Australian Government

AURTTM3005 Balance rotating and reciprocating engine components

Release 2

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

AURTTM3005 Balance rotating and reciprocating engine components

Modification History

Release	Comment
Release 2	Replaces AURTTM3005 Balance rotating and reciprocating engine components (Release 1) Reference to OHS legislation replaced with new WHS legislation

Unit Descriptor

Unit descriptor	This unit describes the performance outcomes required to balance engine rotating and reciprocating components. It includes identifying and confirming work requirements, preparing for work, balancing rotating and reciprocating engine components, and completing work finalisation processes, including clean-up and documentation. Work requires individuals to demonstrate judgement and problem-solving skills in managing own work activities and contributing to a productive team environment. No licensing, legislative, regulatory or certification requirements apply to this unit at time of endorsement.

Application of the Unit

Application of the unit	Work applies to a range of engine components in an engine reconditioning process. Engine cylinder blocks to be balanced may include those of light vehicles, heavy vehicles, agricultural and plant equipment, recreational vehicles and motorcycles. Work is carried out according to award provisions.

Licensing/Regulatory Information

Refer to Unit Descriptor.

Pre-Requisites

Not applicable.

Employability Skills Information

Employability skills	This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare to balance rotating and reciprocating engine components	1.1. ***Workplace instructions*** are used to determine job requirements, including method, process and equipment 1.2. ***Information*** is sourced, procedures and methods are analysed, and ***appropriate tooling options*** are selected for balancing engine components 1.3. ***Tools and measuring equipment*** are checked and prepared for operation 1.4. Safe operating procedures and ***workplace health and safety (WHS)*** and ***environmental requirements*** are observed throughout the work 1.5. ***Preparation for balancing*** the rotating and reciprocating ***engine components*** is performed 1.6. Balancing machine is prepared to accept component(s)
2. Balance rotating engine components	2.1. Component is mounted and engaged with machine 2.2. ***Balancing procedures of rotating engine component*** are carried out to workplace requirements 2.3. Rotating engine component is balanced without causing damage to component or system
3. Balance reciprocating engine components	3.1. Component is mounted and engaged with machine 3.2. ***Balancing procedures of reciprocating engine component*** are carried out to workplace requirements 3.3. Reciprocating engine component is balanced without causing damage to component or system
4. Finalise balancing process	4.1. Final inspection is made to ensure work is to workplace requirements 4.2. Components are cleaned and/or stored to workplace expectations 4.3. Workplace documentation is processed according to workplace procedures

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

- technical skills to:
  - identify worn and damaged machine mountings
  - mount and position components
  - set machining parameters to achieve job requirements and maximise tool life
  - set and measure components to specified tolerances and dimensions
  - use appropriate machines to correct imbalance of components
- communication skills to:
  - follow oral instructions
  - report deviations from specifications
  - work as part of a team
- literacy skills to:
  - read and interpret routine job instructions, specifications, drawings and standard operating procedures
  - record information for use in calculations
  - identify and analyse technical information
  - understand quality procedures
- numeracy skills to use mathematical ideas and techniques to:
  - assess tolerances
  - apply accurate measurements
  - calculate balancing requirements
  - establish quality checks
- problem-solving skills to:
  - locate, interpret and apply workplace policies and procedures, including manufacturer and component supplier procedures
  - identify and avoid planning and scheduling problems
  - prevent time and material wastage
  - organise work and plan processes
- self-management skills to:
  - select and use appropriate equipment, materials, processes and procedures
  - follow workplace documentation, such as codes of practice and operating procedures
- technology skills to use communication devices and computerised equipment to:
  - search and gather supporting material
  - use interfaces to communicate with computerised controls

Required knowledge

- WHS regulations and requirements, equipment, material and personal safety requirements, including:
  - operating principles of component balancing, including:
    - static and dynamic balance
    - inertia
    - internally and externally balanced engines
    - reciprocating mass
    - rotating mass
    - sources of torsional vibration
    - gas pressure
    - purpose of counterweights, torsional vibration dampeners and balance shafts in balancing
    - difference between in-line engine balance, flat-plane and vee-type engine balance
- balancing procedures and techniques, including:
  - procedures for in-line engines, flat-plane crankshafts and vee-type engines
  - procedures for weight-matching the pistons and rod-ends
  - methods of calculating bob-weight values for vee-type engines, including:
    - rotating mass with oil allowance
    - reciprocating mass
    - effect of vee-angle on the total calculation
  - procedures for mounting bob-weights on crankshafts of vee-type engines
  - procedures for balancing internally balanced engines
  - procedures for balancing externally balanced engines
- procedures for adding and removing metal to the crankshaft, including:
  - drilling to remove weight
  - welding to add weight
  - machining and adding heavy metal

