

1. Qualification Profile MSPT Diploma – Specialization Mechatronics

1.1. Job Profile

1.1.1. Working Area/Professional Practice, Relevance of Profession

- Multi-Skilled Production Technicians produce machined components in different materials using manual, conventional machines. They can join the parts by welding, bonding, using fasteners or rivets. They can assemble machines and sub-assemblies as per the assembly drawings and set the tolerance and clearances specified in the drawing. They know the basic functioning of pneumatic components and can assemble as part of assembly process. They know the basic electrical components and can wire the components as per the wiring schema. They create the work plan, determine the required machining tools and clamping devices and set up the machine. They inspect the manufactured parts using measuring and inspection equipment and document the inspection results in the inspection report. They monitor production process & carry out maintenance and commissioning of the equipment.
- Multi-Skilled Production Technicians carry out work orders or work on projects. They are aware of economic and ecological effects of their activities. They carry out the assignments independently. They are used to working in a team and are flexible and open to innovations. They observe the principles of work safety, health and protection of environment.
- Multi-Skilled Production Technicians choose one of the four specialization tracks and expand and enhance their competencies in the respective professional field.

1.1.2. Main Occupational Competencies

- **Foundation professional competencies (Preparatory training focus)**
 - A.1 Measuring work pieces for linear, angular dimensions & tolerances as per drawing
 - A.2 Practical exposure to manufacturing equipment and engineering
- **Basic professional competencies (Primary training focus)**
 - B.1 Manually fabricating work pieces, measuring and inspecting them
 - B.2 Manufacturing work pieces using conventional lathes and milling machines
 - B.3 Sheet metal, joining of metals & basic welding
 - B.4 Assembling of mechanical, electrical and pneumatic components
- **Supplementary professional competencies (Specialization training focus)**
 - Sp.2 Assembly of Pneumatic Systems
 - Sp.3 Assembling and wiring of electrical components
 - a) Assembly and Testing of Electrical Panels
 - b) PLC programming

1.2. Professional Competencies

A.1 Measuring work pieces for linear, angular dimensions & tolerances as per drawing	
Sample situation	List of skills and responsibilities
<p>Juan is given the job of checking the parts produced in a factory for and identify the parts that are not meeting the specifications. The component drawing is given to him. He studies the drawing and checks if it is for the component he is going to inspect. He uses the appropriate measuring tools such as scale, vernier caliper, micrometer or height gauge. He knows the importance of taking care of measuring instruments and also knows how to eliminate zero error. He understands the dimension and tolerance symbols used in drawings and also knows how to get tolerance values from the tables.</p> <p>He keeps the measurement and inspection tools ready and sets up the work station or measuring station appropriately. He inspects the parts according to the work plan and documents the measurement and inspection results in the inspection report.</p> <p>He can calculate perimeter, area, volume, weight of different shapes.</p>	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Understands the work order • Keeps the measuring tools ready • Uses tools and surface plate properly • Checks the dimensions & tolerances • Fills the quality check sheet of parts

A.2 Practical exposure to manufacturing equipment and engineering	
Sample situation	List of skills and responsibilities
<p>Francisco is new to vocational training. He can identify the commonly used equipment in manufacturing. He is aware of the personal and equipment safety. He can fix a job and tool on lathe and milling machine and also can carry out simple basic operations.</p> <p>He has theoretical understanding of basic mechanical, electrical, pneumatic, hydraulics & welding principles and their applications.</p> <p>He has gained substantially from industrial visits and has broadened his understanding of how products are made.</p> <p>He is armed with basic knowledge that will help him gain vocational skills</p>	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Uses personal protective equipment • Follows factory safety guidelines

