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| **Qualification National code and Title** | UEE30811 - Certificate III in Electrotechnology Electrician |
| **Unit/s National code/s and Title/s** | UEENEEG109A - Develop and connect electrical control circuits |

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| **Assessment # and Title** | |  | PORTFOLIO | | | |
| **Lecturer Name** | |  | | | | |
| **Student Name** | |  | | | | |
| **Student ID Number** | |  | | | | |
| **Telephone Contact Number** | |  | | **Email:** | | |
| By completing and submitting this signed form to my lecturer, I am stating that:   1. The attached submission is completely my own work 2. I understand a copy of my assessment will be kept by the NMTAFE for their records 3. I understand my assessment may be selected for use in the NMTAFE’s validation and audit process to ensure student assessment meets requirements | | | | | | |
| **Student Signature** |  | | | | **Date** |  |

**Assessment Result for Attempt \_**1

**\_\_\_**

**Satisfactory / Not Yet Satisfactory** *(please circle)* **Date:**

*In order to satisfy requirements for this assessment, you need to complete the following:*

*Feedback to student:*

* Review all the worksheets and/or exercises.
* Attend evening tutorials.
* Join a study group.
* Apply for a retest before the end of your enrolment period.

### Student Feedback

*Feedback from student:*

**Lecturer Signature**:

**Student Signature:**

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# STUDENT RECORD

*For hard copy submissions of assessment, please detach this part and keep as a record of your submission*

|  |  |
| --- | --- |
| **Assessment Number & Title** |  |
| **Date Submitted** |  |
| **Lecturer Signature** |  |

**Assessment Result for Attempt \_**1

**\_\_\_**

**Satisfactory / Not Yet Satisfactory** *(please circle)* **Date:**

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## Assessment type ():

* Questioning (Written)
* Practical
* Demonstration
* 3rd Party Report
* Other (*please specify.)*

**Assessment Instructions:**

1. Attempt ALL questions
2. Follow all instructions given by your assessor.
3. All diagrams must be neat and labelled.
4. All material handed in must have your full name on it.
5. All calculations and numerical answers must be shown correct to two decimal places and include both the unit of measurement and metric prefix if applicable.
6. If a question asks for a clause number from an Australian Standard, you must include the complete clause number.
7. Time allowed and aids permitted are indicated on the test paper.
8. Programmable and/or graphic calculators and phones are not permitted.
9. All bags, text books, pencil cases etc. must remain on the floor. Only the required pens, pencils, erasers, calculators are to be on the work surface.
10. Consult your assessor for assistance if required.
11. NO collaboration of any description between students.
12. You may not leave the assessment room without the assessor’s permission. If you leave without your assessor’s permission, your assessment attempt will be terminated and assessed as Not Yet Satisfactory.
13. Mobile phones must be Switched Off and placed in your bag for the duration of the assessment. If your mobile device is seen, ‘rings’ or vibrates during the assessment, your assessment attempt will be terminated and assessed as Not Yet Satisfactory.
14. If the assessment is interrupted for any reason, a new assessment will be attempted at a time determined by your assessor.
15. Verbal and written feedback will be given to you after the assessment.

**CANDIDATE ISTO USE CORRECT ISOLATION PROCEDURES AT ALL TIMES**

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***Candidates are reminded of their right to appeal an assessment process.***

**Requirements for motor control;**

|  |  |
| --- | --- |
| 1. Which breaker type is commonly used for protection of motor power circuits? |  |
| 2. According to the wiring rules how many isolating switches are required for multiple motors to run as a group? |  |
| 3. State calculated current under locked rotor conditions for AC and DC motors according to the wiring rules. |  |
| 4. State the location requirements for stop/start stations as stated in the wiring rules. |  |
| 5. State the requirement for manual stopping of remotely controlled motors according to the wiring rules. |  |
| 6. Name one condition when automatic restart of motors does not need to be prevented according to the wiring rules. |  |
| 7. State the maximum motor rating that does not require overload protection as stated in the wiring rules. |  |
| 8. According to Wiring Rules, do motors associated with fire protection require over temperature protection? |  |
| 9. According to the wiring rules which part of a motor needs to be protected by over temperature devices? |  |

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| 10. With reference to the wiring rules state the number of supply conductors required for disconnection of 3 phase motors when operated by over temperature protective device. |  |
| 11. With regards to motor windings, state the requirements for automatic resetting of thermal devices for unattended motors as stated in the wiring rules. |  |
| 12. Which clauses in AS/NZS 3000:2007 outline requirements for emergency switching devices? |  |

**Relay logic control and circuit diagrams**

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| --- | --- |
| 1. Draw and label circuit symbols, for 3 **non-protective** devices used to de- energize a contactor control circuit. |  |
| 2. Draw the correct circuit symbol for the **power** contacts of a three phase controlled DOL motor. |  |
| 3. Name 3 **non-protective** devices used to energize a contactor controlled circuit. |  |
| 4. What does the term “normally” refer to when related to switch positions? |  |
| 5. Which drawing convention must be known when interpreting circuit diagrams? |  |
| 6. Draw a single Stop/Start DOL **control** circuit. [Include an indicator lamp to operate when the motor is energized]. |  |
| 7. Explain why a latch is necessary in a motor control circuit. |  |
| 8. How must multiple start buttons be connected relative to each other? |  |
| 9. How must multiple stop buttons be connected relative to each other? |  |

