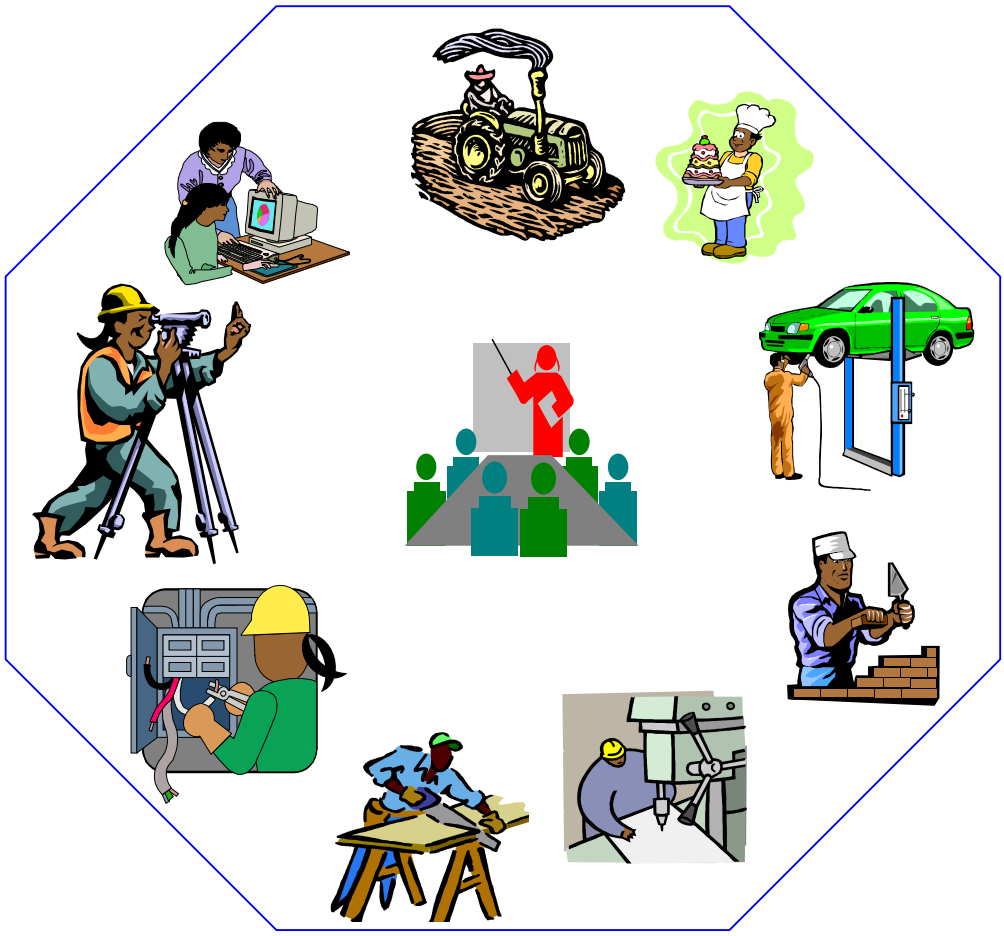
Federal Democratic Republic of Ethiopia

OCCUPATIONAL STANDARD

BASIC METAL WORKS

NTQF Level I



Ministry of Education

February 2017

Introduction

Ethiopia has embarked on a process of reforming its TVET-System. Within the policies and strategies of the Ethiopian Government, technology transformation – by using international standards and international best practices as the basis, and, adopting, adapting and verifying them in the Ethiopian context – is a pivotal element. TVET is given an important role with regard to technology transfer. The new paradigm in the outcome-based TVET system is the orientation at the current and anticipated future demand of the economy and the labor market.

The Ethiopian Occupational Standards (EOS) is the core element of the Ethiopian National TVET-Strategy and an important factor within the context of the National TVET-Qualification Framework (NTQF).They are national Ethiopia standards, which define the occupational requirements and expected outcome related to a specific occupation without taking TVET delivery into account.

This document details the mandatory format, sequencing, wording and layout for the Ethiopia Occupational Standard which comprised of Units of Competence.

A Unit of Competence describes a distinct work activity. It is documented in a standard format that comprises:

- Occupational title, NTQF level
- Unit title
- Unit code
- Unit Descriptor
- Elements and Performance criteria
- Variables and Range statement
- Evidence guide

Together all the parts of a Unit of Competence guide the assessor in determining whether the candidate is competent.

The ensuing sections of this EOS document comprise a description of the respective occupation with all the key components of a Unit of Competence:

- the chart with an overview of all Units of Competence for the respective occupation including the Unit Codes and the Unit Titles
- the contents of each Unit of Competence (competence standard)
- occupational map providing the Technical and Vocational Education and Training (TVET) providers with information and important requirements to consider when designing training programs for this standards, and for the individual, a career path

UNIT OF COMPETENCE CHART

Occupational Standard: Basic Metal Works		
Occupational Code: IND BMW		
NTQF Level I		
IND BMW1 01 0217 Implement and Apply OHS Practice	**IND BMW1 02 0217** Interpret Drawings and Sketches	**IND BMW1 03 0217** Identify Properties of Metals
IND BMW1 04 0217 Perform Bench Work	**IND BMW1 05 0217** Cut and Join Sheet Metal	**IND BMW1 06 0217** Operate Basic Workshop Machinery
IND BMW1 07 0217 Perform Hand Forging	**IND BMW1 08 0217** Perform Cutting Using Oxyacetylene	**IND BMW1 09 0217** Perform Routine Metal Arc Welding
IND BMW1 10 0217 Apply Basic Electrical Practices	**IND BMW1 11 0217** Operate Personal Computer	**IND BMW1 12 0217** Apply Quality Standards
IND BMW1 13 0217 Work with Others	**IND BMW1 14 0217** Receive and Respond to Workplace Communication	**IND BMW1 15 0217** Demonstrate Work Values
IND BMW1 16 0217 Develop Understanding of Entrepreneurship	**IND BMW1 17 0217** Apply 3S	

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Implement and Apply OHS Practice**
Unit Code	**IND BMW1 01 0217**
Unit Descriptor	This unit covers general OHS requirements in all organization functional areas that all workers are expected to be able to uphold and maintain

Elements	Performance Criteria
1. Identify workplace procedures for occupational health and safety	1.1. ***OHS*** policies and procedures are familiarized an ongoing basis in accordance with applied workplace regulations 1.2. Hazards in the work area are recognized and reported to designated personnel according to workplace procedures.
2. Follow workplace procedures for hazard identification and risk control	2.1. ***Work area*** is managed by the individual and maintained with reference to OHS standards and work instructions for the workplace. 2.2. Road traffic accidents and other ***emergencies*** competencies are followed, whenever necessary within the scope of responsibilities and with regards to workplace procedures and regulations
3. Contribute to management of OHS in the workplace	3.1. ***Personnel Protective Equipment (PPE)*** issues are raised with designated personnel in accordance with workplace procedures and relevant OHS legislation. 3.2. ***Preventative OHS*** procedures are demonstrated throughout all scope of work, and with regards to workplace standards and regulations

Variable	Range
OHS	May include, but not may include: • team or work group meetings where OHS information is discussed and shared with colleagues • attendance at OHS seminars (first aid training)where continuous learning and development in OHS matters is developed • participating in continuous improvement processes
Work area	May include, but not may include: • manufacturing and training workshops, tool rooms • indoor or outdoor location • Immediate workstation space, • Offices, class rooms and reception areas
Emergencies	May include, but not may include: • workplace accidents • fires and other environmental hazards • traffic accident
PPE	May include, but not may include: • reflector vest and road sign/signal

	• eye protective (safety goggles and sun glasses) • safety shoes • working gloves • protective clothes
Preventative OHS	in the workplace may be demonstrated by: • identifying opportunities to avoid hazards that are not obvious to others • initiating changes to procedures and processes to avoid or reduce the risk of hazards in the workplace

Evidence Guide	
Critical aspects of Competence	Must demonstrate the knowledge and skills to: • follow defined OHS policies and procedures in the workplace • recognize and report hazards and potential hazards in the workplace • identify and follow all relevant workplace procedures, including OHS and emergency procedures • contribute actively to management of OHS in the workplace
Underpinning Knowledge and Attitudes	Must demonstrate the knowledge to: • council procedures relating to hazards, emergencies, road accidents and risk control • meaning of OHS signs and symbols relevant to area of work
Underpinning Skills	Must demonstrate the skills of: • identifying risks and hazards • verbal communication skills • filling in accident and incident forms • participating in group meetings and sharing information with others • interpreting OHS signs and symbols • deciding appropriate action in emergencies by utilizing basic problem-solving techniques • using two-way radio if relevant to workplace requirements
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Assessment Methods	Competency may be assessed through: • Interview/Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competency may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Interpret Drawings and Sketches**
Unit Code	**IND BMW1 02 0217**
Unit Descriptor	This unit covers the competencies required to read and interpret drawings and sketches. It requires interpretations of standard drawings by using symbols, dimensional tolerances and notations.

