



Australian Government

AURBTY4002 Design and build bicycle frames

Release 1

AURBTY4002 Design and build bicycle frames

Modification History

Release	Comment
Release 1	Replaces AURB428201A Design and build a bicycle frame Unit code updated to meet policy requirements Minor changes to unit title Reference to OHS legislation replaced with new WHS legislation

Unit Descriptor

Unit descriptor	This unit of competency describes the skills and knowledge required to calculate design specifications and custom build a bicycle frame. No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
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Application of the Unit

Application of the unit	This unit applies to individuals who apply mechanical principles and measurements to design and build a custom bicycle frame. The unit applies to individuals working in a bicycle retail, service and repair environment. Work requires individuals to demonstrate judgement and problem-solving skills in managing own work activities.
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

Employability skills	This unit contains employability skills.
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Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or 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
1. Gather information on bicycle frame requirements	1.1. Discuss and confirm customer requirements including intended use of the unit, preferred design, frame materials, construction methods and finish 1.2. Use sizing cycle, observation and measurements to assess physical attributes and riding style of client 1.3. Research bicycle frame design principles and check component suppliers and specifications
2. Design bicycle frame and specify materials and components	2.1. Design a frame to customer measurements and requirements, using a computer-aided design (CAD) program or other means 2.2. Specify frame tubing in terms of diameter and wall thickness to achieve durability and use requirements according to established industry practices 2.3. Prepare parts list and determine availability of parts and materials 2.4. Document and cost custom frame job and obtain customer approval for work to be undertaken 2.5. Place order with suppliers for frame materials, parts and components
3. Prepare for frame building	3.1. Plan frame building sequence and determine availability of tooling and equipment 3.2. Lay out parts and check for damaged and/or missing components 3.3. Select and check tooling and set up jig 3.4. Set up welding, brazing or bonding equipment and materials 3.5. Identify need for additional persons to assist in frame building process and make arrangements
4. Build bicycle frame	4.1. Perform frame building operations according to plan 4.2. Use personal safety equipment and take precautions to protect others in the workplace 4.3. Use and maintain tooling and equipment in accordance with workplace health and safety (WHS) requirements 4.4. Check angles, measurements and frame alignment throughout the operation and make adjustments as required
5. Paint and/or finish frame	5.1. Prepare frame for painting and finishing 5.2. Prepare and apply paint or finish in accordance with manufacturer recommendations 5.3. Follow appropriate safety precautions, including the use of personal protective equipment and adequate ventilation

ELEMENT	PERFORMANCE CRITERIA
	5.4.Clean up equipment in accordance with environmental procedures
6. Prepare frame for delivery and clean up	6.1.Check the finished bicycle frame and prepare unit for delivery 6.2.Clean and store portable tooling and equipment in approved designated areas 6.3.Clean work area and dispose of waste in accordance with workplace procedures 6.4.Complete workplace records, customer file and warranty information as required by enterprise

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

Required skills include:

- technical skills to the level required to use appropriate software, tools and equipment to design and build a bicycle frame
- communication skills to the level required to confirm work requirements and specifications, to communicate effectively regarding work requirements with supervisor, other workers and customers, to report work outcomes and problems, and to relate to people from a range of social, cultural and ethnic backgrounds and of varying physical and mental abilities
- literacy skills to the level required to research information related to bicycle frame design and components and interpret technical information and specifications
- numeracy skills to the level required to correctly complete tests and measurements, calculate ratios and interpret specifications
- problem-solving skills to the level required to apply bicycle design principles and measurements to specify and select suitable components for a custom bicycle frame and recognise design features that detract from durability
- team skills to the level required to work effectively and cooperatively with others to optimise workflow and productivity

Required knowledge

Required knowledge includes:

- purpose and requirements of bicycle frame systems and their relationship to braking, wheels, drivetrain and steering system
- classification of bicycle frames and identification of system components
- materials used in bicycle frames
- application of frame design principles
- causes of frame failures and design alternatives to reduce likelihood of failure
- frame construction procedures and techniques
- selection, checking and use of tooling and equipment
- manufacturer and/or component supplier specifications
- applicable commonwealth, state or territory legislation, regulations, standards and codes of practice, including WHS, personal safety and environment, relevant to designing and building bicycle frames
- organisational policies and procedures, including quality requirements, reporting and recording procedures, and work organisation and planning processes, related to designing and building bicycle frames

