



# Model Curriculum

**QP Name: Battery System Assembly Operator**

**QP Code: ELE/Q6604**

**QP Version: 2.0**

**NSQF Level: 4**

**Model Curriculum Version: 2.0**

Electronics Sector Skills Council of India || 155, 2nd Floor, ESC House, Okhla Industrial Area- Phase 3, New Delhi- 110020

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## Training Parameters

<b>Sector</b>	Electronics
<b>Sub-Sector</b>	E-Mobility & Battery
<b>Occupation</b>	Assembly – EM&B
<b>Country</b>	India
<b>NSQF Level</b>	4
<b>Aligned to NCO/ISCO/ISIC Code</b>	NCO-2015/8212.0100
<b>Minimum Educational Qualification and Experience</b>	8th Grade Pass + NTC (2 years after 8th) +2 Year NAC/relevant Experience) OR 10th Grade pass + 2 Year NTC/NAC/ relevant experience OR Certificate-NSQF (Level-3 in the domain of EV / Electrical / Mechanical / Automobile ) with 2 Years of relevant Experience OR 12th Grade and 18 Years
<b>Pre-Requisite License or Training</b>	NA
<b>Minimum Job Entry Age</b>	18 Years
<b>Last Reviewed On</b>	30.12.2021
<b>Next Review Date</b>	30.12.2026
<b>NSQC Approval Date</b>	30.12.2021
<b>QP Version</b>	2.0
<b>Model Curriculum Creation Date</b>	30.12.2021
<b>Model Curriculum Valid Up to Date</b>	30.12.2026
<b>Model Curriculum Version</b>	2.0
<b>Maximum Duration of the Course</b>	450 Hours

## 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:

- Describe the role and responsibilities of a Battery System Assembly Operator
- Explain the design and connectivity requirement between various components of the assembly
- Explain the process of selecting Battery system components and functional blocks as per the Standard Operating Procedure (SOP)
- Describe the process of planning the assembly as per quality, industry and compliance standards
- Explain the precautionary measures to be taken before starting the assembly
- Demonstrate the process of assembling various components of the battery as per the SOP
- Explain the globally accepted regulatory standards to be adhered to during testing
- Demonstrate the process of testing the battery cells and modules for various performance parameters
- Explain how to find the cause of the problem if the test results diverge from specifications
- Demonstrate the use of correct techniques to rectify malfunctions as per the SOP
- Explain the importance of following inclusive practices towards all genders and pwd at work
- Explain the importance of following health and safety practices at the work

### 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>06:00</b>	<b>04:00</b>	<b>00:00</b>	<b>00:00</b>	<b>10:00</b>
Module 1: Introduction and orientation to the role of a Battery System Assembly Operator	06:00	04:00	00:00	00:00	10:00
<b>ELE/N6604 Assemble the Battery System</b>	<b>30:00</b>	<b>60:00</b>	<b>60:00</b>	<b>00:00</b>	<b>150:00</b>
Module 2: Assembly of the Battery system as per design	30:00	60:00	60:00	00:00	150:00
<b>ELE/N6605 - Test the Battery System assembly</b>	<b>30:00</b>	<b>50:00</b>	<b>90:00</b>	<b>00:00</b>	<b>170:00</b>
Module 3: Testing the Battery system after assembly	30:00	50:00	90:00	00:00	170:00

<b>ELE/N9905 Work effectively at the workplace</b>	<b>15:00</b>	<b>15:00</b>	<b>00:00</b>	<b>00:00</b>	<b>30:00</b>
Module 4: Soft Skills and Work Ethics	15:00	15:00	00:00	00:00	30:00
<b>ELE/N1002 Apply health and safety practices at workplace</b>	<b>15:00</b>	<b>15:00</b>	<b>00:00</b>	<b>00:00</b>	<b>30:00</b>
Module 5: Basic Health and Safety Practice	15:00	15:00	00:00	00:00	30:00
<b>DGT/VSQ/N0102- Employability Skills (60 Hours)</b>	<b>24:00</b>	<b>36:00</b>	<b>00:00</b>	<b>00:00</b>	<b>60:00</b>
Module 6: Employability Skills (60 Hours)	24:00	36:00	00:00	00:00	60:00
<b>Total Duration</b>	<b>120:00</b>	<b>180:00</b>	<b>150:00</b>	<b>00:00</b>	<b>450:00</b>

