

Additional Information for Application to become Licensed Electrician

(1) Qualifications

In accordance with the Electricity (Electrical Workers Regulation), a Licensed Electrician licence may be issued to any person who:

- (a) possesses a National Institute of Technical Education Certificate which curriculum is relevant to the electrical work which an electrician is authorized to perform and has not less than 2 years practical experience in Singapore relevant to the electrical work which an electrician is authorised to perform, or
- (b) has not less than 10 years practical experience in Singapore relevant to the electrical work which an electrician is authorised to perform, or
- (c) has not less than 5 years practical experience in Singapore relevant to the electrical work which an electrician is authorised to perform and has successfully completed a course of instruction specified on the approved courses webpage that is relevant to the electrical work which an electrician is authorised to perform, or
- (d) had been registered as an electrical contractor by the Public Utilities Board before 1st January 1975.

(2) Application

Any individual who meets the qualifications in (1) and is currently involved in electrical work which an electrician is authorized to perform can apply to become a Licensed Electrician by submitting an application to EMA.

(3) Competency Assessment

After successful application, the candidate's technical competency will be assessed through a written test, practical test and interview.

3.1 Written test

A candidate is required to sit for a written test which is conducted approximately once every two months.

The written test consists of five Sections:

- Section A - Domestic Installation (20 MCQs) [40 marks]
- Section B - Domestic Installation long questions [60 marks]
- Section C - Industrial Installation (20 MCQs) [40 marks]
- Section D - Industrial Installation long questions [60 marks]
- Section E - Regulation (20 MCQs) [40 marks]

The duration of the written test is three (3) hours. The overall passing score is 50% provided that the candidate obtains at least 75% score in Section E.

3.1.1 Written Test Syllabus

- (a) Electricity Act and relevant Electricity Regulations

Familiarization of the relevant Electricity Acts and Regulations, including and not limited to:

- i) Definitions in the regulations
- ii) Authority conferred by license under different classes of Licensed Electrical Workers
- iii) Responsibility of holder of each class of licence
- iv) Connection of electrical installation to supply line
- v) Modification to electrical installation / supply installation
- vi) Compliances on testing of electrical installation / supply installation
- vii) Person responsible for electrical installation / supply installation

Reference

- i) Electricity Act Part 9: Electrical and Supply Installations
- ii) Electricity (Electrical Installations) Regulations Part 1: Preliminary, Part II: Electricity Supply, Part III: Electrical Installations, Part V: Licensing of Electrical and Supply Installations.
- iii) Electricity (Electrical Workers) Regulations
- iv) Electricity (Licensing of Electrical and Supply Installations) (Exemption) Notification

(b) Domestic and Industrial Installations

Familiarization of the requirements for electrical installations, including and not limited to:

- i) Understanding the design of single line diagram (SLD)
 - Purpose of each electrical symbol in the SLD. Able to identify the symbol conventions and functions used in the protective devices, such as MCB, RCCB... etc.
 - Typical arrangement of incoming protective devices, outgoing protective devices, external protection devices, measuring instruments, indicating lights...etc. in a circuit.
 - Able to design a SLD for small installation (up to 45kVA)
- ii) Design of an electrical installation
 - Able to calculate maximum demand based on domestic/industrial design requirements
 - Calculate protective devices' rating
 - Calculation and selection of cable size
 - Application of correction factors for ambient temperature, grouping, insulation, harmonics etc.
 - Selection of wiring installation, enclosure, cable conduits, trunking, cable trays ...etc.
 - Calculation of voltage drop in electrical circuits, maximum voltage drops allowance and acceptable limits, methods to reduce voltage drops
 - Segregation of different circuits due to voltage limits, types of loads, mutual interference
- iii) Protection against electric shock
 - Types of electrical shocks (direct contact, indirect contact)
 - Protective measures to prevent electric shock and its applications
 - Application of basic protection and fault protection
 - Physiological effect of electric current
 - Calculation of touch voltage
 - Sensitivity of RCCB (nuisance tripping etc.)
- iv) Earthing and bonding
 - Types of Earthing systems (TN-S, TT etc.)
 - Bonding in the protection against electric shock
 - Purpose of earthing

