



# Model Curriculum

**QP Name: Automotive Additive Manufacturing Technician**

**QP Code: ASC/Q6411**

**QP Version: 1.0**

**NSQF Level: 4**

**Model Curriculum Version: 1.0**

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## Training Parameters

<b>Sector</b>	Automotive
<b>Sub-Sector</b>	Research & Development
<b>Occupation</b>	Production Engineering
<b>Country</b>	India
<b>NSQF Level</b>	4
<b>Aligned to NCO/ISCO/ISIC Code</b>	NCO-2015/2144.0801
<b>Minimum Educational Qualification and Experience</b>	8th Class + 2 years ITI with 2 years of relevant experience OR 10th Class pass with 2 years of relevant experience OR 10th Class + 2 years ITI OR 12th Class with 1 Year of experience OR Certificate NSQF (Automotive Additive Manufacturing Operator Level 3 ) with 2 Years of relevant experience OR Diploma (Mechanical/Automobile ( from recognized regulatory body))
<b>Pre-Requisite License or Training</b>	NA
<b>Minimum Job Entry Age</b>	19 years
<b>Last Reviewed On</b>	30/12/2021
<b>Next Review Date</b>	30/12/2024
<b>NSQC Approval Date</b>	30/12/2021
<b>QP Version</b>	1.0
<b>Model Curriculum Creation Date</b>	30/12/2021
<b>Model Curriculum Valid Up to Date</b>	30/12/2024
<b>Model Curriculum Version</b>	1.0
<b>Minimum Duration of the Course</b>	390 Hours 00 Minutes
<b>Maximum Duration of the Course</b>	390 Hours 00 Minutes

## Program Overview

This section summarizes the end objectives of the program along with its duration.

### Training Outcomes

At the end of the program, the learner should have acquired the listed knowledge and skills.

- Identify product specifications and requirements for CAD designing.
- Carry out designing of product on CAD software.
- Use 3D printing machine for the printing of automotive components.
- Work effectively and efficiently as per schedules and timelines.
- Implement safety practices.
- Use resources optimally to ensure less wastage and maximum conservation.
- Communicate effectively and develop interpersonal skills.

### Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the QP.

NOS and Module Details	Theory Duration	Practical Duration	On-the-Job Training Duration (Mandatory)	On-the-Job Training Duration (Recommended)	Total Duration
<b>Bridge Module</b>	<b>05:00</b>	<b>00:00</b>			<b>05:00</b>
Module 1: Introduction to the role of an Automotive Additive Manufacturing Technician	5:00	0:00			5:00
<b>ASC/N9803 – Organize work and resources (Manufacturing)</b> <b>NOS Version No. – 1.0</b> <b>NSQF Level – 3</b>	<b>15:00</b>	<b>30:00</b>			<b>45:00</b>
Module 2: Organize work and resources according to safety and conservation standards	15:00	30:00			45:00
<b>ASC/N9802 – Interact effectively with colleagues, customers and others</b> <b>NOS Version No. – 1.0</b> <b>NSQF Level - 3</b>	<b>15:00</b>	<b>25:00</b>			<b>40:00</b>
Module 3: Communicate effectively and efficiently	15:00	25:00			40:00
<b>ASC/N6428 – Designing of a new or existing product by using design software tools</b> <b>NOS Version No. –1.0</b> <b>NSQF Level - 4</b>	<b>45:00</b>	<b>120:00</b>			<b>165:00</b>
Module 4: Perform designing	45:00	120:00			165:00

of a new or existing product					
<b>ASC/N6427 – Operate and maintain 3D printing machine for product generation</b> <b>NOS Version No. –1.0</b> <b>NSQF Level - 4</b>	<b>45:00</b>	<b>90:00</b>			<b>135:00</b>
Module 5: Operate and maintain 3D printing machine for product generation	45:00	90:00			135:00
<b>Total Duration</b>	<b>125:00</b>	<b>265:00</b>			<b>390:00</b>

# Module Details

## Module 1: Introduction to the role of an Automotive Additive Manufacturing Technician

### Bridge module

#### Terminal Outcomes:

- Discuss the role and responsibilities of an Automotive Additive Manufacturing Technician.

