

Competency Based Training (CBT) Curriculum Guide for Welder (Grill Maker)

[Market Oriented Short Term (MOST), Modular Curriculum]

Developed by



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1. INTRODUCTION:

The TVET system has a large role to play in economic growth and social development as workforce provider to the labor market and as provider of skills to those who are looking for employment. In the case of Bangladesh, the TVET sector needs major reforms to ensure that issues of quality and capacity, relevance, and access are properly addressed.

This curriculum guide is designed and developed using competency based training (CBT) approach with the aim of producing skilled human resources for respective trade and occupation. This is based on the tasks to be performed for Welder (Grill Maker) occupation. The modules are included in course structure section of this curriculum guide. The training methodology is learner friendly where theoretical inputs, demonstration, guided and individual practices will be sufficiently provided to **master the skills at the industry standards**. Sufficient and updated tools and equipment will also be used during the training to provide hands on skills to the trainees. The curriculum guide is developed in consultation with the trainer, mid-level industry supervisors, and skilled workers. Training Institute for Technical Instruction (TITI) has been involved to develop the curriculum.

2. AIMS:

The main aim of this training program is to produce medium level skilled workforce (semi-skilled workers) required for the construction sector in the formal and informal sector and create better opportunities for employment and increased revenue.

3. OBJECTIVES:

At the end of the training course, the trainees will be able to:

- Practice Occupational Health and Safety (OHS) Procedure;
- Apply Fundamental Skills of Welding Works;
- Prepare Materials for Welding;
- Weld Metal by Manual Arc Welding Process;
- Perform Projects on Grill Works.

4. DESCRIPTION:

This is a competency based training package for the unemployed and underemployed workforce of Bangladesh. The curriculum is based on the tasks to be performed in the Welder (Grill Maker) occupation and subsequently these tasks have been grouped to form various modules. This will provide flexibility for the trainees to learn one module at a time. The modules are included in the 'Course Structure' section of this curriculum guide. The training methodology will be **learner-centered** where theoretical input, demonstration, guided and individual practices will sufficiently be provided to the trainees to **master their skills at business and industry standards**. Sufficient tools, equipment and aids will also be used during the training to provide hands on skills to the trainees.

5. COURSE STRUCTURE:

Job title: Welder (Grill Maker)				Time (hrs.)		
S.N	Modules	Tasks	Nature	Th.	Pr.	Tot.
1	Practice Occupational Health and Safety (OHS) Procedure.	5	T+P	2.5	3.5	6.0
2	Apply Fundamental Skills of Welding Works.	6	T+P	5.0	18.0	23.0
3	Prepare Materials for Welding.	6	T+P	3.5	14.5	18.0
4	Weld Metal by Manual Arc Welding Process.	11	T+P	14.0	63.0	77.0
5	Perform Projects on Grill Works.	3	T+P	4.0	52.0	56.0
All total:		31		25.5	154.5	180

Timings are finalized subject to verification during implementation the training.

It should further be noted that although Health and Safety is dealt with as a separate module, the principles should be integrated into each task. It should be seen as a way of life and not an activity to be done during training only.

6. DURATION:

Total duration of the training is **180 hours** excluding soft skills and On-the-Job Training (OJT)/Apprenticeship. The participants will be sent for wage employment after completion of the training. Only technical modules and occupational health and safety procedure have been considered under this duration.

7. TARGET GROUP:

The target group of this training course will be dropped out youths from the formal schooling, job seekers/underemployed young men or women, disadvantaged people. Male and female both are entitled to receive this training. The basic education for the trainees would be grade-V or equivalent. Above 18 years of age trainees will be enrolled in the training course.

8. GROUP SIZE:

A total of maximum 20 trainees will be placed in each group and provided adequate resources.

9. TARGET LOCATION:

The training will be implemented in partnership with private training providers and industry led training situated in the different areas of the country.

10. MEDIUM OF INSTRUCTION:

The medium of instruction for this course will be Bangla but the trainees will be also oriented on technical terminology in English.

11. PATTERN OF ATTENDANCE:

At least 90% attendee will be required during the theory and practical classes to appear in the internal and final assessment.

12. FOCUS OF THE PROGRAM:

Since this course is a competency based training, the focus is given on the performance of the trainees rather than the theoretical input. Where practicable, at least 80% of the total training time is allocated for practical training and 20% for theory.

13. ENTRY CRITERIA:

The following criteria will be considered for the individual to enter into this training program:

- Education: Class 5 or equivalent
- Age: 18 years and above
- Physical and mental health

14. FOLLOW UP SUGGESTION:

The training institutes who implement CBT program will build rapport with the employers to link graduates with the industries for employment.

Placement: Within one month after completion of the training program, the graduates will be assisted in finding out appropriate and decent wage-based job relevant to the occupation concerned.

To measure the success in job, the follow up will be taken as below:

First follow-up- three months after placement of graduates in job and the next follow up six months after placement of graduates in job.

15. CERTIFICATE REQUIREMENT:

Training service provider and Industry Led Training will certify the graduates as a Semi-Skilled Welder (Grill Maker) only after successful completion of the training program through systematic skills testing. Certification can also be linked to the Bangladesh Technical and Education Board (BTEB) at the relevant NTVQF level through Recognition of Prior Learning (RPL).

16. TRAINEES EVALUATION DETAILS:

Module wise evaluation will be conducted to ensure the performance of the learners. Final evaluation will be conducted to evaluate the participants at the end of the training course. Trainees must secure 100% marks in practical and 80% marks in theoretical examination.

17. TRAINERS' QUALIFICATION:

Preference will be given to the trainer's having the following criteria:

- Minimum five years' experience in the respective occupation in the construction industry
- Working experience as an Instructor/Trainer
- Trade course/Diploma in Mechanical Engineering

18. TRAINER – TRAINEES RATIO:

- For theoretical class, trainer and trainee ratio should be 1:20.
- For practical class, trainer and trainee ratio should be 1:10.
- And for final practical assessment 1:1

19. SUGGESTION FOR INSTRUCTION:

Where practicable:

- At least 80% time of the course will be allocated for practical purpose
- Maximum 20% time of the course will be allocated for theoretical purpose
- Follow the safety rules
- Create a friendly learning environment
- Arrange the materials and equipment at the right place
- Trainer/Instructor will be available in the training classes/labs in time
- Take attendance of participants
- Learner centered training
- Encourage the participants to speak
- Arrange question and answer (Q&A) sessions
- Make plans for classroom / workshop instructions
- Prepare lesson plans for theoretical and practical classes

20. LIST OF MODULES AND SUB MODULES:

Module: 1: Practice Occupational Health and Safety (OHS) Procedure.

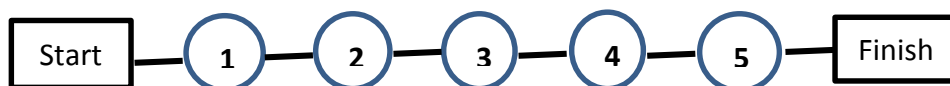
Module: 2: Apply Fundamental Skills of Welding Works.

Module: 3: Prepare Materials for Welding.

Module: 4: Weld Metal by Manual Arc Welding Process.

Module: 5: Perform Projects on Grill Works.

21. MODULE SEQUENCE:



22. DETAILS OF MODULES AND SUB MODULES:

Module 1: Practice Occupational Health and Safety (OHS) Procedure

22.1. Module- 1: Practice Occupational Health and Safety (OHS) Procedure						
	Description: It consists of skills and knowledge related to occupational health and safety applicable to the related performance.			Hours		
	Module outcomes: After completion of this module, trainees will be able to <ul style="list-style-type: none"> Follow safety sign and regulations; Apply personal protective equipment; Control house-keeping hazards; Apply First Aid on minor injuries; Control Electrical Fire Hazards. 			Th. 2.5	Pr. 3.5	Tot. 6.0
1.	Task: Follow safety sign and regulations.	Terminal Performance Objective (TPO):	Th. 0.5	Pr. 0.5	Tot. 1.0	
		Given: Simulated situation				
		What: Follow safety sign and regulations.				
		How well: <ul style="list-style-type: none"> All safety signs and regulations must be followed in the workplace. 				
	Steps: <ol style="list-style-type: none"> Collect the safety sign, emergency exit plan and list of rules and regulation. Explain the application of safety sign and regulation. Follow the emergency exit plan. Comply with safety signs and regulations. 	Enabling objectives: <ul style="list-style-type: none"> Explain about the uses of safety sign and regulation. Explain how to use the regulation. Explain the types of the safety sign. List the safety sign and regulation. Use the all safety items and rules. Explain the emergency exit way. 				
	Tools/equipment/materials required: Safety sign, visual aids, danger zone area indicators and regulation charts					
2.	Task: Apply personal protective equipment.	Terminal Performance Objective (TPO):	Th. 0.5	Pr. 1.0	Tot. 1.5	
		Given: Protective equipment				