Elements	Performance Criteria
1. Identify technical drawing	1.1. ***Drawing*** is checked and validated against job requirements 1.2. Drawing version is checked and validated 1.3. Instructions are confirmed and followed as required
2. Identify views, standard symbols and lines	2.1. Orthographic and isometric drawing are identified 2.2. Orthographic and isometric views are explained 2.3. Alphabet of lines are identified 2.4. Uses of the alphabet of lines are explained 2.5. Codes and symbols are correctly identified and explained according to drawing standards
3. Interpret technical drawing	3.1. Component, assembly or object ***projections*** are recognized as required 3.2. Drawing symbols and codes are interpreted appropriately Dimensions and material requirements are identified, understood and followed as required 3.3. Dimensional ***tolerances***, notations are interpreted according to specifications

Variables	Range
Drawing	May include, but not limited to: • Perspective • Exploded view • Hidden view technique
Projections	May include, but not limited to: • First angle projections • Third angle projections
Tolerances	May include, but not limited to: • General tolerance • Angular tolerance • Geometric tolerance
Tools and equipment	May include, but not limited to: • set square, T-square, compass, divider • different types of drawing paper • pencil • drawing board and masking tape

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills to: • interpreted technical drawings and sketches • interpreted symbols, dimensional tolerances and notations
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • alphabet of lines • drawing symbols • tolerances • relationship between the views contained in the drawing • objects represented in the drawing • units of measurement used in the preparation of the drawing • dimensions of the key features of the objects depicted in the drawing • the instructions contained in the drawing • the actions to be undertaken in response to those instructions • the materials from which the object(s) are made • any symbols used in the drawing as described in range • relationship between the views contained in the drawing • objects represented in the drawing • units of measurement used in the preparation of the drawing • dimensions of the key features of the objects depicted in the drawing • understanding of the instructions contained in the drawing • the actions to be undertaken in response to those instructions • the materials from which the object(s) are made • any symbols used in the drawing as described in range statement • hazard and control measures associated with interpreting technical drawings, including housekeeping • safe work practices and procedures
Underpinning Skills	Must demonstrates skills of: • using projections • drawing technique • dimensioning techniques • checking the drawing against job requirements/related equipment in accordance with standard operating procedures • confirming the drawing version as being current in accordance with standard operating procedures • where appropriate, obtaining the current version of the drawing in accordance with standard operating procedures • reading, interpreting information on the drawing, written job instructions, specifications, standard operating procedures, charts, lists and other applicable reference documents • checking and clarifying task related information • undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Assessment Methods	Competency may be assessed through: • Interview/Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competency may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Identify Properties of Metals**
Unit Code	**IND BMW1 03 0217**
Unit Descriptor	This unit covers the basic skills and knowledge required to classify the characteristics of different ferrous and non-ferrous metals, applications, and common treatments and testing procedures in metal engineering manufacturing.

Elements	Performance Criteria
1. Classify common ferrous and non-ferrous metals	1.1. Distinctions between ***ferrous and non-ferrous metals*** and alloys are classified in terms of color codes, strength, density, corrosion resistance, electrical conductivity and magnetic properties. 1.2. ***Metal properties*** are identified like yield stress, proof stress, tensile stress, elongation, impact strength, toughness, fatigue strength, wear resistance, heat resistance, hardness, bending.
2. Test basic applications and methods for manufacturing	2.1. Correct cutting tools are selected for the machinability 2.2. Basics on cast-ability, weld-ability, forge-ability and corrosion resistance are tested 2.3. Basic methods are carried out of processing engineering materials for rolling, forging, extrusion, drawing and spinning 2.4. Methods of manufacturing in hot working, cold working and thermal processes are experienced.
3. Perform basic common metal tests	3.1. Basic ***metal tests*** of tensile, hardness, shear, impact, spark and bend tests are selected, prepared and carried out 3.2. Basic material test results are recorded and compared
4. Define common heat treatment outcomes and applications	4.1. The most common ***heat treatment*** processes used are identified 4.2. The changes in metal properties caused by heating are explained 4.3. The reasons for heat treatment use are explained

Variable	Range
Ferrous and non-ferrous metals	May Include, but not limited to: • ferrous metals: cast irons, carbon and alloy steels, stainless steels, coated steels • non-ferrous metals may include: ➢ aluminum and its alloys, ➢ copper and its alloys, ➢ nickel alloys,

	➢ zinc-tin lead alloys, ➢ titanium, magnesium.
Property of metals	May Include, but not limited to: • Strength, elasticity, plasticity, malleability, toughness, brittleness, fatigue endurance, mould-ability, weld-ability, machinability, formability, resistance to creep and stress relaxation, resistance to degradation • electrical, magnetic, thermal, chemical and optical • material structure and effect on properties Others: • Corrosion and corrosion protection • Effect of manufacturing processes on materialproperties.
Metal tests	May Include, but not limited to: • Hardness tester – Rockwell, Brinell, Shore, Scleroscope • Spark testing-grinder • Tensile tester • Impact testing equipment
Heat treatment	May Include, but not limited to: • Gas, electric, kilns • Plain carbon steels, alloy steels, non-ferrous • preheating; quenching; tempering; annealing; normalising; carburizing

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills on: • Identifying and classifying metal properties • Using appropriate metal manufacturing processes
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of : • classification of materials may include: ➢ ferrous and non-ferrous metals • properties of materials may include: ➢ electrical conductivity/resistivity ➢ specific gravity/density ➢ thermal conductivity/expansion ➢ specific heat ➢ melting/boiling points ➢ magnetic ➢ optics properties ➢ strength ➢ stress ➢ hardness ➢ toughness ➢ elasticity, plasticity ➢ ductility ➢ malleability ➢ fatigue, creep • engineering applications of ferrous metals may include: ➢ cast irons

	➢ carbon and alloy steels ➢ stainless steels • engineering applications of non-ferrous metals may include: ➢ aluminum and its alloys ➢ copper, brass and bronze ➢ nickel alloys, zinc, titanium ➢ magnesium • effects of selected mechanical and thermal processes on the properties of materials may include: ➢ heat treatment ➢ casting, forging, rolling and extrusion ➢ cold forming ➢ joining ➢ soldering and brazing ➢ welding • basic test methods for materials and components and its significance for manufacturing
Underpinning Skills	Must demonstrate skills of: • collecting, interpreting and applying information nonferrous and non-ferrous metals • selecting range of metals for selected applications based on comparison of properties • identifying characteristics, faults or flaws in metals or products • selecting test methods for materials and components or product • implementing tests correctly for materials • compiling test reports according to specifications
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Assessment Methods	Competency may be assessed through: • Interview/Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competency may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Perform Bench Work**
Unit Code	**IND BMW1 04 0217**
Unit Descriptor	This unit covers the competences required to determine work requirements, perform basic bench work operations (i.e. layout; cutting with hacksaw and chisel; filing; drilling; tapping etc…) and check the components for conformance to specifications.

Elements	Performance Criteria
1. Plan task and prepare work piece	1.1. Work activities are sequentially planned based on the required tasks and the applied safety regulations 1.2. ***Materials*** are selected according to specifications of the drawing. 1.3. Dimensions/features are marked on work piece in accordance with drawing specifications
2. Perform hand tool operations	2.1. Work pieces are clamped based on instructions and applied standards. 2.2. Hand tools are selected and used according to task and safety regulations 2.3. Work pieces are cut, ***chipped***, ***filed*** or scraped within tolerances specified in the drawing. 2.4. ***Threads*** are cut according to standard procedures 2.5. ***Bench work operations*** are performed applying safety procedures and using personal protective devices.
3. Perform basic drill, ream and hone operations	3.1. Boreholes are drilled, reamed and honed to drawing specification and according to guidance. 3.2. All operations are performed applying safety procedures and using personal protective devices.
4. Perform Off-hand grind cutting tools	4.1. Cut edges are honed and free of burrs. 4.2. Cutter is sharpened to conform to specifications. 4.3. Cutters are ground using appropriate cooling agents. 4.4. Cutting tool grinding is performed applying safety procedures and using personal protective devices.