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| 1. Provide a separate written test procedure and results for each of the following components.[Tests to be carried out with ohmmeter connected across de-energized supply conductors, resistance of contactor coil 400ohms]    * Start Button    * Latch    * Stop Button    * Interlock of **jog only** FWD/REV motor circuit.    * Motor reversal |  |
| 11. List 5 advantages for contactor controlled circuits over manual mechanical switching of motors. |  |
| 12. Explain how under voltage protection is achieved in contactor controlled motor circuits. |  |
| 13. Why are interlocks necessary in forward/ reverse motor control circuits? |  |

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| 14. Explain the cause and operation of a thermal overload contact. |  |
| 15. What is the purpose of a utilization category? |  |
| 16. What is the utilization category assigned to a contactor to be used for frequent stopping and starting of a squirrel cage motor? |  |
| 17. List 6 factors to consider when selecting a relay or contactor. |  |
| 18. Which type of electrical drawing would provide terminal numbers and actual connection points of conductors? |  |
| 19. If a contactor were to switch itself on and off rapidly [chatter]. What would be the probable cause? |  |
| 20. Name the 2 types of interlocks used in motor control circuits |  |

**POWER / CONTROL CIRCUIT DIAGRAMS MUST BE PRODUCED AND SUBMITTED FOR THE FOLLOWNG CONTACTOR CONTROLLED THREE PHASE MOTORS CIRCUITS.**

**A FULL WRITTEN TEST PROCEDURE MUST ALSO BE SUBMITTED FOR EACH CIRCUIT.**

**EACH CIRCUIT MUST BE INSTALLED AND CHECKED FOR CORRECT OPERATION.**

* LOCAL AND REMOTE STOP/START DOL
* TIME DELAY CIRCUIT WITH 5 SECONDS DELAY BETWEEN 2 MOTORS.
* FORWARD/REVERSE MOTOR WITH LIMIT SWITCHING

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| --- | --- | --- | --- | --- |
| **Hazard Risk Assessment Sheet** | | | | |
| **Activity description:** | | | | |
| **Completed by:** | | | | **Date:** |
| **Equipment / Resources needed:** | | | | |
| **HAZARD CHECKLIST** | **HAZARD IDENTIFIED** | | **CONTROL MEASURE** | |
| **YES** | **NO** |
| Electricity / Isolation |  |  |  | |
| Ladder and heights |  |  |  | |
| Slips, trips and falls |  |  |  | |
| Housekeeping |  |  |  | |
| Moving parts |  |  |  | |
| Falling or flying objects |  |  |  | |
| Tools or equipment issues |  |  |  | |
| Manual Handling |  |  |  | |
| Loud noise |  |  |  | |
| Fire flammable atmosphere |  |  |  | |
| Poor lighting |  |  |  | |

**LOCAL AND REMOTE STOP/START**

**Control & power**

**Test procedure**

**FORWARD/ REVERSE**

**Control & power**

**Test Procedure**

**TIME DELAY CIRCUIT**

**Control & power**

**Test procedure**

|  |  |  |
| --- | --- | --- |
| **CIRCUIT** | **SATISFACTORY** | **NOT SATISFACTORY** |
| Remote stop/start DOL |  |  |
| Time Delay circuit |  |  |
| Forward/reverse |  |  |

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| DURING THE CIRCUIT INSTALLATIONS | PC | **S** | NYS |
| 1. OHS procedures for a given work area are identified, obtained and understood | 1.1 |  |  |
| 2. Established OHS risk control measures and procedures in preparation for the work are followed. | 1.2 |  |  |
| 3. Safety hazards, which have not previously been identified, are noted and established risk control measures are implemented. | 1.3 |  |  |
| 4. The nature of the circuit(s) problem is obtained from documentation or from work supervisor to establish the scope of work to be undertaken. | 1.4 |  |  |
| 5. Advice is sought from the work supervisor to ensure the work is coordinated effectively with others. | 1.5 |  |  |
| 6. Sources of materials that may be required for the work are established in accordance with established procedures. | 1.6 |  |  |
| 7. Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety. | 1.7 |  |  |
| 8. OHS risk control measures and procedures for carrying out the work are followed. | 2.1 |  |  |
| 9. The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures. | 2.2 |  |  |
| 10. Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures. | 2.3 |  |  |

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| --- | --- | --- | --- |
| 11. Established methods are used to solve circuit problems from measure and calculated values as they apply to single and three-phase low voltage circuit. | 2.4 |  |  |
| 12. Unexpected situations are dealt with safely and with the approval of an authorised person. | 2.5 |  |  |
| 13. Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices. | 2.6 |  |  |
| 14. OHS work completion risk control measures and procedures are followed. | 3.1 |  |  |
| 15. Work site is cleaned and made safe in accordance with established procedures. | 3.2 |  |  |
| 16. Justification for solutions used to solve circuit problems is documented. | 3.3 |  |  |
| 17. Work completion is documented and an appropriate person or persons notified in accordance with established procedures. | 3.4 |  |  |
| 18. Adhere to Anti-discrimination legislation, regulations and workplace procedures? | 3.5 |  |  |

