Unit 337: Erect timber roof structures

# Delivery guide

Unit information

This unit is about erecting timber roof structures.

Learners may be introduced to this unit by asking themselves questions such as:

* What does stress grading mean?
* What is a live load?
* How do I know which truss type to use?
* How can I reduce the risks of working at height?
* How do I plan a sequence of operations to erect a hip-ended roof?
* Why do roofs have to have bracings built in?
* Please note that while there is alignment between this unit and Progression Unit 220, there is additional content within Learning outcome 3, Criteria 3.2.

Learning outcomes

1. Understand resource selection
2. Understand working to a contract specification
3. Comply with the given contract information to carry out the work safely and efficiently to the required specification

Suggested resources

Textbooks

* Brett, P. (2010) *Carpentry and Joinery Book One: Job Knowledge Third edition (Complete Reference Guide).* Oxford: Formerly Nelson Thornes/Oxford University Press. ISBN 978-1-4085-0650-9
* Brett, P. (2010) *Carpentry and Joinery Book Two: Practical Activities*. Oxford: Oxford University Press.   
  ISBN 978-1-4085-0648-6
* Burdfield, M., Jones, S., Redfern, S., Fearn, C. (2020) *The City & Guilds Textbook: Site Carpentry & Architectural Joinery for the Level 3 Apprenticeship (6571), Level 3 Advanced Technical Diploma (7906) & Level 3 Diploma.* London: Hodder Education.

ISBN 978-1-5104-5815-4

* Chudley, R. (2020) *Chudley and Greeno’s Building Construction Handbook*. Oxford: Routledge. ISBN 978-0-3671-3543-0
* Jones, S., Redfern, S., Fearn, C. (2019) *The City & Guilds*

*Textbook: Site Carpentry and Architectural Joinery for the Level 2 Apprenticeship (6571), Level 2 Technical Certificate (7906) & Level 2 Diploma (6706)*. London: Hodder Education.

ISBN 978-1-5104-5813-0

* Lancashire, R., Lewis, T. (2011) *Timber frame construction 5th edition*. BM TRADA. ISBN 978-1-9005-1082-0
* Trada, BM. (2018) *Site check: The timber frame pocket guide*. BM TRADA. ISBN 978-1-9095-9465-4

Websites

* [Designing Buildings | Timber roof](https://www.designingbuildings.co.uk/wiki/Timber_roof)
* [Pasquill | The Different Types of Roof Trusses and their Uses](https://pasquill.co.uk/the-different-types-of-roof-trusses-and-their-uses/)
* [Rafferty Roof Trusses | The Ultimate Guide to Roofing Trusses](https://www.raffertyrooftrusses.co.uk/the-ultimate-guide-to-roofing-trusses)
* [TRADA | Pitched timber roofs: part one and two](https://www.trada.co.uk/publications/magazine-articles/pitched-timber-roofs-a-geometry-lesson/)

Legislation

* [HSE | RIDDOR - Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013](https://www.hse.gov.uk/riddor/)
* [HSE | Health and safety in roof work](https://www.hse.gov.uk/construction/safetytopics/roofwork.htm)