Variables	Range
Materials	used in bench work operations include: • Ferrous • Non Ferrous
Chipped	may include: • Grooves • Slots • keyways

Filed	Filling operations may include: • Contoured outline • Contoured holes File types based on may include: • teeth cut (single cut, double cut, rasp and curved tooth) • cut (bastard, second cut) • cross section (square, round, triangular, half-round) • shape (flat, hand, pillar, mill)
Threads	may include: • Internal threads • External threads
Bench work operations	may include: • Layout and marking • Cutting • Chipping and Filing • Drilling • Boring and counter boring • Lapping • Scraping • Honing • Spot-facing • Reaming • Thread cutting • Off-hand grinding
Work holding Devices	include the use of: • Clamps • Vice
Extractor	may include: • Screw extractor • Stud extractors
Scraper	for: • Flat surface (flat scraper, hook scraper) • Curve surface (half-round bent scraper, three-cornered scraper)
Bench work tools and Equipment	may include: • Drill Press • Pedestal Grinder • Surface plate • Layout and marking tools • Cutting tools (hacksaw, chisel, files) • Drills, reamers, laps • Thread cutting tools (taps and stock and die) • Inspection and measuring tools (templates, vernier caliper, micrometer, straight edge, gages, etc…) • Chisels ➢ flat cold chisel ➢ cape chisel

	➢ diamond-point chisel ➢ round nose chisel

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • Laid-out and marked dimensions/features on the work-piece • Cut, chipped and filed work-piece • Drilled, reamed and lapped holes • Cut threads • Performed off-hand grinding
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • Shop Safety Practices may include: ➢ Safe working habits ➢ Identification of hazardous areas ➢ Use of protective clothing and devices ➢ Safe handling of tools, equipment and materials ➢ Housekeeping practices ➢ Application of first-aid treatment ➢ Use of fire extinguishers • Shop Mathematics may include: ➢ Basic arithmetic operations ➢ Fractions and decimals ➢ Percentages and ratios ➢ Conversion of units (English to metric) ➢ Trigonometric functions ➢ Computation of feed, cutting speed and machine rpm • Drawing/Plans may include: ➢ Standard drawing symbols ➢ Orthographic and isometric drawings • Measurements may include: ➢ Linear measuring tools (rules, vernier, micrometer, height gage) ➢ Geometrical tolerances • Materials and related science may include: ➢ Classification and mechanical properties of engineering materials • Use and care of bench work tools and equipment • Theory, System and Operations may include: ➢ Laying-out and marking ➢ Sawing, cutting, chipping, filing, lapping ➢ Drilling, reaming, tapping ➢ Cutting threads ➢ Scraping and honing ➢ External threading ➢ Extracting fasteners ➢ Off-hand grinding
Underpinning Skills	Must demonstrate skills in: • Performing bench work operations

	• Using bench work tools and equipment • Using measuring instruments • Operating drill press and grinders • Perform layout, filing, cutting, drilling, tapping, scrapping, lapping, honing • Performing safety measures and procedures
Resource Implications	The following resources must be provided: • Materials, tools, equipment and facilities appropriate to proposed activity • drawings, sketches or blueprint
Methods of Assessment	Competence may be assessed through: • Interview/ Written exam • Demonstration/Observation with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in simulated workplace environment.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Cut and Join Sheet Metal**
Unit Code	**IND BMW1 05 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes in applying cutting and joining sheet metal using variety of techniques, and tools and equipment.

Elements	Performance Criteria
1. Analyze work task	1.1. Task is analyzed according to applied requirements and expertise needed 1.2. Quality assurance requirements are identified and adhered based on task specifications 1.3. OHS requirements associated with cutting and joining sheet metal, and the workplace environment, are adhered to throughout the work
2. Plan and prepare work	2.1. Tasks are planned and sequenced in conjunction with others involved or affected by the work 2.2. Tools, equipment and ***materials***, including personal safety equipment, are selected and checked for serviceability and compliance with plans/specifications 2.3. Work area is prepared to support the efficient cutting and joining of sheet metal 2.4. Sealants, fixing and sheet metal materials are checked for compatibility and appropriateness for the job
3. Cut and join sheet metal	3.1. Sheet metal is marked out in accordance with plans/specifications 3.2. Sheet metal is cut to pattern and measured using appropriate cutting tools and according to specifications 3.3. Surface is prepared and cleaned of grease and other contaminants 3.4. Sheet metal is joined to comply with plans/specifications, avoiding damage to all surrounding surfaces
4. Quality assure work and clean up	4.1. Aligned, joined and sealed components are visually inspected and measured according to specifications 4.2. Work area, tools and equipment are cleaned, checked, maintained and stored in accordance with regulations and procedures 4.3. Documentation is completed in accordance with workplace requirements

Variables	Range
Materials	used in sheet metal work operations include:

	• ferrous • non ferrous • galvanized sheet
Tools and machine elements	May include, but not limited to: • Iron scissors • hand shear • machine shear • guillotine • Taping screws • Nut and bolts • Rivets • Adhesives • Sealants

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • removed damaged and broken fasteners • repaired threads and rivets • scraped and honed holes
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • SI and British system of measurement • characteristics of various metal materials their compatibility with different joining methods • electrolysis and problems associated with of dissimilar metals • capillary action, thermal expansion and fabrication techniques to prevent leaking
Underpinning Skills	Must demonstrate skills of: • workplace and equipment safety requirements including relevant statutory regulations, and standards • characteristics of various metal materials their compatibility with different joining methods • appropriateness of different fastening methods for different applications • safe work methods
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Assessment Methods	Competency may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competency may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Operate Basic Workshop Machinery**
Unit Code	**IND BMW1 06 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required in using workshop machines in fabrication and assembly of metals.

Elements	Performance Criteria
1. Determine and plan job requirements	1.1. Work requirements are analyzed and selected from work instructions and drawings/diagrams 1.2. Appropriate ***machine*** and tools are selected based on work requirements 1.3. Sequence of operations is determined for maximum efficiency and to meet work requirements and specifications.
2. Set-up machine	2.1. Tools are inspected and if necessary sharpened according to the work requirements 2.2. Tools are mounted and positioned within machine specifications 2.3. Guards and ***accessories*** are set and adjusted as required 2.4. Speeds and feeds are calculated using appropriate mathematical techniques and reference material. 2.5. Setup operations are performed following correct/standard procedures and applying safety measures.
3. Perform machine operations	3.1. ***Materials*** to be machined is mounted and secured using ***clamping devices*** appropriate to the work requirements 3.2. Machine is operated correctly to suit work and material requirements. 3.3. Operations are performed applying safety procedures and using personal protective devices.
4. Quality assure finished component	4.1. Component is checked for conformance to specifications and predetermined finish in accordance with given standards. 4.2. Appropriate techniques, ***measuring tools*** and equipment are used in checking conformance. 4.3. Deviations are handled appropriately in accordance with organization procedures and standard. 4.4. Routine maintenance and adjustments are carried out based on machine inspection plan

Variables	Range
Machine	May include, but not limited to: • Lathe, radial arm drill, mills, planers, shapers, slotters, etc.

Accessories	May include, but not limited to: • Chucks, Centers • Boring bar • Clamps, Vises, Angle plates
Materials	May include, but not limited to: • Ferrous and non-ferrous metals
Clamping devices	May include, but not limited to: • Chucks, vices, clamps, bars and packing etc.
Measuring tools	May include, but not limited to: • Steel rule • Vernier caliper • Micrometer caliper
Cutting tools	May include, but not limited to: • Lathe tools, milling cutters, drill, reamers, etc.