		<p>What: Apply personal protective equipment.</p> <p>How well:</p> <ul style="list-style-type: none"> • The status of the protective equipment must be checked. • Safety goggle, helmet, hand gloves to be worn at all times during execution of tasks and safety belt must be tightened properly. • Hand shield must be used during welding 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect the personal protective equipment. 2. Check the condition of protective equipment. 3. Use the protective equipment. 4. Maintain the protective equipment. 5. Preserve the protective equipment in organized way at safe place. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain about the uses of protective equipment. • Explain how to use the protective equipment. • Explain the necessities of protective equipment in hazards works. • Use the protective equipment properly. • Explain the positive and negative side of uses the protective equipment. • List the protective equipment. 			
<p>Tools/equipment/materials required: Hamlet, Life Jacket/Apron, Safety Goggles, Hand Gloves, Hand Shield, Safety Belt and Safety shoes/Gumboot.</p>					
3.	<p>Task: Control house-keeping hazards.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Simulated situation</p> <p>What: Control house-keeping hazards.</p> <p>How well:</p> <ul style="list-style-type: none"> • Tools, equipment and safety materials of workplace must be placed in organized way. • The periodical maintenance of tools, equipment and safety 	Th. 0.5	Pr. 0.5	Tot. 1.0

		materials of workplace must be done.			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. List the expected hazards exist in workplace. 2. Place the tools and equipment in workplace following organized way. 3. Follow up the periodic maintenance of tools and equipment. 4. Handle the tools/equipment carefully. 5. Follow up the maintenance of all the electrical fittings and fixtures. 6. Identify the faulty tools/equipment. 7. Dispose the wastage/outdated tools & equipment from workplace. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Define house-keeping hazards. • Identify the types of housekeeping hazards. • Explain the necessity of keeping the house neat and clean (including dinning place, washroom/toilets, store and exit path). • Understand safety precautions to be taken for housekeeping hazards. • List the expected house-keeping hazards in the workplace. 			
Tools/equipment/materials required: Tools and equipment including safety materials.					
4.	<p>Task: Apply First Aid on minor injuries.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Dummy of a simulated victim.</p> <p>What: Apply First Aid on minor injuries.</p> <p>How well:</p> <ul style="list-style-type: none"> • Injured person must be isolated from the crowd. • Information of accident must be given to the administration. 	Th. 0.5	Pr. 1.0	Tot. 1.5
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Isolate the injured person. 2. Collect first aid box with necessary medicine, materials and equipment. 3. Clean the injured area. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Define the minor injury. • Explain about the first aid treatment. • Describe the steps of dressing. • List out the first aid medicine, equipment and materials. 			

	<p>4. Dress the injured portion properly.</p> <p>5. Use the necessary medicine and other materials as per requirement.</p> <p>6. Inform the administration.</p> <p>7. Restore the First Aid Box.</p>					
<p>Tools/equipment/materials required: First Aid Box with required medicine and materials.</p>						
<p>5.</p>	<p>Task: Control Electrical Fire Hazards</p>	<table border="1"> <tr> <td data-bbox="764 537 1170 1398"> <p>Terminal Performance Objective (TPO):</p> <p>Given: Work place situation (real/simulation).</p> <p>What: Control Electrical Fire Hazards.</p> <p>How well:</p> <ul style="list-style-type: none"> • Firefighting aids must be checked periodically. • Arc welding machine is properly checked before operation. • Plug point of welding machine is checked periodically. • Emergency exit must be followed during evacuation. </td> <td data-bbox="1170 537 1276 1398"> <p>Th. 0.5</p> </td> <td data-bbox="1276 537 1382 1398"> <p>Pr. 0.5</p> </td> <td data-bbox="1382 537 1489 1398"> <p>Tot. 1.0</p> </td> </tr> </table>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Work place situation (real/simulation).</p> <p>What: Control Electrical Fire Hazards.</p> <p>How well:</p> <ul style="list-style-type: none"> • Firefighting aids must be checked periodically. • Arc welding machine is properly checked before operation. • Plug point of welding machine is checked periodically. • Emergency exit must be followed during evacuation. 	<p>Th. 0.5</p>	<p>Pr. 0.5</p>	<p>Tot. 1.0</p>
<p>Terminal Performance Objective (TPO):</p> <p>Given: Work place situation (real/simulation).</p> <p>What: Control Electrical Fire Hazards.</p> <p>How well:</p> <ul style="list-style-type: none"> • Firefighting aids must be checked periodically. • Arc welding machine is properly checked before operation. • Plug point of welding machine is checked periodically. • Emergency exit must be followed during evacuation. 	<p>Th. 0.5</p>	<p>Pr. 0.5</p>	<p>Tot. 1.0</p>			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Check the availability of fire extinguishers, sands buckets/ reservoir. 2. Wear safety device to work closed to the electrification area. 3. Maintain Arc Welding Machine with accessories periodically to reduce electrical fire hazards 4. Check the fire extinguisher. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Describe the possible electrical fire hazards in workplace. • List the types of electrical hazards in welding works. 				

	<p>5. Apply fire extinguisher during small electric fire.</p> <p>6. Inform the police and fire station for mass electric fire.</p>	
<p>Tools/equipment/materials required: Safety materials like fire Extinguisher, Sands, Vacuum cleaner/hand blower etc.</p>		

Module 2: Apply Fundamental Skills of Welding Works

22.2. Module- 2: Apply Fundamental Skills of Welding Works							
	<p>Description: This module covers basic skills and knowledge about welding works. It provides skills required to carry out basic measurement and calculation, interpret welding drawings and specifications. It also covers the skills in applying hand and power tools and maintaining welding tools and equipment.</p>				Hours		
	<p>Module outcomes: After completion of this module, trainees will be able to:</p> <ul style="list-style-type: none"> • Perform basic measurement and calculation (Square, Circular and Rectangular); • Take measurement using Vernier Caliper; • Interpret mechanical (technical) welding drawing & specification; • Apply hand tool; • Apply power tools; • Maintain tools and equipment. 				Th. 5.0	Pr. 18.0	Tot. 23.0
1.	<p>Task: Perform basic measurement and calculation (Square, Circular, and Rectangular).</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Actual site/classroom, Drawing and Specification, real objects, Measuring tools, different shapes and calculator.</p> <p>What: Perform basic measurement and calculation (Square, Circular, and Rectangular).</p> <p>How well:</p> <ul style="list-style-type: none"> • The quantity of metal pieces are calculated as per drawing and specifications. • Metal pieces are marked using marking tools. • Measurement error is ± 2 mm for linear 	Th. 1.0	Pr. 3.0	Tot. 4.0		

		<p>measurement of metal piece.</p> <ul style="list-style-type: none"> No calculation error found. 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect drawing/specification, metal pieces with measuring tools marking tools. 2. Calculate the quantity of metal pieces (Metal Bar and Sheet) required as per drawing. 3. Measure metal pieces in MKS and FPS system using measuring tools as per drawing/specification. 4. Mark the measured point on the metal piece using marking tools. 5. Restore all tools and materials. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> Explain the unit of MKS and FPS system. Describe application of measuring tools. State the formulas for calculating different types of Area (Square, rectangular , Circular) List the materials as per drawing. . 			
<p>Tools/equipment/materials required: Measuring tape, Marker pen, Steel rule, Tri square, different type of shapes (straight line, circle), calculator.</p> <p>PPE: Apron, Safety Shoe</p>					
2.	<p>Task: Take measurement using Vernier Caliper.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Any work piece that requires accuracy within 0.001 of an inch or 0.02 of a millimeter.</p> <p>What: Take measurement using vernier caliper.</p> <p>How well:</p> <ul style="list-style-type: none"> The work piece is measured with an accuracy of 0.001 of an inch or 0.02 of a millimeter. Jaws of the caliper are positioned in both sides 	Th. 0.5	Pr. 2.5	Tot. 3.0

		<ul style="list-style-type: none"> The clamp screw of Vernier caliper is lock during measurement. 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect work piece and vernier caliper. 2. Clean the work piece so that no burrs is found on the edges. 3. Open the jaws of the caliper. 4. Position jaws of the caliper on both sides of the piece. 5. Push the jaws firmly against the work piece. 6. Lock the clamp screw of jaws. 7. Read the value of the main (Stationary) bar scale which is just to the left and above the '0' zero reading on the vernier (movable) scale. 8. Add the value on the vernier (movable) scale which exactly coincides with a line on the main (stationary) bar scale. 9. Record all measurement. 10. Restore all tools and materials 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> Define Vernier caliper. Explain the uses of vernier caliper State the steps to take measurement using vernier caliper. 			
	<p>Tools/equipment/materials required: Vernier Caliper, Work Piece, Pen, Paper</p> <p>PPE: Apron</p>				
3.	<p>Task: Interpret mechanical (technical) welding drawing and specifications</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Working drawing of welding works and specification</p> <p>What: Interpret drawing and specifications</p> <p>How well:</p> <ul style="list-style-type: none"> Specifications and abbreviations are identified and explained. 	Th. 1.5	Pr. 4.5	Tot. 6.0

		<ul style="list-style-type: none"> • Signs and symbols are identified and explained. 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect working drawing and specification. 2. Identify portion of working drawing and specification related to arc welding. 3. Identify the terms and abbreviations. 4. Identify signs and symbols. 5. Interpret the schedules, dimensions and other signs and symbols in the drawing and specification. 6. Restore the drawings in a safe place. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Define specification and working drawing. • State different types of signs, symbols used for welding works. • Explain how to interpret dimension, scale, signs and symbols. 			
<p>Tools/equipment/materials required: Technical Specification and Drawing</p> <p>PPE: Apron, Safety Shoe, Helmet</p>					
4.	<p>Task: Apply hand tools.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Different types of welding hand tools.</p> <p>What: Apply hand tools.</p> <p>How well:</p> <ul style="list-style-type: none"> • Safety precaution is taken while using hand tools. • The functions of hand tools are demonstrated. • Right tools are selected for specific job. 	Th. 0.5	Pr. 2.5	Tot. 3.0
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect different types of welding hand tools. 2. Place them separately on the table. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Discriminate welding hand tools from other hand tools. • Explain the functions and types of each hand tools used for welding works. 			

