Trussed Rafter

Technical Manual

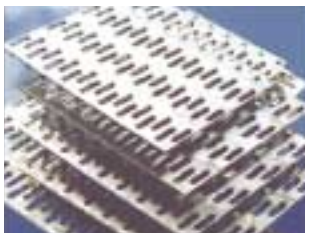
CI SfB (27.9) Xi2

March 2004

Your Constructive Partner

Wolf Systems was formed in 1988 as an integral part of the Austrian based Johann Wolf Group's expansion into the world roof truss systems market, offering an innovative package including:

- Market leading, user-friendly software
- Long-term fair pricing
- New standards of customer service



The development of sophisticated design and technical facilities has placed Wolf in a commanding position amongst its competitors. This is largely due to our advanced timber roof design, manufacturing and management software. All software is user-friendly and very stable allowing detailed working drawings to be produced easily.

Wolf Systems have now added their expertise and knowledge into other products and services, which compliment trussed rafters. These include our easi-joist metal web floor system and KeyBuild Timber frame software, which is marketed through our Keymark subsidiary. We support clients with that special degree of flexibility and innovation that has characterised our success.

Mission Statement

Our mission is to assist customers in achieving industry-leading status. We will provide the most advanced software and efficient nailplate products backed by relevant design services, machinery and other assistance. Wolf Systems will be consistently ethical in applying technical and industry standards and maintain exemplary quality at all times.

Contents

TRUSSED RAFTERS *have proved to be an efficient, safe and economical method for supporting roofs since their introduction into the UK in 1964. They are manufactured by specialised timber engineering companies, who supply to all sections of the construction industry. Developments have been extensive, and today complex roofscapes are easily formed with computer designed trussed rafters.*

With the continuing trend toward individualism in domestic house styling, let alone the reflection of this in new inner city estates, the facility to introduce variations to the standard designs is vital. The provision of many character differences by designing and then constructing L returns, doglegs and hips for example, satisfies the inherent need for individuality at affordable prices.

Economical roofing solutions for many commercial, industrial and agricultural buildings; hospitals, army barracks and supermarket complexes, are achieved by the expeditious installation of trussed rafters.

Experienced roof designers and trussed rafter manufacturers are therefore in an ideal position to assist the architect or specifier in achieving affordable solutions throughout the building industry. Simply provide a brief sketch or description of that being considered, including alternatives, and we will do the rest. The whole roof is designed and specified using state-of-the-art computer aided technology supplied by ***Wolf Systems****. We can also arrange for one of our specialists to visit and advise you.*

This technical manual highlights some of the basic structural arrangements and assembly information you may require. In addition, we can offer technical expertise and experience in a comprehensive advisory service to clients, from initial sketch to completed trussed rafters.

Technical Data

Design
Trusses are designed in accordance with the current Code of Practice, which is BS 5268: Part 3, and the relevant Building Regulations.

Spans
Standard trusses can be designed up to 11 metres in 35mm timber, and 15 metres in 47mm timber. Spans in excess of these can be designed but are often supplied as multiple trusses fixed together.

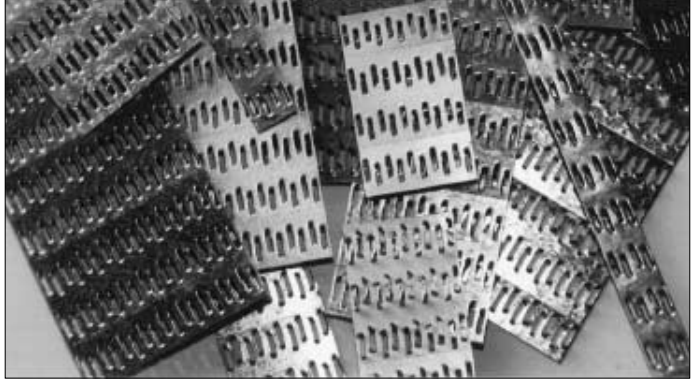
Pitches
It is more economical to standardise the range of pitches between 15 & 40 degrees, however, trusses may be supplied outside this range. Care should be taken when specifying because deflection problems may arise with eg. very shallow pitches.