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills in: • determined job requirements • set-up machine • performed machine operation • checked/measured finish component
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • Shop safety practices may include: ➢ safe working habits ➢ identification of hazardous areas ➢ protective clothing and devices ➢ safe handling of tools, equipment and materials ➢ housekeeping ➢ first-aid ➢ fire extinguishers • Drawing interpretation (within the scope of this unit) may include: ➢ standard drawing scales, symbols and abbreviations ➢ alphabet of lines ➢ orthographic and isometric drawings ➢ angle projections ➢ assembly and detail drawings ➢ interpreting tolerances, limits and fits • Shop mathematics (within the scope of this unit) may include: ➢ basic arithmetic operations ➢ fractions and decimals ➢ percentages and ratios ➢ conversion of units (English to metric) ➢ unit of measurement ➢ applying trigonometric functions • Measurements (within the scope of this unit) may include: ➢ linear measuring tools (rules, vernier, micrometer) ➢ angle measuring tools

	➢ geometrical tolerances ➢ slip gages ➢ precision levels • Materials and related science may include: ➢ classification and mechanical properties of engineering materials • Machine operations (within the scope of this unit) may include: ➢ types and specifications ➢ parts and functions ➢ set-up procedures ➢ setting cutting speed, rpm, feed rate ➢ work holding and tool holding devices ➢ tools and tool geometry ➢ tooling, set up and parameters ➢ accessories, fixtures and attachments ➢ operating procedures • cutting tool sharpening methods and techniques • safe operation of tool sharpening equipment • consequences of incorrect sharpening • consequences of incorrect speeds and feeds • reasons for poor surface finish • hazards and control measures
Underpinning Skills	Must demonstrate skills in: • determining job requirements • reading, interpreting and following routine and familiar information on written job instructions, standard operating procedures and other applicable reference documents • verifying specifications • selecting and setting-up machine • computation of feed, cutting speed and machine rpm • selecting cutting tools • performing machine operations • measuring components to specifications • checking finished component
Resource implications	The following resources must be provided: • tools, equipment and facilities appropriate to the activities • materials relevant to the proposed activity • drawings, sketches or blueprint
Assessment Methods	Competency may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competency may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Perform Hand Forging**
Unit Code	**IND BMW1 07 0217**
Unit Descriptor	This unit covers using hand tools and formers, applying hand forging techniques and operating heat treatment equipment.

Elements	Performance Criteria
1. Analyze and plan hand forging work	1.1. Drawing is interpreted for swaging, bending, upsetting, spreading, punching and drifting techniques is in compliance with specification. 1.2. ***Hand tools and formers*** are selected for required forging techniques. 1.3. Forging temperatures and heat specifications are applied to for various materials requirement 1.4. Work plan is drafted according to specifications
2. Perform hand forging techniques	2.1. ***Heating equipment*** is set up and operated correctly. 2.2. Appropriate ***forging techniques*** are applied and carried out in accordance with safety procedures 2.3. Allowance is made for ***materials*** shrinkage and oxidization
3. Quality assure work	3.1. Equipment is operated in a manner that minimizes oxidization in accordance with operational procedures 3.2. Heat is controlled to specified areas as per instruction 3.3. Form and shape are measured by applying standard devices 3.4. ***Occupational Health and Safety (OHS)*** measures and procedures are followed throughout the process

Variable	Range
Hand tools and formers	May include: • Flatters, set hammers, ball peen hammer, swages, measuring tools, hot/cold sets and other hand/power tools
Heating equipment	May include due to availability but not limited to: • Diesel, electric and gas furnaces; coke fires and gaseous • Oxygen/fuel equipment
Forging techniques	May include: • Drawing, swaging, bending, upsetting, spreading, punching and drifting
Materials	May include: • Low to medium carbon and alloy steels
OHS	are to be in accordance with Federal legislation and regulations and may include: • protective clothing and equipment • proper use of tools and equipment

	• workplace environment and safety, safe handling of materials • use of firefighting and first aid equipment

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • Identifying and using range of hand tools, formers used in hand forging • Applying hand forging techniques (drawing, swaging, bending, upsetting, spreading, punching, drifting) • Calculating mean diameter, length, circumference • Identifying source of information on forging temperatures and heat specifications for various materials • Effects of and allowances for material shrinkage and oxidization • Applying the application, set up, and means of adjustment of a range of heating equipment • Applying personal protective equipment • Application of Safe work practices and assembly procedures
Underpinning knowledge	Must demonstrate knowledge of: • Range of hand tools, formers used in hand forging • How to calculate mean diameter, length, circumference • Source of information on forging temperatures • Heat specifications for various materials • Effects of and allowances for material shrinkage and oxidization
Underpinning skills	Must demonstrate skills of: • Hand forging techniques (drawing, swaging, bending, upsetting, spreading, punching, drifting) • The application, set up, and means of adjustment of a range of heating equipment • Use and application of personal protective equipment • Safe work practices and assembly procedures
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Assessment Methods	Competency may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competency may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Perform Cutting Using Oxyacetylene**
Unit Code	**IND BMW1 08 0217**
Unit Descriptor	This unit covers the necessary competence in performing oxyacetylene cutting in fabrication and assembly of metals.

Elements	Performance Criteria
1. Plan and select cutting work	1.1. Cutting ***equipment and consumables*** are selected and prepared according to job requirements 1.2. ***Materials*** are prepared to achieve required cutting specification.
2. Set up oxyacetylene cutting outfit	2.1. Instructions, symbols, specifications including bead size, bead placement, reinforcement etc. are interpreted correctly in accordance with cutting procedure sheet, if available, and standard operating procedures. 2.2. Cutting equipment including cylinders, regulators, hoses, torches and tips are assembled and set up safely in accordance with standard operating procedures.
3. Cut materials	3.1. Cutting procedures are followed according to regulations 3.2. Materials are cut in all positions according to specifications 3.3. Cut components are quality inspected and released due to procedures

Variable	Range
Equipment and consumables	Fuel gases including oxyacetylene, oxyacetylene generator, LPG, hydrogen etc., cylinders, regulators, hoses, cutting torches, tips
Materials	Low carbon steel, plate, pipe, tube and round bar
Occupational Health and Safety (OHS)	are to be in accordance with Federal legislation and regulations and may include: • Protective clothing and equipment, • Use of tools and equipment, • Workplace environment and safety, handling of materials, • Use of firefighting equipment, use of first aid equipment, • Hazard control and hazardous materials and substances Personal protective equipment is to include that prescribed under legislation, regulation and workplace policies and practices
Tools equipment and materials	are to include: • Hand and power tools, • Measuring equipment, • Oxyacetylene and accessories

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills of: • Preparatory requirements • purpose and examples of cutting • appropriate settings for the given task and the selected equipment/consumables • Fuel gas properties and applications • Safe cutting practices • Use and application of personal protective equipment for oxyacetylene cutting • Relevant hazards and control measures related to the competence
Underpinning knowledge	Must demonstrate knowledge of: • Preparatory requirements • Material and consumable properties and characteristics • Relevant hazards and control measures related to the competence
Underpinning skills	Must demonstrate skills of: • Proper adjustments of cutting flame • Fuel gas properties and applications • Safe cutting practices • Use and application of personal protective equipment for oxyacetylene cutting
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Assessment Methods	Competency may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competency may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Perform Routine Metal Arc Welding**
Unit Code	**IND BMW1 09 0217**
Unit Descriptor	This unit covers the skills, attitudes and knowledge required in preparing the materials and carrying out routine Manual Metal Arc Welding (MMAW).

Elements	Performance Criteria
1. Plan and prepare welding work	1.1. Welding requirements are identified from work instructions and drawing 1.2. ***Materials*** and appropriate ***welding equipment*** are selected based on norms and regulations
2. Perform routine welding	2.1. Welding currency is set up correctly according to standard 2.2. Electrodes are selected to suit application and standard settings 2.3. Materials are cleaned and ***prepared*** based on procedures 2.4. Materials are welded to job requirements and instructions 2.5. Welding seams are ***cleaned*** in accordance with operating procedures 2.6. OHS measures are followed and applied throughout welding activities
3. Assure quality and clean up	3.1. Welding seams are cleaned and inspected in accordance with operating procedures 3.2. Joins are measured according to specification 3.3. Welding equipment and work area are cleaned and maintained after welding activity

Variable	Range
Materials	Low and mild carbon steel or similar
Equipment	Welding leads, welding machines, electrode holder etc.
Preparation	Cleaning, setting up jigs, fixtures, clamps, joint preparation
Cleaning	Slag and spatter, cleaning, using files and grinders

Evidence Guide	
Critical Aspects of Competence	The candidate can: • plan and prepare welding work • perform routine welding • assure quality and clean up
Underpinning Knowledge	Must demonstrate knowledge of: • material and equipment preparation • properties and characteristics of materials and consumables • weld characteristics • equipment set-up and settings