	<ol style="list-style-type: none"> 3. Identify different welding hand tools. 4. Select hand tools based on nature of works. 5. Demonstrate the functions of hand tools. 6. Clean the tools after use. 7. Clean the workplace. 8. Restore the materials. 					
<p>Tools/equipment/materials required: Head shield, hand shield, hammer, chipping hammer, tongs, hacksaw, anvil, chisel, scribe.</p> <p>PPE: Apron, Hand gloves, Safety goggles.</p>						
5.	<p>Task: Apply power tools.</p>	<table border="1"> <tr> <td data-bbox="763 657 1177 1392"> <p>Terminal Performance Objective (TPO):</p> <p>Given: Different types of power tools for the welding works.</p> <p>What: Apply power tools.</p> <p>How well:</p> <ul style="list-style-type: none"> • Safety precaution is taken while working with power tools • Appropriate power tools are selected for specific job. • Power tools are switched OFF/ON while it is operated. </td> <td data-bbox="1177 657 1282 1392"> <p>Th. 1.0</p> </td> <td data-bbox="1282 657 1388 1392"> <p>Pr. 3.0</p> </td> <td data-bbox="1388 657 1489 1392"> <p>Tot. 4.0</p> </td> </tr> </table>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Different types of power tools for the welding works.</p> <p>What: Apply power tools.</p> <p>How well:</p> <ul style="list-style-type: none"> • Safety precaution is taken while working with power tools • Appropriate power tools are selected for specific job. • Power tools are switched OFF/ON while it is operated. 	<p>Th. 1.0</p>	<p>Pr. 3.0</p>	<p>Tot. 4.0</p>
<p>Terminal Performance Objective (TPO):</p> <p>Given: Different types of power tools for the welding works.</p> <p>What: Apply power tools.</p> <p>How well:</p> <ul style="list-style-type: none"> • Safety precaution is taken while working with power tools • Appropriate power tools are selected for specific job. • Power tools are switched OFF/ON while it is operated. 	<p>Th. 1.0</p>	<p>Pr. 3.0</p>	<p>Tot. 4.0</p>			

	<p>Steps:</p> <ol style="list-style-type: none"> 1. Identify the nature of the job. 2. Select the power tools as per the nature of the job. 3. Prepare the power tools for welding/cutting/grinding. 4. Connect the power cable with the power source. 5. Switch ON the power tool. 6. Apply power tools as per nature of the job. 7. Switch OFF the power tools. 8. Clean the power tools. 9. Clean the work place. 10. Restore the power tools. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain the name of power tools for works • Explain the application of different types of power 			
<p>Tools/equipment/materials required: Grinding machine, Electric hand drill, Welding Machine, Hammer Drill Machine, Bench Grinding Machine, Bench Drill Machine.</p> <p>PPE: Apron, Hand gloves, Safety shoes, safety goggles, etc.</p>					
6.	<p>Task: Maintain tools & equipment</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Different types of tools & equipment</p> <p>What: Maintain tools & equipment</p> <p>How well:</p> <ul style="list-style-type: none"> • Tools & equipment are inspected, maintained and repaired periodically. • No damage made while maintaining tools and equipment. 	Th. 0.5	Pr. 2.5	Tot. 3.0
<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools and equipment. 2. Check each tools and equipment individually. 3. Sharpen the cutting tools. 		<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain how to maintain tools & equipment • Explain preventive maintenance methods, techniques and procedure. • Explain the necessity of maintaining the tools & equipment. 			

	<ol style="list-style-type: none"> 4. Remove dust and other unwanted materials from tools & equipment. 5. Wash the tools and materials with clean water (if applicable). 6. Dry the tools and equipment. 7. Check the faults of tools and equipment. 8. Repair the minor faults. 9. Segregate nonfunctional tools & equipment from the store. 10. Restore the tools & equipment. 	
<p>Tools/equipment/materials required: Ball pin hammer, flat screwdriver, star screw driver (Philips Screwdriver), combination pliers, neon tester, electric tape, Welding Machine, Power Saw Machine, Drill Machine and Grinding Machine.</p> <p>PPE: Apron, Hand gloves, Safety shoes, safety goggles</p>		

Module 3: Prepare Materials for Welding

22.3. Module- 3: Prepare Materials for Welding

	Description: This module covers basic skills and knowledge required to prepare materials for welding works. It provides skills to cut different types of metal piece, grind cutting edges and discuss how to straight work piece.	Hours			
	Module outcomes: After completion of this module, trainees will be able to: <ul style="list-style-type: none"> • Cut metal using hack saw. • File the flat surface. • Cut metal work piece using power saw machine. • Grind the surface of metal. • Drill a work piece. • Prepare Z- bar 	Th. 3.5	Pr. 14.5	Tot. 18.0	
1.	Task: Cut metal using hack saw.	Terminal Performance Objective (TPO): Given: Drawing and measurement sheet. What: Cut metal using hack saw. How well: <ul style="list-style-type: none"> • Measurement error is within ± 1mm. • Metal piece is straight. • Metal piece is cut according to the drawing/ measurement sheet. 	Th. 1.0	Pr. 2.0	Tot. 3.0
	Steps: <ol style="list-style-type: none"> 1. Collect Hack saw, metal pieces and drawing/measurement. 2. Mark the metal piece as per measurement. 3. Clamp the metal piece with table vice (the marked line must be outside from the vice). 4. Set up the blade on the hacksaw frame accurately. 5. Mark a small “V” notch at starting point using hacksaw. 	Enabling objectives: <ul style="list-style-type: none"> • Explain how to hold hacksaw while sawing. • State the setting procedure of the blade on the hacksaw. • State the use of hacksaw blade for different metal. • Explain the procedure of using hacksaw. 			

	<ol style="list-style-type: none"> 6. Position the feet to safe stance. 7. Start cutting slowly moving the blade forward by holding hacksaw frame. 8. Apply pressure only doing forward motion. 9. Finish the final cut. 10. Remove the metal piece from the vice. 11. Straight the metal piece using anvil and hammer. 12. Clean the work place. 13. Restore all tools and materials. 				
<p>Tools/equipment/materials required: Measuring tape, Hacksaw, Hammer, Anvil, Wire Brush and Tri-Square and work piece materials.</p>					
<p>PPE: Apron, Safety Goggles, Cotton Hand Gloves and Safety Shoes.</p>					
2.	<p>Task: File flat metal surface</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: A flat work piece with any size.</p> <p>What: File a work piece</p> <p>How well:</p> <ul style="list-style-type: none"> • Filed edge is smooth and uniform. • The work piece is clamped tightly with vice. 	Th. 0.5	Pr. 2.0	Tot. 2.5
<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools and flat work piece. 2. Mark the filing area on cutting edge by scribe. 3. Clamp the work piece on the vice keeping the marked end upward position. 4. Hold the file's handle with one hand and put another hand's thumb in the file tip. 5. Position the feet to safe stance. 		<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain the procedure of filing the metal piece. • Describe safe stance while filing. • Distinguish different types of files • Explain the functions of different types of files. 			

	<p>6. Put the file on top of the work piece by pushing from one hand (holding hand) and pressing only thumb of another hand.</p> <p>7. Clean vice and workplace.</p> <p>8. Restore tools, work piece and materials.</p>				
<p>Tools/equipment/materials required: Measuring Tape, File Sets, Table Vice, Scriber Wire Brush and Tri-Square and work piece.</p> <p>PPE: Apron, Safety Goggles, Cotton Hand Gloves and Safety Shoes.</p>					
3.	<p>Task: Cut metal work piece using power saw machine.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Drawing/measurement sheet.</p> <p>What: Cut metal work piece using power saw machine.</p> <p>How well:</p> <ul style="list-style-type: none"> • Measurement error is within ± 1mm. • Metal piece is place in machine vice straightly. • Coolant is used during cutting the metal • Metal piece is cut according to the drawing/ measurement sheet. 	Th. 0.5	Pr. 2.5	Tot. 3.0
<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect materials, drawing and measurement. 2. Mark the metal piece as per measurement. 3. Fix the metal piece with machine vice. 4. Connect the power saw machine with power source. 		<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain the functions of power saw machine. • Explain the procedure of cutting metal piece. • Explain how to operate Power saw machine • Explain the necessity of using coolant. 			

	<ol style="list-style-type: none"> 5. Cut the metal piece on the mark point 6. Use coolant during cutting operation. 7. Remove the metal piece from the machine vice. 8. Straight the metal piece using anvil and hammer. 9. Clean the work place. 10. Restore all tools and materials. 				
<p>Tools/equipment/materials required: Measuring tap, Power saw machine, Hammer, Anvil, Wire Brush and Tri-Square and work piece materials.</p>					
<p>PPE: Apron, Safety Goggles, Cotton Hand Gloves and Safety Shoes.</p>					
4.	<p>Task: Grind the surface of metal.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Equipped workplace situation with work piece and a set of grinding disc.</p> <p>What: Grind the surface of metal.</p> <p>How well:</p> <ul style="list-style-type: none"> • Grinding wheel is selected based on nature of job. • Work piece with clean, smooth and uniform surface is produced. • Edge of the metal is smooth. • No rough projection left on a work piece after grinding. 	Th. 0.5	Pr. 2.5	Tot. 3.0
<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect hand grinding machine, materials and work piece. 2. Mark the grinding area on cutting edge by scribe. 		<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Describe how to select grinding wheel based on nature of job. • Explain the procedure to set grinding wheel/disk. • Explain how to operate grinding machine. 			

