Education & Communities
Office of Education

State Training Services

NSW Vocational Training Tribunal

Electrical Industry Trades

- **Electrical (Electrician)**
- **Electrical (Electrical Machine Repair)**
- **Electrical (Switchgear and Control Gear)**

INFORMATION GUIDE FOR TRADE RECOGNITION APPLICANTS

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DEMONSTRATING YOUR TRADE SKILLS

Evidence of trade skills and practical experience:

If you are seeking recognition in one of the electrical industry trades, you must provide evidence that demonstrates your skills, training, practical experience and duration of employment in the trade of at least four (4) years. Supporting evidence should include:

- Work related references from employers and/or trade qualified supervisors confirming the duration of employment in the trade and detailing the type of work you have performed, procedures applied and tools and equipment used related to the trade for which you are applying. *Note: References must be on your employer's letter-head, signed and dated*.
- Either job journals, work diaries, log books, photographic evidence or work experience records that illustrate the type and extent of trade work you have performed.
- Certificates and/or achievements of formal training related to the trade including any skill development profiling records or reports. Testimonials of trade skills may also be used.
- Employment records in the trade and any other evidence demonstrating that you are experienced, adequately trained and competent to do trade work.

Trade recognition application and assessment process:

Self Assessment

Refer to the Electrical Industry Trades outlined on **Page 4 and 5** and consider the description of work and skill requirements of each trade.

→ Use the 'Self-Assessment' checklist to confirm:
- Which trade relates to your skills & experience, and
- That your evidence will support trade recognition in that trade.

Lodge Application

Complete the NSW Vocational Training Tribunal (VTT) 'Application for a Recognised Trade Certificate' and ensure that all the supporting evidence relates to the trade requested.

→ Lodge your application with the VTT Unit or State Training Centre (STC) with the required fee.
If all evidence required is included, your application will be submitted to the VTT for assessment

Vocational Training Tribunal (VTT) Assessment and Determination

The VTT will assess your Application for Trade Recognition against the required skills, experience and duration of employment in the trade and make a determination.

→ The VTT may determine to:
- Approve or refuse your application, *or*
- Request more information, or
- Invite you to interview to obtain more detail, *or*
- Arrange further investigation/assessment of your skills & experience at your workplace, *or*
- Request you to do a Trade Test (See **Page 6**).

Applicants **APPROVED** by the VTT with appropriate and sufficient trade skills, training and experience in the trade of at least four (4) years will be issued with a:
- **Certificate of Proficiency** – if you have been awarded the relevant qualification by an RTO, *or*
- **Craft Certificate** – if you have **NOT** been awarded the relevant qualification by an RTO.

SELF ASSESSMENT – ELECTRICAL INDUSTRY TRADES

Electrical Industry Trade – Classifications and Skill Requirements:

Electrical industry trade employees in NSW are involved in a range of specialised trade work. Different trade classifications are declared for these trades in NSW based on the type of work undertaken. Following is a description of the different electrical industry trade classifications and a list of the skill requirements for each trade.

Consider the descriptions and skill requirements of each specialised electrical industry trade classification and use the checklist to confirm which trade matches your skills and experience.