	• MMAW processes and properties • post-welding treatments • safe welding practices • use and application of personal protective equipment
Underpinning Skills	Must demonstrate skills in: • preparing materials and electrodes • setting up welding equipment • welding with MMAW • reading and interpreting routine information on written job instructions, specifications and standard operating procedures • performing measurements for joint preparation and routine MMAW
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Assessment Methods	Competency may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competency may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Apply Basic Electrical Practices**
Unit Code	**IND BMW1 10 0217**
Unit Descriptor	The unit covers skills and knowledge required to apply minor/basic handling and maintenance practices associated with a range of electrical equipment at the metal engineering workplace

Elements	Performance Criteria
1. Prepare for work	1.1. Work requirements are identified from relevant work orders or equivalent 1.2. Occupational Health and Safety standards, statutory requirements, relevant Ethiopian standards, codes of practice, manufacturers' specifications, environmental regulations and enterprise procedures are identified, applied and monitored according to regulations throughout the work process 1.3. Resources (material and equipment) required to perform the tasks are selected for compliance with the work specifications 1.4. Relevant plans, drawings and texts are identified and interpreted in accordance with the work plan 1.5. Work plan is set-up in detail according to regulations 1.6. Potential hazards are identified and prevention and/or control measures are selected in accordance with regulations 1.7. Work area is prepared in accordance with work requirements and site specifications 1.8. Co-ordination requirements, including requests for isolations where appropriate, are resolved with others involved, affected or required by the work according to regulations
2. Conduct minor handling and maintenance	2.1. Required isolations are confirmed where appropriate in accordance with enterprise requirements 2.2. Minor ***maintenance*** is conducted in accordance with the work plan and site requirements 2.3. Minor adjustments are undertaken in accordance with prescribed procedures and schedules and site requirements 2.4. Faults are reported to the relevant and responsible parties in accordance with site/enterprise procedures
3. Notify the completion of quality work	3.1. Work is ***completed*** and responsible personnel notified in accordance with site/enterprise requirements and regulations

	3.2. Final checks with supervisor are made to ensure the work conforms with instructions and regulation 3.3. Work area is cleared of waste, cleaned, restored and secured in accordance with site/enterprise regulations 3.4. Plant, ***tools and equipment*** are maintained and stored in accordance with site/enterprise procedures

Variable	**Range**
Maintenance	May include, but not limited to: • changing globes and starters • switchboard indicator lenses • checking transformer oil levels • flag/tell-tale patrols • changing of oil and air filters and humi-dryers • cleaning of air and oil filters • battery inspection • recording of cell voltages and specific gravity; • cleaning • minor fabrication tasks, e.g. brackets, cable supports, gaskets and similar
Completion	may include: • plant and maintenance records, • job cards • check sheets • on device labelling updates • reporting and/or documenting equipment defects • supervisor acceptance
Tools and equipment	may include: • general hand tools, • portable electrical tools, • measuring tools • specialist tools. • lubricants, • cleaning agents, • contact cleaners, • emery paper • filters • battery cells • air conditioners • cooling plant • transformers • switchboards • control panels

Evidence Guide	
Critical Aspects of Competence	Must demonstrate knowledge and skills in: • basic handling and maintenance of electrical machinery and equipment
Underpinning Knowledge and Attitudes	Must demonstrate knowledge of: • Occupational Health and Safety standards and statutory and regulatory requirements associated with the handling and maintenance of electrical equipment • support and/or protection requirements and specifications • maintenance procedures and associated manufacturer requirements • marking, tagging and labeling requirements for cables, wires, conductors and connections • performing basic maintenance • data to be recorded/reported and the frequency of recording/reporting • requirements for approval to work • use and application of personal protective equipment for terminating and isolating electrical wiring
Underpinning Skills	Must demonstrate skills in: • safe working practices of: ➢ Occupational Health and Safety standards ➢ Relevant statutory requirements and codes of practice ➢ Relevant Ethiopian standards ➢ Equipment and material required to perform the work ➢ Isolation procedures ➢ Layout of plant/work site and operation of its equipment ➢ Maintenance techniques • Use hand and portable power tools • checking materials for conformance to specifications • checking existing and new installation site for correct location and specification • marking, tagging and labeling cables, wires, conductors and connections to specification • reading and interpreting routine information on written work • instructions, specifications and standard operating procedures and may include drawings
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Assessment Methods	Competency may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competency may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Operate Personal Computer**
Unit Code	**IND BMW1 11 0217**
Unit Descriptor	This unit defines the competency required to operate a Personal Computer (PC) with its basic software programs and to communicate via electronic data interchange

Elements	Performance Criteria
1. Identify the functions of PC hardware components	1.1. ***Hardware components*** are identified in terms of device type and functions 1.2. The interaction of components is identified in terms of the flow of data between them
2. Understand operation of the system and application software	2.1. ***System software*** is identified and described in terms of its purpose and operation 2.2. Application software is identified and its purpose stated in terms of outputs 2.3. The interaction between system software and application software is described
3. Perform basic operation and maintenance procedures	3.1. Basic components of a PC system are connected to enable it to be operated safely 3.2. A PC system is powered up according to organisational requirements 3.3. Simple hardware faults are identified and corrected or reported according to organisational requirements 3.4. A PC system is cared for and maintained according to organisational requirements
4. Operate a printer	4.1. Data from a personal computer is displayed on printed output media based on instructions 4.2. Simple ***printer*** hardware faults and printer related error messages are identified and remedied according to manuals
5. Apply ergonomic principles for safe operation.	5.1. ***Ergonomic*** principles are explained in terms of user physical well-being 5.2. Ergonomic requirements are explained in terms of environment

Variable	Range
Hardware components	May include, but not limited to: • central processing unit, • motherboard • keyboard • Mouse • display monitor

	• CD drives, • Random Access Memory (RAM), • Read Only Memory (ROM), • printer, • digital camera, • scanner, • modem, • WiFi, connection to a network or the Internet.
System software	common software applications may include but are not limited to • word processing, • spread sheet • database • desktop publishing • Graphics • Communication • Multimedia • Web browser.
Printer	May include, but not limited to: • data from different applications is printed • remedies must be demonstrated or explained
Ergonomic	May include, but not limited to: • desk dimensions, • posture in chair and seating height; • feet placement • position of monitor • keyboard and mouse relative to user • rest periods and exercise
Safe connections components	May include, but not limited to: • system unit • keyboard • monitor • mouse or other pointing device • power leads • digital camera • scanner • portable external storage • modem • Connection to a network or the Internet • Use of system protection and/or maintenance utility software.

Evidence Guide	
Critical Aspects of Competence	To demonstrate competency in this unit the person will require access to: • Personal computer • Printer • Mouse and keyboard • Monitor • Basic software
Underpinning Knowledge	Must demonstrate knowledge of: • Basic keyboarding skills • Computer functions • Basic parts of a computer and various hardware components • Storage devices and basic categories • Basic software opration
Underpinning Skills	Must demonstrate skills of: • Saving and retrieving files to various locations • Mouse management (button usage) for different applications • Reading and writing at a level where basic workplace documents are understood • Ability to communicate with peers and supervisors • Seeking assistance and expert advice • Interpretation of user manuals and help functions • The ability to input user access details for accessing a Personal Computer (PC), possibly a networked environment
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Assessment Methods	Competency may be assessed through: • Interview/ Written Test • Observation/ Demonstration with Oral Questioning
Context of Assessment	Competency may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Apply Quality Standards**
Unit Code	**IND BMW1 12 0217**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in applying quality standards in the operational activities.

Elements	Performance Criteria
1. Assess own work	1.1 Completed work is checked against organization standards relevant to the activity being undertaken. 1.2 An understanding is demonstrated on how the work activities and completed work relate to the next process and to the final appearance of the service / product. 1.3 Faulty service is identified and isolated in accordance with policies and procedures. 1.4 Faults and any identified causes are recorded and reported in accordance with standard procedures.
2. Assess quality of service rendered	2.1 Services rendered are ***quality checked*** against standards and specifications. 2.2 Service rendered are evaluated using the appropriate evaluation parameters and in accordance with standards. 2.3 Causes of any identified faults are identified and corrective actions are taken in accordance with policies and procedures.
3. Record information	3.1 Basic information on the quality performance is recorded in accordance with organization procedures. 3.2 Records of work quality are maintained according to the requirements of the organization / enterprise.
4. Study causes of quality deviations	4.1 Causes of deviations from final outputs or services are investigated and reported in accordance with standard procedures. 4.2 Suitable preventive action is recommended based on organization ***quality standards*** and identified causes of deviation from specified quality standards of final service or output.
5. Complete documentation	5.1 Information on ***quality parameters*** and other indicators of service performance is recorded. 5.2 All service processes and outcomes are recorded.

