NATIONAL FEDERATION OF ENGINEERS FOR ELECTRICAL SAFETY

Electrical Safety Professional Certification Scheme

COMPETENCE CRITERIA

A. INTRODUCTION:

The National Federation of Engineers for Electrical Safety (NFE) is developing an Electrical Safety Professionals Certification Scheme (ESPCS) [hereafter referred to as the Scheme] for the certification of ES professionals.

The Scheme has a set of competence criteria requirements against which professionals shall be evaluated in order to be certified.

B. OBJECTIVE:

The aim of establishing competence criteria is to provide a clear definition of the competencies expected in individuals seeking professional certification.

C. PURPOSE:

The scheme is for professionals involved in design, selection, erection and verification of electrical systems under the following three categories (the titles of the categories are indicative):

1. Design and Selection: NFE Certified Electrical Consultant.
2. Erection: NFE Certified Electrical Installer.
3. Verification: NFE Certified Electrical Safety Verifier.

This document is a competence standard for defining the competence of the professionals desirous of seeking certification under the Scheme.

1. Design and Selection: NFE Certified Electrical Consultant

a) Roles and Responsibilities

Designing of electrical installation in compliance with the requirements of National Electrical Code of India 2023 (NEC 2023), IEC 60364 (all parts) and the Central Electricity Authority Measures Relating to Safety and Electric Supply Regulations 2023 up to and including a supply voltage of 33 kV. Selection of equipment and devices confirming to IS / IEC standards used in these electrical installation.

I. Designing of electrical installation so as to ensure protection and safety for human beings, livestock and property by providing protection against electric shock by appropriate basic and fault protective measures suitable for the location.

II. Designing of electrical installation so as to protect against thermal effects by minimizing the risk of damage or ignition of flammable materials due to high temperature or electric arc and ensuring no risk burns.

III. Designing of electrical installation so as to protection against injury or damage due to excessive temperatures or electromechanical stresses caused by over currents and fault currents,

IV. Designing of electrical installation so as to protect against voltage disturbances and electromagnetic influences such as fault between live parts of circuits supplied at different voltages, over voltages such as those originating from atmospheric events or from switching, damage as a consequence of undervoltage and any subsequent voltage recovery and ensuring that the installation is having adequate immunity against electromagnetic disturbances so as to function correctly in the specified environment.

b) Prerequisite:

Abilities: Professionals should possess a certificate signed by a medical practitioner that specifically includes assessments of hearing, sight, and colour blindness. In the event of any changes in their physical abilities, professionals are required to promptly notify the PrCB.

i) **Education:** Degree/ Diploma in Engineering.

ii) **Experience:** Post qualification minimum two years for degree holder and five years for diploma holder in relevant field of electrical installation design.

iii) Certified by a consumer/customer with connected load more than 50 kW, in respect of design work undertaken by the professional. The certificate shall comprise the details of work executed.

c) Knowledge:

Knowledge about the characteristics of the supply such as voltage, current, frequency, impedance of circuits and protective provisions inherent in the supply.

Knowledge about optimising the design based on the number and type of circuits required for lighting, heating, power, control, signalling, information and communication technology, etc. determined by location and number of power demand, loads to be expected on the various circuits, daily and yearly variation of demand, any special conditions such as harmonics, requirements for control, signalling, information and communication technology, etc, anticipated future demand if specified.

Knowledge about Electric supply systems for safety services or standby electric supply systems, Environmental conditions, Cross-sectional area of conductors, Characteristics of available supply or supplies, Type of wiring and methods of installation, Protective equipment to be used, Emergency control, Disconnecting devices, Prevention of mutual detrimental influence, Accessibility of electrical equipment and Documentation for the electrical installation.

Knowledge to select electrical equipment complying to IS/IEC standards based on

1. Characteristics such as Voltage, Current, Frequency, Load factor,
2. Conditions of installation so as to withstand safely the stresses and the environmental conditions of its location and to which it may be subjected,
3. Prevention of harmful effects such as power factor, inrush current, asymmetrical load, harmonics, transient overvoltages generated by equipment in the installation on other equipment or impair the supply during normal service.

d) Skill:

Skill in creating;
1. Electrical SLD, layout, BOM with specification and clarity
2. Protection scheme with Relays, MCB, MCCB, Fuses, RCD's based on its characteristics and suitability to the application,
3. Relay setting and protection grading,

4. Right use of notations, symbols, abbreviations and conventions, references, instructions and notes
5. Efficient deployment of circuits and sockets to address all the equipment and installation requirements.

2. Erection: NFE Certified Electrical Installer

a) Roles and Responsibilities

Erection of the electrical installation in compliance with the requirements of National Electrical Code of India 2023 (NEC 2023), IEC 60364 (all parts) and the Central Electricity Authority Measures Relating to Safety and Electric Supply Regulations 2023 up to and including a supply voltage of 33 kV.