	<ol style="list-style-type: none"> 3. Set the grinding wheel as per nature of job. 4. Clamp the work piece on the vice/secure on other fixing device as per the position the of work piece. 5. Connect the grinding machine with the power source. 6. Hold the grinder with one hand positioning the switch button on thumb and other hand in handle of the machine. 7. Position the feet to safe stance during grinding. 8. Push the switch of the machine. 9. Rub the wheel on work surface back and forth or left and right movement. 10. Repeat the same motion until producing even surface. 11. Remove the finished work piece from the vice/other fixing device. 12. Clean the workplace 13. Restore all tools and materials. 				
<p>Tools/equipment/materials required: Grinding machine, Grinding wheels/disc set, scriber, Wire Brush and Tri-Square and work piece materials.</p> <p>PPE: Apron, Safety Goggles, Cotton Hand Gloves and Safety Shoes.</p>					
5.	<p>Task: Drill metal work piece.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Equipped workshop with drill machine, drill bit set, Finished work piece and drawing.</p> <p>What: Drill metal work piece.</p>	Th. 0.5	Pr. 3.0	Tot. 3.5

		<p>How well:</p> <ul style="list-style-type: none"> • Drilled hole is according to the drill layout provided. • Drilled hole is straight. • Drill bit is selected as per the given specification and nature of the work piece. 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect required tools and equipment. 2. Obtain layout marked work piece. 3. Place the work piece on the flat anvil. 4. Hold the center punch by three fingers of one hand and hammer it by another hand. 5. Apply trial stroke. 6. Check the punch for accuracy. 7. Align if required. 8. Punch the center. 9. Clamp the work piece on the machine vice. 10. Mount the required drill bit on drill chunk. 11. Set-up R.P.M. as per drill bit size. 12. Set coolant-housing pipe. 13. Switch ON the machine. 14. Apply steady pressure by giving until obtaining required depth. 15. Switch OFF the machine. 16. Remove the work piece from the vice and clean with wire brush. 17. Remove the drill bit from drill machine. 18. Restore tools and materials. 19. Clean the work place. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain different types of drill machine. • Explain the types of drill bits. • Explain the procedure to set drill bit with machine. • State the purpose of punching before drilling. • State the procedure to drill a metal work piece. 			

<p>Tools/equipment/materials required: Hand Drill Machine, Drill Bit Set, Center Punch, Hammer, Scriber, Wire Brush and Tri-Square and work piece materials.</p> <p>PPE: Apron, Safety Goggles, Cotton Hand Gloves and Safety Shoes.</p>					
6.	<p>Task: Prepare Z- bar.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Drawing/ measurement sheet.</p> <p>What: Prepare Z- bar.</p> <p>How well:</p> <ul style="list-style-type: none"> • Measurement error is within ± 1mm. • Z-bar is straight. • Edge of Z-bar is filed uniformly according to the drawing/ measurement. 	Th. 0.5	Pr. 2.5	Tot. 3.0
<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools, materials and drawing/measurement. 2. Mark the Z-bar as per measurement. 3. Cut the Z-bar at top & bottom position 45' and in middle position 90' angle. 4. Grind the cutting edge of the Z-bar. 5. Straight the cut piece of Z-bar by anvil and hammer. 6. Clean workplace 7. Restore all tools and materials. 		<p>Enabling objectives:</p> <ul style="list-style-type: none"> • State the precaution to be taken while cutting z-bar. • Explain the procedure of cutting Z-bar. 			
<p>Tools/equipment/materials required: Measuring tap, Hacksaw, Power hacksaw, Hammer, Chisel, Anvil, Grinding machine, Grinding wheel, Wire Brush and Tri-Square and work piece materials.</p> <p>PPE: Apron, Safety Goggles, Cotton Hand Gloves and Safety Shoes.</p>					

Module 4: Weld Metal by Manual Arc Welding process

22.4. Module- 4: Weld Metal by Manual Arc Welding process.						
	Description: This module deals with the skills and knowledge required for a Welder (Grill Maker) in the areas of welding metal by manual arc welding process.			Hours		
	Module outcomes: After completion of this module, trainees will be able to- <ul style="list-style-type: none"> • Perform Arc welding (Straight bead and weaving bead); • Weld butt joint in flat position; • Weld butt joint in horizontal position; • Weld fillet joint in (2F) horizontal position; • Weld butt joint in vertical position; • Weld fillet joint in (3F) vertical position; • Weld butt joint in overhead position; • Weld fillet joint in 4F overhead position; • Weld round bar (pipe and shaft) to plate in flat position; • Tack weld with bar to bar; • Tack weld bar to sheet. 			Th. 14.0	Pr. 63.0	Tot. 77.0
1.	Task: Perform Arc welding (Straight bead and weaving bead).		Terminal Performance Objective (TPO): Given: Workshop and drawing/specification What: Perform Arc welding (Straight bead and weaving bead). How well: <ul style="list-style-type: none"> • Negative and positive terminal in the welding machine/transformer is fixed before welding. • Weld bead is uniform and straight. • No undercut, overlap and Arc crater seen. • Welding is done as per drawing/ specification • Metal piece is attached with C-Clamp 	Th. 4.0	Pr. 12.0	Tot. 16.0

		<ul style="list-style-type: none">• Earth clamp is attached with metal piece• Correct electrode is selected.• Two ends of metal pieces are tacked before continuous welding.• Slag and spatter removed from the job and PPE is worn.			
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<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools, equipment and materials. 2. Prepare the work area. 3. Place the metal piece in flat position on the working table. 4. Attach C-clamps to hold the metal piece. 5. Fix negative and positive terminal in the welding machine/transformer. 6. Attach earth clamp to the metal piece. 7. Select the correct electrode. 8. Turn ON the welding machine/transformer. 9. Set amperage range. 10. Set electrode in welding holder. 11. Select the start point for welding. 12. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 13. Continue welding across the line with consistent speed keeping 70° angle of the electrode with the metal piece. 14. Turn OFF welding machine. 15. Clean the finished weld (slag and spatter) using wire brush. 16. Restore tools and equipment. 17. Clean the work area. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain the precaution to be taken while performing welding. • Explain the necessities for using PPE. • State the amperage range for straight bead and weaving bead. • Describe the use of different types of electrode. • Sketch flat position of welding. • Explain different types of welding beads. • Explain how to make straight bead and weaving bead. • Explain metal cleaning procedure.
<p>Tools/equipment/materials required: Welding machine. C-clamp, Tongs, Chipping hammer, Wire brush, Electrode (Code: E-6013 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, leather hand gloves, safety goggles.</p>	

2.	<p>Task: Weld butt joint in flat position.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification.</p> <p>What: Weld butt joint in flat position.</p> <p>How well:</p> <ul style="list-style-type: none"> • Negative and positive terminal in the welding machine/transformer is fixed before welding. • Metal piece is attached with C-Clamp. • Earth clamp is attached with metal piece. • Correct electrode is selected. • Two ends of metal pieces are tacked before continuous welding. • Butt joint welding is found uniform and straight. • No undercut, overlap and Arc crater seen. • Welding is done as per drawing/ specification. • Slag and spatter is removed and PPE is worn. • 	Th. 1.0	Pr. 4.0	Tot. 5.0
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools, equipment and materials. 2. Prepare the work area. 3. Fix negative and positive terminal in the welding machine/transformer. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain different types of welding joints. • Sketch butt joint. • List the required tools & materials to weld butt joint in flat position. • State the amperage range for welding butt joint. 			

	<ol style="list-style-type: none"> 4. Place the two metal pieces in flat position on the working table. 5. Attach C-clamps to hold the metal pieces. 6. Attach earth clamp to one metal piece. 7. Select the correct electrode. 8. Turn ON the welding machine/transformer. 9. Set amperage range. 10. Set electrode in welding holder. 11. Align the two metal pieces. 12. Tack both ends of the two metal pieces together. 13. Turn the metal pieces upside down. 14. Select the start point for welding. 15. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 18. Continue welding across the line with consistent speed keeping 70° angle of the electrode with the metal pieces. 16. Turn OFF welding machine. 17. Clean the finished weld (slag and spatter). 18. Restore tools and equipment. 19. Clean the work area. 	<ul style="list-style-type: none"> • Explain the procedure to weld butt joint in flat position. 								
<p>Tools/equipment/materials required: Welding machine, C-clamp, Tongs, Chipping hammer, Wire brush, Electrode (Code: E-6013 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles</p>										
3.	<p>Task: Weld butt joint in horizontal position.</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="764 1696 1157 1808"> <p>Terminal Performance Objective (TPO):</p> </td> <td data-bbox="1157 1696 1265 1808">Th. 1.0</td> <td data-bbox="1265 1696 1372 1808">Pr. 4.0</td> <td data-bbox="1372 1696 1481 1808">Tot. 5.0</td> </tr> <tr> <td colspan="4" data-bbox="764 1808 1481 1890"> <p>Given: Workshop, Drawing/ specification</p> </td> </tr> </table>	<p>Terminal Performance Objective (TPO):</p>	Th. 1.0	Pr. 4.0	Tot. 5.0	<p>Given: Workshop, Drawing/ specification</p>			
<p>Terminal Performance Objective (TPO):</p>	Th. 1.0	Pr. 4.0	Tot. 5.0							
<p>Given: Workshop, Drawing/ specification</p>										

		<p>What: Weld butt joint in horizontal position.</p> <p>How well:</p> <ul style="list-style-type: none"> • Negative and positive terminal in the welding machine/transformer is fixed before welding. • Metal piece is attached with C-Clamp. • Earth clamp is attached with metal piece. • Correct electrode is selected. • Two ends of metal pieces are tacked before continuous welding. • Butt joint welding is found uniform and straight. • No undercut, overlap and Arc crater seen. • Welding is done as per drawing/ specification. • Slag and spatter is removed using wire brush. • PPE is worn during welding. 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools, equipment and materials. 2. Prepare the work area. 3. Fix negative and positive terminal in the welding machine/transformer. 4. Place the two metal pieces in flat position. 5. Attach C-clamps to hold the metal pieces. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • List the required tools & materials. • Explain the precaution to be taken while welding butt joint in horizontal position. • State the amperage range for welding butt joint in horizontal position. • Explain the procedure for welding butt joint in horizontal position. 			

