



<b>PROA PROFESSIONAL PROFILE 1: MANUFACTURING AND ASSEMBLY OF INDUSTRIAL PIPE FACILITIES</b>	
<b>Definition:</b>	Perform design, assembly and installation of pipes, fittings and incorporated items, as well as basic joining operations following established procedures, interpreting drawings and technical documents, in line with quality, occupational safety and environmental standards.
<b>N° ECVET Credits:</b>	
<b>EQF Level:</b>	
<b>UNITS OF PPP1:</b>	<ol style="list-style-type: none"><li><b>1. DRAW AND MACHINE PIPES</b><ul style="list-style-type: none"><li>• Interpretation of drawing in Pipe manufacturing</li><li>• Organization of workplace.</li><li>• Outlining and cutting pipes</li><li>• Pipe machining</li></ul></li> <li><b>2. PIPEBENDING AND ASSEMBLY</b><ul style="list-style-type: none"><li>• Collecting technical documentation</li><li>• Organization of workplace</li><li>• Pipe forming and assembly</li><li>• Assembly of pipes Flanges and branches</li><li>• Treatment and finishing pipes</li></ul></li> <li><b>3. ASSEMBLY OF PIPE INSTALLATIONS</b><ul style="list-style-type: none"><li>• Preparation of means for the assembly of pipe installation</li><li>• Preparation of templates and drawings for the pipe assembly</li><li>• Installation of supports for pipe assembly / positioning and fastening</li><li>• Making simple welds</li></ul></li></ol>



PROA PROFESSIONAL PROFILE			
EQF LEVEL:		PARTNER:	COUNTRY: SPAIN
NAME OF THE LEARNING OUTCOME	MANUFACTURING AND ASSEMBLY OF INDUSTRIAL PIPE FACILITIES		
DEFINITION OF LEARNING OUTCOME	Perform design, assembly and installation of pipes, fittings and incorporated items, as well as basic joining operations following established procedures, interpreting drawings and technical documents, in line with quality, occupational safety and environmental standards.		
TITLE OF UNIT 1.: DRAW AND MACHINE PIPES (150 h.)			
KNOWLEDGE		SKILLS	COMPETENCE
<b>INTERPRETATION OF DRAWINGS IN PIPE MANUFACTURING</b> <ul style="list-style-type: none"> <li>Have knowledge of the geometry applied to pipe routing. (Definition of straight lines, angles, triangles, quadrangles and flat closed curves, perpendicular lines, oblique and parallel lines, triangles, quadrilaterals, circumferences, spirals: their application oval, egg-shaped, ellipse, parabola: application on piping).</li> <li>Describe graphical representation systems used in the manufacture of pipes (Relationship between views of an object, possible views and necessary and sufficient views, most common views used in drawings of pipes, parts sketching, classification of representation systems, orthographic, isometric and schematic view)</li> <li>Elicit standards and symbols used in</li> </ul>		<b>INTERPRETATION OF DRAWINGS IN PIPE MANUFACTURING</b> <ul style="list-style-type: none"> <li>Synthesise technical graphical information used in the manufacture of pipes.</li> <li>Understand the various representation systems employed in drawings of pipelines with the information needed in a each case.</li> <li>Interpret the views, sections and details of the orthogonal, American and European, isometric and schematic drawings.</li> <li>Interpret self-control sheets and understand the measurements to control.</li> <li>Assess the time allocated for working out the laying of different lengths of pipe.</li> </ul>	<b>INTERPRETATION OF DRAWINGS IN PIPE MANUFACTURING</b> <ul style="list-style-type: none"> <li>Obtain the information necessary to operate and handle machine and tools to interpret (graphical, technical, or other) production engineering documentation.</li> <li>Get technical information for the lay-out and machining process by interpreting orthogonal (American, European), isometric or schematic pipe drawings.</li> <li>Adjust the specifications relating to machines and tools to the indications given in the technical documentation.</li> <li>Establish a work schedule setting durations and methods to use in laying pipelines.</li> <li>Obtain operations and self-control parameters for laying and machining pipelines from technical documentation.</li> </ul>