# Module Details

## Module 1: Introduction and orientation to the role of a Battery System Assembly Operator

### Terminal Outcomes:

- Describe the role and responsibilities of a Battery System Assembly Operator

<b>Duration: 06:00</b>	<b>Duration: 04:00</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Describe the size and scope of the Electronics industry and its sub-sectors.</li> <li>• Explain the working principle of an Electric Vehicle.</li> <li>• Explain the functions of a Battery system in an Electric vehicle.</li> <li>• Explain the role and responsibilities of a Battery System Assembly Operator.</li> <li>• Discuss various employment opportunities for a Battery System Assembly Operator in the Electronics industry.</li> <li>• Discuss the organisational policies on incentives, personnel management reporting structure, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Familiarization with the Battery Assembly Line</li> </ul>
<b>Classroom Aids</b>	
Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop	
<b>Tools, Equipment and Other Requirements</b>	
NA	

## Module 2: Assembly of the Battery system as per design

### Mapped to ELE/N6604

#### Terminal Outcomes:

- Explain the design and connectivity requirement between various components of the assembly
- Explain the criteria for selecting Battery system components and functional blocks
- Describe the process of planning the assembly as per quality, industry and compliance standards
- Explain the precautionary measures to be taken before starting the assembly
- Demonstrate the process of assembling various components of the battery

<b>Duration: 30:00</b>	<b>Duration: 60:00</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Explain the basic principles governing Electronics Engineering including ionization and the flow of electricity</li> <li>• Describe the safety and environmental standards that must be followed while assembling a Battery system</li> <li>• Explain the functions of Integrated Circuits (IC), Micro-Controller Unit (MCU), circuit diagram, ampere-hours and cell balancing</li> <li>• Explain the terminologies, graphical representations, signs and symbols related to Battery assembly</li> <li>• List the tools and equipment required for assembling a Battery system</li> <li>• Explain the use of various Battery systems software</li> <li>• Explain the importance of following quality standards during the assembly process</li> <li>• Explain the factors that may cause short circuits in the battery pack assembly</li> <li>• Explain the precautionary measures to be taken to protect against electrostatic discharge</li> </ul>	<ul style="list-style-type: none"> <li>• Prepare a sample design and connectivity for establishing interoperability between various components of the Battery system</li> <li>• Demonstrate the standard process of designing the Battery system using the components such as circuit, busbar, ICs, temperature monitoring sensor, functional block etc.</li> <li>• Demonstrate the use of relevant Personal Protective Equipment (PPE) to avoid shock, heat, deformation, short circuit etc. during the assembly process</li> </ul>
<b>Classroom Aids</b>	

Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop

**Tools, Equipment and Other Requirements**

Various Tools and Equipment Such as Soldering Station, Jigs, Fixture, Screw Guns, Torque Wrench, Digital Multimeter, ESD Gloves, Line Tester, Power Supply, Precision Screw Driver, Screw Driver Set, Shear Cutters, Universal Crimp Tool, Wire Stripper, ESD Mat, Ac Power Source, Allen Key Set, Connecting Wire, Safety Helmet, Safety Shoes Etc., Organizational Documents.



