interpreting and applying technical information 3.2 Using tools and instrument correctly and safely 3.3 Maintain measuring instrument 2.1 Using measuring instrument
3 Resource implications	The following resources **MUST** be provided: 4.1 Workplace: Real or simulated work area 4.2 Appropriate Tools & instrument 4.3 Materials relevant to the activity
4 Method of assessment	Competency **MUST** be assessed through 5.1 Demonstration of skills in measurement of length, squareness, flatness, angles, roundness, depth, clearance or any measurements that can be taken from analogue or digital devices. 5.2 Written examination
5 Context of assessment	6.1 The assessment of practical skills must only take place after a period of supervised practice and repetitive experience in a safe working environment. If workplace conditions are not available, assessment in simulated workplace conditions is acceptable.

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 Pattern Making NC II.

3.1 CURRICULUM DESIGN

Course Title: **Foundry-Pattern Making** NC Level: **NC II**

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

Course Description:

This course is designed to enhance the knowledge, skills and attitudes of an individual in the field of foundry-pattern making in accordance with industry standards. It covers core competencies such as; develop and manufacture wood patterns, develop and manufacture polymer patterns, develop and manufacture assembled plated patterns, develop and manufacture polystyrene patterns, develop and manufacture production patterns, develop and manufacture vacuum forming moulds, develop and manufacture precision molds, develop and manufacture gear conveyor screw and propeller patterns, perform general woodworking machine operations, use and maintain measuring instrument.

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

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

BASIC COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Participate in workplace communication	1.1 Obtain and convey workplace information. 1.2 Complete relevant work related documents. 1.3 Participate in workplace meeting and discussion.	• Group discussion • Interaction	• Written test • Practical/performance test • Interview
2. Work in a team environment	2.1 Describe and identify team role and responsibility in a team. 2.2 Describe work as a team member.	• Discussion • Interaction	• Observation • Simulation • Role playing

3. Practice career professionalism	3.1 Integrate personal objectives with organizational goals. 3.2 Set and meet work priorities. 3.3 Maintain professional growth and development.	• Group Discussion • Interaction	• Demonstration • Observation • Interviews/ questioning
4. Practice occupational health and safety	4.1Identify hazardous risks 4.2 Evaluate hazard and risks 4.3 Control hazards and risks 4.4 Maintain occupational health and safety awareness	• Discussion • Plant tour • Symposium	• Observation • Interview

COMMON COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Read, Interpret and Apply Engineering Drawings	1.1 Identify and access engineering drawings/ specification 1.2.Interpret drawings 1.3.Apply information in the drawings & specifications 1.4 Store drawings	• Lecture/ Demonstration • Dual training	• Direct observation • Interview
2. Perform Mensuration and Calculation	2.1. Select measuring instrument and 2.2 Carry out measurement and calculations. 2.3. Maintain measuring instruments	• Lecture/ Demonstration • Simulation • Exercises	• Written test • Oral questioning • Direct observation
3. Read, Interpret and Apply Specifications and Manual	4.1. Identify/accessed manuals and interpret data and specification 4.2 Apply information accessed in manual 4.3 Store manual	• Lecture/ Demonstration • Dual training • Distance Learning	• Written test • Direct observation • Project method • Interview
4. Perform Shop Maintenance	4.1 Inspect/clean tools and work area 4.2 Store/arrange tools and shop equipment 4.3 Dispose wastes/used lubricants 4.4 Report damaged tools/equipment	• Lecture/ Demonstration • Dual training • Self paced (modular) • Simulation	• Written test • Direct observation • Demonstration • Interview