Eaves Overhangs
Any overhang can be supplied to suit the customer's requirements. NB. Very large overhangs may cause the trusses to be uneconomical.

Spacing
Trusses are usually spaced at 600mm, but can also be positioned at 450mm or 400mm to support heavier loads.

Timber
We use timber which is kiln dried and stress graded, and which complies with current European and British Standards.

Preservation
Trusses may be treated with one of the new waterborne solutions, or with non-corrosive spirit-based organic solvents. Copper Chrome Arsenate and similar treatments, are not recommended.

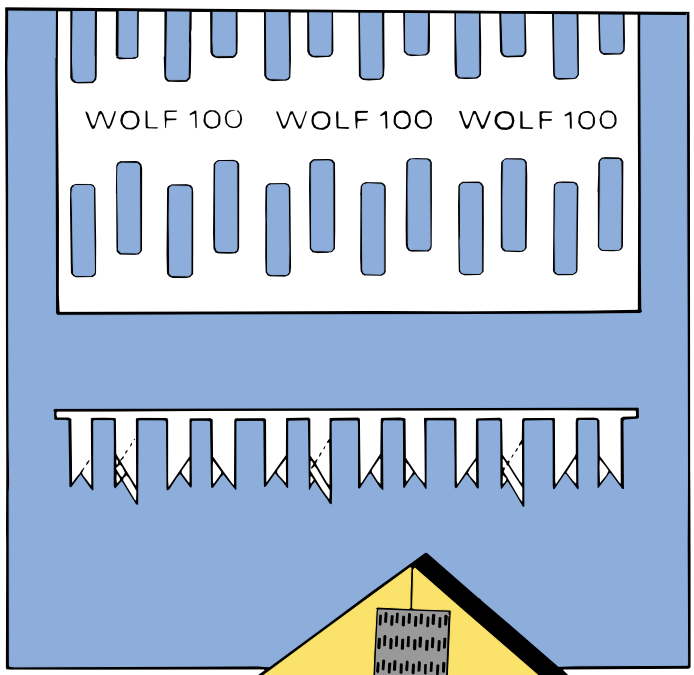


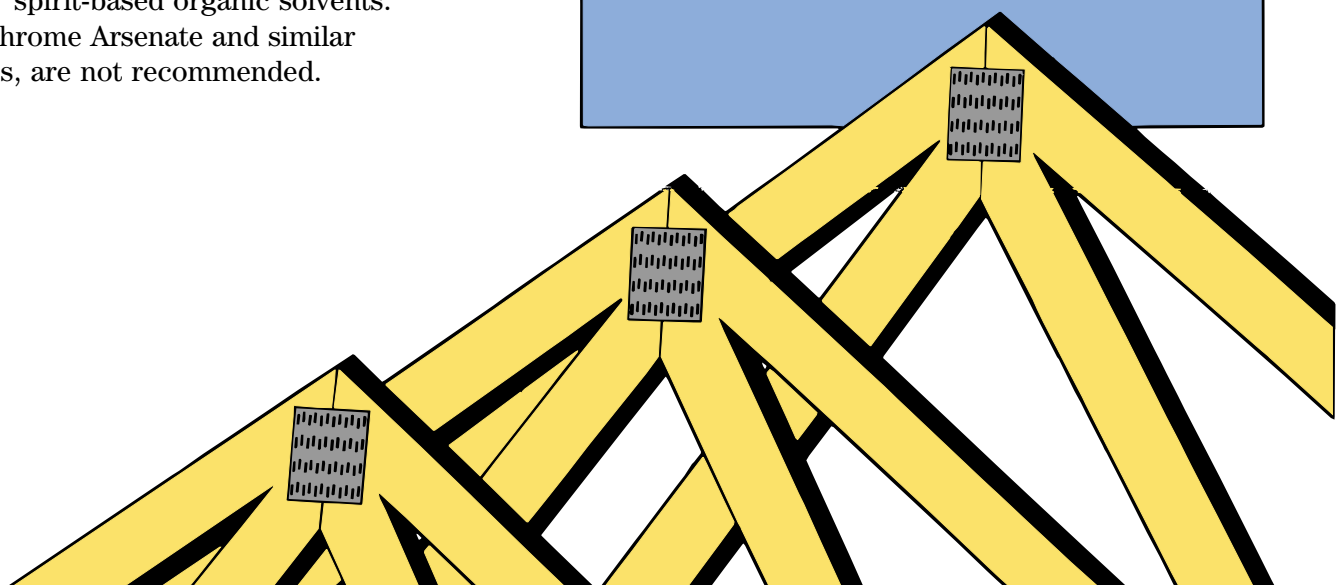
Nailplates
We use and recommend Wolf 100 nailplates which are precision punched 1mm gauge metal plates with integral teeth and are manufactured from structural grade galvanised mild steel to BS 10147 Fe E 220 G275. They carry a 60 year performance warranty and are covered by Certificate No.89/2290 issued by the British Board of Agrément.

