Australian Government

UEENEEG156A Rewind HV three phase induction machines rated for voltages above 3.3 kV

Release: 2

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

UEENEEG156A Rewind HV three phase induction machines rated for voltages above 3.3 kV

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor **1) Scope:**

1.1) Descriptor

This unit covers preparing, placing and connecting coils and insulating three phase stators and rotors rated for high voltage above 3.3 kV. It encompasses working safely, using hand and powered tools, measuring, applying knowledge of electrical circuits and HV stator windings, applying technical and quality standards and keeping winding records.

Application of the Unit

Application of the Unit **2)**

This unit is intended for competency development entry-level employment based programs incorporated in approved contracts of training.

Licensing/Regulatory Information

License to practice **3)**

The skills and knowledge described in this unit do not require a license to practice in the workplace. However, practice in this unit is subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.

Pre-Requisites

Prerequisite Unit(s) **4)**

Competencies **4.1)**

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE102A	Fabricate, assemble and dismantle utilities industry components
UEENEEE104A	Solve problems in d.c. circuits
UEENEEE107A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEG150A	Wind electrical coils
UEENEEG151A	Place and connect electrical coils
UEENEEG153A	Rewind three phase low voltage induction machines
UEENEEG155A	Rewind HV three phase induction machines rated for voltages to 3.3 kV

Literacy and numeracy skills **4.2)**

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading 4 Writing 4 Numeracy 4

Employability Skills Information

Employability Skills **5)**

This unit contains Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a competency standard unit	Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the Evidence Guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA	
1 Prepare to rewind three phase induction machines.	1.1	OHS procedures for a given work area are identified, obtained and understood.
	1.2	Established OHS risk control measures for work preparation are followed.
	1.3	The extent of the work is determined from job sheets, specifications and regulatory requirements.
	1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.
	1.5	Induction machine is dismantled and parts tagged and stored to prevent loss or damage.
	1.6	Winding data is obtained from winding data records or directly from measurements of stator and recorded in accordance with established procedures.

ELEMENT	PERFORMANCE CRITERIA	
	1.7	Winding is stripped from stator in accordance with established procedures.
	1.8	Materials required for the work are obtained in accordance with established procedures and procedures.
	1.9	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.
2 Rewind three phase induction machines.	2.1	Established OHS risk control work measures are followed.
	2.2	Machines/equipment are checked as being isolated where necessary in strict accordance OHS requirements and procedures. (See Note 1).
	2.3	Induction machine is dismantled and parts tagged and stored to prevent loss or damage.
	2.4	Winding is stripped from stator in accordance with established procedures.
	2.5	Stator is wound and insulated to 3.3 kV standards in accordance with winding data and established procedures.
	2.6	Machine is assembled and prepares for final testing in accordance with established procedures.
	2.7	Prescribed solutions are used to resolve work completion issues.
	2.8	Routine quality checks are conducted to ensure coils are correctly wound with correct wire, number of turns and shape.
	2.9	Work is completed in acceptable timeframe given environment and workplace conditions.
3 Complete work report.	3.1	OHS measures work completion risk controls are followed.
	3.2	Work report forms/data sheets are completed accurately in accordance with established

ELEMENT	PERFORMANCE CRITERIA
	procedures. Note 1: Particular attention shall be given to following risk control measures related to high voltage hazards.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

8) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and rewinding three phase induction machines rated for high voltage above 3.3 kV.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EG156A High voltage three phase motor winding techniques rated above 3.3 kV

Evidence shall show knowledge and skills of high voltage three phase motor winding techniques rated above 3.3 kV to an extent indicated by the following aspects:

T1 HV winding conductors and their applications.

T2 HV winding wire connection methods encompassing:

- Conductor handling
- Conductor preparation
- Connection mediums

T3 Insulation types and methods

T4 Critical details and measurements when stripping a stator encompassing:

- Winding types

  Note.

  Example are hairpin wound stator and lap wound stator
- Winding diagram
- Wedges of a radially ventilated machine
- Factors to be considered when selecting cables for a stator.

T5 Procedures for checking the condition of a stripped in preparation for rewind encompassing:

- Manufacturers' specifications.
- Sequence of events between the removal of the old winding and the start of rewinding.
- Core loss test, the effect this test may have on the core and expected test results
- Methods of overcoming hot spots in a stator core.
- Level of insulation required to insulate the steel bracing rings that support the overhang.
- Difference between the slot liners and packers of a 6.6 kV machine.

T6 Procedures for the fitting of coils to core, wedging and bracing.

- Significance of the slot portion of coils for machines above 3.3 kV
- Method of inserting the coils of a ribbon winding into slots.

