



Australian Government

AURTTM006 Perform advanced machining and blueprinting of engine components

Release: 1

AURTTM006 Perform advanced machining and blueprinting of engine components

Modification History

Release	Comment
Release 1	New unit of competency.

Application

This unit describes the performance outcomes required to compare engine components to original manufacturer and component supplier specifications and match them in relation to weight, size and capacity. It involves preparing for the task, measuring and machining components to original manufacturer and component supplier specifications, and completing workplace processes and procedures.

It applies to those working in the automotive service and repair industry. The engine components include those in vehicles from all sectors of the industry.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

Competency Field

Mechanical Miscellaneous

Unit Sector

Technical - Manufacture

Elements and Performance Criteria

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold and italicised text is used, further information is detailed in the range of conditions section.
1. Prepare to blueprint engine	1.1 Job requirements are determined from workplace instructions 1.2 Information is sourced, procedures and methods are analysed, and appropriate tools are selected for machining and blueprinting

Elements Elements describe the essential outcomes.	Performance Criteria Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold and italicised text is used, further information is detailed in the range of conditions section.
	engines 1.3 Tools and measuring equipment are selected and checked for serviceability 1.4 Hazards associated with the work are identified and risks are managed 1.5 Cylinder block and cylinder head are <i>prepared</i> for blueprinting according to <i>safety and environmental requirements</i>
2. Measure components	2.1 Measurements, clearances and tolerances are sourced and interpreted from manufacturer and component supplier literature 2.2 Components are measured and clearances and tolerances are calculated according to workplace procedures
3. Machine components	3.1 Components are adjusted or machined to meet manufacturer and component supplier specifications according to workplace procedures and safety and environmental requirements, and following machinery safe operating procedures 3.2 Dummy assembly of engine is performed as required and clearances and tolerances are calculated according to workplace procedures 3.3 Further machining is carried out as required to achieve required clearances and tolerances 3.4 Engine is assembled according to job requirements and clearances, and tolerances are calculated again 3.5 Bright surfaces are treated with rust prevention solution and component is prepared for further process or storage according to workplace procedures 3.6 <i>Blueprinting schedule documentation</i> is completed according to workplace procedures
4. Complete blueprinting and machining process	4.1 Final inspection is made to ensure finished work complies with workplace requirements 4.2 Work area is cleaned, waste and non-recyclable materials are disposed of, and recyclable material is collected 4.3 Tools and equipment are checked and stored according to workplace procedures 4.4 Workplace documentation is processed according to workplace procedures

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance and are not explicit in the performance criteria.

Skills	Description
Learning skills to:	locate appropriate sources of information efficiently.
Reading skills to:	- interpret engine component specifications from workshop literature - interpret machinery safe operating procedures from operating manuals.
Writing skills to:	legibly and accurately fill out workplace documentation when making recommendations and recording measurements and material used.
Numeracy skills to:	- interpret numerical information in manufacturer specifications, workshop literature, and machinery dials and gauges - use basic mathematical operations, including addition and subtraction, multiplication and division to: - convert metric dimensions to imperial, and imperial dimensions to metric - calculate tolerances and clearances.
Planning and organising skills to:	select best tooling option for the work and sequence procedure to reduce time and material wastage.
Technology skills to:	- operate machinery when adjusting or machining engine components - use metric and imperial precision measuring equipment.

Range of Conditions

This section specifies work environments and conditions that may affect performance.

Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included. Bold italicised wording, if used in the performance criteria, is detailed below.

<i>Preparation</i> must include:	ensuring surfaces are clean and oil and water passageways are clear using appropriate tools, such as a rifle brush.
<i>Safety and environmental requirements</i> must include:	- work health and safety (WHS) and occupational health and safety (OHS) requirements, including: - procedures for selecting and using personal protective equipment (PPE) for: - handling engine blocks and sub-assemblies

	• using chemical cleaning agents • operational risk assessment and treatments associated with: • electrical safety of machinery • machinery movement and operation • environmental requirements, including procedures for trapping, storing and disposing of cleaning and lubricating fluids released during process.
<i>Blueprinting schedule documentation</i> must include:	• record of work performed, including tolerances and clearances achieved.

Unit Mapping Information

Equivalent to AURTTM3006 Perform advanced machining and blueprinting of engine components

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b4278d82-d487-4070-a8c4-78045ec695b1>

Assessment Requirements for AURTTM006 Perform advanced machining and blueprinting of engine components

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Performance Evidence

Before competency can be determined, individuals must demonstrate they can perform the following according to the standards defined in this unit's elements, performance criteria, range of conditions and foundation skills:

- machine and blueprint two of the following different engine components:
 - engine with multiple overhead camshafts
 - V configuration engine with at least six cylinders
 - multi-cylinder diesel engine.