CORE COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Develop and manufacture wood patterns	1.1 Determine job requirements 1.2 Develop and lay out wood patterns 1.3 Manufacture wood patterns	• Lecture/ Demonstration • Dual Training • Distance learning	• Written examination • Direct Observation • Project method • Inteview
2. Develop and manufacture polymer patterns	2.1 Determine job requirements. 2.2 Inspect and prepare pattern 2.3 Manufacture molds	• Lecture/ Demonstration • Dual Training • Practical exercises	• Interview • Demonstration • Direct Observation w/questioning • Portfolio • Third party report
3. Develop and manufacture assembled plated patterns	3.1 Determine job requirement 3.2 Inspect and layout patterns 3.3 Mount pattern on plates 3.4 Mount runner system 3.5 Inspect plated pattern assembly	• Lecture/ Demonstration • Dual Training • Practical exercises	• Direct Observation • Questioning • Demonstration • Portfolio
4. Develop and manufacture production patterns	4.1Determine job requirements 4.2.Manufacture production patterns and core boxes	• Lecture/ Demonstration • Dual Training • Practical exercises	• Direct Observation • Questioning • Third party • Portfolio
5. Performs general woodworking machine operations	5.1 Determine job requirements 5.2 Set up woodworking machines 5.3 Operate woodworking machines 5.4 Check finished component	• Lecture/ Demonstration • Dual Training • Practical exercises	• Direct Observation • Questioning • Demonstration • Portfolio
6. Use and Maintain Measuring Instruments	6.1 Measure dimensions or variables using appropriate instruments 6.2 Maintain measuring instruments	• Lecture/ Demonstration • Dual Training • Practical exercises	• Demonstration • Written exam

3.2 TRAINING DELIVERY

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

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

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

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

3.3 TRAINEE ENTRY REQUIREMENTS

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

- With experience in basic machining
- With good moral character;
- Ability to communicate both oral and written; and
- Physically and mentally fit

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS FOUNDRY PATTERN MAKING NC II

Recommended list of tools, equipment and materials for the training of 25 trainees for Foundry Pattern Making NC II

TOOLS		EQUIPMENT		MATERIALS	
QTY		QTY		QTY	
2 sets	Box wrench	1 unit	Wood lathe	12 pcs	Plywood (1/2 thk)
2 sets	Open end wrench	1 unit	Band saw	12 pcs	Plywood (1/4 thk)
2 sets	Socket wrench	1 unit	Circular saw	24 pcs	Lumber 1”x4”x12”
2 pcs	Adjustable wrench	1 unit	Planer	24 pcs	Lumber 2”x4”x12”
2 sets	Screwdriver (+)	1 unit	Disc grinder	24 pcs	Lumber 2”x6”x12”
2 sets	Screwdriver (-)	1 unit	Wood router	24 pcs	Lumber 2”x2”x12”
2 pcs	Plier (side cutting)	1 unit	Portalble drill (12mm)	12 pcs	Laminate 4”x8”x1/8”
2 pcs	Plier (long nose)	1 unit	Bench drill	12 pcs	Card board 4”x8”x1/8”
2 pcs	Mechanical plier	1 unit	Pedestal tool grinder	12 pcs	Marker pen (red)
2 pcs	Ballpein hammer	2 set	Work bench	12 pcs	Marker pen (black)
4 pcs	Wood mallet	4 sets	Clamp	3 cans	Lay-out blue
4 pcs	Claw hammer	4 sets	Wood clamp	6 ft	Steelwire 6mm dia
1 set	Feeler gauge	4 set	C-clamp 300mm	24 pcs	Ball pen
2 pcs	Hammer (plastic faced)	2 units	Storage cabinet	4 gallons	Rugby adhesive
1 set	Number punch	2 units	Open shelf cabinet	4 gallons	Wood putty (2-system)
1 set	Alphabet punch	1 pc	Anvil	4 gallons	Wood filler (fula tite)
1 set	Straight drill			24 sheets	Sand paper #120
8 sets	Tap / die (M-8			24	Sand paper #160