Variable	Range
Quality check	May include, but not limited to: • Visual inspection • Physical measurements • Check against specifications/preferences

Quality standards	May include, but not limited to: • materials • service • output and processes/procedures
Quality parameters	May include, but not limited to: • style/design/specifications • durability • service variations • materials, damage and imperfections

Evidence Guide	
Critical Aspects of Competency	Demonstrates skills and knowledge to: • Check completed work continuously against standard • Identify and isolate faulty service / workmanship • Check service rendered against organization standards • Identify and apply corrective actions on the causes of identified faults • Record basic information regarding quality performance • Investigate causes of deviations of services against standard • Recommend suitable preventive actions
Underpinning Knowledge	Demonstrates knowledge of: • Relevant quality standards, policies and procedures • Characteristics of services • Safety environment aspects of service processes • Relevant evaluation techniques and quality checking procedures • Workplace procedures • Reporting procedures
Underpinning Skills	Demonstrates skills to: • Interpret work instructions, specifications and standards appropriate to the required work or service • Carry out relevant performance evaluation • Maintain accurate work records in accordance with procedures • Meet work specifications • Communicate effectively within defined workplace procedures
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation/Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Work with Others**
Unit Code	**IND BMW1 13 0217**
Unit Descriptor	This unit covers the knowledge, skills, and attitudes required to develop workplace relationship and contribute in workplace activities.

Element	Performance Criteria
1. Develop effective workplace relationship	1.1. ***Duties and responsibilities*** are done in a positive manner to promote cooperation and good relationship 1.2. Assistance is sought from ***workgroup*** when difficulties arise and addressed through discussions 1.3. ***Feedback on performance*** provided by others in the team is encouraged, acknowledged and acted upon 1.4. Differences in personal values and beliefs are respected and acknowledged in the development
2. Contribute to work group activities	2.1. ***Support is provided to team members*** to ensure workgroup goals are met 2.2. Constructive contributions to workgroup goals and tasks are made according to ***organizational requirements*** 2.3. Information relevant to work are shared with team members to ensure designated goals are met

Variable	Range
Duties and responsibilities	May include, but not limited to: • Job description and employment arrangements • Organization's policy relevant to work role • Organizational structures • Supervision and accountability requirements including OHS • Code of conduct
Work group	May include, but not limited to: • Supervisor or manager • Peers/work colleagues • Other members of the organization
Feedback on performance	May include, but not limited to: • Formal/Informal performance appraisal • Obtaining feedback from supervisors and colleagues and clients • Personal, reflective behavior strategies • Routine organizational methods for monitoring service delivery
Providing support to team members	May include, but not limited to: • Explaining/clarifying • Helping colleagues

	• Providing encouragement • Providing feedback to another team member • Undertaking extra tasks if necessary
Organizational requirements	May include, but not limited to: • Goals, objectives, plans, system and processes • Legal and organization policy/guidelines • OHS policies, procedures and programs • Ethical standards • Defined resources parameters • Quality and continuous improvement processes and standards

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Provide support to team members to ensure goals are met • Acton feedback from clients and colleagues • Access learning opportunities to extend own personal work competencies to enhance team goals and outcomes
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • relevant legislation that affects operations, especially with regards to safety • reasons why cooperation and good relationships are important • the organization's policies, plans and procedures • how to elicit and interpret feedback • workgroup member's responsibilities and duties • importance of demonstrating respect and empathy in dealings with colleagues • how to identify and prioritize personal development opportunities and options
Underpinning Skills	Demonstrates skills to: • understand the organization's policies and work procedures • write simple instructions for particular routine tasks • interpret information gained from correspondence • request advice, receive feedback and work with a team • organize work priorities and arrangement • select and use technology appropriate to a task • relate to people from a range of social, cultural and ethnic backgrounds
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Receive and Respond to Workplace Communication**
Unit Code	**IND BMW1 14 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to receive, respond and act on verbal and written communication.

Element	Performance Criteria
1. Follow routine spoken messages	1.1. Required information is gathered by listening attentively and correctly interpreting or understanding information/instructions. 1.2. Instructions/information is properly recorded. 1.3. Instructions are acted upon immediately in accordance with information received. 1.4. Clarification is sought from workplace supervisor on all occasions when any instruction/information is not clear.
2. Perform workplace duties following written notices	2.1. ***Written notices and instructions*** are read and interpreted correctly in accordance with ***organizational guidelines***. 2.2. Routine written instruction is followed in sequence. 2.3. Feedback is given to workplace supervisor based on the instructions/information received.

Variable	Range
Written notices and instructions	May include, but not limited to: • Handwritten material • printed material • Internal memos • External communications • Electronic mail • Briefing notes • General correspondence • Marketing materials • Journal articles
Organizational guidelines	May include, but not limited to: • Information documentation procedures • Company policies and procedures • Organization and service manuals

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Demonstrate knowledge of organizational procedures for handling verbal and written communications • Receive and act on verbal messages and instructions • Record instructions/information

Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • organizational policies/guidelines in regard to processing internal/external information • ethical work practices in handling communications • communication process
Underpinning Skills	Demonstrates skills to: • receive and clarify conciseness messages/information/communication • record messages/information accurately
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Demonstrate Work Values**
Unit Code	**IND BMW1 15 0217**
Unit Descriptor	This unit covers the knowledge, skills and attitude required in demonstrating proper work values.

Elements	Performance Criteria
1. Define the purpose of work	1.1. One's unique sense of purpose for working and the 'whys' of work are identified, reflected on and clearly defined for one's development as a person and as a member of society. 1.2. Personal mission is achieved in harmony with company's values.
2. Apply work values/ethics	2.1. ***Work values/ethics/concepts*** are classified and reaffirmed in accordance with the transparent company ethical standards, policies and guidelines. 2.2. ***Work practices*** are undertaken in compliance with industry work ethical standards, organizational policy and guidelines 2.3. Personal behavior and relationships with co-workers and/or clients are conducted in accordance with ethical standards, policy and guidelines. 2.4. ***Company resources*** are used in accordance with transparent company ethical standard, policies and guidelines.
3. Deal with ethical problems	3.1. Company ethical standards, organizational policy and guidelines on the prevention and reporting of unethical conduct are accessed and applied in accordance with transparent company ethical standard, policies and guidelines. 3.2. ***Work incidents/situations*** are reported and/or resolved in accordance with company protocol/guidelines. 3.3. Resolution and/or referral of ethical problems identified are used as learning opportunities.
4. Maintain integrity of conduct in the workplace	4.1. Personal work practices and values are demonstrated consistently with acceptable ethical conduct and company's core values. 4.2. Instructions to co-workers are provided based on ethical, lawful and reasonable directives. 4.3. Company values/practices are shared with co-workers using appropriate behavior and language.

Variable	Range
Work values/ethics/ concepts	May include, but are not limited to: • Commitment/ Dedication

	• Sense of urgency • Sense of purpose • Love for work • High motivation • Orderliness • Reliability and Dependability • Competence • Goal-oriented • Sense of responsibility • Being knowledgeable • Loyalty to work/company • Sensitivity to others • Compassion/Caring attitude • Balancing between family and work • Sense of nationalism
Work practices	May include, but are not limited to: • Quality of work • Punctuality • Efficiency • Effectiveness • Productivity • Resourcefulness • Innovativeness/Creativity • Cost consciousness • 5S • Attention to details
Company resources	May include, but are not limited to: • Consumable materials • Equipment/Machineries • Human • Time and Financial resources
Work incidents/ Situations	May include, but are not limited to: • Violent/intense dispute or argument • Gambling • Use of prohibited substances • Pilferages • Damage to person or property • Vandalism • Falsification • Bribery • Sexual Harassment and Blackmail

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Define one's unique sense of purpose for working • Clarify and affirm work values/ethics/concepts consistently in the workplace • Demonstrate work practices satisfactorily and consistently in compliance with industry work ethical standards, organizational policy and guidelines • Demonstrate personal behavior and relationships with co-workers and/or clients consistent with ethical standards, policy and guidelines • Use company resources in accordance with company ethical standard, policies and guidelines. • Follow company ethical standards, organizational policy and guidelines on the prevention and reporting of unethical conduct/behavior
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Occupational health and safety • Work values and ethics • Company performance and ethical standards • Company policies and guidelines • Fundamental rights at work including gender sensitivity • Work responsibilities/job functions • Corporate social responsibilities • Company code of conduct/values • Balancing work and family responsibilities
Underpinning Skills	Demonstrates skills in: • Interpersonal skills • Communication skills • Self awareness, understanding and acceptance • Application of good manners and right conduct
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Develop Understanding of Entrepreneurship**
Unit Code	**IND BMW1 16 0217**
Unit Descriptor	This unit covers knowledge, skills and attitude required to understand the concepts, principles, functions, strategies and methods of entrepreneurship. It also covers identifying and developing the entrepreneurial competencies.