1. Good workmanship and proper materials shall be used.
2. Electrical equipment shall be installed in accordance with the instructions provided by the manufacturer of the equipment.
3. The characteristics of the electrical equipment, as specified by the electrical consultant shall not be impaired during erection.
4. Materials and components used shall not be damaged,
5. Routing, glanding and terminations of the cables are carried out for the best performance of the electrical installation.

b) Prerequisite:

Abilities: Professionals should possess a certificate signed by a medical practitioner that specifically includes assessments of hearing, sight, and colour blindness. In the event of any changes in their physical abilities, professionals are required to promptly notify the PrCB.

i) **Education:** Professional shall have the ability to understand the scheme documents and the defined criteria.

ii) **Experience:** Minimum two years in execution of electrical installation or operation and maintenance work including installation and commissioning of products / equipment such as UPS, Drives, Panels, BMS system.

iii) Certified by a contractor or a consumer with more than 250 kW connected load in respect of works undertaken or maintained respectively by the professional. The certificate may comprise the details of work executed or operated and maintained or both.

c) Knowledge:

1. Conductors and terminals, if necessary, shall be identified in accordance with IEC 60445.
2. All electrical equipment shall be installed in such a manner that the designed heat dissipation conditions are not impaired.
3. All electrical equipment likely to cause high temperatures or electric arcs shall be placed or guarded so as to minimize the risk of ignition of flammable materials.
4. Exposed parts of electrical equipment is likely to cause injury to persons due to high temperature shall be so located or guarded to prevent accidental contact therewith.
5. Suitable warning signs and/or notices shall be provided if necessary for safety purposes, insulated mats to be provided in front of switch boards.

6. Where an installation is erected by using new materials, inventions or methods leading to deviations from the rules of NEC 2023/IEC 60364 series, the resulting degree of safety of the installation shall not be less than that obtained by compliance with NEC 2023/IEC 60364 series.
7. In the case of an addition or alteration to an existing installation, it shall be determined that the rating and condition of existing equipment, which will have to carry any additional load, is adequate for the altered circumstances as specified by the electrical consultant. Furthermore, the earthing and bonding arrangements, if necessary for the protective measure applied for the safety of the addition or alteration, shall be adequate.

d) Skill:

Overall skills for an electrical Installer:

1. Connections between conductors and other electrical equipment shall be made in such a way that safe and reliable contact is ensured.
2. Protection devices are optimum and effectively deployed as per the design,
3. Circuits are deployed as per design and optimum use of cables and sockets,
4. Neat and efficiently deployed cabling, earthing, cabling accessories etc.

3. Verification: NFE Certified Electrical Safety Verifier.

a) Roles and Responsibilities:

Verification of the electrical installation in compliance with the requirements of National Electrical Code of India 2023 (NEC 2023), IEC 60364 (all parts) and the Central Electricity Authority Measures Relating to Safety and Electric Supply Regulations 2023 up to and including a supply voltage of 33 kV.

Initial verification of an electrical installation before being placed in service and after any important modification to confirm proper execution of the work. Periodic verification of an electrical installation as per the recommended periods and practices.

b) Prerequisite:

Abilities: Professionals should possess a certificate signed by a medical practitioner that specifically includes assessments of hearing, sight, and colour blindness. In the event of any changes in their physical abilities, professionals are required to promptly notify the PrCB.

a. **Education:** Degree or Diploma in Electrical, Electronics or Instrumentation Engineering .

b. **Experience:** Post qualification three-year experience in the field of electrical verification works such as verification of electrical installation/cabling, earthing system, protective devices, equipment and materials as per specification given by electrical consultant / standards.

c. Self-declaration by the professional along with filled form as per NEC 2023 part 1, section 17 annexure D of one verification completed or participated as a member in a group.

c) Knowledge:

Knowledge of all safety requirements in NEC 2023, IS732 & IEC 60364 including methods adopted for protection against electric shock by appropriate basic and fault protective measures suitable for normal and special locations, protection against thermal effects by minimizing the risk of damage

or ignition of flammable materials due to high temperature or electric arc and ensuring no risk burns, protection against injury or damage due to excessive temperatures or electromechanical stresses caused by over currents and fault currents, protection against voltage disturbances and electromagnetic influences such as fault between live parts of circuits supplied at different voltages, over voltages such as those originating from atmospheric events or from switching, damage as a consequence of undervoltage and any subsequent voltage recovery and ensuring that the installation is having adequate immunity against electromagnetic disturbances so as to function correctly in the specified environment.

Knowledge about Electric supply systems for safety services or standby electric supply systems, type of wiring and methods of installation, protective equipment to be used, emergency control, disconnecting devices, prevention of mutual detrimental influence, accessibility of electrical equipment and documentation for the electrical installation.

Knowledge in the electrical installation condition report on an electrical installation as per Part 1 section 17 annexure D of NEC 2023.

Knowledge on CEA Measures relating to safety and electric supply regulations 2023 up to and including a supply voltage of 33 kV.

d) Skill:

The electrical safety verifier is skilled in

1. Basic and additional safety and reliability requirements in normal and special locations.
2. Selection of devices based on relevant standards,
3. Inspection and Testing of LV system as per NEC,
4. Test instruments, standards, calibration, accuracy, application,
5. Application of equipment, devices and their safety requirements,
6. To identify that every circuit, cabling, socket and installation has been addressed effectively,
7. To make a clear electrical installation condition report on an electrical installation,
8. Understand and fill the model forms including the schedule of inspections and schedule of test of results as per NEC 2023 and to grade non-compliances into C1, C2 or C3,
9. Perform tests to measure loop impedance, insulation resistance, RCD trip times and protective conductor resistance,
10. Locate and guide to rectify faults,
11. Report of compliance and noncompliance if any also submit Punch / Snag list after verification is complete.

Bibliography: The following documents were consulted and utilized as sources of information:

1. Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023.
2. National Electrical Code of India 2023 (SP-30).
3. IS732: Code of Practice for Electrical wiring.
4. IS/IEC 61936-1: Power installations exceeding 1 kV AC and 1,5 kV DC – Part 1: AC.
5. IEC 60364 (all parts).