Electrical Trade Classifications in NSW	Description of Trade Work and Skill Requirements	Self Assessment Check List
➢ **Electrical (Electrician) Trade** [License required in NSW]	***Electrical (Electrician)* trade workers select, install, set up, test, fault find, repair and maintain electrical systems and equipment in industrial, commercial and domestic settings.** ***Core skill requirements include:*** ▪ Dismantle, assemble and fabricate general electrical components as well as fix and secure electrical equipment ▪ Solve problems in extra-low voltage single path circuits, multiple path direct current circuits, electromagnetic circuits and in single and three phase low voltage circuits ▪ Use electrical drawings, diagrams, schedules and manuals. ***Specialised skill requirements include:*** ▪ Lay wiring and terminate accessories for ELV ▪ Install wiring and accessories for low voltage (LV) circuits (including a range of LV power cables, data cables and cable support systems such as metal and non-metal conduit/trunking and underground systems) ▪ Install LV electrical apparatus and associated equipment (including switchboards, circuit protection devices, power/heating and lighting apparatus, AC/DC motors, transformers and associated controls) ▪ Select and arrange equipment for general electrical installations (including design, install & termination of consumer mains, sub-mains & final sub-circuits AND experience with the MEN wiring system) ▪ Find and repair faults in electrical apparatus and circuits (including fault finding LV power and control circuit wiring as well as mechanical repairs to electrical gear) ▪ Develop and connect control circuits ▪ Verify compliance and functionality of general electrical installations (must include testing of insulation, earth continuity/resistance, polarity & fault-loop impedance testing).	**I can provide evidence for these skills with my application:** ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Electrical Trade Classifications in NSW	Description of Trade Work and Skill Requirements	Self Assessment Check List
➢ **Electrical (Electrical Machine Repair) Trade** [NON Licensed trade]	***Electrical (Electrical Machine Repair)*** **trade workers maintain and repair electrical machines and associated controls within a variety of industrial and commercial contexts. They overhaul, repair and rewind motors, transformers and control gear.** ***Core skill requirements include:*** (Same as core skill requirements for Electrical (Electrician) Trade) ***Specialised skill requirements include:*** ▪ Wind coils (including selection of wire and insulation to specifications and set up /operation of winding machines) ▪ Place and connect coils (including insulation preparation, coil forming, interconnection and termination) ▪ Rewind and repair of single phase and three phase low voltage induction machines (including dismantling, repair and re-assembly of machine components, stator preparation, winding specifications, winding types and connections) ▪ Conduct electrical tests on LV machines (including fault finding of single & three phase motors and/or transformers and testing methods used to verify electrical safety and operation) ▪ Disconnect and reconnect fixed wired LV electrical equipment (including isolation procedures, testing prior to reconnection).	**I can provide evidence for these skills with my application:** ☐ ☐ ☐ ☐ ☐ ☐
➢ **Electrical (Switchgear & Control Gear) Trade** [NON Licensed trade]	***Electrical (Switchgear & Control Gear)*** **trade workers construct, assemble and wire switchboards and electrical control panels.** ***Core skill requirements include:*** (Same as core skill requirements for Electrical (Electrician) Trade) ***Specialised skill requirements include:*** ▪ Assemble, mount and connect switchgear and control gear including make-up and assembly of bus bars (requires selection and placement of protection and control components, assemble and termination of bus bars) ▪ Assemble and wire control panels (including panel wiring techniques, selection of components and circuits for specific electrical motor / transformer control applications) ▪ Overhaul and repair switchgear, control gear and mechanical components of electrical machines (including fault finding) ▪ Assemble and connect communication frames and cabinets ▪ Enter and verify operating instructions of microprocessor equipped devices (including functions & parameters, testing) ▪ Develop, enter and verify programs for Programmable Logic Controllers (including PLC ladder instructions for control systems, connection and testing of external control devices) ▪ Disconnect and reconnect fixed wired LV electrical equipment (including isolation procedures, testing prior to reconnection).	**I can provide evidence for these skills with my application:** ☐ ☐ ☐ ☐ ☐ ☐ ☐

TRADE TEST PROCESS, SUPPORT AND DETAILS

Trade Test Process and Support:

If the Vocational Training Tribunal (VTT) requires you to do a Trade Test, the following process will be applied and support will be provided to ensure you have every chance of success.

Trade Testing is designed to assess a broad sample of knowledge and practical skills related to the electrical industry trade that matches your skills, training and experience. Results of the Trade Test will provide the VTT with additional information to support your application for trade recognition.

The VTT requests you to undertake a Trade Test. If you decide to proceed with the Trade Test you will need to pay the required Trade Test fee. Once the fee is paid the VTT will arrange a Trade Test with a TAFE NSW College.

Please consider the Trade Test details on the following pages to assist with your decision and preparation for the Trade Test.

TAFE NSW will contact you about the Trade Test and make arrangements for you to receive information about the Trade Test and assistance provided by the College.

Trade Test help includes:
- Interpreter services at your request.
- Adjusting assessment methods for those with a disability or learning difficulty.

