Australian Government

AURTTM3006 Perform advanced machining and blueprinting of engine components

Release 2

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

AURTTM3006 Perform advanced machining and blueprinting of engine components

Modification History

Release	Comment
Release 2	Replaces AURTTM3006 Perform advanced machining and blueprinting of 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 compare components to original manufacturer and component supplier specifications and match them in relation to weight, size and capacity. 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 the blueprinting of internal combustion engine components. Engine cylinder blocks to be blueprinted and machined may include those of light vehicles, heavy vehicles, agricultural and plant equipment, recreational vehicles and motorcycles.

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 blueprint engines	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 machining and blueprinting engines 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. Measuring and/or calibration requirements for blueprinting and machining are determined 1.6. Cylinder block and cylinder head are prepared for blueprinting and machining
2. Measure components	2.1. Information is accessed and interpreted from manufacturer and component supplier specifications 2.2. Components are measured and clearances and tolerances are calculated
3. Machine components	3.1. Components are adjusted and/or machined to meet manufacturer and component supplier specifications 3.2. Blueprinting and machining of components are achieved without causing damage to components or system
4. Finalise blueprinting and machining process	4.1. Blueprinting schedule documentation is completed 4.2. Final check is made to ensure finished work complies with workplace requirements 4.3. Engine components are prepared for storage according to workplace requirements 4.4. 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:
  - select and use machines required for blueprinting
  - measure to specified tolerances and dimensions
- communication skills to:
  - follow oral instructions
  - report deviations from specifications
  - interact with customers and team members
- literacy skills to:
  - read and interpret routine job instructions, specifications, drawings and standard operating procedures
  - identify and analyse technical information
  - understand quality procedures
- numeracy skills to use mathematical ideas and techniques to:
  - assess tolerances
  - apply accurate measurements
  - calculate material 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 to search and gather supporting material

Required knowledge

- WHS regulations and requirements, equipment, material and personal safety requirements, including:
  - personal protective equipment (PPE) for handling engine blocks and using machines
  - equipment relevant to blueprinting

- procedures for blueprinting cylinder block, including:
  - testing the engine block, including sonic testing and crack testing
  - line boring main tunnels to produce datum/zero point
  - chasing threads to remove debris
  - fitting bearings and checking crush with bearing blue
  - recording sizes of main bearing tunnel with bearings fitted
  - selecting bearings for correct grading and clearances
  - resizing connecting rods and fitting new bolts to ensure centre-to-centre length is correct
  - cross-drilling crankshaft to enhance oil flow
  - grinding crankshaft to suit bearings and to achieve desired clearance and phasing consistency
  - sleeving lifter bores to centreline of camshaft
  - fitting semi-finished camshaft bearings and line boring to ensure crankshaft to camshaft alignment
  - squaring up the deck to the crankshaft tunnel to ensure crankshaft is parallel to block
  - chasing head bolt retaining threads
  - fitting torque plate to bore and hone
  - honing cylinders, matching individual pistons to respective bores
  - dummy assembling to achieve consistent piston height for desired compression ratio and checking rotational clearance
  - setting ring end gap
- procedures to blueprint cylinder heads, including:
  - machining for larger valves
  - operating flow bench
  - porting for improved air flow and to balance combustion chambers
  - calculating capacity of individual combustion chambers and machining combustion chambers to achieve consistency
  - calculating compression ratio
  - selecting camshaft
  - setting valve heights
  - dialling camshaft
  - machining pistons to achieve desired compression ratio
  - setting rocker geometry, including length and sweep
- Australian standards relating to engine reconditioning

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 • select methods and techniques for machining and blueprinting appropriate to the circumstances • complete preparatory activity in a systematic manner • complete blueprinting of a range of engines to workplace requirements • conduct machining operations according to workplace, manufacturer and component supplier requirements • complete work without damage to tools and equipment or injury to persons.
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. Performance is demonstrated consistently over a period of time and in a suitable range of contexts. 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: • appropriate worksite

Evidence Guide	
	• engines appropriate to the workplace, including in-line multi-cylinder engine blocks and vee-configuration multi-cylinder engine blocks • fixed and portable hand, air and power tools, and equipment appropriate to blueprinting engines • 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 machining and blueprinting engine components • verbal, written and graphical instructions, signage, work schedules, plans, specifications, work bulletins, memos, material safety data sheets (MSDS), diagrams or sketches.
Tools and measuring equipment may include:	• burette • degree wheel • dial indicator • dummy push rod • feeler gauge • flow bench • gauge for setting valve protrusion • micrometer • ring end gapper • sonic tester • valve spring tester.

OHS requirements may include:	• operational risk assessment and treatments associated with:
	  • electrical safety
	  • machinery movement and operation

Range Statement	
	• manual and mechanical lifting and shifting • toxic substances • working in proximity to others and site visitors • 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.

Unit Sector(s)

Competency field	Mechanical Miscellaneous
Sector	Technical - Manufacture

Custom Content Section

Not applicable.