<p>manufacturing drawings of pipes. (Types of lines used in drawings, section and detail view, dimensioning in drawing, symbols used in drawings, most common welding symbols)</p> <ul style="list-style-type: none"> <li>• Interpretation of drawings of pipe lay-out. (Graphical representation of profiles and measurements of sections, flanges, diaphragms, branches, connections, expansion joints, expansion pipes and stop cocks in orthogonal systems, and of brackets used in piping. Representation of drilled through and threaded holes, differences, equivalences and representation of most common types of threads: metric, Whitworth and gas - Calculation of clamps and straps, scales in drawings)</li> </ul>		
<p><b>ORGANIZATION OF WORK PLACE</b></p> <ul style="list-style-type: none"> <li>• Be able to correctly select the equipment and tools for scribing on pipelines, (Drawing and scribing devices, construction of templates and scribing tools, marks for identifying elements.)</li> </ul>	<p><b>ORGANIZATION OF WORK PLACE</b></p> <ul style="list-style-type: none"> <li>• Classify the machines and lay-out equipment, relating the material (pipes, flanges, elbow pipes among others) and pipe routing process.</li> <li>• Analyse the material according to size, thickness and quality according to work instructions.</li> <li>• Classify the equipment, tools and means required to manufacture different pipe lengths.</li> <li>• Specify tasks specific for each machine or equipment.</li> <li>• Check condition of tools and machines performing preventive maintenance.</li> </ul>	<p><b>ORGANIZATION OF WORK PLACE</b></p> <ul style="list-style-type: none"> <li>• Arrange and check availability of all items and materials necessary for pipe machining.</li> <li>• Check all necessary personal protective equipment and availability.</li> <li>• Arrange machinery and tools according to the specifications in the technical documentation.</li> <li>• Prepare the machines and tools according to the manufacturer's instructions and maintenance requirements.</li> <li>• Apply risk prevention systems regarding lifting and transport, using the most optimum technique for collecting the necessary materials.</li> <li>• Secure proper operation of equipment or machinery used in laying and machining of</li> </ul>

		<p>pipelines by adhering to the instructions in the maintenance scheme. Prepare the required means and equipment</p>
<p><b>OUTLINING AND CUTTING PIPES</b></p> <ul style="list-style-type: none"> <li>• Be familiar with the outlines of geometric shapes and intersections of pipes (angles, triangles and quadrangles, plane figures from drawings or sketches, cylinder and cone distances, cylindrical, design of round surfaces. Design of round elbow pipes of one, two, three or more sections, branches with the same and different diameter.)</li> <li>• Have knowledge of materials to be used in industrial piping. (Types of material used in the manufacturing of pipes and standard pipes)</li> <li>• Know the measurements for scribing on industrial piping. (Dimensional control, tolerances, causes of deformations and corrective procedures, safety in handling and maintenance of drawing and scribing tools.)</li> </ul>	<p><b>OUTLINING AND CUTTING PIPES</b></p> <ul style="list-style-type: none"> <li>• Arrange the layout drawing of various geometric shapes and intersections in tubes to define its forms.</li> <li>• Explain the defining characteristics of two-dimensional shapes and arrangements of intersections.</li> <li>• Correctly interpret graphics procedures that allow obtaining two-dimensional shapes and arrangements, taking account the constructive process variables.</li> <li>• Analyse the standardized profiles in the charts: dimensions, characteristics and weight.</li> <li>• Classify laying equipment common in representation of shapes and in obtaining intersections.</li> <li>• Relate the plastic deformations that may occur during the construction process using intersections.</li> </ul>	<p><b>OUTLINING AND CUTTING PIPES</b></p> <ul style="list-style-type: none"> <li>• Perform the layout for cutting and subsequent bending taking into account the space necessary to position the clamps at the start of the bending process.</li> <li>• Calculate the length of the runs to meet the specifications stated in the technical documents.</li> <li>• Perform the outline considering the maximum use of materials.</li> <li>• Arrange the part by marking and labelling.</li> <li>• Mark using a centre punch following the outlining or reference points.</li> <li>• Use anticipated cutting techniques following the provided work instructions.</li> <li>• Use the cutting technique with control of parameters such as feed, depth, speed, pressure, consumption, gas type, distance from the nozzle, among others, as well as specific material properties (thickness, diameter, material type or others).</li> </ul>
<p><b>PIPE MACHINING</b></p> <ul style="list-style-type: none"> <li>• Have knowledge of the pipe cutting process. (Safety in pipe cutting, flame cutting, plasma arc cutting, mechanical cutting, cutting speeds in relation to the material and thickness of the workpieces, cutting techniques, with flame and plasma arc cutting, defectology in cutting processes, variables to consider in flame-</li> </ul>	<p><b>PIPE MACHINING</b></p> <ul style="list-style-type: none"> <li>• Classify the machines and cutting and machining equipment relating material (pipes, flanges, elbow pipes amongst others) with the cutting and machining process.</li> <li>• Assess the material in terms of dimensions, thickness and quality as per work instructions.</li> <li>• Explain the equipment, tools and supplies necessary to manufacture different lengths of</li> </ul>	<p><b>PIPE MACHINING</b></p> <ul style="list-style-type: none"> <li>• Prepare the edges according to requirements for subsequent assembly or welding.</li> <li>• Perform machining operations taking into account the item or equipment to be joined.</li> <li>• Chamfer the edges considering the dimensions required to perform subsequent welding.</li> <li>• Prepare the threaded parts taking into account</li> </ul>