	<ol style="list-style-type: none"> 6. Attach earth clamp to one metal piece. 7. Select the correct electrode. 8. Turn ON the welding machine/transformer. 9. Set amperage range. 10. Set electrode in welding holder. 11. Align the two metal pieces. 12. Tack both ends of the two metal pieces together. 13. Place the metal pieces in horizontal position using positioner. 14. Select the start point for welding. 15. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 16. Continue welding with short Arc across the line with consistent speed maintaining 70^o- 80^o angle of the electrode with the metal pieces. 17. Turn OFF welding machine. 18. Clean the finished weld (slag and spatter) using wire brush. 19. Restore tools and equipment. 20. Clean the work area. 					
<p>Tools/equipment/materials required: Welding machine, C-clamp, Positioner, Tongs, Chipping hammer, Wire brush, Electrode (Code: E-6013 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles, leather cap.</p>						
4.	<p>Task: Weld fillet joint in 2F horizontal position.</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="764 1541 1157 1890"> <p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification.</p> <p>What: Weld fillet joint in 2F horizontal position.</p> </td> <td data-bbox="1157 1541 1263 1890" style="text-align: center;"> <p>Th.</p> <p>1.0</p> </td> <td data-bbox="1263 1541 1370 1890" style="text-align: center;"> <p>Pr.</p> <p>4.0</p> </td> <td data-bbox="1370 1541 1481 1890" style="text-align: center;"> <p>Tot.</p> <p>5.0</p> </td> </tr> </table>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification.</p> <p>What: Weld fillet joint in 2F horizontal position.</p>	<p>Th.</p> <p>1.0</p>	<p>Pr.</p> <p>4.0</p>	<p>Tot.</p> <p>5.0</p>
<p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification.</p> <p>What: Weld fillet joint in 2F horizontal position.</p>	<p>Th.</p> <p>1.0</p>	<p>Pr.</p> <p>4.0</p>	<p>Tot.</p> <p>5.0</p>			

		<p>How well:</p> <ul style="list-style-type: none"> • Negative and positive terminal in the welding machine/transformer is fixed before welding. • Two metal pieces are placed in 2F position • Correct electrode is selected. • Two ends of metal pieces are tacked before continuous welding. • Fillet weld joint is found uniform and straight. • No undercut, overlap and Arc crater seen. • Welding is done as per drawing/ specification • Slag and spatter is removed and PPE is used. 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools, equipment and materials. 2. Prepare work area. 3. Fix negative and positive terminal in the welding machine/transformer. 4. Place the two metal pieces in fillet joint 2F position. 5. Attach earth clamp to one metal piece. 6. Select the correct electrode. 7. Turn ON the welding machine/transformer. 8. Set amperage range. 9. Set electrode in welding holder. 10. Align the two metal pieces. 11. Tack both ends of the two metal pieces together. 12. Select the start point for welding. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain the precaution to be taken while welding fillet joint in 2F horizontal position. • State the amperage range for welding fillet joint in 2F horizontal position. • Explain the procedure for welding fillet joint in 2F horizontal position. 			

	<p>13. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs.</p> <p>14. Continue welding with short Arc across the line with consistent speed maintaining 45⁰- 50⁰ angle of the electrode with the metal pieces.</p> <p>15. Turn OFF welding machine.</p> <p>16. Clean the finished weld (slag and spatter) using wire brush.</p> <p>17. Restore tools and equipment</p> <p>18. Clean the work area</p>					
<p>Tools/equipment/materials required: Welding machine, Tongs, Chipping hammer, Wire brush, Electrode (Code: E-6012 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles.</p>						
5.	<p>Task: Weld butt joint in vertical position.</p>	<table border="1"> <tr> <td data-bbox="764 961 1157 1799"> <p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification.</p> <p>What: Weld butt joint in vertical position.</p> <p>How well:</p> <ul style="list-style-type: none"> • Negative and positive terminal in the welding machine/transformer is fixed before welding. • Two metal pieces are placed in 2F position • Correct electrode is selected. • Two ends of metal pieces are tacked before continuous welding. </td> <td data-bbox="1157 961 1263 1799">Th. 1.0</td> <td data-bbox="1263 961 1370 1799">Pr. 6.0</td> <td data-bbox="1370 961 1481 1799">Tot. 7.0</td> </tr> </table>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification.</p> <p>What: Weld butt joint in vertical position.</p> <p>How well:</p> <ul style="list-style-type: none"> • Negative and positive terminal in the welding machine/transformer is fixed before welding. • Two metal pieces are placed in 2F position • Correct electrode is selected. • Two ends of metal pieces are tacked before continuous welding. 	Th. 1.0	Pr. 6.0	Tot. 7.0
<p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification.</p> <p>What: Weld butt joint in vertical position.</p> <p>How well:</p> <ul style="list-style-type: none"> • Negative and positive terminal in the welding machine/transformer is fixed before welding. • Two metal pieces are placed in 2F position • Correct electrode is selected. • Two ends of metal pieces are tacked before continuous welding. 	Th. 1.0	Pr. 6.0	Tot. 7.0			

		<ul style="list-style-type: none"> • Butt joint welding is found uniform and straight. • No undercut, overlap and Arc crater seen. • Welding is done as per drawing/ specification. • Slag and spatter is removed. 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools, equipment and materials. 2. Prepare work area. 3. Fix negative and positive terminal in the welding machine/transformer. 4. Attach earth clamp to the positioner. 5. Place the two metal pieces in butt joint vertical position using positioner. 6. Align the two metal pieces. 7. Select the correct electrode. 8. Turn ON the welding machine/transformer. 9. Set amperage range. 10. Set electrode in welding holder. 11. Tack both ends of the two metal pieces together. 12. Select the start point for welding. 13. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 14. Continue welding with short Arc across the line with consistent speed maintaining 70^o- 80^o angle of the electrode with the metal pieces. 15. Turn off welding machine. 16. Clean the finished weld (slag and spatter) using wire brush. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain the precaution to be taken while welding butt joint in vertical position. • State the amperage range for welding butt joint in vertical position. • Explain the procedure for welding butt joint in vertical position. 			

	17. Restore tools and equipment. 18. Clean the work area.				
<p>Tools/equipment/materials required: Welding machine, Positioner, Tongs, Chipping hammer, Wire brush, Electrode (Code: E-6013 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles, leather cap.</p>					
6.	<p>Task: Weld fillet joint 3F vertical position</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification.</p> <p>What: Weld fillet joint 3F vertical position</p> <p>How well:</p> <ul style="list-style-type: none"> • Negative and positive terminal in the welding machine/transformer is fixed before welding. • Two metal pieces are placed in 3F vertical position • Correct electrode is selected. • Two ends of metal pieces are tacked before continuous welding. • Fillet weld joint in 3F vertical position is found uniform and straight. • No undercut, overlap and Arc crater seen. • Welding is done as per drawing/ specification • Slag and spatter remove is removed and PPE is used 	Th. 1.0	Pr. 5.0	Tot. 6.0
Steps:		Enabling objectives:			

<ol style="list-style-type: none"> 1. Collect tools, equipment and materials. 2. Prepare work area. 3. Fix negative and positive terminal in the welding machine/transformer. 4. Attach earth clamp to one metal piece. 5. Place the two metal pieces in 2F position. 6. Align the two metal pieces. 7. Select the correct electrode. 8. Turn ON the welding machine/transformer. 9. Set amperage range. 10. Set electrode in welding holder. 11. Tack both ends of the two metal pieces together. 12. Place the metal piece in 3F vertical position using a positioner. 13. Select the start point for welding. 14. Weld vertically upward if the metal thickness is above 3mm. 15. Weld vertically downward if the metal thickness is 3mm or less. 16. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 17. Continue welding with short Arc across the line with consistent speed maintaining 70^o- 80^o angle of the electrode with the metal pieces. 18. Turn OF welding machine. 19. Clean the finished weld (slag and spatter). 20. Restore tools and equipment. 21. Clean the work area. 	<ul style="list-style-type: none"> • Explain the precaution to be taken while welding fillet joint 3F vertical position. • State the amperage range for welding fillet joint 3F vertical position. • Explain the procedure for welding fillet joint 3F vertical position.
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	<p>Tools/equipment/materials required: Welding machine, Positioner, Tongs, Chipping hammer, Wire brush, Electrode (Code: E-6012 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles, leather cap.</p>				
7.	<p>Task: Weld butt joint in overhead position.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification</p> <p>What: Weld butt joint in overhead position</p> <p>How well:</p> <ul style="list-style-type: none"> • Negative and positive terminal in the welding machine/transformer is fixed before welding. • Two metal pieces are placed in flat position • Correct electrode is selected. • Two ends of metal pieces are tacked before continuous welding. • Butt joint welding in overhead position is found uniform and straight. • No undercut, overlap and Arc crater seen. • Welding is done as per drawing/ specification • Slag and spatter is removed and PPE is used 	Th. 1.0	Pr. 6.0	Tot. 7.0
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools, equipment and materials. 2. Prepare work area. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain the precaution to be taken while welding butt joint in overhead position. • State the amperage range for welding butt joint in overhead position. 			

	<ol style="list-style-type: none"> 3. Fix negative and positive terminal in the welding machine/transformer. 4. Attach earth clamp to one metal piece. 5. Place the two metal pieces in flat position. 6. Align the two metal pieces. 7. Select the correct electrode. 8. Turn ON the welding machine/transformer. 9. Set amperage range. 10. Set electrode in welding holder. 11. Tack both ends of the two metal pieces together. 12. Place the metal piece in overhead position using a positioner. 13. Select the start point for welding. 14. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 15. Continue welding with short Arc across the line with consistent speed maintaining 80°- 85° angle of the electrode with the metal pieces. 16. Turn OFF welding machine. 17. Clean the finished weld (slag and spatter). 18. Restore tools and equipment. 19. Clean the work area. 	<ul style="list-style-type: none"> • Explain the procedure for welding butt joint in overhead position. 			
<p>Tools/equipment/materials required: Welding machine, Positioner, Tongs, Chipping hammer, Wire brush, Electrode (Code: E-6013 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles, leather cap, leather arm guard.</p>					
8.	Task: Weld fillet joint in 4F overhead position.	Terminal Performance Objective (TPO):	Th. 1.0	Pr. 8.0	Tot. 9.0

		<p>Given: Workshop, drawing/specification.</p> <p>What: Weld fillet joint in 4F overhead position.</p> <p>How well:</p> <ul style="list-style-type: none"> • Negative and positive terminal in the welding machine/transformer is fixed before welding. • Two metal pieces are placed in 4F position • Correct electrode is selected. • Two ends of metal pieces are tacked before continuous welding. • Fillet welding joint in 4F overhead position is found uniform and straight. • No undercut, overlap and Arc crater seen. • Welding is done as per drawing/ specification • Slag and spatter is removed and PPE is worn 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools, equipment and materials. 2. Prepare the work area. 3. Fix negative and positive terminal in the welding machine/transformer. 4. Attach earth clamp to one metal piece. 5. Place the two metal pieces in 2F position. 6. Align the two metal pieces. 7. Select the correct electrode. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain the precaution to be taken while welding fillet joint in 4F overhead position. • State the amperage range for welding fillet joint in 4F overhead position. • Explain the procedure for welding fillet joint in 4F overhead position. 			