## Module 3: Testing the Battery system after assembly

### Mapped to ELE/N6605

#### Terminal Outcomes:

- Explain the globally accepted regulatory standards to be followed during testing
- Demonstrate the process of testing the battery cells and modules for various performance parameters
- Explain how to find the cause of the problem if the test results diverge from specifications
- Demonstrate the use of relevant techniques to rectify malfunctions as per the SOP

<b>Duration: 30:00</b>	<b>Duration: 50:00</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Describe the globally accepted standards for testing BE systems</li> <li>• Explain the standard performance parameters for battery cells, modules and Battery systems</li> <li>• Explain the usage mechanism of various testing equipment such as hydrometer, multimeter etc.</li> <li>• Describe the process of carrying out various battery cell tests such as thermal performance test, cold start test, capacity test, pulse power test, self-discharge test, energy efficiency test, cycle life test, etc.</li> <li>• Describe the process of carrying out various battery pack tests such as impedance spectroscopy test, thermal test, vibration test, etc.</li> <li>• Explain how to evaluate the test results to find the root cause of the problem</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the process of inspecting the battery cells, modules and systems against various performance parameters</li> <li>• Demonstrate the use of appropriate techniques to rectify malfunctions with the Battery system</li> </ul>
<b>Classroom Aids</b>	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
<b>Tools, Equipment and Other Requirements</b>	
Tools And Various Testing Equipment Such as Hydrometer, Multimeter, Power Supply, Wire Stripper, Ac Power Source, Allen Key Set etc. Organizational Documents.	

## Module 4: Soft Skills and Work Ethics

### Mapped to ELE/N9905

#### Terminal Outcomes:

- Work effectively at the workplace.
- Demonstrate practices related to gender and PwD sensitization.

Duration: 15:00	Duration: 15:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• State the importance of work ethics and workplace etiquette.</li> <li>• State the importance of effective communication and interpersonal skills.</li> <li>• Explain ways to maintain discipline at the workplace.</li> <li>• Discuss the common reasons for interpersonal conflict and ways of managing them effectively.</li> <li>• Discuss the importance of following organisational guidelines for dress code, time schedules, language usage and other behavioural aspects.</li> <li>• Explain the importance of working as per the workflow of the organisation to receive instructions and report problems.</li> <li>• Explain the importance of conveying information/instructions as per defined protocols to the authorised persons/team members.</li> <li>• Explain the common workplace guidelines and legal requirements on non-disclosure and confidentiality of business-sensitive information.</li> <li>• Describe the process of reporting grievances and unethical conduct such as data breaches, sexual harassment at the workplace, etc.</li> <li>• Explain the concept and importance of gender sensitivity and equality.</li> <li>• Discuss ways to create sensitivity for different genders and Persons with Disabilities (PwD).</li> <li>• Discuss ways of dealing with</li> </ul>	<ul style="list-style-type: none"> <li>• Prepare a sample plan to achieve organisational goals and targets.</li> <li>• Create a sample feedback form to obtain feedback from customers, colleagues etc.</li> <li>• Roleplay to demonstrate the use of professional language and behaviour that is respectful of PwD and all genders.</li> <li>• Apply organisational protocol on data confidentiality and sharing only with the authorised personnel.</li> </ul>

heightened emotions of self and others.	
<b>Classroom Aids</b>	
Training Kit (Trainer Guide, Presentations)	
<b>Tools, Equipment and Other Requirements</b>	
Sample Of Escalation Matrix, Organization Structure.	

## Module 5: Basic Health and Safety Practice

### Mapped to ELE/N1002

#### Terminal Outcomes:

- Apply health and safety practices at the workplace.