<p>cutting and plasma arc welding processes, safety in flame cutting and in plasma arc welding:</p> <ul style="list-style-type: none"> <li>• Have knowledge of pipe machining. (Machining operations for industrial pipes, tools, machinery and equipment used in machining pipes, operating, characteristics and preventive maintenance, operation and parameter setting, operational techniques used in machining processes, defects, techniques and items used for protection, risk assessment, environmental management, waste management, legal and regulatory aspects)</li> <li>• Understand quality standards in cutting and machining of industrial pipelines. (Specifications for quality control, measuring and checking means, dimensional control of the finished product, checking the tolerance fit.)</li> <li>• Have knowledge of occupational risk prevention and environmental standards applicable to pipe cutting and machining processes:</li> </ul>	<p>pipe.</p> <ul style="list-style-type: none"> <li>• Analyse tasks specific for each machine or equipment.</li> <li>• Assess the condition of tools and machines performing preventive maintenance.</li> <li>• Identify cutting and machining equipment (manual and half-automatic) meeting the required specifications.</li> <li>• Sort the components of the different cutting and machining equipment, and the function of each and the interrelationship in the assembly.</li> <li>• Establish a relationship between cutting equipment, procedure parameters and the desired results.</li> <li>• Differentiate the cutting and machining procedures, establishing typical "defectology".</li> </ul>	<p>parameters of length, angle, diameter, pitch and depth.</p> <ul style="list-style-type: none"> <li>• Perform extrusion and flared connections following parameters required for welding.</li> <li>• Make the beaded edges respecting the parameters specified in the procedure.</li> <li>• Perform the machining processes in compliance with equipment usage and safety standards.</li> </ul>
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TITLE OF UNIT 2.: PIPE BENDING AND ASSEMBLY (160 hrs)		
KNOWLEDGE	SKILLS	COMPETENCE
<p><b>COLLECTING TECHNICAL DOCUMENTATION</b></p> <ul style="list-style-type: none"> <li>• Have knowledge of the geometry applied to pipe routing. (Definition of straight lines, angles, triangles, quadrangles and flat closed curves, perpendicular lines, oblique and parallel lines, triangles, quadrilaterals, circumferences, spirals: their application oval, egg-shaped, ellipse, parabola: application on piping).</li> <li>• Describe graphical representation systems used in the manufacture of pipes (Relationship between views of an object, possible views and necessary and sufficient views, most common views used in drawings of pipes, parts sketching, classification of representation systems, orthographic, isometric and schematic view)</li> <li>• Elicit standards and symbols used in manufacturing drawings of pipes. (Types of lines used in drawings, section and detail view, dimensioning in drawing, symbols used in drawings, most common welding symbols)</li> <li>• Interpretation of drawings of pipe lay-out. (Graphical representation of profiles and measurements of sections, flanges, diaphragms, branches, connections, expansion joints, expansion pipes and stop</li> </ul>	<p><b>COLLECTING TECHNICAL DOCUMENTATION</b></p> <ul style="list-style-type: none"> <li>• Analyse technical graphical information used in the manufacture of pipes.</li> <li>• Link the different representation systems employed in drawings of pipes with the information needed in each case.</li> <li>• Interpret the views, sections and details of the orthogonal, American and European, isometric and schematic drawings.</li> <li>• Interpret self-control sheets and understand the measurements to control.</li> <li>• Estimate the time needed for the different runs of pipelines.</li> </ul>	<p><b>COLLECTING TECHNICAL DOCUMENTATION</b></p> <ul style="list-style-type: none"> <li>• Determine the information required for operation of machines and tools in the production engineering documentation (graphical, technical, or other).</li> <li>• Use technical information for the forming and assembly process by interpreting orthogonal (American, European), isometric or schematic pipe drawings.</li> <li>• Collect technical documentation to define operations and self-control parameters for pipe forming and assembly.</li> <li>• Generate documentation with the obtained information, and classify and organise it.</li> </ul>