- Purpose of bonding
 - Earthing and bonding connection methods
 - Identifying extraneous conductive parts
- v) Alternating Current (AC) and Direct Current (DC) supplies
- Voltage levels in Singapore
 - Application of ohm's law, Kirchhoff's laws, Thevenin's theorem, electrical quantities in mean and r.m.s. value in circuits
 - relationship between three phase line current and phase current and relationship between three phase line voltage and phase voltage
 - Generation of Direct Current (DC) electricity, conversion of electricity from AC to DC, DC to AC, principles of solar PV, battery supply
 - harmonics due to non-linear loads
 - colour code identification for single phase AC, three phase AC and DC cables
 - power factor in electrical circuits, power factor correction methods, problems due to low power factors
- vi) Principles of operation of rotating machines, AC and DC machines
- Characteristics of motor starting methods (direct-on-line, star-delta, soft starter)
 - Control diagram of motor control circuits, interlocking, start-stop control, emergency stop, sequential starting, use of PLC, relays and contactors
 - trouble shooting of machines, abnormal humming sound, machines stalled, machines cannot be started
 - Able to calculate real, apparent and reactive power of a motor
- vii) Principles and operation of small generator
- Generator protection
 - Generator installation
- viii) Pre-commissioning and turn-on inspection & test
- Types of the commissioning tests and the purpose of each test
 - Visual Inspection
 - Earth resistance test
 - Insulation resistance test
 - Phasing and polarity test
 - Continuity test
 - Earth loop impedance test
 - RCCB test
 - MCCB trip test
 - Voltage measurement
 - Use of common test instruments
 - Operation, testing and maintenance of small electrical installation
 - Tests after supply turn-on
 - Electrical safety requirements for temporary electrical installation, SOA

Candidate can use non-programmable calculator during the written test. However, use of any electronic communication devices such as mobile phones and tablets is not permitted.

Reference:

- i) Singapore Standard SS 638: Code of Practice for electrical Installations

- ii) SS 650 Code of practice for temporary electrical installations Part 1: Construction and building sites
- iii) SS 650 Code of practice for temporary electrical installations Part 2: Festive lighting, trade fairs, mini-fairs and exhibition sites
- iv) SS CP 83 Code of Practice for construction computer-aided design (CAD) – Part 2: CAD symbols
- v) Handbook for application of electrical installation license
- vi) Relevant Singapore Standards, Code of Practice and publications on design, installation, commissioning and maintenance of electrical installations

Those who pass the test will be invited to attend a Practical Assessment and Oral Assessment. Please note that the written test is valid for three (3) years. Candidates are required to obtain the electrician license within three years after passing the written test, failing which the candidate will have to re-take the written test.

3.2 Practical Test and Technical Competency Assessment Interview

3.2.1 The Practical Test is to assess the candidate's ability to test and / or troubleshoot the electrical wiring installation in an electricity board, where there are a few electrical faults. Candidates are encouraged to bring along their personal:

- i) Continuity Tester / multimeter
- ii) Screwdriver (Philips and flathead)
- iii) Hand gloves, if preferred

Candidate must be appropriately dressed during the practical assessment including wearing sleeved shirt, long pants and covered footwear.

3.2.2 Technical Competency Assessment Interview

Candidates who successfully pass the practical test will immediately proceed to an interview with a panel. During the Assessment Interview, the candidates are required to demonstrate their understanding on the following topics:

- (a) The use the Electrical Single Line Diagram to show the design intent and requirements of an electrical installation
 - i) The standard graphical symbols in accordance with the Singapore Standard CP 83 Part 2
 - ii) The important information to be included in the single line diagram, i.e. the current carrying capacity, short circuit capacity, protection current transformer or measurement current transformer details, busbar size ...etc
 - iii) Protective device settings to ensure electrical safety
 - iv) Type and rating of all outgoing circuits
 - v) Instrumentation / metering requirements
 - vi) Generator or other sources of supply
 - vii) Type of earthing and earthing requirements
- (b) Protection for electrical safety
 - i) Protection against electric shock using basic protection and fault protection measures
 - ii) Protection against thermal effects due to heat, ignition, combustion and degradation of materials, flames and smokes due to fire
 - iii) Protection against overcurrent which include the use of built-in protection device and external protection relays against overload and against electrical fault

- iv) Selection of protective and isolation devices and the use of log-out-tag-out for isolation purpose
- (c) Earthing and bonding
 - i) The design and installation requirements of protective earthing and protective bonding
 - ii) TT and TN-S earthing system in Singapore, the protective measures for TT and TN-S earthing systems
 - iii) Difference between Earth Resistance and Earth loop impedance, the acceptable limit of earth resistance and earth loop impedance to ensure electrical safety
- (d) Testing and commissioning procedures
 - i) Visual inspection to verify the installation is in accordance with the design requirements, labelling and identification, basic protection measures
 - ii) Pre-turn on commissioning test such as continuity test, insulation resistance test, polarity test
 - iii) Safety measures to protect the testing personnel from danger and the importance of the sequence of commissioning tests
 - iv) Post-turn on commissioning tests such as rotation test, voltage measurement test, RCCB test ...etc
- (e) Temporary installation
 - i) Requirements in Singapore Standards SS 650 Part 1 and Part 2
 - ii) Basic and fault protection in temporary installation
 - iii) Earthing system of generator for temporary installation
 - iv) Application of Socket Outlet Assembly in construction work site