B.1 Manually manufacturing, measuring and inspecting the work pieces	
Sample situation	List of skills and responsibilities
<p>Antonio is given the job of making parts manually. The manufacturing involves the use of hand tools, filing, marking, punching and the drilling machine. The inspection and measurement tools, the inspection report and the materials are specified in the order documents. He studies the work order and the production documents and prepares his work plan. He selects the specified machining tools and clamping devices and determines the cutting data. He sets up the work station by keeping the hand tools ready, mounting the clamping device and machining tools on the drilling machine and aligning them if necessary.</p> <p>Before he starts with the manufacturing, he ensures that he knows how the drilling machine works and that he can meet the safety regulations while fabricating the parts. He fabricates the parts according to the work plan.</p> <p>He keeps the measurement and inspection tools ready and sets up the work station or measuring station appropriately. He inspects the parts according to the work plan and documents the measurement and inspection results in the inspection report.</p>	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Understands the work order • Plans the work sequence • Keeps the tools and auxiliary products ready • Keeps the material ready • Prepares the drilling machine • Uses tools and clamping devices • Fabricates work pieces manually • Checks the quality and documenting

B.2 Manufacturing work pieces using conventional lathes and milling machines	
Sample situation	List of skills and responsibilities
<p>Daniel is given the job of manufacturing parts using a conventional lathe or milling machine.</p> <p>The inspection and measurement tools, inspection reports and the raw materials are specified in the order documents. He studies the work order and the production documents and prepares his work plan. He selects the specified machining tools and clamping devices and determines the cutting data. If necessary Daniel measures the tools and records the readings and the cutting data in the machine setup document.</p> <p>He prepares the machine tool by mounting and aligning the clamping device and machining tools on the machine tool. Before starting with the machining, he ensures that he knows the functions of the machine tool and he can meet the safety regulations.</p> <p>He manufactures the parts according to the work plan.</p> <p>He can turn the parts, do taper turning, external threading, grooving. He can also do face milling, key slot and drilling.</p> <p>Daniel inspects the fabricated parts using the measuring and inspection equipment and documents the inspection results in the inspection report.</p>	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Understands the work order • Plans the work sequence • Keeps the tools and consumables ready • Keeps the material ready • Prepares the machine tool • Uses tools and clamping devices • Manufactures the work pieces • Checks the quality and documents

B3.1 Sheet Metal Technology	
Sample situation	List of skills and responsibilities
<p>Carlos is assigned the task to prepare the assembly using sheet metal with punching and bending. The required materials, machine and all the documents are supplied to him. He first studies the drawing and understands the sequence of the production to be done. He then ensures that the supplied raw materials & documents are complete Machine is suitable and in working condition for the part to be produced. He then prepares the work process and calculates all the parameters required for punching and bending. He ensures that he has the knowledge of the metal & its properties for calculating the stress elongation of the sheet. He ensures that he is qualified and trained for operating the punching and bending machine professionally before starting of the task. He then starts to operate the machine and performs the required operations. He is able to do shearing, Punching, Bending, Stamp bending, Straightening, Tapering and Flanging. He then commissions the sheets with the fastening elements to form the required assembly. He then gives more attention to do necessary modification for accuracy and to achieve the assigned dimensions. He then inspects the assembly and prepares the necessary documents. He gives importance to cleanliness in</p> <ul style="list-style-type: none"> * work place and tools arrangement *Operating the machine <p>He follow the safety precautions in</p> <ul style="list-style-type: none"> *Using right personal protective equipment *machine work and safety as per manual * Assembly work safety 	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Knowledge of assembling of units • Knowledge of punching and bending machine and their function • Knowledge of calculating the bending radius and punching of the sheet. • Understands the work order • Plans the work sequence • With due importance to accuracy and smooth functioning of the assembly • Keeps the materials and consumables ready • Inspects the machines and ensures in good working condition • Inspects all components and the tools before assembling • Uses tools and clamping devices • Time management • Checks the function of assembly • Checks the quality and documentation