<p>cocks in orthogonal systems, and of brackets used in piping. Representation of drilled through and threaded holes, differences, equivalences and representation of most common types of threads: metric, Whitworth and gas - Calculation of clamps and straps, scales in drawings)</p>		
<p><b>ORGANIZATION OF WORK PLACE</b></p> <ul style="list-style-type: none"> <li>• Select and check availability of material and items required for forming and assembling the pipelines using the specifications relative to materials and services given in drawings, isometric drawings or the material list.</li> <li>• Elicit all necessary personal protective equipment required for forming operations and assembly of the pipelines.</li> <li>• Mention selected machines and tools according to the specifications of the technical documentation.</li> <li>• Select the machines and tools according to the manufacturer's instructions and maintenance requirements.</li> <li>• List the occupational risk prevention systems, following the instructions of the safety scheme established for forming and assembly.</li> <li>• Revise operation of equipment or machinery used in forming and assembly of pipelines, in compliance with the maintenance plan.</li> <li>• Elicit and locate the resources and equipment required for use.</li> </ul>	<p><b>ORGANIZATION OF WORK PLACE</b></p> <ul style="list-style-type: none"> <li>• Define pipe forming and bending machinery, meeting the required technical specifications.</li> <li>• Classify the material according to dimensions, thickness and quality as per work instructions.</li> <li>• Explain the equipment, tools and supplies necessary to manufacture different lengths of pipe.</li> <li>• Define the tasks specific for each machine or equipment.</li> <li>• Assess the operation of the machines performing preventive maintenance.</li> </ul>	<p><b>ORGANISATION OF WORK PLACE</b></p> <ul style="list-style-type: none"> <li>• Organise and check availability of material and items required for forming and assembling the pipelines using the specifications relative to materials and services given in drawings, isometric drawings or the material list.</li> <li>• Collect and select all necessary personal protective equipment required for forming operations and assembly of the pipelines.</li> <li>• Prepare the selected machines and tools according to the specifications of the technical documentation.</li> <li>• Prepare the machines and tools according to the manufacturer's instructions and maintenance requirements.</li> <li>• Apply the occupational risk prevention systems, following the instructions of the safety scheme established for forming and assembly.</li> <li>• Establish the operation of equipment or machinery used in forming and assembly of pipelines, in compliance with the maintenance plan.</li> <li>• Prepare and locate the resources and equipment required for use.</li> </ul>

<b>PIPE FORMING AND ASSEMBLY</b>	<b>ORGANIZATION OF WORK PLACE</b>	<b>ORGANISATION OF WORK PLACE</b>
<ul style="list-style-type: none"> <li>• Have knowledge of the exploded views for assembly of pipelines. (Functionality of assembly, used symbols and technical specifications, exploded views, views, sections and details according to the type of installation, assembly drawings, making sketches of part sections of pipelines.)</li> <li>• Know how to draw up templates and intersections of pipelines (marks for identification of items, techniques for drawing up templates, working out of cylindrical surfaces, drawing of elbow pipes, drawing and working out of branches with the same or different diameter, working out development of concentric and eccentric reducers.)</li> <li>• Differentiate the pipe assembly processes. (Phases of the pipe assembly process:, materials used in the manufacture of pipes, standardised tubes, ranges of diameters and wall thicknesses, elbow pipes, Ts and standardised reducers, flange types, equipment, machines and tools used in pipe assembly, preventive maintenance of equipment, fittings, valves and small equipment required for assembly, scaffolding needs, protection techniques and elements. Risk assessment and environmental management)</li> </ul>	<ul style="list-style-type: none"> <li>• Define pipe forming and bending machinery, meeting the required technical specifications.</li> <li>• Classify the material according to dimensions, thickness and quality as per work instructions.</li> <li>• Explain the equipment, tools and supplies necessary to manufacture different lengths of pipe.</li> <li>• Define the tasks specific for each machine or equipment.</li> <li>• Assess the operation of the machines performing preventive maintenance.</li> </ul>	<ul style="list-style-type: none"> <li>• Organise and check availability of material and items required for forming and assembling the pipelines using the specifications relative to materials and services given in drawings, isometric drawings or the material list.</li> <li>• Collect and select all necessary personal protective equipment required for forming operations and assembly of the pipelines.</li> <li>• Prepare the selected machines and tools according to the specifications of the technical documentation.</li> <li>• Prepare the machines and tools according to the manufacturer's instructions and maintenance requirements.</li> <li>• Apply the occupational risk prevention systems, following the instructions of the safety scheme established for forming and assembly.</li> <li>• Establish the operation of equipment or machinery used in forming and assembly of pipelines, in compliance with the maintenance plan.</li> <li>• Prepare and locate the resources and equipment required for use.</li> </ul>