Evidence Guide

EVIDENCE GUIDE	
<p>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.</p>	
Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> • communicate effectively with customer to determine requirements • apply mechanical principles and measurements to design a bicycle frame to meet client requirements • select frame components, materials and equipment to meet design requirements • observe safety procedures and requirements • use appropriate construction procedures and techniques to build a bicycle frame to design specifications.
Context of, and specific resources for assessment	<ul style="list-style-type: none"> • The application of competency is to be assessed in the workplace or a simulated environment that reflects as far as possible the actual working environment. • Assessment is to occur using standard and authorised work practices, safety requirements and environmental constraints. • Assessment is to comply with relevant regulatory requirements, including specified Australian standards. • Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. • The following resources should be made available: <ul style="list-style-type: none"> • a range of bicycle frame parts and components • equipment and tools appropriate to constructing bicycle frames • BikeCAD or other design tools • technical specifications and standards • workplace documentation.
Method of assessment	<ul style="list-style-type: none"> • 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

EVIDENCE GUIDE	
	<p>include questioning on Required Skills and Knowledge to ensure its correct interpretation and application.</p> <ul style="list-style-type: none"> • Assessment may be applied under project-related conditions (real or simulated) and require evidence of process. • Assessment must confirm a reasonable inference 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 functional units which together form part of the holistic work role.
Guidance information for assessment	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. 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.

Bicycle frames	Bicycle frames may include: <ul style="list-style-type: none"> • all-terrain, touring, racing, recumbent and BMX bicycle frames • steel, lugged, brazed or welded • titanium • composite material • aluminium • lugged, brazed or welded • painted, anodised, natural state and polished surface finishes
Bicycle measurements	Bicycle measurements may include: <ul style="list-style-type: none"> • head tube length and angle (steering axis) • bottom bracket drop • seat tube length and angle • top tube length • saddle setback • chainstay length • fork rake or offset • fork trail and bicycle stability
Client physical attributes	Client physical attributes to be considered may include: <ul style="list-style-type: none"> • height • body shape and weight distribution • length of arms and legs • fitness, agility and injuries
Design considerations	Design considerations may include: <ul style="list-style-type: none"> • common reasons for frame failure • design features that affect durability • balancing weight reduction, durability (fatigue) and impact resistance (collision) • characteristics of tubes with equal weight but differing wall thicknesses, stiffness and failure • features and characteristics of advanced fixtures
Design and build methods	Design and build methods may include:

RANGE STATEMENT	
	<ul style="list-style-type: none"> • CAD programs • tube cutting, mitreing and preparation • welding, brazing and bonding processes • correcting distortion and misalignment • painting and surface finishing
Tooling and equipment	<p>Tooling and equipment may include:</p> <ul style="list-style-type: none"> • hand tooling and equipment • welding, brazing and bonding equipment and material • frame jig, workbench and air tooling
Materials	<p>Materials may include:</p> <ul style="list-style-type: none"> • tubing, lugs, bottom bracket shells, fork crowns and dropouts • welding consumables • paint, surface preparation and finishes • cleaning materials
Information/documents	<p>Information/documents may include:</p> <ul style="list-style-type: none"> • verbal or written and graphical instructions, signage, work schedules/plans/specifications, work bulletins, memos, material safety data sheets (MSDS), diagrams or sketches • safe work procedures related to designing and building bicycle frames • regulatory/legislative requirements pertaining to bicycle safety • design specifications and instructions • organisation work specifications and requirements • instructions issued by authorised enterprise or external persons • Australian standards
WHS requirements	<p>WHS requirements are to be in accordance with applicable commonwealth, state or territory legislation and regulations, and organisational safety policies and procedures, and may include:</p> <ul style="list-style-type: none"> • personal protective equipment and clothing • safety equipment • first aid equipment • hazard and risk control • elimination of hazardous materials and substances • manual handling, including shifting, lifting and carrying • emergency procedures
Legislative requirements	<p>Legislative requirements are to be in accordance with applicable commonwealth, state or territory legislation, regulations, certification requirements and codes of practice, and may include:</p>

RANGE STATEMENT	
	<ul style="list-style-type: none"> • award and enterprise agreements • industrial relations • Australian standards • Australian Design Rules • confidentiality and privacy • WHS • the environment • equal opportunity • anti-discrimination • relevant industry codes of practice • duty of care
Environmental requirements	<p>Environmental requirements may include:</p> <ul style="list-style-type: none"> • waste management • hazardous gases and fumes • noise • dust • clean-up management
Quality requirements	<p>Quality requirements may include:</p> <ul style="list-style-type: none"> • regulations, including Australian standards • internal organisational quality policies and procedures • enterprise operations and procedures
Organisational policies and procedures	<p>Organisational policies and procedures may include:</p> <ul style="list-style-type: none"> • quality policies and procedures, including Australian standards • WHS, sustainability, environment, equal opportunity and anti-discrimination • manufacturer specifications and industry codes of practice • safe work procedures • reporting and recording procedures

Unit Sector(s)

Unit sector	Bicycle
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Co-requisite units

Not applicable.

Competency field

Competency field	Technical - Chassis and Frame
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