	up to M-20)			sheets	
2 sets	Tap / die handle			24 sheets	Sand paper #60
2 pcs	Hack saw			4meters	Disc sander (wood)
2 pcs	Straight edge (1000 mm long)				Engineering drawing
2 pcs	Tri-square (300mm long)				Machine numeral
1 pc	Adjustable protractor				Catalogues
2 pcs	Steel rule (3 meters)				Brochure
2 pcs	Cross cut saw				Paint brush
2 pcs	Rasp file (heefround)			1 liter	Paint (Blue, Orange, Red, Black)
2 pcs	Rasp file (rectangle)				
2 pcs	Rasp file (round)				
2 pcs	File (coarse) heefround				
2 pcs	File (fine) heefround				
2 pcs	File (coarse) rectangle				
2 pcs	File (fine) rectangle				
2 pcs	File (coarse) round				
2 pcs	File (fine) round				
2 pcs	File (coarse) square				
2 pcs	File (fine) square				
2 pcs	File (coarse) Triangle				
2 pcs	File (fine) Triangle				
2 sets	Vernier caliper (300)				
2 sets	Vernier caliper (250)				
2 sets	Depth gage (300)				
1 set	Vernier height gage (1000mm)				
1 set	Vernier height gage (500mm)				

2 sets	Wood turning tools				
3 pcs	Divider (300mm)				
2 pcs	Trammel point				
3 pcs	Divider (200mm)				
2 pcs	Straight edge (510mm)				
2 pcs	Jack plane (long) – Katam				
2 pcs	Jack plane (short) – Katam				
4 pcs	Chisel 1 ½" wide				
4 pcs	Chisel 1" wide				
4 pcs	Chisel 1/2 " wide				
4 pcs	Chisel ¼" wide				

3.5 TRAINING FACILITIES

FOUNDRY PATTERN MAKING NC II

Based on a class size of 25 students/trainees

SPACE REQUIREMENT	SIZE IN METERS	AREA IN SQ. METERS	TOTAL AREA IN SQ. METERS
• Building (permanent)	26.00 x 28.00	728.00	728.00
• Trainee Working Space	3.50 x 3.50 per student / trainee	10.25 per student	123
• Lecture room	9.00 x 10.00	90.00	90.00
• Learning resource center	5.00 x 8.00	40.00	40.00
• Facilities / Equipment / Circulation area	-	-	291.75

3.6 TRAINER'S QUALIFICATIONS FOR AUTOMOTIVE MANUFACTURING SUB SECTOR

FOUNDRY PATTERN MAKING NC II
TRAINER QUALIFICATION (TQ II)

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

* 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 Patternmaking NC II, the candidate must demonstrate competence in all the units listed in Section 1. Successful candidates shall be awarded a National Certificate signed by the TESDA Director General.

4.2 The qualification of Foundry Patternmaking NC II may be attained through.

4.2.1 Accumulation of Certificates of Competency (COCs) in all the following areas:

4.2.1.1 Manufacture Wood Pattern
- Develop and manufacture wood patterns
- Performs general woodworking machine operations
- Use and maintain measuring instrument

4.2.1.2 Manufacture Polymer Patterns
- Develop and manufacture polymer patterns
- Use and maintain measuring instrument

4.2.1.3 Manufacture Plated Pattern
- Develop and manufacture assembled plated patterns
- Develop and manufacture production patterns
- Use and maintain measuring instrument

Successful candidates shall be awarded Certificates of Competency (COC) bearing the signature of the Regional Director and Chair of the recognized local industry body.