B3.2 Joining of metals by gas welding or Arc welding or bonding	
Sample situation	List of skills and responsibilities
<p>Welding: Fernando is given the job of joining various components by welding. The equipment, instruments, hand tools, clamping devices, welding compound, inspection and measurement tools, the raw materials are specified in the work order documents. The production documents specify how the parts need to be joined. Fernando studies the work order and the production documents and amends the specified work plan if required. He prepares the specified welding equipment and adjusts the welding parameters. He sets up the work station for welding by keeping the equipment, instruments, hand tools, clamping devices, welding compound, inspection and measurement tools ready. Before starting the welding work, Fernando ensures that he knows the functions of the welding equipment and can meet the safety regulations in the individual work operations. Fernando is aware of the work safety and health regulations (protection of eyes, skin and respiratory tract against ionizing radiation and toxic fumes) and follows them. He fabricates the parts according to the work plan. Fernando inspects the fabricated parts using the measuring and inspection equipment and documents the inspection results in the inspection report.</p> <p>Bonding: Fernando is given the job of joining various components using bonding methods. The equipment, instruments, hand tools, clamping devices, adhesive, inspection and measurement tools and the raw materials are specified in the order documents. The production documents specify how the parts need to be joined. Fernando studies the work order and the production documents. He prepares the materials and equipment required for bonding. He sets up the work station for bonding by keeping the equipment, instruments hand tools, clamping devices, adhesive, inspection and measurement tools. Before starting the bonding work, Fernando ensures that he knows the bonding process and any auxiliary devices that are required. Fernando is aware of the work safety and health regulations (protection of eyes, skin and respiratory tract against toxic fumes) and follows them. He fabricates the parts according to the work plan. Fernando inspects the bonded parts and documents the inspection results in the inspection report.</p>	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Understands the work order • Plans the work sequence • Keeps the materials and raw material ready • Uses the welding machine • Uses tools and clamping devices • Joins components by Bonding • Checks the product quality • Files the inspection report

B4.1 Assembly of machines & machine components	
Sample situation	List of skills and responsibilities
<p>Pedro is assigned the task to prepare an assembly of various parts in the form of a kit supplied to him. He studies the technical documentation (Drawings, BOM, data sheets, standards, etc.) and creates a work plan for all the activities.</p> <p>From the assembly drawing and BOM list he recognizes the work process, assigns them as required. He has the necessary qualifications for the given assembly process.</p> <p>He checks the individual items for dimensional accuracy, cleans and prepares them for assembling. He particularly pays attention to the suitability of the selected parts.</p> <p>He pays attention to secure the parts with appropriate fasteners to the correct limit of tightness.</p> <p>He pays special attention to position tolerances like, parallelism, angularity and symmetry.</p> <p>By proper use of tools he does commissioning and decommissioning of the assembly.</p> <p>Uses appropriate measuring tools and fills out the measurement protocol.</p> <p>Any necessary corrections or improvements are entered in the order documents.</p> <p>He gives importance to cleanliness of the tools and work place during the process of assembly and after finishing the assembly.</p>	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Plans the assembly sequence • Knowledge of assembly standards • Prepares the material & work area • Selects and sets the working tools • Carries out the work according to specifications • Prepares the assembly according to the technical specifications • Checks the quality, functioning and documents the work process • Evaluates and documents the manufacturing process

B4.2 Mounting of Pneumatic components	
Sample situation	List of skills and responsibilities
<p>Roberto is assigned the task to prepare an assembly of various parts supplied to him in the form of a kit. The kit also has a few pneumatic parts.</p> <p>He studies the technical documentation (Drawings, schematics, BOM, data sheets, standards, etc.) and creates a work plan for all the activities.</p> <p>From the assembly drawing and BOM list he recognizes the work process and assigns them as required. He has the necessary qualifications for the given assembly process.</p> <p>He checks the individual items for dimensional accuracy, cleans and prepares them for assembling. He pays attention to the suitability of the selected parts.</p> <p>He identifies the pneumatic components, checks its specifications and basic functioning. He then mounts</p>	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Can identify different pneumatic parts • Knows the mounting method and checking the basic functioning of pneumatic parts • Plans the assembly sequence • Knowledge of assembly standards • Plans the manufacturing process