<b>Duration:</b> <05:00>	<b>Duration:</b> <00:00>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• List the role and responsibilities of an Automotive Additive Manufacturing Technician.</li> <li>• Discuss the job opportunities for an Automotive Additive Manufacturing Technician in the automobile industry.</li> <li>• Explain about Indian automobile manufacturing market.</li> <li>• List various automobile Original Equipment Manufacturers (OEMs) and different products/ models manufactured by them.</li> <li>• Discuss manufacturing and automotive product design standards and procedures followed in the company.</li> </ul>	
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	

## Module 2: Organize work and resources according to safety and conservation standards

### Mapped to ASC/N9803, v1.0

#### Terminal Outcomes:

- Employ appropriate ways to maintain safe and secure working environment.
- Perform work as per the quality standards.
- Apply conservation practices at the workplace.

Duration: <15:00>	Duration: <30:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• List the potential workplace related risks and hazards, their causes and preventions.</li> <li>• Identify PPE to be used at workplace.</li> <li>• Identify various warning signs used at the workplace.</li> <li>• Describe appropriate strategies to deal with emergencies and accidents at the workplace.</li> <li>• Outline the organizational structure to be followed to report about health, safety and security breaches to the concerned authorities.</li> <li>• Discuss the importance of keeping work area clean and tidy.</li> <li>• Discuss the significance of conforming to basic hygiene practices such as washing hands, using alcohol based hand sanitizers or soap.</li> <li>• Discuss organizational hygiene and sanitation guidelines and ways of reporting breaches/gaps if any to the concerned authorities.</li> <li>• Discuss the ways of dealing with stress and anxiety.</li> <li>• Discuss how to complete the given work within the stipulated time period.</li> <li>• Explain how to maintain a proper balance between team and individual goals.</li> <li>• Explain 5S guidelines at workplace.</li> <li>• List the various materials used at the workplace.</li> <li>• Explain organisational recommended procedure for storage of tools, equipment and material after completion of work.</li> <li>• Explain the ways to optimize usage of resources.</li> <li>• Discuss various methods of waste management and its disposal.</li> </ul>	<ul style="list-style-type: none"> <li>• Apply appropriate safety practices to ensure safety of people at the workplace</li> <li>• Display the correct way of wearing and removing PPE such as face masks, hand gloves, face shields, PPE suits, etc.</li> <li>• Demonstrate the use of fire extinguisher.</li> <li>• Apply basic first aid procedure in case of emergencies.</li> <li>• Perform routine cleaning of tools, equipment and machines.</li> <li>• Employ various techniques for checking malfunctions in the equipment as per Standard Operating Procedure (SOP).</li> <li>• Show how to sanitize and disinfect one's work area regularly.</li> <li>• Demonstrate the correct way of washing hands using soap and water.</li> <li>• Demonstrate the correct way of sanitizing hands using alcohol-based hand rubs.</li> <li>• Demonstrate how to evacuate the workplace in case of an emergency.</li> <li>• Demonstrate sorting of materials, tools and equipment and spare parts after completion of work.</li> <li>• Demonstrate the steps involved in storage of tools, equipment and material after completion of work.</li> <li>• Perform basic checks to identify any spills and leaks and that need to be plugged /stopped.</li> <li>• Demonstrate different disposal techniques depending upon types of waste.</li> <li>• Employ different ways to check if equipment/machines are functioning as per requirements and report malfunctioning, if observed.</li> <li>• Employ ways for efficient utilization of</li> </ul>

<ul style="list-style-type: none"> <li>• List the different categories of waste for the purpose of segregation</li> <li>• Differentiate between recyclable and non-recyclable waste</li> <li>• State the importance of using appropriate colour dustbins for different types of waste.</li> <li>• Discuss common practices for conserving electricity at workplace.</li> <li>• Discuss the common sources of pollution and ways to minimize it.</li> </ul>	material and water.
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
<ul style="list-style-type: none"> <li>• Housekeeping material: Cleaning agents, cleaning cloth, waste container, dust pan and brush set, liquid soap, hand towel, fire extinguisher</li> <li>• Safety gears: Safety shoes, ear plug, goggles, gloves, helmet, first-aid kit</li> </ul>	



## Module 3: Communicate Effectively and Efficiently

### Mapped to ASC/N9802, v1.0

#### Terminal Outcomes:

- Use effective communication and interpersonal skills.
- Apply sensitivity while interacting with different genders and people with disabilities.