BBA BRITISH BOARD OF AGRÉMENT
CERTIFICATE No. 89/2290

Also available and often specified for spliced timber joints, are the Wolf 125 nailplates in 1.25mm galvanised mild steel.

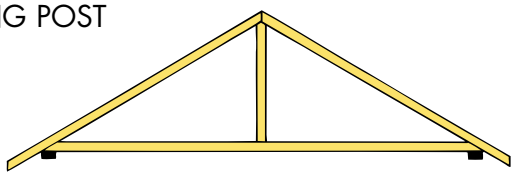
1.5mm gauge nailplates, imported from Austria, are available for heavier timber constructions requiring longer teeth. They are supplied in limited pre-determined sizes. Wolf 15N are galvanised: Wolf 15NE are stainless steel for specific applications only.



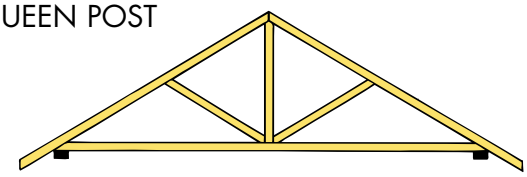


Some common trussed rafter shapes

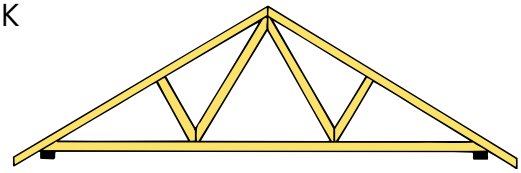
KING POST



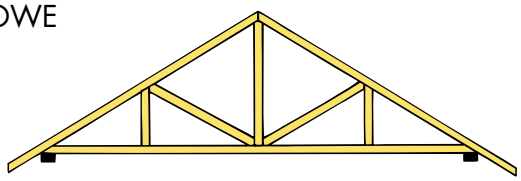
QUEEN POST



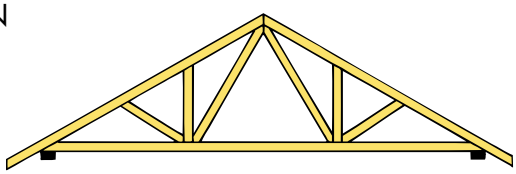
FINK



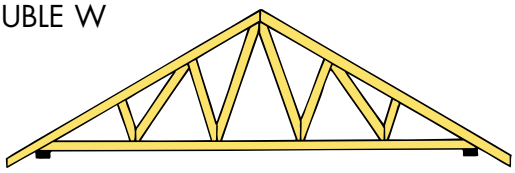
HOWE



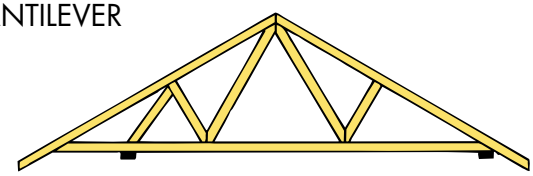
FAN



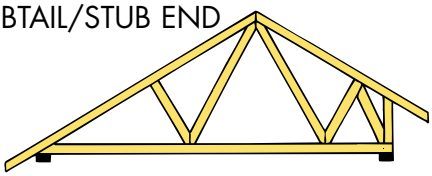
DOUBLE W



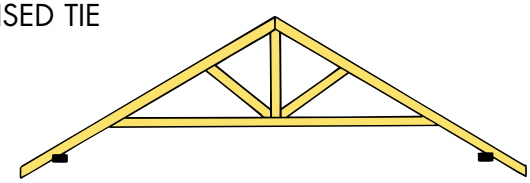
CANTILEVER



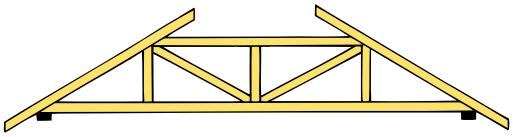
BOBTAIL/STUB END