Elements	Performance Criteria
1. Describe and explain the concept, principles, and scope of entrepreneurship	1.1. The concept and principles of entrepreneurship are analyzed and discussed. 1.2. Entrepreneurial traits and distinguishing features, entrepreneurial motivations and types of entrepreneurs are identified and discussed. 1.3. The role of entrepreneurship development for the Ethiopian economy is explained and discussed. 1.4. Entrepreneurship for women and disables is discussed and analyzed.
2. Discuss how to become an entrepreneur	2.1. The positive mind set, attitude towards poverty and “can do mentality” is developed. 2.2. Self-employment as an individual economic independence and personal growth is discussed and analyzed. 2.3. Advantages and disadvantages of self-employment and being an employee are explained and discussed. 2.4. Major competencies of successful entrepreneurs are identified and explained. 2.5. Self-potential is assessed to determine if qualified to become an entrepreneur. 2.6. The behaviors of successful entrepreneurs are identified and discussed. 2.7. Business ideas are generated using appropriate tools, techniques and steps. 2.8. Business opportunities are identified and assessed.
3. Discuss how to start and organize an enterprise	3.1. The concepts and ***legal forms*** of ***business enterprises*** in Ethiopia are identified and discussed 3.2. Business Ethics is understood and developed. 3.3. Facts about micro, small and medium enterprises are discussed, clarified and understood. 3.4. Key success factors in setting up micro, small and medium businesses are identified and explained. 3.5. Procedures for identifying suitable market for business are

	discussed and understood. 3.6. ***Major factors*** to consider in selecting a location for a business are identified and discussed. 3.7. Amount of money needed to start an enterprise is estimated and various sources of finance identified and discussed.
4. Discuss how to operate an enterprise	4.1. Processes of hiring and managing people are explained and discussed. 4.2. The importance, techniques and application of self-management skills, negotiation skills and time management skills, decision skills are discussed and understood. 4.3. The techniques and procedures of managing sales are explained and discussed. 4.4. Factors to be considered in selecting suppliers and the steps to follow when doing business with them are identified and discussed. 4.5. Awareness of how new technologies can affect micro, small and medium business is developed, and Characteristics of appropriate technology for use are explained and discussed. 4.6. Risk assessment and management of business enterprise are performed regularly. 4.7. Qualities are properly inspected and inventories properly managed. 4.8. Basic concepts of Monitoring and Evaluation are explained and understood.
5. Discus how to prepare and use financial records	5.1. Importance of ***financial source documents*** and record keeping is discussed. 5.2. ***Financial recording documents*** are identified and prepared. 5.3. Different types of cost and expense that occur in a business and how to manage them are discussed and understood. 5.4. Factors and procedures in knowing the cost and expense of the enterprise are discussed and understood. 5.5. Simple financial statements are prepared and understood.
6. Develop one's own business plan	6.1. The concept, importance and process of preparing/ writing a business plan are discussed and understood 6.2. ***Feasibility of the business*** idea is made clear and understood. 6.3. Findings of the feasibility study are interpreted, assessed and analyzed. 6.4. Standard structure and format are applied in preparing business plan.

	6.5. Problems that may arise or encounter when starting a business are identified and understand.

Variables	Range
Legal forms	May include, but not limited to: • Sole proprietorship • Partnership • Cooperatives • Private Limited Company
Business Enterprises	May include, but not limited to: • Micro • Small • Medium
Major factors	May include, but not limited to: • Economics (local economy) • Population • Competition
Financial source documents	May include, but not limited to: • Cash book • Vouchers • Invoices • Receipts • Check
Financial recording documents	May include, but not limited to: • Journal • Ledger • Fixed asset records • Inventory record • Payroll sheet • Account receivable • Account payable • Daily sales record
Feasibility of the business	May include, but not limited to: • opportunities available • market competition • timing/ cyclical considerations • skills available • resources available • location and/ or premises available • risk related to a particular business opportunity, especially • in regard to Occupational Health and Safety and • environmental considerations

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Explain principles and concept of entrepreneurship • Discuss how to become entrepreneur • Discuss how to organize an enterprise • Discuss how to operate an enterprise • Discus how to prepare and use financial records • Develop business plan
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Entrepreneurship concepts, principles, roles and types • Entrepreneurial traits, motivation and distinguishing features • Types of entrepreneurs • Entrepreneurial competencies • Entrepreneurial behaviors • Business ideas and business opportunities • Self potential assessment • Types of enterprises • Legal forms of business ownership • Risk assessment and evaluation • Self-employment and employment • Managing sales, people and time • Facts about micro, small and medium enterprises • Micro, Small and Medium Enterprises • Key success factors for setting up micro, small and medium enterprises • Procedures for identifying suitable markets • Business location • Major factors for selecting business location • Quality control • Inventory management • Monitoring and evaluation • New technologies • Startup capital • Investment capital • Working capital • Financing options • Financial records • Costs and expenses • Business plan and Feasibility study
Underpinning Skills	Demonstrate skills to: • Planning, organizing, hiring and leading skills • Self-management skills • Negotiation skills • Time management skills • Problem solving skills • Decision making skills

	• Selling skills • Risk assessment skills • Presentation skills • Inventory controlling skills • Using technology • Financial record keeping skills • Preparing simple financial statement • Financial reporting skills • Managing money • Suppliers selection skills • Monitoring and evaluation skills
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Basic Metal Works Level I	
Unit Title	**Apply 3S**
Unit Code	**IND BMW1 17 0217**
Unit Descriptor	This Unit Title covers the knowledge, skills and attitudes required by a worker to apply 3S techniques to his/her workplace. The unit assumes the worker has a particular job in the allocated workplace known by the individual.

Elements	Performance Criteria
1. Organize junior Kaizen Promotion Team (KPT).	1.1. Basics, principles and stages of KPT are identified using appropriate procedures. 1.2. Structure of ***Junior KPT*** is established in accordance with the organizational procedures. 1.3. Effective and appropriate contributions are made to complement team activities and objectives using individual skills and competencies. 1.4. Effective and appropriate forms of communications are used and undertaken with KPT members who contribute to know KPT activities and objectives. 1.5. Kaizen Board (Visual Management Board) is prepared and used in harmony with different workplace contexts.
2. Prepare for work.	2.1. Work instructions are used to determine job requirements, including method, material and equipment. 2.2. Job specifications are read and interpreted following working manual. 2.3. ***OHS requirements***, including dust and fume collection, breathing apparatus and eye and ear personal protection needs are observed throughout the work. 2.4. Appropriate materials are selected. 2.5. ***Safety equipment and tools*** are identified and checked for safe and effective operation.
3. Sort items.	3.1. Plan is prepared to implement sorting activities. 3.2. Cleaning activities are performed. 3.3. All ***items*** in the workplace are identified following ***the appropriate procedures***. 3.4. Necessary and ***unnecessary items*** are listed using the ***appropriate format***. 3.5. ***Red tag*** strategy is used for unnecessary items. 3.6. Unnecessary items are evaluated and placed in an appropriate place other than the workplace. 3.7. ***Necessary items*** are recorded and quantified using appropriate format.