PIPE FORMING AND ASSEMBLY	PIPE FORMING AND ASSEMBLY	PIPE FORMING AND ASSEMBLY
<ul style="list-style-type: none"> <li>• Have knowledge of the exploded views for assembly of pipelines. (Functionality of assembly, used symbols and technical specifications, exploded views, views, sections and details according to the type of installation, assembly drawings, making sketches of part sections of pipelines.)</li> <li>• Know how to draw up templates and intersections of pipelines (marks for identification of items, techniques for drawing up templates, working out of cylindrical surfaces, drawing of elbow pipes, drawing and working out of branches with the same or different diameter, working out development of concentric and eccentric reducers.)</li> <li>• Differentiate the pipe assembly processes. (Phases of the pipe assembly process:, materials used in the manufacture of pipes, standardised tubes, ranges of diameters and wall thicknesses, elbow pipes, Ts and standardised reducers, flange types, equipment, machines and tools used in pipe assembly, preventive maintenance of equipment, fittings, valves and small equipment required for assembly, scaffolding needs, protection techniques and elements. Risk assessment and environmental management)</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Assess the operation with equipment and forming and bending means fulfilling the technical specifications.</li> <li>• Relate the several forming and bending equipment with materials and required forms and finish.</li> <li>• Differentiate the equipment and methods used forming elements, establish their relationship and the expected performance.</li> <li>• Describe the deformations caused by applying heat to the parts, establishing causes and work out a practical demonstration.</li> <li>• Relate the different forming and bending procedures and the expected results.</li> <li>• Analyse the health and safety measures required during the use of the means and equipment used in forming.</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust the matrix, radius, feed, mandrel, straight sections, bending length, and turns spiral or turns and bend angles according to the construction specifications.</li> <li>• Prepare the machines with the required tools to perform bending without deformations (wrinkles, oval-shaped, cracks, or others).</li> <li>• Obtain the bending radius without deformations using hot bending and selecting the nozzle according to the material and filling of the pipe.</li> <li>• Program the cold bending sequences bearing in mind diameters, radii, thicknesses, material quality, besides the characteristics of the used machine, and consider the need for prior annealing or not.</li> <li>• Perform the forming process in line with the usage instructions of machinery and equipment in compliance with the occupational safety and environmental standards.</li> </ul>