You should arrange to familiarise yourself with the College workshop facilities & equipment prior to the test.

You will be required to attend the Trade Test at a date and time scheduled by the College. The Trade Test will be supervised by a technical expert who will be assessing your practical skills and knowledge related to the Trade.

- You are required to bring your own safety gear such as proper footwear, safety glasses & clothing.
- You may bring your own tools, meters, equipment.

A report on your achievements in the Trade Test will be submitted to the VTT following the test.

Your College Trade Test supervisor / assessor will NOT be able to give you feedback on your achievements in the Trade Test UNTIL AFTER the VTT has reviewed the results and provided you with a WRITTEN RESPONSE to your application for recognition.

The VTT will consider your Trade Test achievements, advice provided by the TAFE NSW College technical expert and your application and either:

- ***Approve** your application and issue a **Craft Certificate**.*
- ***Refuse** your application and recommend you undertake further training and experience in the trade.*

If you are seeking recognition in a full national qualification related to the Trade, TAFE NSW offers recognition (RPL) services such as the Skills Express RPL process for Electricians. You should be employed in the trade to facilitate this process.

Trade Test Details:

Trade Tests for the electrical industry trades will take place at a TAFE NSW College determined by the VTT. The test is supervised by a TAFE NSW technical expert and is usually conducted in one day taking approximately 5 to 6 hours to complete.

The Trade Test is in two parts (*Part A – Knowledge Test and Part B – Practical Skills Test*). Details of each part have been described below to assist you to prepare for the test. You should familiarise yourself with knowledge requirements and the practical skill requirements of your selected trade.

PART A: Electrical Knowledge Test

The electrical knowledge test is designed to provide evidence that you can apply basic electrical trade knowledge to circuits and equipment to a level that meets acceptable requirements of electrical industry trades.

The electrical knowledge test covers core knowledge requirements across the three electrical trades outlined in this document. The test includes:

Knowledge Task	Detail
Basic dc circuits –analysis, connection and measurement.	- Single and multiple path dc series and parallel circuits: calculations of current, voltage and resistance and meter connections / readings.
Basic single and three phase circuits – analysis and measurement.	- Single phase ac circuits: calculations of voltage, current and ac power - Phasor relationships & analysis: current & voltage in ac resistive, inductive, capacitive circuits - Three phase supply: line and phase voltage measurement and socket outlet polarity.
Transformer connections, analysis and measurement.	- Star (Wye) and Delta connections of single phase transformers to a three phase supply - Transformer turns, voltage and current ratios; - Single phase transformer winding connections.
Basic circuits for electrical machines and controls.	- Basic dc motor connections and analysis - Basic single phase and three phase ac motor connections - Basic three phase ac motor starter circuit connections (main and control circuits).
Electromagnetic effects in ac circuit components.	- Adverse effects of electromagnetic induction - Inductors and inductance - Magnetic poles of machines and solenoids.
Electrical equipment testing and connection.	- Mandatory testing of electrical equipment including continuity, earth and insulation resistance - Using appropriate electrical test equipment and range selection.

The following references may help you to prepare for the Knowledge and Practical Skills tests.

- Jenneson & Harper, 2010, Electrical Principles for the Electrical Trades, 6th Ed, McGraw Hill
- Hampson & Hanssen, 2008, Electrical Trade Principles : a Practical Approach, 2nd Ed, Pearson
- Pethebridge & Neeson, 2010, Electrical Wiring Practice, 7th Ed, Volumes 1 & 2, McGraw Hill

PART B: Practical Skills Test

The practical skills test includes a number of tasks designed to assess a broad range of practical trade skills to a level that meets acceptable requirements of each of the electrical industry trades.

The practical skills tests outlined below cover the requirements of **each of the three electrical trades** outlined in this document.

