

<b>Module M 03 Arc-Welding and Gas Welding</b>			<b>128 h</b>
<b>Evaluation criteria</b> <b>Trainees are able to produce welds by oxy-acetylene and manual electric arc welding according to technical drawings - Trainees adhere to safety regulations</b>			
Capacity 1: <b>Classifying welding methods according to material used and welding positions</b> Capacity 2: <b>Determining the equipment required for oxyacetylene welding</b> Capacity 6: <b>Identifying sources of dangers in oxyacetylene welding and observing the safety precautions</b>	Content 1: <b>Welding processes according to international standards</b>  Content 2: <b>Oxygen and acetylene cylinders and its construction; welding torches, its construction and use</b>  Content 6: <b>International standards on safety regulations in gas welding</b>		<b>32 h</b>
<b>Technology</b>	<b>Technical Communication</b>	<b>Technical Mathematics</b>	Week
Defining Welding. Considering welding as one of the permanent joints. Classifying Welding according to the material to be welded and the type of production. (manual, semi-automatic and automatic) Differentiating between soldering, adhesive bonding and welding. Describing the equipment required for oxy-acetylene welding. Describing the standards of the oxyacetylene welding equipment (colour code, threads, pressure gauges..) Explaining the construction and function of the oxyacetylene gas welding torch. Recognising sources of accidents and explaining the safety rules for oxyacetylene welding.	Drawing different types of seams. (flare-V groove-, butt-, V-groove-, Y- butt-, double-V-, fillet weld) Distinguishing between the different welding positions, using the standard symbols.	Calculating the consumption of gas for welding work (oxygen and acetylene)	<b>17</b>
<b>Computer Applications</b>	<b>Workshop Practice</b>	<b>Laboratory Exercises</b>	
Drafting of welded constructions, modelling in 3D with the inclusion of welded seams and designing the technical drawing (3-views) with the standardized weld symbols and welding positions.	Practical implementation of safety procedures in oxyacetylene welding including the use of personal protection equipment . Setting up a gas-welding workstation. Work instruction for appropriate connections and equipment regulations, settings and adjustments, observing the correct gas pressures and flame. Maintaining and caring for the equipment.	Adjusting of different types of flames: neutral flame, excess of oxygen and excess of acetylene and determining the temperatures of the flame. Determining the optimum distance of flame and work. Exercising the appropriate sequence of steps of igniting and extinguishing of the flame.	

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Capacity 3: <b>Identifying the symbols for the types of welds and welding positions in technical drawings</b> Capacity 2: <b>Making sketches and technical drawings of welded construction using the standardised symbols</b> Capacity 7: <b>Producing of welds in the leftward welding method, thickness of steel sheets 1...3mm; butt welds and fillet welds in flat welding positions</b>	Content 3: <b>ISO standards for technical drawings</b>  Content 2: <b>Drawings of welded constructions according to ISO</b>  Content 7: <b>Welding practice; defects in welding and inspection methods</b>		<b>32 h</b>
<b>Technology</b>	<b>Technical Communication</b>	<b>Technical Mathematics</b>	<b>Semana</b>
Explaining the gas properties. Explaining the construction and the function of central gas supply units. Distinguishing between rightward-welding and leftward welding. Describing the principle of oxyacetylene flame-cutting and the equipment required.	Creating data presenting the different welding processes (DVD, movies, etc) demonstrating the risks and dangers in welding.  Elaborating oxyacetylene welding related drawings	Identifying the calorific capacities of the welding gas in cylinders. The ideal gas law. Calculating the gas pressure for constant temperature and constant volume	<b>18</b>
<b>Computer Applications</b>	<b>Workshop Practice</b>	<b>Laboratory Exercises</b>	
Drafting of welded constructions, modeling in 3D with the inclusion of welded seams and designing the technical drawing (3-views) with the standardized weld symbols and welding positions.	Practicing leftward welding for steel sheets of 1mm – 3mm thickness: - Build-up welding - Flare – V welding - I – seam weld - Fillet weld  Welding with neutral flame. Maintaining and caring for the equipment	Measuring the dimensions of the welds. Identifying and analyzing typical defects in oxyacetylene welding.	