| **Learning outcomes** | **Criteria** | **Delivery guidance** |
| --- | --- | --- |
| 1. Understand resource selection | * 1. Characteristics of the resources | * Learners to understand and compare the characteristics, limitations and differences between structural and non-structural roof components, load and non-loadbearing components and a range of materials that include Unplasticised Polyvinyl Chloride (UPVC), timber types (hardwood, softwood), timber grading, sustainability and timber defects. * Learners should be given a drag and drop exercise allowing them to identify roof components and which type of load they are subject to (compression, tension, etc). * Learners to understand how sustainability can be applied to roof construction and the benefits of using sustainable materials. * Learners to know the advantages of using locally sourced materials including enhanced material properties (energy saving) and lower carbon footprint (to include embodied carbon) and how they relate to protecting the natural environment, controlling waste management, energy-loss prevention and U-Values. * Learners to research the above two points and present their findings to their group. * Learners to research and know the current legislation that applies to the use of timber roof structures including the Health and Safety Executive (HSE) and Building Regulations. * Learners to understand the types of load: dead, live and dynamic, i.e. wind. This can be linked to the first task above. * Learners to understand the fundamental difference between truss and traditional cut roofs. * Learners should research the development of roofs through the ages that has led to both hand-cut and trussed rafter roof construction.   **Truss roof**   * Learners to be able to identify the different types of truss rafter roofs including fink, fan, king post, queen post, attic, girder and mono and their differences in application and use. * Learners to know the different components required to erect a trussed roof (truss rafters roof hips, valleys, diminishing trusses, gable ladders, eaves, verges, straps and wall plates). * Learners to know where restraint straps, bracing including lateral, diagonal and chevrons and truss clips are used and the reason for temporary bracing during erection.   In groups, learners should be given one of the above trussed rafter types and prepare a short presentation to the group about:   * its suitable use * the components within its construction * how it is erected and braced * Learners to know the different types of eaves (open, closed, flush and sprocketed) and the materials used including hardwood, softwood and UPVC. * Learners to know the different types of verge systems including closed, flush, plastic and dry systems. * Learners should research traditional and modern eaves construction. Each type should be presented to the group including information about their construction and benefits.   **Traditional cut gables and flat roofs**   * Learners to know the different types of traditional cut roof construction including single, double, gable, lean to, couple, close couple, collared and flat roofs. * Learners to know the uses for the different components used in traditional gable-end roof construction including wall plate, ridge board, common rafter, purlins, sprocket ends, ceiling rafter, collar ties, binders, gable ladder, eaves, verges, fascias, bargeboards, soffits, soffit brackets, straps, lateral and diagonal bracings. * In groups, learners should be given one of the roof types above and should produce an information sheet with annotated diagrams of the component parts and its construction. These can then be shared with the group. (This can form the basis of the extended activity in Criteria 2.1 below.) * Learners to know the uses for the different components used in roof construction (flat roofs) including wall plate, ceiling rafter, strutting, fillets and firings, fascias, soffits, cold and warm decking, and decking materials. * In groups, learners should be given either the cold or warm deck roof and should produce an information sheet with annotated diagrams of the component parts and its construction showing where the insulation is positioned and the requirements for ventilation. * Learners to understand the importance of design for manufacture, off-site construction and modern methods of timber construction. * Learners to understand the concept of fabric-first principles and building performance in terms of acoustic and thermal performance (including sound transfer, airtightness, ventilation, airflow, U-Values and cold bridging). * Learners to research the above in particular relation to the current Building Regulation requirements. * Learners to know and understand the importance of quality control, quality assurance, certification and warranties in reducing the performance gap, the role of different materials, components and assemblies. * Learners to know the importance of fire safety in construction onsite and offsite, the importance of moisture control and the importance and methods of minimising waste. |
| * 1. Use of resources | * Learners to know the procedure for erecting truss and cut roofs.   Truss roof   * Learners to know the procedure on how to install roof trusses and to understand the importance and position of lateral bracing, diagonal bracing, chevron bracing, lateral restraints, wall plate, gable ladder, straps (wall plate and lateral) and truss clips. * This can be an extension to the first activity in Criteria 1.1 above and include: * how it is erected and braced * what strapping is required and at what centres they are required * how the trusses are stored prior to being positioned.   Traditional cut   * Learners to understand the methods for determining lengths and cuts of common rafters including plumb cut, seat cut and third/pitch line and the importance and position of wall plate, ridgeboard, purlins, gable ladder, bracings and straps (wall plate and lateral). * In groups, learners should use as an example of a hand cut hipped-end roof drawing for this roof and be asked to: * specify all the materials required * consider how the construction will conform to current building regulations * write a risk assessment and method statement for the work * write a fixing procedure * determine, using one of the above listed methods, the true lengths and bevels required for the common and hip rafter of a roof with a span of 7.2 m and a rise of 3.1m.   