PLEASE NOTE:
Only consider tasks & detail of the Practical Skills Test relevant to your trade application

Electrical (ELECTRICIAN) Practical Skills Test	
Practical Task	**Detail**
Cable preparation and jointing techniques.	- Preparation of cables to fit lug types (essential to ensure lug is mechanically sound and electrically safe) - Soldered termination of stranded cables.
Flexible cable termination and polarity.	- Preparation of flexible cable to fit plug and socket to specifications - Terminations mechanically sound, electrically safe and polarity in accordance with standards.
Selection and connection of circuit protection devices – single phase.	- Selection of suitable circuit protection devices for single phase circuits in a domestic installation - Connection of circuit protection devices at a distribution board – MEN system.
Installation of low voltage enclosed wiring system – cables installed in conduit.	- Select and wire appropriate cable type and cable size for an enclosed wiring system connecting LV single and three phase socket outlets - Selection and preparation of metallic and non-metallic conduit types and accessories including conduit bending, setting and support - Use of appropriate mandatory testing procedures and test equipment to ensure the safety and integrity of the cables, conduits and socket outlets prior to connection to the supply.
Installation of low voltage un-enclosed wiring system – cables installed on a flat surface.	- Selection and wire appropriate cable type and cable size for an un-enclosed wiring system connecting LV single phase mixed power and lighting circuit (correct connection and polarity) - Correct cable preparation, termination and installation support of cables and accessories - Use of appropriate mandatory testing procedures and test equipment to ensure the safety and integrity of the cables and accessories prior to connection to the supply.
Isolation, disconnection, testing and reversal of a three phase induction motor.	- Correct isolation, disconnection and connection (including connections required to reverse direction) - Select appropriate test equipment and apply electrical tests to ensure safety and correct motor operation.
Electrical testing of equipment and circuits to verify safety compliance and operational integrity.	- Selection of appropriate test equipment, meter range selection and testing procedures to test: o Continuity, polarity and insulation resistance o Continuity and insulation resistance of Class I and Class II equipment o Single phase power and lighting circuit installation prior to connecting to supply.

Electrical (ELECTRICAL MACHINE REPAIR) Practical Skills Test	
Practical Task	**Detail**
Application of practical knowledge to general machine repair.	- Motor winding and winding insulation types including coil winding characteristics and basic calculations related to single & three phase motors - Single and three phase motor components, typical faults and fault remedies.
Sizing winding conductors and determining coil turns for a rewind.	- Use of appropriate equipment, wire gauge and insulation charts to determine coil turns, conductor size and temperature ratings of insulation for a motor rewind.
Pre-winding preparation for a three phase induction motor rewind.	- Use of appropriate equipment and techniques to determine poles and stator slots from name plate details - Calculation of coils per pole, coils per group and identification of coil span from appropriate Chord Factor data sheets.
Prepare and fit winding insulation, wind and place coils for a rewind.	- Measure, cut and fold and correct slot insulation - Wind and place coils - Use appropriate techniques to avoid insulation / coil damage.
Connect stator coils of a three phase induction motor.	- Identify starts and finishes of coil windings - Connect coils in star (wye) configuration and with correct polarity for the three phases - Solder and insulate joins and lace windings.
Winding tests and general fault tests related to electrical machines.	- Selection and use of appropriate test equipment to test coil continuity and insulation resistance - General fault testing methods to find short and open circuits on stator windings, rotor bars, armatures and earth faults.

Electrical (SWITCHGEAR & CONTROL GEAR) Practical Skills Test	
Practical Task	**Detail**
Manufacture copper bus bar.	- Use appropriate tools, materials and equipment – manufacture a copper bus bar to predetermined specifications.
Assemble and connect a three phase induction motor starter.	- Use appropriate tools, equipment and circuit diagrams - Selection and mounting of correct circuit breakers, fuses, contactors, overload / timer relays and other external control devices for a three phase induction motor starter assembly; - Selection, wiring and termination of correct circuit conductors for power and control circuits - Pre-test of circuit safety and operation prior to connection to supply.
PLC (Programmable Logic Controller) ladder diagrams.	- Conversion of schematic circuit diagrams to PLC ladder diagram including correct address labeling of input and output devices.
Isolation, disconnection, testing and reversal of a three phase induction motor.	- Correct isolation, disconnection and connection (including connections required to reverse direction) - Select appropriate test equipment and apply electrical tests to ensure safety and correct motor operation.