	3.8. Performance results are reported using appropriate formats. 3.9. Necessary items are regularly checked in the workplace.
4. Set all items in order.	4.1. Plan is prepared to implement set in order activities. 4.2. General cleaning activities are performed. 4.3. Location/layout, storage and indication methods for items are decided. 4.4. Necessary ***tools and equipment*** are prepared and used for setting in order activities. 4.5. Items are placed in their assigned locations. 4.6. After use, the items are immediately returned to their assigned locations. 4.7. Performance results are reported using appropriate formats. 4.8. Each item is regularly checked in its assigned location and order.
5. Perform shine activities.	5.1. Plan is prepared to implement shine activities. 5.2. Necessary tools and equipment are prepared and used for shinning activities. 5.3. ***Shine activity*** is implemented using appropriate procedures. 5.4. Performance results are reported using appropriate formats. 5.5. Regular shining activities are conducted.

Variable	**Range**
Junior KPT	May include, but not limited to: • 3S • 3MU (Mura, Muri and MUDA) • 4P (Policy, Procedure, People and Plant) • 4M (Material, Method, Man and Machine) • PDCA (Plan, Do, Check and Act)
OHS requirements	May include, but not limited to: • Legislation/ regulations/codes of practice and enterprise safety policies and procedures. This may include protective clothing and equipment, use of tooling and equipment, workplace environment and safety, handling of material, use of fire fighting equipment, enterprise first aid, hazard control and hazardous materials and substances. • Personal protective equipment is to include that prescribed under legislation/regulations/codes of practice and workplace policies and practices. • Safe operating procedures are to include, but are not limited

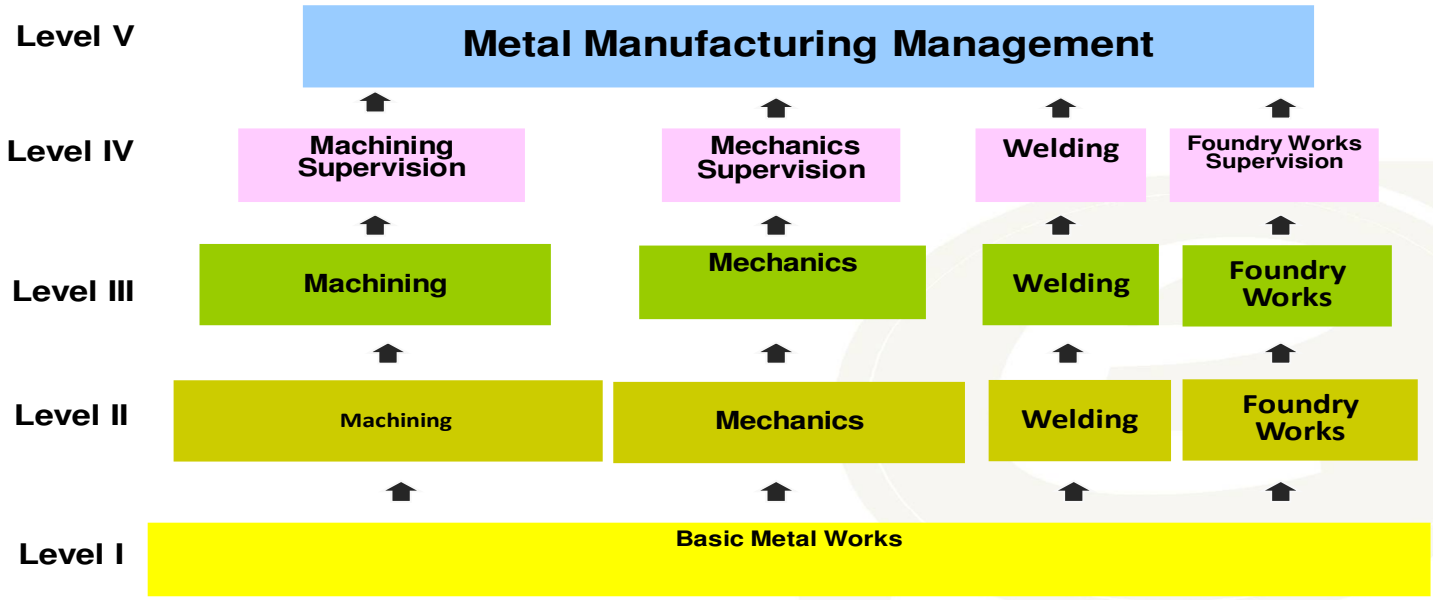
	to the conduct of operational risk assessment and treatments associated with workplace organization. • Emergency procedures related to this unit are to include but may not be limited to emergency shutdown and stopping of equipment, extinguishing fires, enterprise first aid requirements and site evacuation.
Safety equipment and tools	May include, but not limited to: • dust masks / goggles • glove • working cloth • first aid and safety shoes
Items	May include, but not limited to: • tools • jigs/fixtures • materials/components • machine and equipment • manuals • documents • personal items (e.g. bags, lunch boxes and posters) • safety equipment and personal protective equipment • other items which happen to be in the work area
The appropriate procedures	May include, but not limited to: • steps for implementing 3S (sort, set in order and shine) activities. • written, verbal and computer based or in some other format.
Unnecessary items	are not needed for current production or administrative operation and include but not limited to: • defective or excess quantities of small parts and inventory • outdated or broken jigs and dies • worn-out bits • outdated or broken tools and inspection gear • old rags and other cleaning supplies • electrical equipment with broken cords • outdated posters, signs, notices and memos some locations where unneeded items tend to accumulate May include, but not limited to: • in rooms or areas not designated for any particular purpose • in corners next to entrances or exists • along interior and exterior walls • next to partitions and behind pillars • under the eaves of warehouses • under desks and shelves and in desk and cabinet drawers • near the bottom of tall stacks of items • on unused management and production schedule boards • in tools boxes that are not clearly sorted
Appropriate format	May include, but not limited to: • all items, necessary and unnecessary items.

Red tag	A format prepared with a red color paper or card which is filled and attached temporarily on the unnecessary items until decision is made. The red tag catch people's attention because red is a color that stands out. So to fill and attach red tag on items, asks the following three questions: • Is this item needed? • If it is needed, is it needed in this quantity? • If it is needed, does it need to be located here?
Necessary items	Are required in the workplace for current production or administrative operation in the amount needed.
Tools and equipment	May include, but not limited to: • paint • hook • sticker • signboard • nails • shelves • chip wood • sponge • broom • pencil • shadow board/ tools board
Shine activity	May include, but not limited to: • Inspection • Cleaning • Minor maintenance may include: ➢ Tightening bolts ➢ Lubrication and Replacing missing parts

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Discuss how to organize KPT. • Describe the pillars of 5S. • Implement 3S in own workplace by following appropriate procedures.
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Kaizen principle, pillars and concept • Key characteristic of Kaizen • Elements of Kaizen • Wastes/MUDA • Basics of KPT • Aims, benefits and principles of KPT • Stages of KPT • Structure and role of the components of Junior KPT • Concept and parts of Kaizen board • Concept and benefits of 5S • The pillars of 5S

	• Three stages of5S application • Benefits and procedure of sorting activities • The concept and application of Red Tag strategy • OHS procedures • Benefits and procedure of set in order activities • Set in order methods/techniques • Benefits and procedure of shine activities • Inspection methods • Planning and reporting methods • Method of Communication
Underpinning Skills	Demonstrates skills of: • Participating actively in KPT • technical drawing • communication skills • planning and reporting own tasks in implementation of 3S • following procedures to implement 3S in own workplace • using sorting formats to identify necessary and unnecessary items • improving workplace layout following work procedures • preparing labels, slogans, etc. • reading and interpreting documents • observing situations • gathering evidence by using different means • recording activities and results using prescribed formats • working with others • solving problems by applying 3S • preparing and using Kaizen board • preparing and using tools and equipment to implement 3S
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview/Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

METALS MANUFACTURING



Acknowledgement

We wish to extend thanks and appreciation to the many representatives of business, industry, academe and government agencies who donated their time and expertise to the development of this occupational standard.

We would like also to express our appreciation to the Experts of GIZ, Techtra Engineering, Steely RMI P.L.C., Walia Steel Industry, Akaki Metal Products Factory, Akaki Spare Parts, Holland Car P.L.C., B and C Aluminum P.L.C./Inter Africa Extrusion, Zukuala Steel Production Factory, Mesfin Industrial Engineering P.L.C., Kaliti Metal Production Factory, Metal Corporation, Metals Industry Development Institute, Ministry of Trade and Industry; and Federal Technical and Vocational Education and Training (TVET) who made the development of this occupational standard possible.

This occupational standard was developed on February 2017 at Addis Ababa, Ethiopia.