<p>the component and connects by suitable pneumatic piping. He pays attention to secure the parts with appropriate fasteners to the correct limit of tightness. He pays special attention to position tolerances like, parallelism, angularity and symmetry. Through use proper use of tools he does commissioning and decommissioning of the assembly. Uses appropriate measuring tools and fills out the measurement protocol. Any necessary corrections or improvements are entered in the order documents. He gives importance to cleanliness of the tools and work place during the process of assembly and after finishing the assembly.</p>	<ul style="list-style-type: none"> • Prepares the material • Prepares the work area • Selects and sets the working tools • Carries out the work according to specifications • Prepares the assembly according to the technical specifications • Checks functioning of the pneumatic assembly by connecting with correct air supply • Assembles and cleans the component • Checks the quality, functioning and documents the work process • Evaluates and documents the manufacturing process
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B4.3 Mounting of electrical fittings & electrical wiring	
Sample situation	List of skills and responsibilities
<p>Manuel is given the job of assembling and wiring electrical controllers. He studies the work order and the production documents and prepares a work plan. He checks the components required for the controller for completeness using the bill of materials. Before starting the assembly work, he ensures that he knows the functions of the tools, implements and the electrical and mechanical parts as well as components that need to be assembled. Manuel studies the work safety regulations and follows them. Manuel assembles the individual electrical controller components according to the procedure. Subsequently he wires the main and control circuits according to the wiring diagram. In the process he ensures that the connections are technically correct. Manuel pays special attention to the earth conductor connections. Manuel inspects the work using appropriate measuring and inspection equipment and documents the inspection results in the inspection report.</p>	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Prepares the order • Keeps the tools and auxiliary material ready • Assembles the components for the controller layout • Uses joining techniques • Wires the controller layout • Uses measuring and inspection equipment • Documents the inspection results

Sp.2 Assembly of Pneumatic Systems	
Sample situation	List of skills and responsibilities
<p>Miguel is assigned the task to do mechanical assembly with pneumatic components. For this an assembly kit supplied to him.</p> <p>He first studies the drawing and understands the sequence of the assembly function.</p> <p>He also studies the Pneumatic circuit diagram</p> <p>He then studies and inspects all the parts required for the assembly with the help of all documents supplied.</p> <p>He then prepares the work place for assembly.</p> <p>He ensures that he is capable and qualified with all the components required for the assembly. He also ensures that he knows the function of all the pneumatic components required for the function of the assembly.</p> <p>He is able to use pneumatic components like cylinders, flow control valves, pressure control valves, and throttle return valves.</p> <p>He can recognise the symbolic representation of the individual pneumatic components.</p> <p>He then starts to commission the components according to the drawing and do the assembly.</p> <p>While assembling he pays attention through all the parameters like parallelism, symmetry and angularity.</p> <p>He then assembles all the pneumatic components as per drawing and inspects the function of the same as required.</p> <p>Through proper use of tools and measuring instruments he does the necessary correction and adjusts the components to the required dimensions.</p> <p>He then finally inspects the function of the assembly kit and prepares the inspection report.</p> <p>He gives importance for the cleanliness in</p> <p>* during /after assembly</p> <p>* Systematic arrangement of all tools used/ required</p> <p>* The work place.</p>	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Knowledge of assembling units • Knowledge of pneumatic components and their function • Knowledge of symbolic representation of all pneumatic components • Understands the work order • Plans the work sequence • Gives due importance to accuracy and smooth functioning of the assembly • Keeps the materials and consumables ready • Inspects of all components and all the tools before assembling • Uses tools and clamping devices • Time management • Checks the function of assembly • Checks the quality and documentation