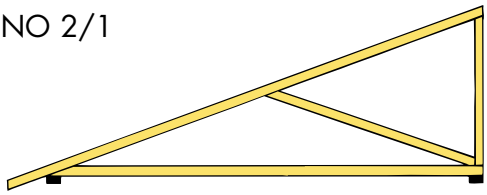
RAISED TIE



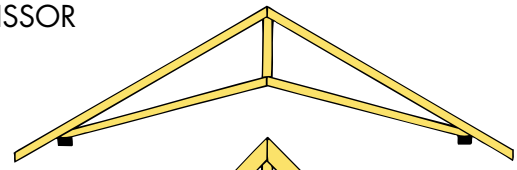
FLAT TOP (HIP END)



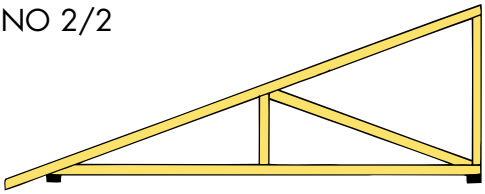
MONO 2/1



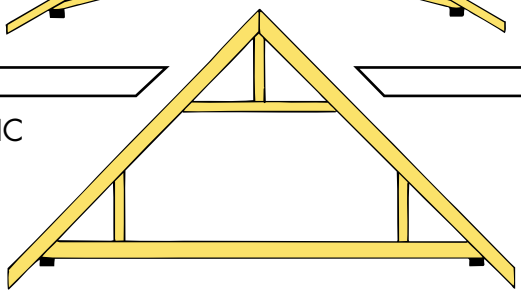
SCISSOR



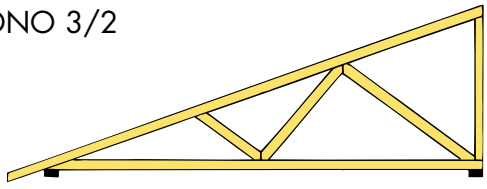
MONO 2/2



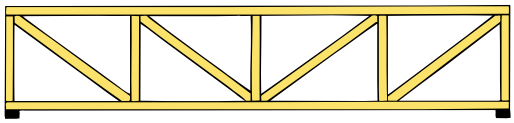
ATTIC



MONO 3/2



PARALLEL



Truss Loadings

Imposed loads in accordance with BS 6399.

RAFTER LOADS

Long Term Loads: For standard concrete interlocking tiles the loads are as follows:

Tile weight	575 N/m²
Truss self weight	75 N/m²
Battens & felt	35 N/m²
	685 N/m²

Where a rafter bay forms part of the room (in raised tie and attic trusses) an additional load of 250 N/m² is added for the ceiling finishes.

Medium Term Loads: For small buildings ie. total floor area less than 200m² and where roof shape calculations have not been made, the 0 - 30 degrees site snow load is 750 N/m². This reduces for pitches greater than 30 degrees, reducing to zero at 60 degrees.