Duration: 15:00	Duration: 15:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Discuss job-site hazards, risks and accidents.</li> <li>• Explain the organizational safety procedures for maintaining electrical safety, handling tools and hazardous materials.</li> <li>• Elaborate on electronic waste disposal procedures.</li> <li>• Describe the process of disposal of hazardous waste</li> <li>• List the name and location of concerned people, documents and equipment for maintaining health and safety in the workplace.</li> <li>• Describe how to interpret warning signs while accessing sensitive work areas.</li> <li>• Explain the importance of good housekeeping.</li> <li>• Describe the importance of maintaining appropriate postures while lifting heavy objects.</li> <li>• List the types of fire and fire extinguishers.</li> <li>• Explain the importance of efficient utilisation of water, electricity and other resources.</li> <li>• List the common sources of pollution and ways to minimize it.</li> <li>• Describe the concept of waste management and methods of disposing hazardous waste.</li> <li>• Explain various warning and safety signs.</li> <li>• Describe different ways of preventing accidents at the workplace.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the use of protective equipment suitable as per tasks and work conditions.</li> <li>• Report any abnormal situation/behaviour of any equipment/system to the relevant authorities.</li> <li>• Administer first aid in case of a minor accident.</li> <li>• Demonstrate the steps to free a person from electrocution safely.</li> <li>• Administer Cardiopulmonary Resuscitation (CPR).</li> <li>• Demonstrate the application of defined emergency procedures such as raising alarm, safe/efficient, evacuation, moving injured people, etc.</li> <li>• Prepare a sample incident report.</li> <li>• Use a fire extinguisher in case of a fire incident.</li> <li>• Demonstrate the correct method of lifting and handling heavy objects.</li> </ul>

<b>Classroom Aids</b>
Training kit (Trainer guide, Presentations)
<b>Tools, Equipment and Other Requirements</b>
Personal Protection Equipment: Safety Glasses, Head Protection, Rubber Gloves, Safety Footwear, Warning Signs and Tapes, Fire Extinguisher, First Aid Kit, Fire Extinguishers and Warning Signs.

## Module 6: Employability Skills (60 Hours)

### Mapped to DGT/VSQ/N0102

#### Terminal Outcomes:

1. Discuss about Employability Skills in meeting the job requirements
2. Describe opportunities as an entrepreneur.
3. Describe ways of preparing for apprenticeship & Jobs appropriately.

<b>Duration: 24:00</b>	<b>Duration: 36:00</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Explain constitutional values, civic rights, responsibility towards society to become a responsible citizen</li> <li>• Discuss 21<sup>st</sup> century skills</li> <li>• Explain use of basic English phrases and sentences.</li> <li>• Demonstrate how to communicate in a well-behaved manner</li> <li>• Demonstrate how to work with others</li> <li>• Demonstrate how to operate digital devices</li> <li>• Discuss the significance of Internet and Computer/ Laptops</li> <li>• Discuss the need for identifying business opportunities</li> <li>• Discuss about types of customers.</li> <li>• Discuss on creation of biodata</li> <li>• Discuss about apprenticeship and opportunities related to it.</li> </ul>	<ul style="list-style-type: none"> <li>• List different learning and employability related GOI and private portals and their usage</li> <li>• Show how to practice different environmentally sustainable practices.</li> <li>• Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management, etc.</li> <li>• Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone</li> <li>• Demonstrate how to communicate in a well-mannered way with others.</li> <li>• Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette</li> <li>• Utilize virtual collaboration tools to work effectively</li> <li>• Demonstrate how to maintain hygiene and dressing appropriately.</li> <li>• Perform a mock interview</li> </ul>
<b>Classroom Aids</b>	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
<b>Tools, Equipment and Other Requirements</b>	
Computer, UPS, Scanner, Computer Tables, LCD Projector, Computer Chairs, White Board	
OR	
Computer Lab	