	<ol style="list-style-type: none"> 8. Turn ON the welding machine/transformer. 9. Set amperage range. 10. Set electrode in welding holder. 11. Tack both ends of the two metal pieces together. 12. Place the metal piece in overhead position using a positioner. 13. Select the start point for welding. 14. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 15. Continue welding with short Arc across the line with consistent speed maintaining 40°- 45° angle of the electrode with the metal pieces. 16. Turn OFF welding machine. 17. Clean the finished weld (slag and spatter) using wire brush. 18. Restore tools and equipment. 19. Clean the work area. 				
<p>Tools/equipment/materials required: Welding machine, Positioner, Tongs, Chipping hammer, Wire brush, Electrode (Code: E-6013 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles, leather cap, leather arm guard.</p>					
9.	<p>Task: Weld round bar (pipe and shaft) to plate in flat position.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification</p> <p>What: Weld round bar (pipe and shaft) to plate in flat position.</p> <p>How well:</p>	Th. 1.00	Pr. 4.0	Tot. 5.0

		<ul style="list-style-type: none"> • Negative and positive terminal in the welding machine/transformer is fixed before welding. • Correct electrode is selected. • Welding joints are found uniform and circular. • No undercut, overlap and Arc crater seen. • Welding is done as per drawing/ specification • Slag and spatter is removed and PPE is worn. 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools, equipment and materials. 2. Prepare work area. 3. Fix negative and positive terminal in the welding machine/transformer. 4. Attach earth clamp to one metal piece. 5. Select the correct electrode. 6. Turn ON the welding machine/transformer. 7. Set amperage range. 8. Set electrode in welding holder. 9. Place the round bar on the base metal plate in 90° angle fillet position. 10. Use a tri-square to measure 90 angle of the round bar with base metal and tack the opposite side. 11. Check the measurement again for 90 angle and weld the other side. 12. Repeat the step 11 and 12 for other two sides. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain the precaution to be taken while welding round bar (pipe and shaft) to plate in flat position. • State the amperage range for welding round bar (pipe and shaft) to plate in flat position. • Explain the procedure for welding round bar (pipe and shaft) to plate in flat position. 			

	<p>13. Place the metal piece in 2F position.</p> <p>14. Select the start point for welding.</p> <p>15. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs.</p> <p>16. Continue welding with short Arc circling the line with consistent speed maintaining 40°- 45° angle of the electrode with the metal pieces.</p> <p>17. Turn OFF welding machine.</p> <p>18. Clean the finished weld (slag and spatter).</p> <p>19. Restore tools and equipment.</p> <p>20. Clean the work area.</p>				
<p>Tools/equipment/materials required: Welding machine, Tri-square, Tongs, Chipping hammer, Wire brush, Electrode (Code: E-6013 and Size: 3.2mm/ SWG – 10) and work piece materials.</p>					
<p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles.</p>					
10.	<p>Task: Tack weld with bar to bar.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification.</p> <p>What: Tack weld with bar to bar.</p> <p>How well:</p> <ul style="list-style-type: none"> • 1mm tolerance for alignment of two bars in T-position and corner position • Tack weld is uniformed and round shaped. • No Arc crater seen. • Slag and spatter is removed • PPE is used 	Th. 1.0	Pr. 4.0	Tot. 5.0
<p>Steps:</p>		<p>Enabling objectives:</p>			

<ol style="list-style-type: none"> 1. Collect tools, equipment and materials. 2. Prepare the work area. 3. Fix negative and positive terminal in the welding machine/transformer. 4. Attach earth clamp to one metal piece. 5. Place the two metal pieces in flat position. 6. Align the two metal pieces in corner joint position. 7. Select the correct electrode. 8. Turn ON the welding machine/transformer. 9. Set amperage range. 10. Set electrode in welding holder. 11. Tack both ends of the two metal pieces together. 12. Place the metal piece in flat position. 13. Select the start point for tack. 14. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 15. Continue tack with short Arc across the line with consistent speed. 16. Align the two metal pieces in T-joint position. 17. Tack both ends of the two metal pieces together. 18. Place the metal piece in flat position. 19. Select the start point for tack. 20. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 21. Continue tack with short Arc across the line with consistent speed. 	<ul style="list-style-type: none"> • Explain the precaution to be taken while performing tack welding with bar to bar. • State the amperage range for performing tack welding with bar to bar. • Explain the procedure for performing tack welding with bar to bar. • Explain the necessities of Tack weld.
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	<p>22. Turn OFF welding machine. 23. Clean the finished weld (slag and spatter) using wire brush. 24. Restore tools and equipment. 25. Clean the work area.</p>				
<p>Tools/equipment/materials required: Welding machine, Tri-square, Tongs, Chipping hammer, Wire brush, Electrode (Code: E-6012 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles.</p>					
11.	<p>Task: Tack weld with bar to sheet.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: Workshop, drawing/specification.</p> <p>What: Tack weld with bar to sheet.</p> <p>How well:</p> <ul style="list-style-type: none"> • Tack weld is uniformed and round shaped. • Slag and spatter is removed • PPE is used 	Th. 1.0	Pr. 6.0	Tot. 7.0
<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect tools, equipment and materials. 2. Prepare work area. 3. Fix negative and positive terminal in the welding machine/transformer. 4. Attach earth clamp to one metal piece. 5. Place the metal frame in flat position. 6. Align the metal sheet with the edge of the metal frame. 7. Check the sheet is align with the 4 corners of the metal frame. 8. Select the correct electrode. 		<p>Enabling objectives:</p> <ul style="list-style-type: none"> • Explain the precaution to be taken while performing tack welding with bar to sheet. • State the amperage range for performing tack welding with bar to sheet. • Explain the procedure for performing tack welding with bar to sheet. 			

<ol style="list-style-type: none"> 9. Turn ON the welding machine/transformer. 10. Set amperage range. 11. Set electrode in welding holder. 12. Tack metal sheet with metal frame in flat position. 13. Place support metal bars in the middle. 14. Select the start point for tack from the middle bars. 15. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 16. Continue tack with short Arc across the line with consistent speed. 17. Tack corner bars with the metal sheet similar. 18. Continue tack with short Arc across the edge with consistent speed. 19. Turn OFF welding machine. 20. Clean the finished weld (slag and spatter) using wiring brush. 21. Restore tools and equipment. 22. Clean the work area. 	
<p>Tools/equipment/materials required: Welding machine, Tri-square, Tongs, Chipping hammer, Wire brush, Electrode (Code: E-6012 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles.</p>	

Module 5: Perform Projects on Grill Works

22.5. Module- 5: Perform Projects on Grill Works							
	Description: This module deals with the skills and knowledge required to perform basic project works such as making window/balcony using flat/square bar, making window using z-bar/angle bar, and metal for door.				Hours		
	Module outcomes: After completion of this module, trainees will be able to- <ul style="list-style-type: none"> • Weld grill by flat/square bar for window/balcony. • Weld grill by z-bar/angle bar for window. • Prepare metal door. 				Th. 6.0	Pr. 53.0	Tot. 59.0
1.	Task: Weld grill by flat/square bar for window/balcony.		Terminal Performance Objective (TPO): Given: A fully equipped Workshop and drawing/specification of the project. What: Weld grill by flat/square bar for window/balcony. How well: <ul style="list-style-type: none"> • Tack weld is uniformed and round shaped. • No Arc crater seen. • Correct electrode is selected. • Negative and positive terminal of welding machine is fixed. • Ampere range is set • Metal cut is done as per drawing/ specifications provided. • Welding is done following measurement • Slag and spatter removed and PPE used. 	Th. 2.0	Pr. 15.0	Tot. 17.0	