Short Term Loads: A man point load of 675 N (900 N x 75% for load sharing) is applied to rafters up to 30 degrees. However, experience has shown that for standard truss configurations designed for 750 N/m² snow loads, the rafter man point load is not a critical load case.

Wind Loads: Wind loads are calculated in accordance with CP3: Chapter V part 2, all structures are assumed to be of Class B.

CEILING TIE LOADS

Long Term Loads: These are as follows:

Truss self weight	75 N/m²
Plaster board	175 N/m²
Imposed load (loft storage)	250 N/m²
Total long term load	500 N/m²

Tank load at 2 node points normally 450 N per node (see tank details on page 19).

Short Term Loads: A man point load of 675 N (900 N x 75% for load sharing) is applied at a point likely to produce the highest stress in the ceiling tie.

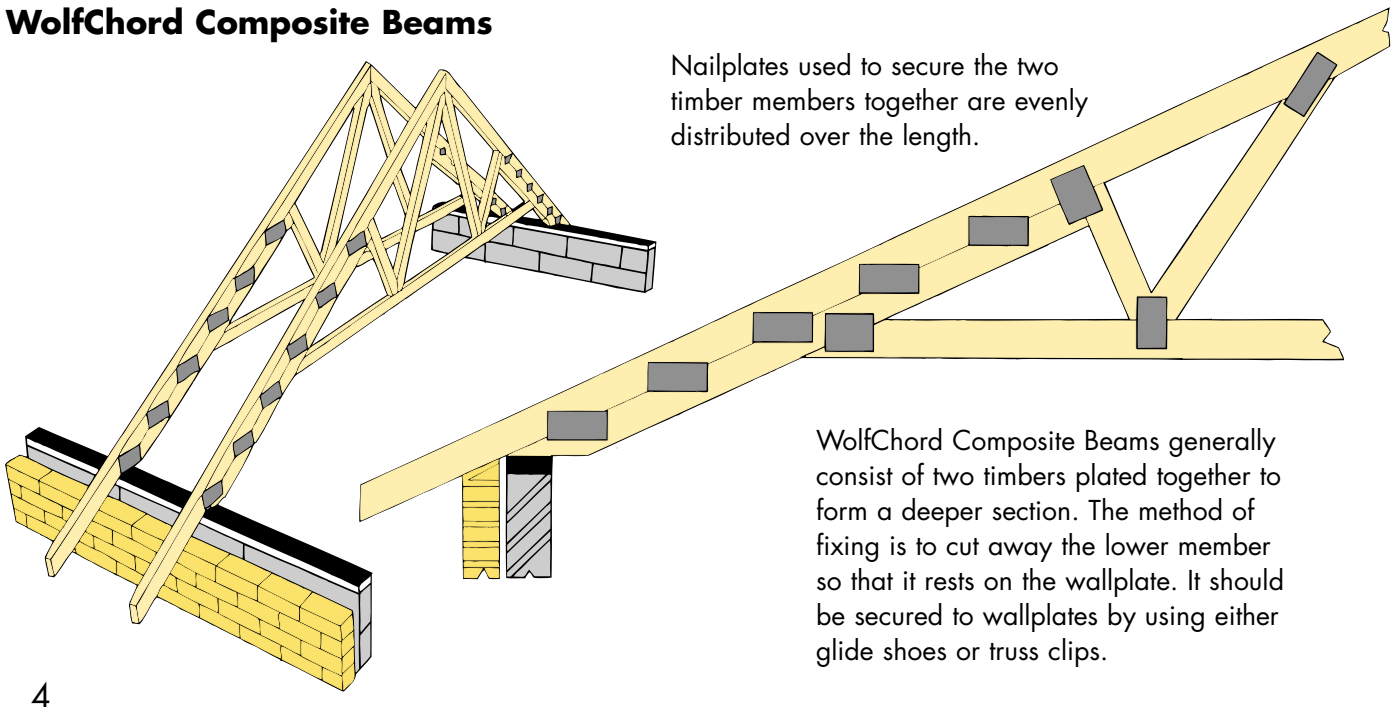
ADDITIONAL LONG TERM LOADS FOR ATTIC TRUSSES

The floor area will be loaded as follows:

Domestic imposed load	1500 N/m²
Partition loads	250 N/m²
Truss self weight	75 N/m²
Plaster board	175 N/m²
Floor boarding	250 N/m²
	2250 N/m²

Point loads are applied to the nodes at the side of the room for the plaster board of 250 N/m². x height at the side of the room. A load of 250 N/m² is applied to rafters where they form part of the room.