<b>Duration:</b> <15:00>	<b>Duration:</b> <25:00>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Explain the organizational structure for communicating with colleagues, seniors and others.</li> <li>• Discuss the ways to adjust the communication styles to reflect sensitivity towards gender and persons with disability (PwD).</li> <li>• Explain the importance of respecting personal space of colleagues.</li> <li>• State the procedure to receive work instructions and report problems to the supervisor.</li> <li>• List the various organizational policies and procedures to be followed at the workplace.</li> <li>• Describe different ways to rectify commonly occurring errors.</li> <li>• Explain the importance of complying with the instructions/guidelines and procedures while performing tasks related to the job specifications.</li> <li>• Discuss the importance of PwD and gender sensitization.</li> </ul>	<ul style="list-style-type: none"> <li>• Employ different means of communication depending upon the requirement while interacting with others.</li> <li>• Demonstrate using new ways to maintain good relationships with colleagues and supervisor.</li> <li>• Prepare a sample report to send the work status to the supervisor.</li> <li>• Demonstrate how to communicate with different genders and persons with disability (PwD) in a sensitive manner.</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
Sample of escalation matrix, organisation structure.	

## Module 4: Perform designing of a new or existing product

### Mapped to ASC/N6428, v1.0

#### Terminal Outcomes:

- Identify requirements and specifications for the product designing process.
- Perform preparatory activities to carry out product designing process.
- Perform the steps to carry out 3D modelling of product in CAD software.

Duration: <45:00>	Duration: <120:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Discuss the information needed to collect from the work order, process manuals and instructions from internal design team and supervisor about the customer requirements and work to be done.</li> <li>• List various designing software like CATIA, Unigraphics, Fusion 360 etc. required for creating the designs and models.</li> <li>• List the design requirement in terms of material used for making the component, packaging and other requirements to decide the dimensions, measurements and tolerances of the aggregate/ component.</li> <li>• Elaborate draughting standards and techniques e.g. ANSI series IS/ ISO.</li> <li>• List technical drawing practices as per the company standards.</li> <li>• Describe drawings and modelling techniques like 2D and 3D.</li> <li>• Identify the reporting hierarchy and procedure for escalating faults and issues related to design concept clarity, dimensions and practicality.</li> <li>• Describe algebra and trigonometric rules and applications.</li> <li>• Describe Geometric and Trigonometric rules/ formula for developing the specifications of the component.</li> <li>• List the steps to be performed for creating 3D model of product in CAD software.</li> <li>• Describe various CAD techniques available in the CAD software and required or designing of product 3D model.</li> <li>• List types of files format such as STL or AMF etc. generated in the various steps of the process.</li> <li>• List the steps to be performed for checking and correcting the common</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to interpret the work order, process manuals, instructions etc. to obtain the design requirements.</li> <li>• Show how to select the designing software like CATIA, Unigraphics, Fusion 360 etc. for creating the designs and models.</li> <li>• Demonstrate the use of designing software.</li> <li>• Demonstrate how to interpret the new or existing product to collect the design requirements.</li> <li>• Show how to create an object model as per drawing/dimension by using selected CAD software.</li> <li>• Demonstrate use of the Geometric and Trigonometric rules/ formula for developing the specifications of the component.</li> <li>• Apply appropriate procedure of setting required units and dimension parameters in the CAD file.</li> <li>• Demonstrate how to insert sketches, scanned images, diagrams, signs or symbols etc. in a CAD file.</li> <li>• Prepare a sample 3D model of product by applying appropriate CAD techniques.</li> <li>• Demonstrate the use of software features like tools modelling, sculpting, generative design, simulation, assemblies, collaboration, tool validation and design options for creating the object model.</li> <li>• Apply appropriate ways to verify the object model by comparing it with the information and specifications mentioned in the product modelling document.</li> <li>• Show how to convert the object model into STL or AMF file format.</li> <li>• Apply appropriate ways check and rectify the common errors in object model files</li> </ul>

<p>errors in object model file.</p> <ul style="list-style-type: none"> <li>Discuss methods of using instruments like Vernier callipers, Micrometres, rulers and other inspection tools.</li> </ul>	<p>by following organisational guidelines.</p> <ul style="list-style-type: none"> <li>Demonstrate steps to transfer the verified object model STL / AMF file into portable storage device or directly to 3D printer.</li> </ul>
<b>Classroom Aids:</b>	
Whiteboard, marker pen, projector	
<b>Tools, Equipment and Other Requirements</b>	
<ul style="list-style-type: none"> <li>Drafting tools, MS office, designing software like CATIA, Unigraphics, Fusion 360</li> <li>Handbook, job orders and Technical Reference Books.</li> <li>Safety materials: Fire extinguisher, safety gloves, aprons, safety glasses, ear plug, safety shoes and first-aid kit.</li> </ul>	

## Module 5: Operate and maintain 3D printing machine for product generation

### Mapped to ASC/N6427, v1.0

#### Terminal Outcomes:

- Perform the steps to operate and set up the machine for printing the automotive components.
- Demonstrate post-processing activities like quality check, segregation, storage etc.