<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect Drawing/diagram. 2. Collect tools, equipment and materials. 3. Collect raw materials (flat bar). 4. Prepare the work area. 5. Cut the raw materials as per measurement, drawing/diagram. 6. Straight the raw materials using anvil and Sledge hammer. 7. Place the metal piece in flat position. 8. Arrange metal pieces for grill out frame. 9. Fix negative and positive terminal in the welding machine/transformer. 10. Attach earth clamp to the metal piece. 11. Select the correct electrode. 12. Turn ON the welding machine/transformer. 13. Set amperage range. 14. Set electrode in welding holder. 15. Select the start point for tack welding. 16. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 17. Continue tack welding with short Arc across the line with consistent speed. 18. Tack weld the four corners of out frame keeping 90° angle. 19. Check length, width and diagonal measurements. 20. Mark the partition gaps as per drawing/specification. 21. Position the metal pieces in marked place 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • List tools and materials required to weld grill by flat/square bar for window/balcony. • Describe the procedure to estimate cost for welding grill by flat/square bar for window/balcony. • Explain the purpose of painting grill with red oxide. • Describe the procedure of painting grill with red oxide. • State the overall procedure to weld grill by flat/square bar for window/balcony stage by stage.
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	<p>22. Tack weld the partition without frame.</p> <p>23. Mark the lines for cut pieces as per drawing/ specification.</p> <p>24. Position the cut pieces in the marked point.</p> <p>25. Tack weld the cut pieces without frame and partitions.</p> <p>26. Check the measurements for out frame, partitions and cut pieces as per drawing/specification.</p> <p>27. Turn over the grill to the opposite side.</p> <p>28. Weld the four corners of the out frame.</p> <p>29. Weld the partitions without frame.</p> <p>30. Weld the cut pieces without frame and partitions.</p> <p>31. Straight the grill.</p> <p>32. Weld the clamp with the out frame as per drawing/specification.</p> <p>33. Turn OFF welding machine.</p> <p>34. Drill holes for screw on the out frame as per drawing/specification using drill machine.</p> <p>35. Clean the finish weld (slag and spatter).</p> <p>36. Paint the grill with red oxide.</p> <p>37. Restore tools and equipment.</p> <p>38. Clean the work area.</p>				
<p>Tools/equipment/materials required: Welding machine, drilling machine set, Hand grinding machine, Tri-square, Measuring tape, Scriber/Marking chalk, Cutter set, Anvil, Sledge Hammer, Chipping hammer, Ball pin hammer, Tongs, Wire brush, Electrode (Code: E-6012 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles</p>					
2.	<p>Task: Weld grill by z-bar/angle bar for window.</p>	<p>Terminal Performance Objective (TPO):</p>	Th. 2.0	Pr. 21.0	Tot. 23.0

		<p>Given: Workshop, drawing/specification.</p> <p>What: Weld grill by z-bar/angle bar for window.</p> <p>How well:</p> <ul style="list-style-type: none"> • Weld is uniformed and straight. • No undercut, overlap, Arc crater seen. • Correct electrode is selected. • Negative and positive terminal of welding machine is fixed. • Ampere range is set • Metal cut is done as per drawing/ specifications provided. • Welding is done following measurement • . • Slag and spatter removed and PPE used. 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect Drawing/diagram. 2. Collect tools, equipment and materials. 3. Collect raw materials (angle bar/z-bar). 4. Prepare the work area. 5. Cut the raw materials as per drawing/diagram and calculation. 6. Straight the raw material using anvil and sledge hammer. 7. Place the metal piece in flat position. 8. Arrange metal pieces for window out frame. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • List tools and materials required to weld grill by z-bar/angle bar for window. • Describe the procedure to estimate cost for welding grill by z-bar/angle bar for window. • State the overall procedure to weld grill by z-bar/angle bar for window stage by stage. 			

<ol style="list-style-type: none"> 9. Fix negative and positive terminal in the welding machine/transformer. 10. Attach earth clamp to the metal piece. 11. Select the correct electrode. 12. Turn ON the welding machine/transformer. 13. Set amperage range. 14. Set electrode in welding holder. 15. Select the start point for tack welding. 16. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 17. Continue tack welding with short Arc across the line with consistent speed. 18. Tack weld the four corners of the window out frame keeping 90° angle. 19. Mark the partition gaps as per drawing/specification. 20. Position the metal pieces in marked place on window out frame. 21. Tack weld the partition with window out frame. 22. Check length, width and diagonal measurements. 23. Weld the window out frame along with partition. 24. Tack the weld four corners of the window shutter (পালা) keeping 90° angle. 25. Check length, width and diagonal measurements. 26. Weld the window shutter (পালা). 27. Grind the window shutter (পালা). 28. Weld hinge with window out frame and shutter (পালা) as per specification. 	
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	<p>29. Fix locking handle with the window shutter (পাল্লা).</p> <p>30. Mark the partition gaps as per drawing/specification.</p> <p>31. Position the metal pieces in marked place.</p> <p>32. Tack weld partition with window shutter (পাল্লা).</p> <p>33. Fix stopper on the other side of the window shutter (পাল্লা).</p> <p>34. Weld the clamp with the window out frame.</p> <p>35. Turn OFF welding machine.</p> <p>36. Clean the finish weld (slag and spatter).</p> <p>37. Paint window frame and shutter (পাল্লা) with red oxide.</p> <p>38. Restore tools and equipment.</p> <p>39. Clean the work area</p>				
<p>Tools/equipment/materials required: Welding machine, Drilling machine set, Hand grinding machine, Tri-square, Measuring tape, Scriber/Marking chalk, Cutter set, Anvil, Sledge Hammer, Chipping hammer, Ball pin hammer, Tongs, Wire brush, Electrode (Code: E-6012 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles.</p>					
3.	<p>Task: Prepare metal door.</p>	<p>Terminal Performance Objective (TPO):</p> <p>Given: A fully equipped workshop and a drawing/ specification.</p> <p>What: Prepare metal door.</p> <p>How well:</p> <ul style="list-style-type: none"> • Weld is uniformed and straight. • No undercut, overlap, Arc crater seen. • Correct electrode is selected. 	Th. 2.0	Pr. 17.0	Tot. 19.0

		<ul style="list-style-type: none"> • Negative and positive terminal of welding machine is fixed. • Ampere range is set • Metal cut is done as per drawing/ specifications provided. • Welding is done following measurement • The prepared metal door is as per drawing/ specification. • Slag and spatter removed and PPE used while preparing metal door. 			
	<p>Steps:</p> <ol style="list-style-type: none"> 1. Collect Drawing/diagram. 2. Collect tools, equipment and materials. 3. Collect raw materials (angle bar, flat bar, plane sheet). 4. Prepare the work area. 5. Cut the raw materials as per drawing/diagram and calculation. 6. Straight the raw material using anvil and sledge hammer. 7. Place the metal piece in flat position. 8. Arrange metal pieces for door out frame. 9. Fix negative and positive terminal in the welding machine/transformer. 10. Attach earth clamp to the metal piece. 11. Select the correct electrode. 12. Turn ON the welding machine/transformer. 13. Set amperage range. 14. Set electrode in welding holder. 15. Select the start point for tack welding. 	<p>Enabling objectives:</p> <ul style="list-style-type: none"> • List tools and materials required to prepare metal door. • Describe the procedure to estimate cost for preparing metal door. • State the overall procedure to prepare metal door. 			

<ol style="list-style-type: none"> 16. Strike the electrode against the surface of the metal piece, pulling it back slightly when an electric Arc occurs. 17. Continue tack welding with short Arc across the line with consistent speed. 18. Tack weld the four corners of the door out frame keeping 90⁰ angle. 19. Check length, width and diagonal measurements. 20. Weld the outside of upper two corner of door out frame. 21. Tack weld the four corners of the door shutter (পাল্লা) keeping 90⁰ angle. 22. Check length, width and diagonal measurements. 23. Place the plane sheet on the door out frame. 24. Align the plane sheet with the edge of the out frame. 25. Tack the plane sheet with metal frame in flat position in two point. 26. Place the flat bars on the plane sheet as per drawing/specification. 27. Tack the flat bars to angle bars, flats bar to flat bars and flat bars to plane sheet. 28. Tack weld the angle bar to plane sheet keeping 4 inches distance. 29. Turn over the gate to the opposite side. 30. Weld four corners of the door shutter (পাল্লা) from outside. 31. Straight the door shutter (পাল্লা) frame using anvil and hammer. 32. Grind the door out frame and shutter (পাল্লা). 	
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<p>33. Weld hinge with door out frame and shutter (পাল্লা) as per specification.</p> <p>34. Fix hasp bolt with the door shutter (পাল্লা) as per drawing/specification.</p> <p>35. Weld clamp with the door out frame as per drawing/specification.</p> <p>36. Turn OFF welding machine.</p> <p>37. Clean the finish weld (slag and spatter).</p> <p>38. Paint door out frame and shutter (পাল্লা) with red oxide.</p> <p>39. Restore tools and equipment.</p> <p>40. Clean the work area.</p>	
<p>Tools/equipment/materials required: Welding machine, Drill machine set, Hand grinding machine, Tri-square, Measuring tape, Scriber/Marking chalk, Cutter set, Chisel, Snip, Anvil, Sledge Hammer, Chipping hammer, Ball pin hammer, Tongs, Wire brush, hasp bolt, Electrode (Code: E-6012 and Size: 3.2mm/ SWG – 10) and work piece materials.</p> <p>PPE: Safety shoes, apron, hand shield/helmet, hand gloves, safety goggles.</p>	

23. LIST OF TOOLS, EQUIPMENT AND MATERIALS:

LIST OF TOOLS AND EQUIPMENT:

S. No	Name of the items	Specification	QTY.	Unit
1.	Welding Machine (AC/DC)	250 Amp	05	Pcs
2.	Grinding Machine	4"	05	Pcs
3.	Electric Hand Drill		02	Pcs
4.	Power Saw Machine		01	Pcs
5.	Bench Grinding Machine		01	Pcs
6.	Bench Drill Machine		01	Pcs
7.	Disc Cutter	14"	02	Pcs
8.	Screwdriver Set		02	Pcs
9.	Neon tester		05	Pcs
10.	Combination pliers		02	Pcs
11.	Adjustable Wrench		02	Pcs
12.	Hacksaw		06	Pcs
13.	Chisel		06	Pcs
14.	Pipe/bench vice		01	Pcs
15.	Positioner		05	set
16.	C-clamp		10	set
17.	Tongs		10	Pcs
18.	File set		05	Pcs
19.	Sledge Hammer	8lbs	05	Pcs
20.	Ball pin hammer	1.5lbs	10	Pcs
21.	Chipping hammer		20	Pcs
22.	Anvil	18"	02	Pcs
23.	Rail line	36"	03	Pcs
24.	Measuring Tape	3m	24	Pcs
25.	Tri-Square	12"	12	Pcs
26.	Divider		05	Pcs
27.	Sheet Gauge		02	Pcs