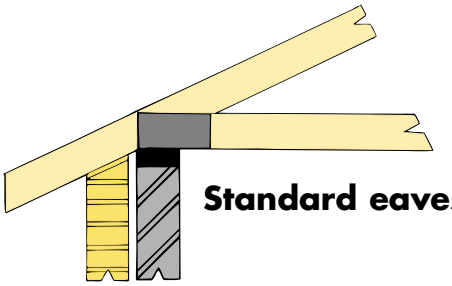
WolfChord Composite Beams



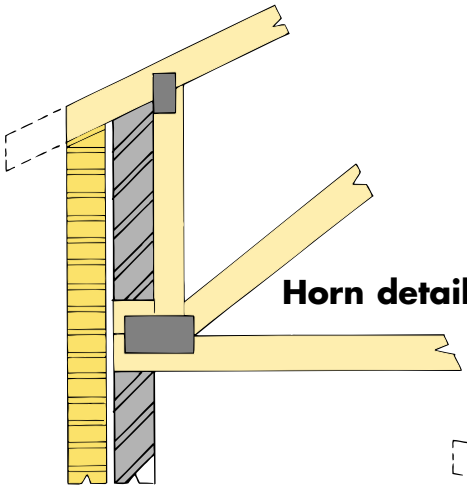
Nailplates used to secure the two timber members together are evenly distributed over the length.

WolfChord Composite Beams generally consist of two timbers plated together to form a deeper section. The method of fixing is to cut away the lower member so that it rests on the wallplate. It should be secured to wallplates by using either glide shoes or truss clips.