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:

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

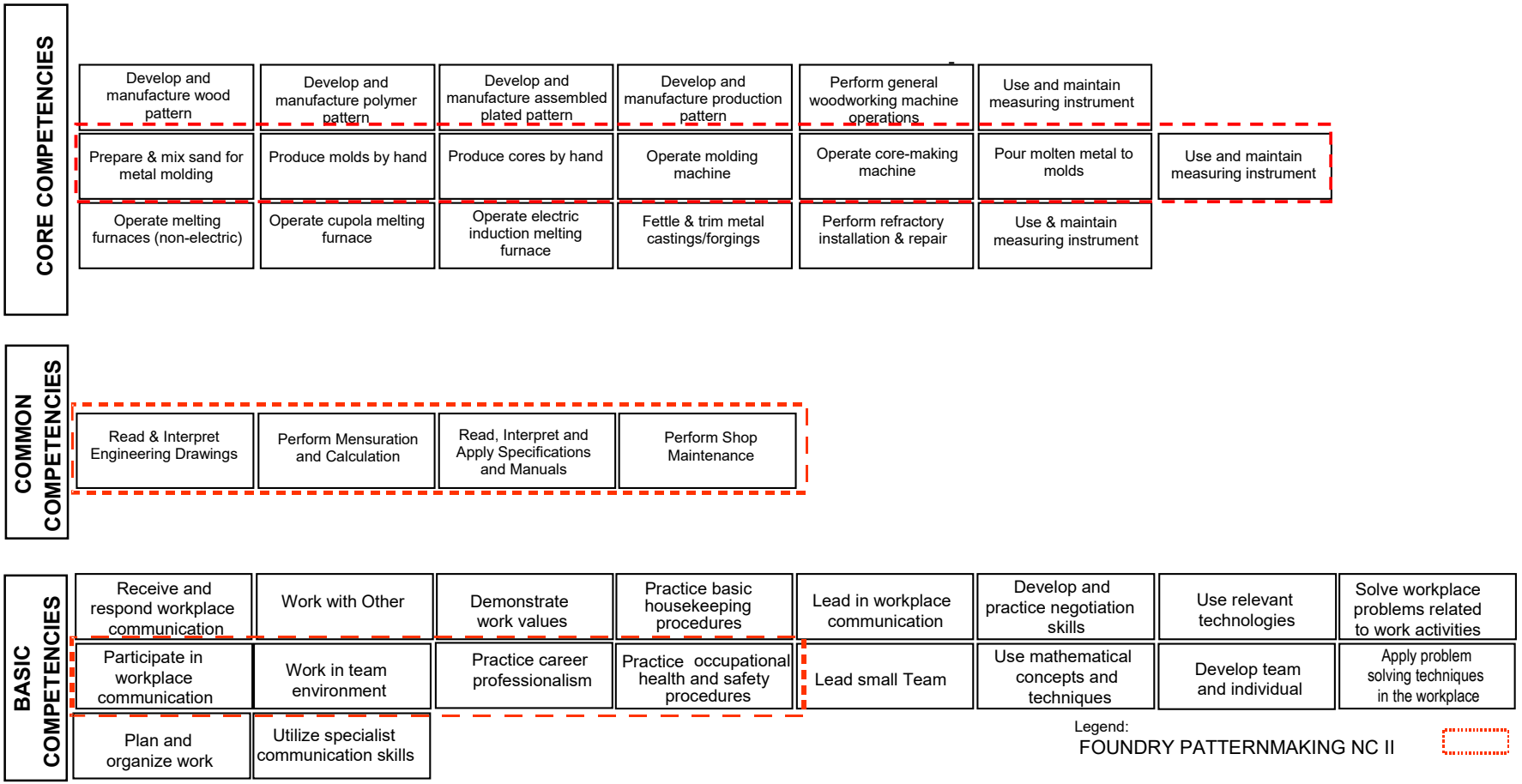
1.1.2 Experienced workers (wage employed or self-employed)

4.5 The guidelines on assessment and certification are discussed in detail in the Procedures Manual on Assessment and Certification and Guidelines on the Implementation of the Philippine TVET Qualification and Certification System (PTQCS)

ANNEX A

COMPETENCY MAP- AUTOMOTIVE SECTOR
MANUFACTURING SUB-SECTOR

FOUNDRY PATTERNMAKING NC II



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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