S. No	Name of the items	Specification	QTY.	Unit
28.	Steel Rule	1m	20	Pcs
29.	Center Punch	6"	06	Pcs
30.	Hand Shield		20	Pcs
31.	Helmet		20	Pcs
32.	Cotton Hand Gloves		20	Pcs
33.	Leather Hand Gloves		20	Pcs
34.	Safety Goggles		20	Pcs
35.	Leather Cap		20	Pcs
36.	Leather Arm Guard		20	Pair

LIST OF TRAINING MATERIALS:

SI No	Name of the items	Specification	QTY.	Unit
1.	Cutting Discs	14"	24	Pcs
2.	Electrode	(Code: E-6013 and Size: 3.2mm/ SWG – 10)	50	Kg
3.	Electrode	(Code: E-6012 and Size: 3.2mm/ SWG – 10)	50	Kg
4.	Emery Paper		60	Pcs
5.	Grinding Discs		50	Pcs
6.	Metal flat bar		200	Kg
7.	Metal sheet		100	Sq. ft.
8.	Red Oxide Paint		05	Liter//Kg
9.	Round bar		100	Rft.
10.	Wire brush		40	Pcs
11.	Cutter Set		06	Pcs
12.	Snip		06	Pcs
13.	Painting Brush	1.5"	10	Pcs
14.	Scriber/Marking Chalk		05	Pcs
15.	Drill Bit Set		02	Pcs
16.	Dark Glass (Hand Shield/Helmet)		60	Pcs

SI No	Name of the items	Specification	QTY.	Unit
17.	Clear Glass (Hand Shield/Helmet)		200	Pcs
18.	Safety Shoes		20	Pair
19.	Apron		20	Pcs

24. PHYSICAL FACILITIES FOR 20 TRAINEES:

SI No	Name of the items	Specification	QTY.	Unit
1.	Working Place/Practical Room	40' X 30'	1	Room
2.	Stool	Plastic (RFL)	20	Pcs
3.	Instructor Chair Arm Less	Size: 18" X 16" X 36"	2	Pcs
4.	Working Table	Size: 8' X 3' X 3'	5	Pcs
5.	Class Room Table	Size: 24" X 30" X 36"	1	Pcs
6.	Display Board	4' X8' X3/4", Surface Cover With White Formica, Border bracing with 3/4 " Aluminum Angle	1	Pcs
7.	White Board	6'X4'X3/4" Surface Cover With White Formica, Border bracing with 3/4 " Aluminum Angle	1	Pcs
8.	Steel Rack	44" X 72" X 15" 20-22 SWG	2	Pcs
9.	First Aid Box with accessories		1	
10.	Steel Almirah	Standard Size , 20-22 SWG	2	Pcs
11.	White Board Marker	Red leaf	5	Doz
12.	Water Filter	40 Ltr	1	Pcs
13.	Fire extinguisher	ABC	2	cylinder

25. LIST OF TOOLS IN THE HAND TOOL BOX:

S. No	Name of the items	Specification	QTY.	Unit
1.	Ball Pin Hammer	½ Pound	1	Pc

2.	Center Punch	6"	1	Pc
3.	Chisel		1	Pc
4.	Combination pliers		1	Pc
5.	Cutter Set		1	Pc
6.	Cutting Pliers	8 inches	1	Pc
7.	Flat Chisel	10"- 12"	1	Pc
8.	Flat Screw Driver	8 inches	1	Pc
9.	Hacksaw		1	Pc
10.	Lock with Keys	3"	1	Pc
11.	Long Nose Pliers	8 inches	1	Pc
12.	Neon tester		1	Pc
13.	Scriber/Marking Chalk		1	Pcs/box
14.	Slide Wrench	8"- 12"	1	Pc
15.	Star Screw Driver	8 inches	1	Pc
16.	Steel Measuring Tape	5 meters	1	Pc
17.	Steel Rule	1m	1	Pc
18.	Try Square	12"	1	Pc

26. SUGGESTED REFERENCE BOOKS:

- Bangladesh Oxygen Limited (n.d.), Electrode Guide No.1 in Welding, Printed by Pioneer Printing Press Ltd., Bangladesh
- The ABC's of Arc Welding and Inspection published by KOBE Steel Ltd, 2015, Japan.
- Parmar, R. S., *Welding Engineering and Technology*, Khanna Publishers (Latest Edition).
- AWS S1.1/D1.1 M: 2004, An American National Standards, American Welding Society.
- Jeffus, L., *Welding Principles and Applications*, Delmar Sengage Learning (Latest Edition).

27. CURRICULUM TERMS AND DEFINITION:

Competency	Competency means a cluster of related abilities, commitments, knowledge, and skills that enable a trainees or person to act effectively in a job.
Curriculum Guide	A curriculum guide is a detail resource for trainers/instructors to conduct training programs effectively. The guide intends to add the trainers/instructors in developing lesson plan, handouts/learning materials, training manuals, and

	evaluation criteria etc, which are basic elements in the teaching learning process.
Curriculum	A plan for providing sets of learning opportunity to achieve broad goal and related specific objectives for the people by a single school center.
DACUM/RJA	Developing A Curriculum / Rapid Job Analysis. DACUM/RJA is a technique that is used to identify the competencies relevant to a particular occupation. Then the competencies of the DACUM/RJA have been formulated in details to build a curriculum guideline
Duty	Duty is an arbitrary clustering of related tasks in to broad functional area or general area of responsibility of trainees.
Enabling Objective	A statement expressing a knowledge, skills or attitudes those will enable the trainee to accomplish a terminal performance objective.
Instructional Guide	Instructional guide is a well-planned and structured document for the instructor to deliver effective instruction so that trainees can attain learning objectives as per training standards.
Module	A module is defined as a specific learning material. Modules are essentially self-contained. Self-instructional packages, with learning paced by each learner according to his/her individual ability and needs. A module covers either a single element of subject matter content or a group of content elements forming a discrete unit of subject matter or area of skills.
Occupational Analysis	Occupational analysis is a process used to identify the duties and tasks those are important to workers in any given occupation. A number of alternative and acceptable approaches to occupational analysis are available.
Program guide	A program guide is a comprehensive resource for trainers/instructors, planners, and top-level management for planning and implementation of any training programs.
Program Objectives	The objectives are set in a broad way to target to achieve mastery learning of the complete occupation.
Skill	The ability to perform on occupational task with the degree of proficiency required for a given occupation
Step	The smallest discrete or observable aspect of a task.
Task Analysis	Task analysis is the process of identifying and writing down the specific skills, knowledge and attitudes that distinguish someone who performs a task competently from someone who cannot perform the task at all.
Task	A unit of work complete in itself that forms a logical part of an occupation. It can be broken down into discrete steps.
Terminal Performance Objective	The objectives set to attain at the end of the training completion. It includes condition, unit of work and standard of teaching and learning.

28. CURRICULUM DEVELOPMENT TEAM:

SL #	Name	Designation	Organization	Contact Number
1.	Md. Mostafa Kamal	Workshop Super (Mech)	Dhaka Polytechnic Institute	01552360563 Engrkamal6059@gmail.com

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4.	Md. Jamir Uddin (Rony)	Supervisor (Welding)	Ashique Engineering Works	01819485055
5.	Meer Esrar Ahammed	Project Engineer (Civil Construction)	Petronize Housing Ltd.	01717594198
6.	Al-Halal Md. Islamul Hoque	Ass. Engineer (Civil Construction)	Engineer's Foundation & Consultant	01751159532 alhalalarc@gmail.com

Overall Supervision: Md. Anisuzzaman

Workshop Facilitator(s): Md. Anisuzzaman, Anoj Bhattarai and Akim Shrestha

Record and Documentation: Anoj Bhattarai and Akim Shrestha

29. REFERENCES (FOR DEVELOPING CURRICULUMS)

- Skills and Employment Programme-Bangladesh (SEP-B) (2015, May). Rapid Job Analysis of Welder (Grill Maker). Dhaka Bangladesh.
- Bangladesh Technical Education Board (n.d.) *National Competency Standards for Welder*. National Skills Certificate-I in Welder (Light Engineering Sector).
- UCEP-Bangladesh, *Curriculum on Shielded Metal Arc Welding (SMAW)*, Dhaka, Bangladesh.
- Bangladesh Oxygen Limited (n.d.), *Electrode Guide No.1 in Welding*, Printed by Pioneer Printing Press Ltd., Bangladesh

30. LINKAGES OF SUDOKKHO CURRICULUM WITH BTEB COMPETENCY STANDARDS:

S.N.	SEP-B Training Module	BTEB Competency Standards
1.	Practice Occupational Health and Safety (OHS) Procedure	GN100312A : Practice workplace cleanliness GN100412A: Practice occupational health and safety (OHS) procedures
2.	Apply Fundamental Skills of Welding Works.	LEG 100212A: Interpret drawing and specifications in Light Engineering. LEG 100312A: Perform measurement and calculation in Light Engineering.

S.N.	SEP-B Training Module	BTEB Competency Standards
		LEG 100412A: Use hand tools and power tools in Light Engineering
3.	Prepare Materials for Welding	LEGWEL100112A: Prepare steel plate for Arc Welding. LEGWEL200512A: Prepare edge of work piece.
4.	Weld Metal by Manual Arc Welding Process	LEGWEL100212A: Weld Steel Plate by Arc Welding.
5.	Perform Projects on Grill Works	LEG 100212A: Interpret drawing and specifications in Light Engineering. LEG 100312A: Perform measurement and calculation in Light Engineering. LEG 100412A: Use hand tools and power tools in Light Engineering LEGWEL100112A: Prepare steel plate for Arc Welding. LEGWEL200512A: Prepare edge of work piece. LEGWEL100212A: Weld Steel Plate by Arc Welding.

31. SPECIAL NOTE FOR TRAINING PROVIDERS:

Since the technology is moving fast, if there will have any new demand/skills beyond the curriculum guide, please send the comments and suggestions to the address given in the curriculum. The project believes that the development has no boundaries.

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