<p><b>ASSEMBLY OF PIPES, FLANGES AND BRANCHES</b></p> <ul style="list-style-type: none"> <li>• Have knowledge assembling pipe brackets (Assembly techniques of welded and bolted pipe runs, accessory mounting techniques, alignment and levelling of pipe runs, equipment and tools, equipment and tools used in the assembly of pipes, types of brackets and attachment of pipes, mounting scaffolding, raising pipe sections.)</li> <li>• Have knowledge of pipe fasteners (fastening of sections or tubes to be lifted, pipe fasteners and lifting elements, construction and fastening brackets for pipes, assembly of pipe sections at height properly aligned and levelled, fixing pipes by means of welding points, bolted pipe fastening, prior pipe fitting, valves and other accessories, protection techniques and elements. Risk assessment, legal aspects and standards.</li> <li>• Thermal expansion in industrial pipe installations (Causes and effects, corrective systems.)</li> <li>• Quality standards in mounting brackets and assembly of industrial pipelines. (Specifications for quality control)</li> <li>• Prevention of occupational and environmental hazards (safety and health standards applicable to different pipe assembly and laying processes.)</li> </ul>	<p><b>ASSEMBLY OF PIPES, FLANGES AND BRANCHES</b></p> <ul style="list-style-type: none"> <li>• Prepare assembly machinery and equipment, meeting the required technical specifications.</li> <li>• Explain the material according to dimensions, thickness and quality as per work instructions.</li> <li>• Explain the equipment, tools and supplies necessary to manufacture different lengths of pipe.</li> <li>• Define the tasks specific for each machine or equipment.</li> <li>• Check the operation of the machines performing preventive maintenance.</li> <li>• Analyse pipe, flange and branch assembly operations for pipe assembly, meeting the specifications.</li> <li>• Differentiate pipe, flange and branch assembly techniques, among others.</li> <li>• Classify the components of the welding equipment, and the function of each and the interrelationship in the assembly, as well as performance.</li> <li>• Relate the tools and auxiliary means required for assembly and spotwelding with the expected results.</li> <li>• Identify the different operative tube welding techniques simple positions.</li> <li>• Analyse the safety measures required during the use of the means and equipment used in assembly and spotwelding.</li> </ul> <p><b>TREATMENT AND FINISHING PIPES</b></p>	<p><b>ASSEMBLY OF PIPES, FLANGES AND BRANCHES</b></p> <ul style="list-style-type: none"> <li>• Obtain the weld using capillary brazing obtaining the required clearance between pipes and fittings.</li> <li>• Obtain the alignment of the assembly by a perfect positioning of the flanges on the tube.</li> <li>• Perform the assembly according to the projections shown in isometric drawings or construction plans.</li> <li>• Perform the assembly sequences following the established procedure (couple, align and fasten).</li> <li>• Spot weld in the appropriate places using the established procedure, including spot welding with TIG.</li> <li>• Check that the work done meets the conditions and specifications required for the assembly.</li> <li>• Mark and label for part identification.</li> </ul>
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<p><b>TREATMENT AND FINISHING PIPES</b></p> <ul style="list-style-type: none"> <li>• Have knowledge of quality standards in industrial forming and pipe bending (Specifications for quality control, measurement and testing tools, dimensional control of the final product, check the given tolerance fits.)</li> <li>• Know occupational risk prevention and environmental standards applicable to pipe forming and bending processes:</li> </ul>	<ul style="list-style-type: none"> <li>• Assess the required tube treatments according to the different service types.</li> <li>• Analyse the characteristics of different cleaning, painting and surface treatment products.</li> <li>• Examine possible incompatibility between the different products for pipe treatment.</li> <li>• Describe the different equipment, tools and auxiliary means used in treatments.</li> <li>• Assess the safety measures required during the use of the means and equipment used in treatments.</li> </ul> <p>Analyse environmental protection measures required for different treatments</p>	<p><b>TREATMENT AND FINISHING PIPES</b></p> <ul style="list-style-type: none"> <li>• Obtain the finishing degree as stated in the specifications, work orders, classification societies and requirements of the service the pipes will be used for by applying the appropriate treatment.</li> <li>• Perform final treatment in the sequential order specified in the work orders following the techniques listed for each process.</li> <li>• Perform the cleaning and pickling operations using appropriate parameters for each treatment.</li> </ul> <p>Protect the piping following specifications after finishing treatment of the pipe and prior to mounting to avoid damage to the treatment</p>
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KNOWLEDGE	SKILLS	COMPETENCE
<p><b>PREPARATION OF MEANS FOR THE ASSEMBLY OF PIPE INSTALLATIONS</b></p> <p>Have knowledge of the exploded views for assembly of pipelines. (Functionality of assembly, used symbols and technical specifications, exploded views, views, sections and details according to the type of installation, assembly drawings, making sketches of part sections of pipelines)</p>	<p><b>PREPARATION OF MEANS FOR THE ASSEMBLY OF PIPE INSTALLATIONS</b></p> <ul style="list-style-type: none"> <li>Analyse the technical information and the pipe assembly drawings.</li> <li>Interpret the symbols and technical characteristics that relate to the pipe assembly process.</li> <li>Interpret the views, sections and details of the orthogonal, American and European, isometric and schematic drawings.</li> <li>Deduce the most ideal sequence for assembly and dismantling of other pipes.</li> <li>Define the means and equipment that must be used, from the assembly drawing.</li> <li>Analyse the safety standards that are applicable to the assembly process.</li> <li>Explain the different pipe assembly processes in naval or industrial construction.</li> <li>Explain the materials, services, fittings, valves and small pieces of equipment necessary for assembly.</li> <li>Describe the different templates to be produced for the correct assembly and installation of               <ul style="list-style-type: none"> <li>pipes and fittings.</li> </ul> </li> <li>Analyse the reinforcements, thicknesses and materials to use in template preparation.</li> </ul>	<p><b>PREPARATION OF MEANS FOR THE ASSEMBLY OF PIPE INSTALLATIONS</b></p> <ul style="list-style-type: none"> <li>Store and provide all the elements necessary for the assembly of the pipes; this is carried out in accordance with the material and service needs criteria, specified on the drawings, isometrics or materials lists.</li> <li>Use the machines and tools according to the specifications of the technical documentation.</li> <li>Prepare the machines and tools according to the manufacturer's instructions and maintenance requirements.</li> <li>Store and provide all the personal protective equipment necessary, depending on the requirements of the pipe assembly operations.</li> <li>Collect together the fittings, valves and small pieces of equipment in accordance with the requirements of the assembly to be carried out.</li> <li>Assess the technical requirements to be used in the assembly process.</li> <li>Carry out the assembly following the templates produced from the information, drawings, regulations and prescribed specifications.</li> <li>Establish operational equipment controls, following instructions that allow anomalies to be detected that are rectified by the maintenance operation.</li> <li>Apply the occupational risk prevention systems, following the instructions of the safety scheme established for forming and assembly.</li> </ul>
<p><b>PREPARATION OF TEMPLATES AND</b></p>	<p><b>PREPARATION OF TEMPLATES AND</b></p>	<p><b>PREPARATION OF TEMPLATES AND</b></p>

