



**Australian Government**

# **AURTTM3004 Assemble engine blocks and sub-assemblies**

**Release 2**

## AURTTM3004 Assemble engine blocks and sub-assemblies

### Modification History

| Release   | Comment                                                                                                                                         |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Release 2 | Replaces AURTTM3004 Assemble engine blocks and sub-assemblies (Release 1)<br><br>Reference to OHS legislation replaced with new WHS legislation |

### Unit Descriptor

|                 |                                                                                                                                                                                                                                                                             |
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| Unit descriptor | <p>This unit describes the performance outcomes required to assemble a short engine block and sub-assemblies and check clearances and tolerances.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at time of endorsement.</p> |
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### Application of the Unit

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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| Application of the unit | <p>Work applies to a range of engine blocks and sub-assemblies in an engine reconditioning process. Engine cylinder blocks to be assembled may include those of light vehicles, heavy vehicles, agricultural and plant equipment, recreational vehicles and motorcycles.</p> <p>This unit does not cover fitting semi-finished sleeves nor boring and honing cylinders (see AURTTM3009 Fit sleeves and bore and hone engine cylinders).</p> <p>Work is carried out according to award provisions.</p> |
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### Licensing/Regulatory Information

Refer to Unit Descriptor.

## Pre-Requisites

Not applicable.

## Employability Skills Information

|                             |                                          |
|-----------------------------|------------------------------------------|
| <b>Employability skills</b> | This unit contains employability skills. |
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## Elements and Performance Criteria Pre-Content

|                                                                   |                                                                                                                                                                                                                                                                                                                  |
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| 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. |
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## Elements and Performance Criteria

| ELEMENT                                                | PERFORMANCE CRITERIA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| 1. Prepare to assemble engine block and sub-assemblies | <p>1.1 <b>Workplace instructions</b> are used to determine job requirements, including method, process and equipment</p> <p>1.2 <b>Information</b> is sourced, procedures and methods are analysed, and <b>appropriate tooling options</b> are selected for rebuilding engine components</p> <p>1.3 <b>Tools and measuring equipment</b> are checked and prepared for operation</p> <p>1.4 Safe operating procedures and <b>workplace health and safety (WHS)</b> and <b>environmental requirements</b> are observed throughout the work</p> <p>1.5 <b>Technical information</b> for assembly is sourced, and <b>support equipment</b> and <b>facilities</b> are identified and prepared</p> <p>1.6 <b>Pre-assembly cleaning</b> of <b>engine components</b> is carried out and components are laid out in logical order</p> <p>1.7 <b>Replacement component parts</b> are checked for size and suitability</p> |
| 2. Check clearances and tolerances                     | <p>2.1. <b>Clearances and tolerances are measured</b> according to workplace requirements</p> <p>2.2. <b>Clearances and tolerances are adjusted</b> without causing damage to components or system according to workplace requirements</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 3. Assemble engine sub-assemblies                      | <p>3.1. <b>Engine sub-assemblies are assembled</b> in correct order and without damage, according to workplace requirements, manufacturer and component supplier specifications, established industry guidelines and relevant Australian standards</p> <p>3.2. Relevant measurements of engine sub-assemblies are made</p> <p>3.3. Engine sub-assemblies are adjusted without causing damage to components or systems</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 4. Assemble engine blocks                              | <p>4.1. <b>Engine blocks are assembled</b> in correct order and without damage, according to workplace requirements, manufacturer and component supplier specifications, established industry guidelines and relevant Australian standards</p> <p>4.2. Relevant measurements of components are made</p> <p>4.3. Engine blocks are adjusted without causing</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| ELEMENT                      | PERFORMANCE CRITERIA                                                                                                                                                                                                         |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | damage to components or system                                                                                                                                                                                               |
| 5. Finalise assembly process | 5.1.Final inspection is made to ensure work is to workplace requirements<br>5.2.Engine block is prepared for storage to workplace expectations<br>5.3.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:
  - clean parts using appropriate solutions and procedures
  - determine size and suitability of replacement components
  - measure to specified tolerances and dimensions
  - use appropriate tools for assembling engine blocks and sub-assemblies
  - perform necessary machining operations for assembling engine blocks and sub-assemblies
- communication skills to:
  - follow oral instructions
  - work as part of a team
- literacy skills to:
  - understand quality procedures
  - read, interpret and follow job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
  - obtain and record measurements
  - document required repairs and parts
- numeracy skills to use mathematical ideas and techniques to:
  - assess tolerances and clearances
  - calculate component dimensions to the required tolerances
- problem-solving skills to:
  - prevent time and material wastage
  - plan and sequence operations
- 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

### Required knowledge

- WHS regulations and requirements, equipment, material and personal safety requirements, including:
  - personal protective equipment (PPE) for handling engine blocks and sub-assemblies and using chemical cleaning agents
  - correct operation of specialised equipment, such as heating torches, ovens and presses