**CURRENT LIMITING STARTERS**

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| 1. Why are **current limiting** control circuits sometimes required to start three phase motors? |  |
| 2. State the maximum motor rating according to the WA connections manual that would not require a current limiting starter. |  |
| 1. State the voltages across the windings of a 400v three phase motor when in    * star configuration    * delta configuration. |  |
| 4. What percentage of full load torque is obtained when a delta motor is connected in the star configuration? |  |
| 5. How many times greater is the line current to a motor connected in delta when compared to a star connection of the same motor? |  |
| 6. Write a circuit explanatory for a star/delta control circuit. |  |
| 7. What causes reduced voltages across motor windings when employing a primary resistance starter? |  |

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| 8. Why are primary resistance starters not suitable for starting heavy loads? |  |
| 9. If the starting voltage of a motor is reduced to 80% of supply voltage, what percentage of full load current and full load torque would be available? |  |
| 10. Draw the **power** circuit diagram for a secondary resistance starter. |  |
| 11. Which type of starter reduces resistance of the rotor windings during start up? |  |
| 12. State the major drawback of reduced voltage starters working on standard line voltage and frequency. |  |
| 13. State what happens to values of voltage and frequency during ramp up of a VSD controlled motor. |  |

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| 14. Which 2 parameters dictate the synchronous speed of a three phase motor? |  |
| 15. What happens to available torque as the speed increases when using VSD control? |  |
| 16. Why do VSD starters increase input voltage during ramp up? |  |

**MOTOR BRAKING**

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| 1 Which braking system is the only one used to bring a motor to a complete standstill? |  |
| 2 Which braking system requires the disconnection of the AC supply and connection of a DC supply to the windings? |  |
| 3 Which braking system uses the mechanical energy of the rotor to generate a voltage back into the supply? |  |
| 4 Name 2 applications for regenerative braking systems. |  |
| 5 Explain the principle of operation for plug braking. |  |
| 6 Which braking system is employed with electric trains and large cranes? |  |

**PLC and LADDER LOGIC**

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| 1. What system of control was introduced to replace relay logic control? |  |
| 2. What is the definition of a transducer? |  |
| 3. How are transducers incorporated into PLC programs? |  |
| 4. What is the name given to the decision making component of a PLC system? |  |
| 5. List 6 inputs and 2 outputs used in PLC systems. |  |
| 6. Draw the block diagram for a programmable controller. |  |
| 7. How must stop inputs be connected in the field? Normally open or normally closed |  |
| 1. Give an application for each of the following transducers    * Thermocouple    * Thermostat    * PIR    * Pressure switch    * Float switch |  |

**PROGRAMMABLE LADDER DIAGRAMS MUST BE PRODUCED AND SUBMITTED FOR THE FOLLOWNG CONTACTOR CONTROLLED THREE PHASE MOTOR AND BRAKING CIRCUITS.**

**EACH CIRCUIT MUST BE CHECKED FOR CORRECT OPERATION PRIOR TO INSTALLATION.**

* STAR/DELTA
* DC INJECTION BRAKING CONTROL.

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| --- | --- | --- | --- | --- |
| **Hazard Risk Assessment Sheet** | | | | |
| **Activity description:** | | | | |
| **Completed by:** | | | | **Date:** |
| **Equipment / Resources needed:** | | | | |
| **HAZARD CHECKLIST** | **HAZARD IDENTIFIED** | | **CONTROL MEASURE** | |
| **YES** | **NO** |
| Electricity / Isolation |  |  |  | |
| Ladder and heights |  |  |  | |
| Slips, trips and falls |  |  |  | |
| Housekeeping |  |  |  | |
| Moving parts |  |  |  | |
| Falling or flying objects |  |  |  | |
| Tools or equipment issues |  |  |  | |
| Manual Handling |  |  |  | |
| Loud noise |  |  |  | |
| Fire flammable atmosphere |  |  |  | |
| Poor lighting |  |  |  | |

**STAR/DELTA**

**DC INJECTION BRAKING**

|  |  |  |
| --- | --- | --- |
| **CIRCUIT** | **SATISFACTORY** | **NOT SATISFACTORY** |
| STAR/DELTA |  |  |
| DC INJECTION |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **DURING THE CIRCUIT INSTALLATIONS** | **PC** | **S** | **NYS** |
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| 34. Justification for solutions used to solve circuit problems is documented. | 3.3 |  |  |
| 35. Work completion is documented and an appropriate person or persons notified in accordance with established procedures. | 3.4 |  |  |
| 36. Adhere to Anti-discrimination legislation, regulations and workplace procedures? | 3.5 |  |  |

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| I declare that all work submitted is my own unless otherwise credited. | Student signature..............................................  Date........................................................... |
| ***See North Metro TAFE policy on plagiarism*** | |