<p><b>DRAWINGS FOR PIPE ASSEMBLY</b></p> <p>Understand the development of templates and pipe intersections (marking for identification of elements, template preparation techniques, development of cylindrical surfaces, layout of cylindrical elbows, layout and development of inserts of equal and different diameter, development of concentric</p>	<p><b>DRAWINGS FOR PIPE ASSEMBLY</b></p> <ul style="list-style-type: none"> <li>• Interpret templates of a pipe section.</li> <li>• Explain a diagram based on a pipe section to be assembled.</li> <li>• Analyse rod templates for non-standard curves.</li> <li>• Examine templates for curved segments, branches and holes in material that could roll to the outside of the pipe.</li> <li>• Identify the type of profile considering force to withstand and the accuracy required.</li> <li>• Explain the cutting of templates.</li> <li>• Explain the marking of templates and the identification of jigs.</li> </ul>	<p><b>DRAWINGS FOR PIPE ASSEMBLY</b></p> <ul style="list-style-type: none"> <li>• Prepare the pipe schematic in accordance with criteria that are established on the project's drawings and technical documents, and in accordance with criteria that the inspection of the classification societies establish.</li> <li>• Ascertain the installation that allows a simple dismantling of other pipes, bearing in mind interferences with other services and the visual impact.</li> <li>• Prepare the templates and isometric drawings for shut off pipe or pipes of reduced diameter taking into account interferences with other services, the dismantling of other pipes or equipment and the visual impact.</li> </ul> <p>Design the templates with the thickness and buttressing necessary</p>
<p><b>INSTALLATION OF SUPPORTS FOR PIPE ASSEMBLY / POSITIONING AND FASTENING</b></p> <ul style="list-style-type: none"> <li>• Understand how pipe supports are installed (techniques for reinforcing sections of pipe by welding and bolting, techniques for installing fittings, alignment and levelling of sections of pipe, devices and tools, equipment and tools used for pipe assembly, types of supports and fastening of pipes, assembly of scaffold and raising pipe sections).</li> <li>• Know how to fasten pipes. (fastening of pipe sections for lifting, pipe fastening and lifting elements, construction and fastening</li> </ul>	<p><b>INSTALLATION OF SUPPORTS FOR PIPE ASSEMBLY / POSITIONING AND FASTENING</b></p> <ul style="list-style-type: none"> <li>• Explain the operations for installing supports, alignment, positioning and assembling of pipe fastening elements, in accordance with assembly plans, preventing stresses and vibrations in the pipe and equipment.</li> <li>• Distinguish the measurement and levelling means and equipment used in the installation of pipe fastening elements.</li> <li>• Differentiate the types of pipe supports and fastenings.</li> <li>• Examine the various auxiliary means for fitting and repair, relating them to the safety measures applicable to their use.</li> </ul>	<p><b>INSTALLATION OF SUPPORTS FOR PIPE ASSEMBLY / POSITIONING AND FASTENING</b></p> <ul style="list-style-type: none"> <li>• Locate the supports appropriately to prevent stresses and vibrations of the pipe and equipment.</li> <li>• Determine the need or not to use reinforcement in the structure to prevent deformation or breakage, during the positioning of the pipe supports.</li> <li>• Install the fixed points that may deform both the structure and the pipes in such a way that it allows the expansion lyres or joints to work correctly.</li> <li>• Detect and protect with the softest materials or in accordance with indicated requirements, the materials that, due to their properties, cannot be in contact with others and, due to their expansion movement, could damage the surface.</li> </ul>

of supports for pipes, assembly of pipe sections at height, properly aligned and levelled, fastening of pipes using spot welding, fastening of pipes using bolts, prior positioning of seals, valves and other fittings, pipe fastening and joint elements, protection techniques and elements). Risk assessment:

- Know how to distinguish thermal expansion in industrial pipe installations, its causes, effects and correction systems.