- procedures for handling freezing substances, such as liquid nitrogen
- manual-handling techniques, including:
  - using machinery for lifting engine blocks and engine components
  - using slings, chains and other lifting equipment according to safe work practices
- procedures for clearance testing and adjusting or machining components, including:
  - piston to connecting rod big-end alignment
  - big-end bearing crush with bearing blue
  - piston ring end gap, back clearance and side clearance
  - bearing crush with bearing blue and measuring clearances
  - semi-flanged thrust bearings
  - finished camshaft bearings and measuring clearances
  - camshafts and cam followers
  - camshaft endfloat
  - crankshaft endfloat
  - gear backlash
  - oil pump sealing and pick-up oil piping
- procedures for assembling processes and components, including:
  - reasons for and methods of producing a clean assembly space
  - performing a final wash of components prior to re-assembly
  - welsh plugs and oil gallery plugs
  - piston and connecting rod assemblies
  - big-end bearings
  - piston rings to pistons
  - main bearings and thrust washers
  - semi-flanged thrust bearings
  - crankshafts, including protection measures for crankshaft journals, bearings, rings and bores
  - finished camshaft bearings
  - camshafts and cam followers
  - timing gears
  - chains and tensioners
  - oil pumps, oil squirters and oil pump pick-ups
  - balance shafts
  - fitting ancillary components, including covers and seals, housings, diesel fuel injection pumps, oil coolers, crankshaft pulleys, flywheels and bell-housings
- Australian standards relevant to engine reconditioning

## Evidence Guide

| <b>Evidence Guide</b>                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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| 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. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Overview of assessment</b>                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>                                                                                                                    | <p>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.</p> <p>A person who demonstrates competency in this unit must be able to:</p> <ul style="list-style-type: none"> <li>• observe safety procedures and requirements</li> <li>• select methods and techniques for assembling engine blocks and sub-assemblies appropriate to the circumstances</li> <li>• complete the assembly of multi-cylinder blocks, including: <ul style="list-style-type: none"> <li>• measuring and checking against manufacturer and component supplier specifications</li> <li>• carrying out assembly to manufacturer and component supplier requirements without causing damage to components, tools or systems</li> </ul> </li> <li>• complete workplace and equipment records.</li> </ul> |
| <b>Context of, and specific resources for assessment</b>                                                                                                                                                               | <p>Competency is to be assessed in the workplace or a simulated workplace environment that accurately reflects performance in a real workplace setting.</p> <p>Assessment is to occur:</p> <ul style="list-style-type: none"> <li>• using standard workplace practices and procedures</li> <li>• following safety requirements</li> <li>• applying environmental constraints.</li> </ul> <p>Assessment is to comply with relevant:</p> <ul style="list-style-type: none"> <li>• regulatory requirements</li> <li>• Australian standards</li> <li>• industry codes of practice.</li> </ul> <p>The following resources must be made available for the assessment of this unit:</p> <ul style="list-style-type: none"> <li>• appropriate worksite</li> <li>• multi-cylinder engines appropriate to the workplace,</li> </ul>                                                                                                        |

**Evidence Guide**

|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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|                             | <p>including in-line multi-cylinder engine and vee-configuration multi-cylinder engine blocks</p> <ul style="list-style-type: none"> <li>• fixed and portable hand, air and power tools, lifting equipment, torque wrench, measuring equipment and other equipment appropriate to assembling engine blocks and sub-assemblies</li> <li>• specifications and work instructions.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Method of assessment</b> | <p>Assessment must satisfy the endorsed Assessment Guidelines of this Training Package.</p> <p>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.</p> <p>Assessment methods must be by direct observation of tasks and include questioning on required skills and knowledge to ensure its correct interpretation and application.</p> <p>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.</p> <p>Competence in this unit may be assessed in conjunction with other units which together form part of a holistic work role.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Assessment processes and techniques must be culturally sensitive and appropriate to the language and literacy capacity of the candidate and the work being performed.</p> |

## Range Statement

| Range Statement                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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| <p>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.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Workplace instructions</b> include:                                                                                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• computer-generated instructions</li> <li>• verbal instructions</li> <li>• written instructions.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Information</b> may include:                                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>• Australian standards</li> <li>• engineer's design specifications and instructions</li> <li>• instructions issued by authorised workplace or external persons</li> <li>• workplace specifications and requirements</li> <li>• regulatory and legislative requirements relating to the automotive industry, including Australian Design Rules</li> <li>• safe work procedures relating to the operation of machinery associated with assembling engines</li> <li>• verbal, written and graphical instructions, signage, work schedules, plans, specifications, work bulletins, memos, material safety data sheets (MSDS), diagrams or sketches.</li> </ul> |
| <b>Appropriate tooling options</b> may include:                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>• comparator gauges</li> <li>• ring compressors</li> <li>• hand tooling</li> <li>• plasti-gauge</li> <li>• power tooling</li> <li>• torque wrenches.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Tools and measuring equipment</b> may include:                                                                                                                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>• clamps</li> <li>• dial indicators</li> <li>• inside and outside micrometers</li> <li>• lifting equipment.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>WHS requirements</b> may include:                                                                                                                                                                                                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>• individual state or territory regulatory requirements</li> <li>• operational risk assessment and treatments associated with: <ul style="list-style-type: none"> <li>• electrical safety</li> <li>• machinery movement and operation</li> <li>• manual and mechanical lifting and shifting</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                         |