Evidence Guide

Evidence Guide	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	The evidence required to demonstrate competency in this unit must be relevant to workplace operations and satisfy all of the requirements of the performance criteria and required skills and knowledge. A person who demonstrates competency in this unit must be able to: • observe safety procedures and requirements • communicate effectively with others involved in or affected by the work • select methods and techniques to balance engine components appropriate to the circumstances • complete preparatory activity in a systematic manner • balance a range of crankshafts and components according to workplace, manufacturer and component supplier requirements • balance components within workplace timeframes • present components to customer according to workplace requirements.
Context of, and specific resources for assessment	Competency is to be assessed in the workplace or a simulated workplace environment that accurately reflects performance in a real workplace setting. Assessment is to occur: • using standard workplace practices and procedures • following safety requirements • applying environmental constraints. Assessment is to comply with relevant: • regulatory requirements • Australian standards • industry codes of practice. The following resources must be made available for the assessment of this unit: • workplace location or simulated workplace • material relevant to balancing rotating and

Evidence Guide	
	reciprocating engine components • equipment and hand and power tools appropriate to balancing rotating and reciprocating engine components • multi-cylinder engines appropriate to the workplace, including in-line multi-cylinder engine and vee-configuration multi-cylinder engine blocks • specifications and work instructions.
Method of assessment	Assessment must satisfy the endorsed Assessment Guidelines of this Training Package. Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of required skills and knowledge. Assessment methods must be by direct observation of tasks and include questioning on required skills and knowledge to ensure its correct interpretation and application. Assessment must confirm that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances. Competence in this unit may be assessed in conjunction with other units which together form part of a holistic work role. Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. Assessment processes and techniques must be culturally sensitive and appropriate to the language and literacy capacity of the candidate and the work being performed.

Range Statement

Range Statement	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
Workplace instructions may include:	• computer-generated instructions • verbal instructions • written instructions.
Information may include:	• Australian standards • engineer's design specifications and instructions • instructions issued by authorised workplace or external persons • workplace specifications and requirements • regulatory and legislative requirements relating to the automotive industry, including Australian Design Rules • safe work procedures relating to the operation of machinery associated with balancing engine components • verbal, written and graphical instructions, signage, work schedules, plans, specifications, work bulletins, memos, material safety data sheets (MSDS), diagrams or sketches.
Appropriate tooling options may include:	• comparator gauges and ring compressors • hand tooling • plasti-gauge • power tooling • torque wrenches.
Tools and measuring equipment may include:	• balancing equipment • balancing weights • scales.

WHS requirements may include:	• individual state or territory regulatory requirements
	• operational risk assessment and treatments associated with:
	  • electrical safety
	  • machinery movement and operation
	  • manual and mechanical lifting and shifting
	  • toxic substances

Range Statement	
	• working in proximity to others and site visitors • personal protective equipment (PPE) required by legislation, regulations, codes of practice and workplace policies and procedures.
Environmental requirements are to include:	• clean-up management • dust and noise minimisation • waste management.
Preparation for balancing includes:	• thoroughly cleaning all components • checking all components to ensure there is no further machining required.
Engine components to be balanced include:	• crankshafts • flywheels • piston and connecting rod assemblies.
Balancing procedures of rotating engine components include:	• using different machines to determine positions where material is to be removed or added • different methods of removing or adding weight to engine components, such as drilling, welding, machining and adding metal slugs.
Balancing procedures of reciprocating engine components include:	• using different scales and associated equipment to measure the weight of the piston and connecting rod assembly. • different methods of removing or adding weight to piston and connecting rod assembly, such as drilling, welding, machining and adding metal slugs.

Unit Sector(s)

Competency field	Mechanical Miscellaneous
Sector	Technical - Manufacture

Custom Content Section

Not applicable.