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Capacity 8: <b>Explaining the working principle of manual electric arc welding</b> Capacity 9: <b>Classifying welding electrodes according to the required job</b> Capacity 10: <b>Identifying the equipment required for electric arc welding</b> Capacity 12: <b>Maintaining the safety precautions in electric arc-welding, care and maintenance of the equipment</b>	Content 8: <b>AC- welding / DC welding; Properties of the electric arc</b> Content 9: <b>ISO standards for welding electrodes; Construction of the welding electrode</b> Content 10: <b>Welding transformer, welding rectifier and welding generator</b> Content 12: <b>ISO standards on safety in electric arc welding</b>		32 h
<b>Technology</b>	<b>Technical Communication</b>	<b>Technical Mathematics</b>	<b>Semana</b>
Describing the principle of manual electric arc welding. Describing the influence of arc length on the welding process. Differentiating between AC / DC – welding. Explaining the welding equipment and special tools. Explaining the preparation of the joint prior to welding.	Elaborating electric arc welding related drawings and using the standardized symbols as per ISO.	Calculating the consumption of electrodes for given welding jobs.	
<b>Computer Applications</b>	<b>Workshop Practice</b>	<b>Laboratory Exercises</b>	<b>19</b>
Drafting of welded constructions, modeling in 3D with the inclusion of welded seams and designing the technical drawing (3-views) with the standardized weld symbols and welding positions.	Describing the safety precautions in electric arc welding. Welding of beads on steel plates. (build-up welds; t=2–3mm; I = 80A) Practicing fillet welds horizontal position. (t=2-3mm) Practicing fillet welds vertical position; downward; (t =2 -3mm) Practicing butt welds horizontal position; (t = 2 - 3mm)	Adjusting the welding current according to sheet thickness and electrode diameter. Analyzing the results of the welding jobs.	

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Capacity 11: <b>Producing of build-up welds, butt welds and fillet welds in horizontal position and downward position; material thickness 2..3 mm</b>	Content 11: <b>Welding practice</b>		<b>32 h</b>
Capacity 9: <b>Classifying welding electrodes according to the required job</b>	Content 9: <b>ISO standards for welding electrodes; Construction of the welding electrode</b>		
Capacity 10: <b>Identifying the equipment required for electric arc welding</b>	Content 10: <b>Welding transformer, welding rectifier and welding generator</b>		
Capacity 12: <b>Maintaining the safety precautions in electric arc-welding, care and maintenance of the equipment</b>	Content 12: <b>ISO standards on safety in electric arc welding</b>		
<b>Technology</b>	<b>Technical Communication</b>	<b>Technical Mathematics</b>	<b>Semana</b>
Describing construction and composition of the welding electrode. Explaining the influence and the function of the electrode coating. Explaining the ISO standards on welding electrodes. Selecting the suitable electrodes for different types of steel with the help of the technical tables.	Elaborating a production plan for a welding job, considering preparation of the joint prior to welding, the sequence of operations, the welding positions and the types of electrodes used.	Calculating the cost of welding job including labour cost, material cost, depreciation and cost of energy.	<b>20</b>
<b>Computer Applications</b>	<b>Workshop Practice</b>	<b>Laboratory Exercises</b>	
Drafting of welded constructions, modeling in 3D with the inclusion of welded seams and designing the technical drawing (3-views) with the standardized weld symbols and welding positions.	Describing the safety precautions in electric arc welding. Practicing fillet welds horizontal position. (t=2-3mm) Practicing fillet welds vertical position; downward; (t =2 -3mm) Practicing butt welds horizontal position; (t = 2 - 3mm). Self-assessing the welding jobs	Testing of welded joints. Identifying and analyzing typical defects in electric-arc welding	