REQUIRED SKILLS AND KNOWLEDGE

- Effects of undue mechanical stress on B stage insulated coils.
- Importance of coil pitch and why it is important.
- Sequence of events in fitting the first pole pitch group of coils in a lap winding
- Sequence of events in fitting the coils of a concentric winding
- Purpose and location of the excess packing in a slot.
- Difference between the wedges for a lap and hairpin winding.
- Method of fitting a wedge.
- Difference that may be encountered between the wedges for a radial ventilated and the wedges for an axially ventilated machine.
- Methods used to brace and strengthen the overhang of a lap winding and a hairpin winding

T7 Procedures for making inter turn and inter coil connections on a hairpin winding and inter coil connections on a lap and bar winding encompassing:

- Sequence of events in making turn to turn connections, and insulating the turns of a lap winding

  Note.

  Connection methods include silver solder or brazing and soft solder
- Sequence of events, from hand forming the coil to final insulation, in making the turn to turn connections in a hairpin winding, using a welded joint.
- Sequence of events in making the coil to coil connections in a bar winding.

T8 Testing according to British and IEC standards.

Note.

Examples of testing are 6.6 kV B stage insulated winding and VPI winding test.

T9 Materials, procedures, tests and precautions required during and after the impregnation of completed windings according to Australian, British and IEC standards.

- Precautions to be taken when handling and using varnishes and resins.
- Important features of an oven used to cure large impregnated machines.
- Application and features of various impregnating materials

  Note.

  Examples are water based varnish, Xylol base varnish and 100% solids resin
- Method of carrying out a gel test on a resin and a viscosity test on a varnish
- Typical quality procedures carried out on an impregnating varnish.
- Procedure and precautions for carrying out the a hot dip impregnation, a flood coat impregnation and a VPI impregnation
- Tests to be carried out after impregnation and bake on a a 6.6 kV B stage insulated winding and a VPI winding

T10 Winding to terminal connections according to British and IEC standards.

- Criteria for selection of winding to terminal cables

REQUIRED SKILLS AND KNOWLEDGE

Note.

Examples are voltage rating, full load current and fault capacity.

- Common types of terminal boxes and their structure.

  Note.

  Example are phase segregated, phase separated and phase insulated
- Method of making the joint between winding and terminal cables and insulating such a joint.

T11 Procedures and precautions to be followed when performing static electrical testing of a completed rewind according to Australian, British and IEC standards encompassing:

- Types and purpose of tests
- Testing safety precautions
- Testing procedures

  Note.

  Examples of tests are repetitive surge test, loss tangent test, polarisation index (PI) test, cold resistance test and polarity test.
- Interpretation of test results
- Calculation of winding cold resistance and line and phase resistance

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of this unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment **9.1)**

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry's preferred model for apprenticeships. However, where summative (or final) assessment

is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal every day work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

Critical aspects of evidence required to demonstrate competency in this unit

9.2)

Before the critical aspects of evidence are considered all prerequisites shall be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines – UEE11'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace

procedures and practices including the use of risk control measures as specified in the performance criteria and range statement

- Apply sustainable energy principles and practices as specified in the performance criteria and range statement
- Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
- Demonstrate an appropriate level of skills enabling employment
- Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures

- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Rewind three phase induction machines rated for high voltage above 3.3 kV as described as described in 8) and including:

A Dismantling machine and storing parts securely.

B Preparing stator for winding.

C Following winding specifications.

D Selecting correct coils and insulation.

E Winding and connecting stator correctly.

F Assembling machine and preparing for testing.

G Adhering to quality procedures.

H Completing work report/forms accurately.

I Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items.

Note:

Successful completion of relevant vendor training may be used to contribute to evidence on which competency is deemed. In these cases the alignment of outcomes of vendor training with performance criteria and critical aspects of evidence shall be clearly identified.

Context of and specific resources for assessment **9.3)**

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

OHS policy and work procedures and instructions.

Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this unit.

Resources required to assess this unit are listed above in Context of assessment', which should also be used in the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to rewinding three phase induction machines rated for high voltage above 3.3 kV.

Method of assessment **9.4)**

This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'.

Note:

Competent performance with inherent safe working practices is expected in the industry to which this unit applies. This requires assessment in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

Concurrent assessment and relationship with other units

9.5)

For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with unit:

UEENEEG155A	Rewind HV three phase induction machines rated for voltages to 3.3 kV
UEENEEG158A	Conduct electrical tests on HV electrical machines

The critical aspects of occupational health and safety covered in unit UEENEEE101A and other discipline specific occupational health and safety units shall be incorporated in relation to this unit.

Range Statement

RANGE STATEMENT

10) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit shall be demonstrated in relation to dismantling and winding stators for at least two different three phase induction machines at for HV above 3.3 kV in an environment designed specifically for the purpose.

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not applicable.

Competency Field

Competency Field **11)**

Electrical