Duration: <45:00>	Duration: <90:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Discuss the information needed to interpret from the instructions received from supervisor related to work to be done and work requirements.</li> <li>• Explain various 3D Printing technologies such as Fused Deposition Modelling, StereoLithography etc.</li> <li>• Identify various symbols and notifications being displayed by the 3D Printing machine.</li> <li>• Describe functionality of the 3D printing machine.</li> <li>• List the machine, support structure, raw material etc. required for work.</li> <li>• List types of materials available for fabrication in various 3D printing technique.</li> <li>• Explain the selection criteria of raw material and 3D printing machine as per the product specifications.</li> <li>• Recall various specifications of machine such as build speed, extrusion speed, nozzle temperature etc.</li> <li>• List machine operating parameters such as room temperature range, air cleanliness.</li> <li>• Explain standard tessellation language (.stl) code file and its selection criteria for machine operation.</li> <li>• List steps for preparing 3D printing machine for operation.</li> <li>• List the steps to be performed for operating the 3D printing machine.</li> <li>• List the steps to be performed for uploading and removing new code files in the machine memory.</li> <li>• Discuss the importance of preserving critical electronic parts/equipment from moisture/ heat/ environmental external conditions.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to select the raw material and 3D printing machine for printing the automotive components as per product specifications.</li> <li>• Apply appropriate ways to check the material and 3D printing machine for any issues and required quality standards before use.</li> <li>• Use appropriate resources to obtain information about part orientation, support structure requirement, machine specifications, machine operating parameters etc. as per the work requirement.</li> <li>• Show how to set the 3D printing machine and its parameters as per SOP/WI.</li> <li>• Demonstrate how to clean the 3D printing machine before starting the printing operation by following organisational procedures.</li> <li>• Demonstrate how to connect the data storage devices with the machine.</li> <li>• Role play a situation on how to co-ordinate with the designer for rectifying the errors generated during file uploading and observed during running of process.</li> <li>• Show how to pre-heat the bed of the machine and set the laser or nozzles temperature of the machine to defined values.</li> <li>• Demonstrate organizational specified procedure of starting and operating the 3D printing machine for printing of automotive components.</li> <li>• Show how to stop the machine during an unwanted situation.</li> <li>• Apply appropriate ways to identify and rectify errors in machine during the machine operation.</li> </ul>

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| <ul style="list-style-type: none"> <li>• Describe post-processing techniques such as removing and cleaning printed parts, inspection, segregation etc. of parts.</li> <li>• Discuss ways for removing the fabricated part from machine and support structures from the part.</li> <li>• Explain methods of inspecting the quality and non-conformities of the part.</li> <li>• Discuss the process of storing of ok parts as per organisational guidelines.</li> <li>• List maintenance activities for a 3D printing machine.</li> <li>• List the steps to be performed for troubleshooting and repairing defects in the machine.</li> <li>• List the steps to be performed for lubricating the 3D printing machine.</li> <li>• Discuss the importance of placing tags on machines for next maintenance cycles.</li> <li>• Summarise the documents, records and information to be maintained related to the maintenance and repairing done.</li> </ul> | <ul style="list-style-type: none"> <li>• Prepare a sample report about the errors identified and rectified in the machine.</li> <li>• Demonstrate how to remove the printed part and support structures from the machine carefully.</li> <li>• Apply appropriate ways to clean the part for getting required surface finish.</li> <li>• Demonstrate how to clean and store the tools, equipment and auxiliaries after completion of work as per organisational guidelines.</li> <li>• Apply appropriate inspection methods for checking the quality and non-conformities of the part.</li> <li>• Demonstrate how to store and preserve the manufactured automotive parts as per organisational guidelines.</li> <li>• Apply appropriate ways to check the critical components of machine as per maintenance checklist or manufacturer guidelines.</li> <li>• Employ appropriate ways for troubleshooting and repairing defects in the machine.</li> <li>• Show how to lubricate the machine by using appropriate lubricant.</li> </ul> |
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**Classroom Aids:**

Whiteboard, marker pen, projector

**Tools, Equipment and Other Requirements**

3D Printing machines- Fixed Deposition Modelling Machine, Stereo-Lithography Machine, Metal Sintering Machine & any other type of 3D printing machine with the all the consumables required, Flash Drive (With pre-stored program)