## Module 7: On-the-Job Training

### *Mapped to Battery System Assembly Operator*

<b>Mandatory Duration: 150:00</b>	<b>Recommended Duration: 00:00</b>
<b>Location: On-Site</b>	
<p><b>Terminal Outcomes</b></p> <ol style="list-style-type: none"> <li>1. Explain the fundamental concept of an Electric Vehicle.</li> <li>2. Explain the application of battery, battery system and chargers in an Electric Vehicle.</li> <li>3. Review the design thoroughly before starting the assembly process.</li> <li>4. Implement necessary precautionary measures before the assembly.</li> <li>5. Comply with global standards for Battery assembly and testing.</li> <li>6. Assemble the Battery system as per Standard Operating Procedure.</li> <li>7. Perform various standard tests for evaluating the performance of a battery and battery system.</li> <li>8. Perform necessary corrective measures after reviewing the test results.</li> <li>9. Interact and coordinate with supervisor and colleagues.</li> <li>10. Perform assigned work within timelines and with defined quality.</li> <li>11. Demonstrate how to maintain a healthy, safe and secure working environment.</li> </ol>	

# Annexure

## Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
ITI/ Diploma/ Certified in relevant CITS Trade	Electronics / Mechanical/ Electrical	1	Battery System Assembly Operator	1	Electronics	

Trainer Certification	
Domain Certification	Platform Certification
“Battery System Assembly Operator”, “ELE/Q6604, v2.0”, Minimum accepted score is 80%	Recommended that the Trainer is certified for the <b>Battery System Assembly Operator</b> “Trainer (VET and Skills)”, mapped to the Qualification Pack: “MEP/Q2601, V2.0”, with minimum score of 80%



## Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training/Assessment Experience		Remarks
		Years	Specialization	Years	Specialization	
ITI/ Diploma/ Certified in relevant CITS Trade	Electronics / Mechanical/ Electrical	2	Battery System Assembly Operator	1	Electronics	

Assessor Certification	
Domain Certification	Platform Certification
<p>“Battery System Assembly Operator”, “ELE/Q6604, v2.0”, Minimum accepted score is 80%</p>	<p>Recommended that the Assessor is certified for the <b>Battery System Assembly Operator</b> “Assessor (VET and Skills)”, mapped to the Qualification Pack: “MEP/Q2701, V2.0”, with minimum score of 80%</p>

## 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
- The assessment agency deploys the ToA certified Assessor for executing the assessment
- SSC monitors the assessment process & records

### 2. Testing Environment

To ensure a conducive environment for conducting a test, the trainer will:

- 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 10 a.m. and 5 p.m. respectively
- Ensure there are two Assessors if the batch size is more than 30.
- 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 levels 1 to 3 are for the unskilled & semi-skilled individuals, and levels 4 and above are for the skilled, supervisor & higher management
- The assessor must be ToA certified & the trainer must be ToT Certified
- The 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:

To verify the details submitted by the training centre, the assessor will undertake:

- A surprise visit to the assessment location
- A random audit of the batch
- A random audit of any candidate

### 6. Method for assessment documentation, archiving, and access

To protect the assessment papers and information, the assessor will ensure:

- 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 drive

# 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</b>	A key learning outcome is a 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
<b>Training Outcome</b>	Training outcome is a statement of what a learner will know, understand and be able to do <b>upon the completion of the training.</b>
<b>Terminal Outcome</b>	The terminal outcome is a statement of what a learner will know, understand and be able to do <b>upon the completion of a module.</b> A set of terminal outcomes help to achieve the training outcome.

## Acronyms and Abbreviations

Term	Description
DC	Direct Current
EM&B	E-Mobility & Battery
IC	Integrated Circuit
ITI	Industrial Training Institute
MCU	MicroController Unit
NCO	National Occupational Standards
NOS	National Skills Qualification Committee
NSQF	National Skills Qualification Framework
OJT	On-the-Job Training
OMR	Optical Mark Recognition
PC	Performance Criteria
PwD	Persons with Disabilities
QP	Qualification Pack
SDMS	Skill Development & Management System
SIP	Skill India Portal
SME	Small and Medium Enterprises
SOP	Standard Operating Procedure
SSC	Sector Skill Council
TC	Trainer Certificate
ToA	Training of Assessors
ToT	Training of Trainers
TP	Training Provider
UL	Underwriter Laboratories
VTP	Vocational Training Provider