Eaves and verge finishes   * Learners to sketch and describe the methods of forming closed, open, sprocketed and flush eaves including soffit brackets, soffits, tilting fillet, fascias, bargeboard, proprietary ventilation systems, dry-verge finishes, plastic and cement systems. * Learners to know the Personal Protective Equipment (PPE) requirements for erecting roof structures including mandatory PPE such as harnesses. * Learners to know what collective protective measures are and should prepare a list of those specifically related to roof erection and select the PPE and Respiratory Protective Equipment (RPE) required. * Learners to know the access equipment required for the work and the research associated legislation including HSE, The Work at Height (WAH) Regulations 2005 and Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR). * Learners to know the procedures for reporting problems related to resources (hierarchy charts, company structures, architect’s role, terms of contracts and changes to specifications, variation orders and architect instructions). * In pairs, learners should, from a given scenario, state how each problem is reported and who it should be reported to. |
| * 1. Organisational procedures to select resources | * Learners to know who selects materials using what technical information sources (drawings, specifications, schedules, digital information and 3D modelling) and the interaction between the different types of documentation. * Learners to research the above point and write a report as to who is responsible for undertaking the following procedures and the benefits gained from each. * Learners to research the benefits of planning the sequence of materials and labour requirements for the roof structure and the use of Bills of Quantities (BOQ), programmes of work, stock systems, stock-control lead times, schedules, specifications, Gantt charts, bar charts and critical path analyses in managing the building project. |
| * 1. Hazards | * In small groups, learners should identify the hazards that are present when setting out and erecting roofs and compare these with their peers. This should be followed by writing a risk assessment for this operation. * Hazards and risks include falls from heights, exposure to hazardous substances, plant and vehicles, lifting, mechanical and manual handling and muscular/skeletal injuries from poor working practices. * Learners to understand their responsibilities in relation to the hazards that may be encountered. * In groups, learners should be given a scenario associated with this unit and be asked to select correct Personal Protective Equipment (PPE) required including harnesses, lanyards, helmet, boots, Hi-Viz and collective protective measures requirements. * Learners should be given a variety of scenarios of how hazards can be created by changing circumstances in the workplace including construction site developments and ongoing work, plant and vehicles and periods of extreme weather. Learners should be asked to present their thoughts about how these can be mitigated to their group. |
| 1. Understand working to a contract specification | * 1. Methods of work | * Learners to understand the importance of using the appropriate materials and skills (mark, measure, set out) in timber roof construction methods. * Learners to know how to select suitable materials for tasks and their uses and to understand the process of timber roof construction.   Truss   * Learners to produce a method of work for the process of how to measure, mark out, fit, align, finish, position and secure truss rafter roofs. * Learners to research the implications, benefits, advantages and disadvantages of constructing trussed rafter roof structures at ground level.   Traditional cut   * As an extension to the first activity in Criteria 1.1 above, learners should write the method of how to measure, mark out, fit, align, finish, position and secure traditional cut roofs including single, double, gable, lean to, couple, close couple, collared and flat roofs. * Learners to understand the importance of working to drawings, specifications and schedules and the interaction of these documents. * Learners should extract information from working drawings, schedules and specifications for position, size and fixing for a given roof. |
| * 1. Tools and equipment | * Learners should research how to safely sharpen, maintain and store hand and power tools and how to record any faults found with equipment and who this should be reported to. * Tools and equipment to include saws, hammers, chisels, screwdrivers, electric drills, cordless drills, drill bits, powered nailer, battery-powered tools, tape measure, try square, spirit level, plumb bob and string line. |
| 1. Comply with the given contract information to carry out the work safely and efficiently to the required specification | * 1. Demonstrate work skills to measure, mark out, fit, align, finish, position and secure | * Learners should be set activities that allow them to mark out, fit, align, finish, position and secure a truss rafter roof. This should allow them to select and fix the different components required to erect a trussed roof including truss rafter, gable, ladder, wall plate, eaves, verge, straps, wall plate and restraint bracing, lateral, diagonal, truss clip and temporary bracing. * Learners should determine the true lengths and bevels for a given cut roof structure using at least two methods and compare the results with their peers for consistency. * Learners should mark out, fit, align, finish, position and secure traditional cut roofs including single, gable and flat roofs for the given roof. |
| * 1. Use and maintain hand tools, portable power tools and ancillary equipment to construct, erect and/or install the following roof structures to given working instructions: * in-situ roofs (manually and/or mechanically handled) * pre-assembled roof structures (mechanically handled) | * Learners should select, safely set up, use and maintain: * measuring equipment (rulers, tape measures, digital measuring equipment) * saws (hand and PPT including chop saw and circular saw) * squares (to include roofing, adjustable bevel, and 90 degree) * claw hammer, framing nailer * string line, chalk line, straight-edge * levels (optical, laser, 600mm, 1000mm and 1800mm level). * Learners should select, safely handle, stack and store resources using correct manual handling techniques. |