# Annexure

## Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E/B.Tech	Mechanical/Automobile/ Electronics/ Instrumentation	2	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electronics/ Instrumentation	3	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electronics	3	Mechanical/ Automobile/ Electronics	1	Mechanical/ Automobile/ Electronics	NA
Diploma	Mechanical/Automobile/ Electronics	4	Mechanical/ Automobile/ Electronics	0	Mechanical/ Automobile/ Electronics	NA

Trainer Certification	
Domain Certification	Platform Certification
“Automotive Additive Manufacturing Technician, ASC/Q6411, version 1.0”. Minimum accepted score is 80%.	“Trainer, MEP/Q2601 v1.0” Minimum accepted score is 80%.

## Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E/B.Tech	Mechanical/Automobile/ Electronics/ Instrumentation	3	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electronics/ Instrumentation	4	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electronics	4	Mechanical/ Automobile/ Electronics	1	Mechanical/ Automobile/ Electronics	NA
Diploma	Mechanical/Automobile/ Electronics	5	Mechanical/ Automobile/ Electronics	0	Mechanical/ Automobile/ Electronics	NA

Assessor Certification	
Domain Certification	Platform Certification
"Automotive Additive Manufacturing Technician, ASC/Q6411, version 1.0". Minimum accepted score is 80%.	"Assessor; MEP/Q2701 v1.0" Minimum accepted score is 80%.

## Assessment Strategy

1. Assessment System Overview:
  - Batches assigned to the assessment agencies for conducting the assessment on SDMS/SIP or email
  - Assessment agencies send the assessment confirmation to VTP/TC looping SSC
  - Assessment agency deploys the ToA certified Assessor for executing the assessment
  - SSC monitors the assessment process & records
2. Testing Environment:
  - Confirm that the centre is available at the same address as mentioned on SDMS or SIP
  - Check the duration of the training.
  - Check the Assessment Start and End time to be as 10 a.m. and 5 p.m.
  - If the batch size is more than 30, then there should be 2 Assessors.
  - Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
  - Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
  - Confirm the number of TABs on the ground are correct to execute the Assessment smoothly.
  - Check the availability of the Lab Equipment for the particular Job Role.
3. Assessment Quality Assurance levels / Framework:
  - Question papers created by the Subject Matter Experts (SME)
  - Question papers created by the SME verified by the other subject Matter Experts
  - Questions are mapped with NOS and PC
  - Question papers are prepared considering that level 1 to 3 are for the unskilled & semi-skilled individuals, and level 4 and above are for the skilled, supervisor & higher management
  - Assessor must be ToA certified & trainer must be ToT Certified
  - Assessment agency must follow the assessment guidelines to conduct the assessment
4. Types of evidence or evidence-gathering protocol:
  - Time-stamped & geotagged reporting of the assessor from assessment location
  - Centre photographs with signboards and scheme specific branding
  - Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period
  - Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos
5. Method of verification or validation:
  - Surprise visit to the assessment location
  - Random audit of the batch
  - Random audit of any candidate
6. Method for assessment documentation, archiving, and access
  - Hard copies of the documents are stored
  - Soft copies of the documents & photographs of the assessment are uploaded / accessed from Cloud Storage
  - Soft copies of the documents & photographs of the assessment are stored in the Hard Drives



## References

## Glossary

Term	Description
<b>Declarative Knowledge</b>	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem.
<b>Key Learning Outcome</b>	Key learning outcome is the statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application).
<b>OJT (M)</b>	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on site
<b>OJT (R)</b>	On-the-job training (Recommended); trainees are recommended the specified hours of training on site
<b>Procedural Knowledge</b>	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work, or produce a tangible work output by applying cognitive, affective or psychomotor skills.
<b>Training Outcome</b>	Training outcome is a statement of what a learner will know, understand and be able to do upon the completion of the training.
<b>Terminal Outcome</b>	Terminal outcome is a statement of what a learner will know, understand and be able to do upon the completion of a module. A set of terminal outcomes help to achieve the training outcome.

## Acronyms and Abbreviations

<b>NOS</b>	National Occupational Standard(s)
<b>NSQF</b>	National Skills Qualifications Framework
<b>QP</b>	Qualifications Pack
<b>TVET</b>	Technical and Vocational Education and Training
<b>SOP</b>	Standard Operating Procedure
<b>WI</b>	Work Instructions
<b>PPE</b>	Personal Protective equipment