Identify the quality standards for installing supports and assembling industrial pipes (tolerances, dimensional control, characteristics to control, acceptance criteria, measurement and checking devices, control guidelines, dimensional control of the final product, check that marked tolerances are met

#### **MAKING SIMPLE WELDS**

##### **1. Understand welding technology**

- Weldability of carbon steels, austenitic stainless

- Analyse the contact incompatibilities between different materials.
- Assess the consequences and solutions resulting from the expansions of the different materials.

#### **MAKING SIMPLE WELDS**

- Analyse the edges to join and the edge preparation required.

- Install the pipes following the reference points indicated on the assembly plans, and the established procedure (positioning, coupling and fastening).
- Position all the pipes and fittings within the admissible tolerances for their subsequent joining.
- Spot weld in the appropriate places using the established procedure, including spot welding with TIG.
- Carry out the penetrations and position the bulkheads following the indications in the isometrics or assembly drawings.
- Position the expansion joints, stress free, at the distance indicated by the manufacturer.
- Carry out the levelling and vertical alignment of the pipes using conventional levels, an optical level, water hose or laser levels in accordance with the technical specifications.
- Bring together and orientate the holes in the flange joints, using bar ends and long bolts, putting in place appropriate seals for the joint, the bolts are tightened sequentially, in a cross to the specified torque.
- Comply with the specified requirement by means of self-control of work done.

#### **MAKING SIMPLE WELDS**

- Prepare the edges that are to be joined in accordance with established specifications or standards.



steels, coppers, brasses and plastics.

- Standards on welding processes.
- Types of joint and weld positions.
- Standards on edge preparation, separation and levelling.
- Operational sequences and methods depending on the type of joint and arrangement of the structure.
- Pipe spot welding technique.
- Weld defects:
  - Causes and corrections.
- Expansions, contractions, deformations and stresses produced during pipe welding.
- Safety in welding processes: risks, protective measures and equipment.

## 2. Welding for assembly of industrial pipes.

- Welding by electrode.
- Electrical welding equipment:
  - Characteristics, description of the components and installation.
  - Handling and parameter setting.
- Semi-automatic welding (MIG-MAG):
  - Semi-automatic welding equipment.
  - Characteristics, description of the components and installation.
  - Handling and parameter setting.
- Capillary brazing:
  - Characteristics, description of the components and installation.
  - Handling and parameter setting.
- Stud resistance welding:
  - Characteristics, application, description of the components and installation.
  - Handling and parameter setting.
- Plastics welding:
  - Characteristics and equipment.
  - Use of the equipment.
- Joining with adhesives.
- Preventive maintenance of welding equipment.

- Assess the various procedures for welding, bearing in mind the type of material to weld.
- Consider the defects that could occur during the different welding processes.
- Interpret the current regulations for performing the structural strength and leak-tightness tests.
- Select the fastening devices to carry out the tests.
- Analyse the tests in accordance with the established procedure.
- Control the test parameters (times, pressure, among others).
- Assess the absence of leaks and cracks at the joints.

- Set the welding machine parameters, in accordance with the welding that is to be done (electrode, semi-automatic MIG, MAG, TIG, oxy-gas, brazing, resistance for studs, plastic welding and its derivatives, and joining with adhesives).
  - Use the base materials required for the welding procedures (carbon steels, austenitic stainless steels, copper, brasses and plastics).
  - Make the welds in the most common positions in accordance with the quality standards specified in the field, in terms of surface quality, dimension, undercuts and cleaning.
  - Identify and repair defects of the welds to make them acceptable, or notify the technician responsible following the established procedure.
- Check that surfaces adjacent to the weld bead are free of defects due to pitting or other causes



### **3. Structural and leak-tightness testing in industrial pipe installations.**

- Leak-tightness tests.
  - Types, characteristics and applications.
  - Machines, equipment and tools.
  - Parameter control
- Structural testing.
  - Types, characteristics and applications.
  - Machines, equipment and tools.
  - Parameter control
- Operating procedures for carrying out strength and leak-tightness tests.
- Safety measures to take during testing.
- Applicable regulations.
- Quality control.
- Measurement and checking devices.
- Report sheet for the test results.
- Protective techniques and elements. Risk assessment:
  - Environmental management. Processing of waste