Sp.3 (a) Assembling and testing of electrical panels	
Sample situation	List of skills and responsibilities
<p>Jorge is given the job of assembling and panel wiring for electrical components along with the bench work.</p> <p>He is supplied with all the materials, equipment, measuring/testing instruments and all the documents.</p> <p>He first studies the drawing and understands the sequence of the wiring assembly to be done</p> <p>He then prepares the work process for the task to be carried on systematically.</p>	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Knowledge of mechanical functions like bending/ punching / rolling and bench work. • Time management

<p>He then inspects all the materials, equipment and tools supplied to him are suitable for achieving the results according to drawing.</p> <p>He then does the mechanical part / bench work to form the panel/ board for wiring by using bending / punching and drilling process.</p> <p>He then ensures that he is qualified and professionally trained about the electrical components and their functions.</p> <p>He also ensures that he is capable of identifying the colour codes for wiring.</p> <p>He then starts to implement all the mechanical functions and wire the circuit.</p> <p>He will be able to do cutting, stripping, crimping, insulating, assembling and dressing of wire sleeves accordingly.</p> <p>He then assembles the individual electrical components according to the drawing. Subsequently he wires the power and control circuits according to the wiring diagram.</p> <p>In this process he ensures that the connections are proper and technically correct.</p> <p>He then carries out the control circuit and power circuit impedance check, continuity check as per the inspection sheet.</p> <p>He then carries out the functional check as per test instructions and fixes defects if any.</p> <p>He pays special attention to the earth connections.</p> <p>He inspects the work using appropriate measuring equipment and documents the inspection/test results in the inspection/test report.</p>	<ul style="list-style-type: none"> • Preparing the work planning • Keeping the tools and auxiliary material ready • Wiring of components as per layout/drawing • Using joining techniques • Using measuring equipment and tools • Document the inspection/test results
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Sp.3 (b) PLC programming	
Sample situation	List of skills and responsibilities
<p>José is given the job of assembly and implementation of electro pneumatic programmable controllers using the appropriate PLC program.</p> <p>He is supplied with all the materials, equipment, measuring/testing instruments and all the documents.</p> <p>He first studies the drawing and understands the sequence of process operation and plans for PLC programming to be done.</p> <p>He ensures that he is qualified and trained for doing the programming.</p> <p>He has the knowledge of symbolic presentation of the electro pneumatic components and also the schema of the PLC</p>	<ul style="list-style-type: none"> • Follows the regulations on work safety • Follows the regulations on health safety • Follows the regulations on environmental protection • Knowledge of Programmable logic controllers. • Knowledge of electro pneumatic components and function • Symbolic presentation of components. • Time management • Preparing the work planning

<p>He then prepares the work process plan for the task to be carried out systematically.</p> <p>He does Instruction list, Ladder diagram and Logic diagram if not given.</p> <p>He ensures that he is qualified and professionally trained about the electro pneumatic components and their functions.</p> <p>He then starts to program the PLC as per logic for the given task.</p> <p>In this process he ensures that the connections are proper and technically correct.</p> <p>He pays special attention to the earth connections.</p> <p>He then starts to implement the program and do the necessary inspection tests accordingly for achieving the desired results.</p> <p>He documents the inspection & test results in the inspection or test report.</p> <p>He gives more attention during/after the task for the following</p> <ul style="list-style-type: none"> *Personal safety and equipment * Electrical Hazard safety 	<ul style="list-style-type: none"> • Keeping the tools and auxiliary material ready • Wiring of components as per layout/drawing • Using joining techniques • Using measuring equipment and tools • Document the inspection/test results
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1.3. Requirements/ Entry Competencies

- Option 1: The candidate must have skills in the relevant trade (f.e. 2-years course as fitter, machinist, electrician, welder). These competencies could be obtained at a local public or private training institute.
- Option 2: The candidate should have passed 9th or 10th standard and have done SkillSonics Foundation course.
- Candidates with MSPT Certificate can also join the final year of MSPT Diploma