Knowledge Evidence

Individuals must be able to demonstrate knowledge of:

- work health and safety (WHS) and occupational health and safety (OHS) requirements relating to performing advanced machining and blueprinting of engine components, including:
 - procedures for selecting and using personal protective equipment (PPE) for:
 - handling engine blocks and sub-assemblies
 - using chemical cleaning agents
 - operational risk assessment and treatments associated with:
 - electrical safety of machinery
 - machinery movement and operation
- environmental requirements, including procedures for trapping, storing and disposing of cleaning and lubricating fluids released during process
- procedures for preparing cylinder blocks and cylinder heads for blueprinting, including:
 - chemically cleaning engine components, including methods for avoiding damage or loss of components
 - chasing threads to remove debris with correct grade tap

- hardness testing components
- pressure testing cylinder heads
- checking cylinder heads for bend on both sides
- checking cylinder heads for minimum thickness
- checking valve guides, valve stems, collets and valve springs for wear
- testing engine block, including sonic testing and crack testing
- dummy assembling engines, including reasons for dummy assembling engines
- procedures for blueprinting cylinder blocks, including:
 - line boring main tunnels to produce datum
 - fitting bearings and checking crush
 - measuring main bearing tunnel with bearings fitted
 - grinding crankshaft to suit bearings and to achieve desired clearance and phasing consistency
 - sleeving lifter bores to centre line of camshaft and checking lifter to bore clearance and alignment to camshaft
 - fitting camshaft bearings and checking running clearances
 - squaring up deck to crankshaft tunnel to ensure crankshaft is parallel to block
 - fitting torque plate to bore and hone
 - honing cylinders to desired surface finish, matching individual pistons to respective bores
 - setting ring end gap
 - achieving consistent piston height for desired compression ratio and checking rotational clearance
- procedures for blueprinting connecting rods, including:
 - shot peening connecting rods
 - preparing rod for re-sizing, including removing and locating dowels as required
 - selecting bolts
 - tensioning and re-sizing tunnel, maintaining centre-to-centre height
 - checking little end running clearance
 - removing bushes and checking parent bore of rod and bush fitment
 - pin fitting rod, maintaining centre-to-centre height and running clearance
 - checking alignment of rod
 - fitting up bearings, checking crush and running clearance
 - resizing connecting rods and fitting new bolts to ensure centre-to-centre length and alignment is correct
- procedures to blueprint cylinder heads, including:
 - methods for achieving optimum airflow, including limitations of cylinder head modifications
 - machining for larger valves, including identifying machining shifts in castings
 - 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
- calculating installed height of valve springs and seat pressure
- calculating valve spring open height and pressure
- calculating valve spring solid height and coil bind clearance
- calculating spring retainer to stem seal clearance
- dialling camshaft
- machining pistons to achieve desired compression ratio
- setting rocker geometry, including length and sweep
- requirements of Australian standards relevant to engine reconditioning, including:
 - AS 4182 Automotive repairs – Code of practice for reconditioning reciprocating spark ignition engines
 - AS 4427 Automotive repairs – Code of practice for reconditioning reciprocating compression ignition engines
- post-grinding operations, including rust protection of machined surfaces.

Assessment Conditions

Assessors must satisfy NVR/AQTF assessor requirements.

Competency is to be assessed in the workplace or a simulated environment that accurately reflects performance in a real workplace setting.

Assessment must include direct observation of tasks.

Where assessment of competency includes third-party evidence, individuals must provide evidence that links them to the engine components that they have machined and blueprinted, e.g. repair orders.

Assessors must verify performance evidence through questioning on skills and knowledge to ensure correct interpretation and application.

The following resources must be made available:

- automotive repair workplace or simulated workplace
- workplace instructions
- manufacturer engine specifications
- AS 4182 Automotive repairs – Code of practice for reconditioning reciprocating spark ignition engines
- AS 4427 Automotive repairs – Code of practice for reconditioning reciprocating compression ignition engines
- two different multi-cylinder engines as specified in the performance evidence requiring machining and blueprinting
- precision measuring equipment, including:

- dial bore gauges
- dial indicators
- inside and outside metric and imperial micrometers
- inside and outside spring calipers
- fixed and portable hand, air and power tools
- lifting equipment
- material suitable for machining and blueprinting the engine components.

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