| <b>Range Statement</b>                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                             | <ul style="list-style-type: none"> <li>• toxic substances</li> <li>• working in proximity to others and site visitors</li> <li>• PPE required by legislation, regulations, codes of practice and workplace policies and procedures.</li> </ul>                                                                                                                                                                                        |
| <b>Environmental requirements</b> include:                  | <ul style="list-style-type: none"> <li>• clean-up management</li> <li>• dust and noise minimisation</li> <li>• waste management.</li> </ul>                                                                                                                                                                                                                                                                                           |
| <b>Technical information</b> may include:                   | <ul style="list-style-type: none"> <li>• manufacturer or supplier component specifications.</li> </ul>                                                                                                                                                                                                                                                                                                                                |
| <b>Support equipment</b> includes:                          | <ul style="list-style-type: none"> <li>• assembly bench</li> <li>• assembly trolleys</li> <li>• engine stands</li> <li>• lifting equipment.</li> </ul>                                                                                                                                                                                                                                                                                |
| <b>Facilities</b> include:                                  | <ul style="list-style-type: none"> <li>• dedicated engine assembly room</li> <li>• dust and gas exhaust units.</li> </ul>                                                                                                                                                                                                                                                                                                             |
| <b>Pre-assembly cleaning</b> includes:                      | <ul style="list-style-type: none"> <li>• removing machining residue</li> <li>• ensuring gasket faces are clean and oil and water passageways are clear using tools, such as a rifle brush.</li> </ul>                                                                                                                                                                                                                                 |
| <b>Engine components</b> include:                           | <ul style="list-style-type: none"> <li>• engine blocks, sleeves, crankshafts, camshafts, camshaft followers, piston and connecting rod assemblies, timing chains and gears, oil pumps, oil squirters and coolers</li> <li>• other variables, including ancillary systems and components, such as: <ul style="list-style-type: none"> <li>• cooling systems</li> <li>• exhaust systems</li> <li>• fuel systems.</li> </ul> </li> </ul> |
| <b>Replacement component parts</b> may include:             | <ul style="list-style-type: none"> <li>• bearing sets</li> <li>• gasket sets</li> <li>• oil pumps</li> <li>• piston rings</li> <li>• pistons</li> <li>• seals</li> <li>• sleeves</li> <li>• timing chains and gears.</li> </ul>                                                                                                                                                                                                       |
| <b>Clearances and tolerances that are measured</b> include: | <ul style="list-style-type: none"> <li>• back clearance and side clearance</li> <li>• bearing to journal clearances</li> <li>• endfloats</li> </ul>                                                                                                                                                                                                                                                                                   |

| <b>Range Statement</b>                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                    | <ul style="list-style-type: none"> <li>• gear backlashes</li> <li>• parent bore to dry sleeve fit</li> <li>• piston ring end-gap</li> <li>• piston to bore clearance</li> <li>• sleeve heights.</li> </ul>                                                                                                                                                                                                                                      |
| <b><i>Clearances and tolerances that are adjusted</i></b> include: | <ul style="list-style-type: none"> <li>• adjusting gear backlash</li> <li>• machining semi-finished thrust bearings</li> <li>• machining piston protrusion and valve pockets</li> <li>• pin-boring connecting rod little-ends.</li> </ul>                                                                                                                                                                                                       |
| <b><i>Assembling engine sub-assemblies</i></b> includes:           | <ul style="list-style-type: none"> <li>• assembling, aligning and fitting:             <ul style="list-style-type: none"> <li>• air brake compressors</li> <li>• oil coolers</li> <li>• oil pumps</li> <li>• pistons.</li> </ul> </li> </ul>                                                                                                                                                                                                    |
| <b><i>Assembling engine blocks</i></b> includes:                   | <ul style="list-style-type: none"> <li>• fitting finished dry interference and slip-fit sleeves, chrome sleeves and wet sleeves</li> <li>• fitting crankshafts, piston assemblies, camshafts, camshaft followers, push rods, oil pumps, timing gears and timing chains</li> <li>• fitting balance weights and timing gears to crankshafts</li> <li>• fitting covers, seals, housings, flywheels and forced air induction assemblies.</li> </ul> |

## Unit Sector(s)

|                         |                          |
|-------------------------|--------------------------|
| <b>Competency field</b> | Mechanical Miscellaneous |
| <b>Sector</b>           | Technical - Manufacture  |

## Custom Content Section

Not applicable.