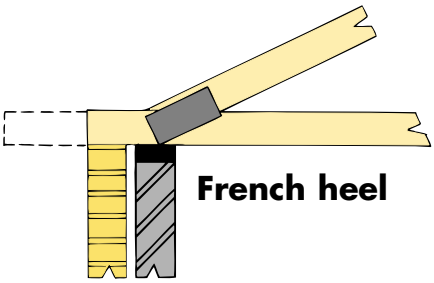
Typical eaves details



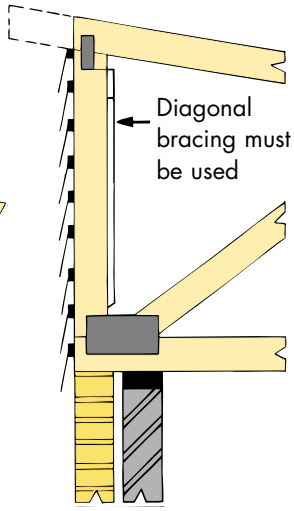
Standard eaves joint



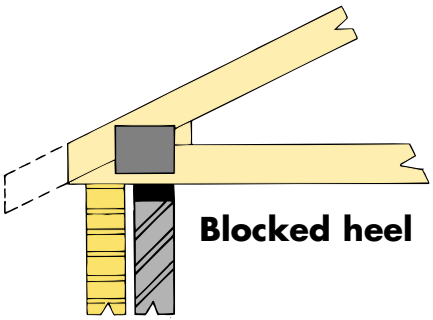
Horn detail built into wall



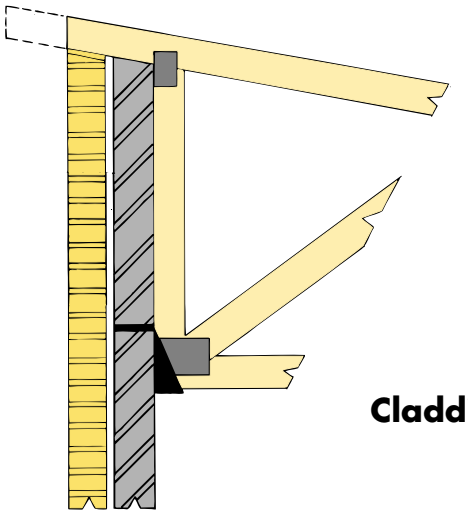
French heel



Cladding to vertical face

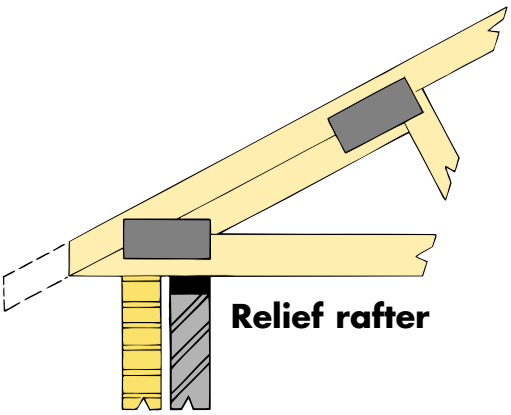


Blocked heel

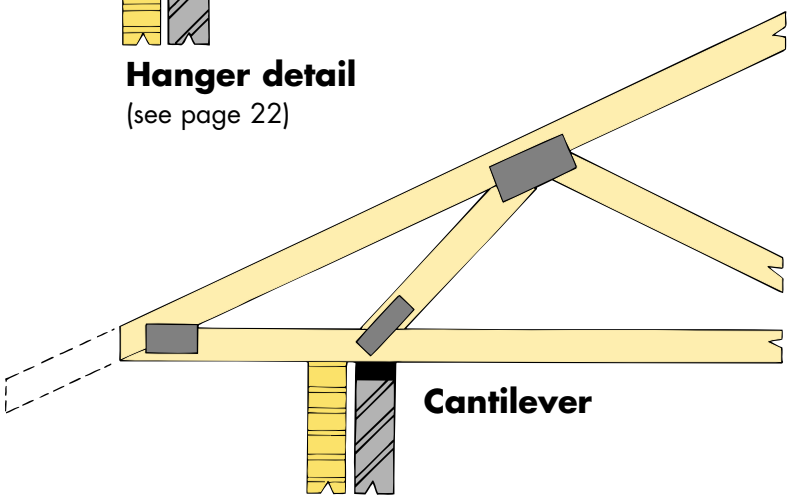


Hanger detail

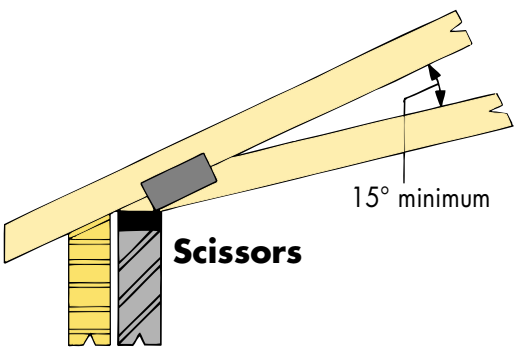
(see page 22)



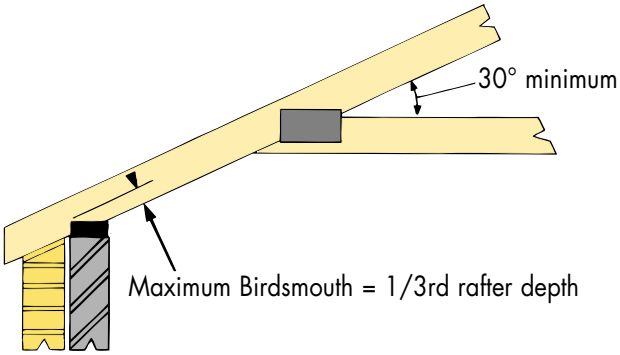
Relief rafter



Cantilever



Scissors



Raised Tie

Attic trusses

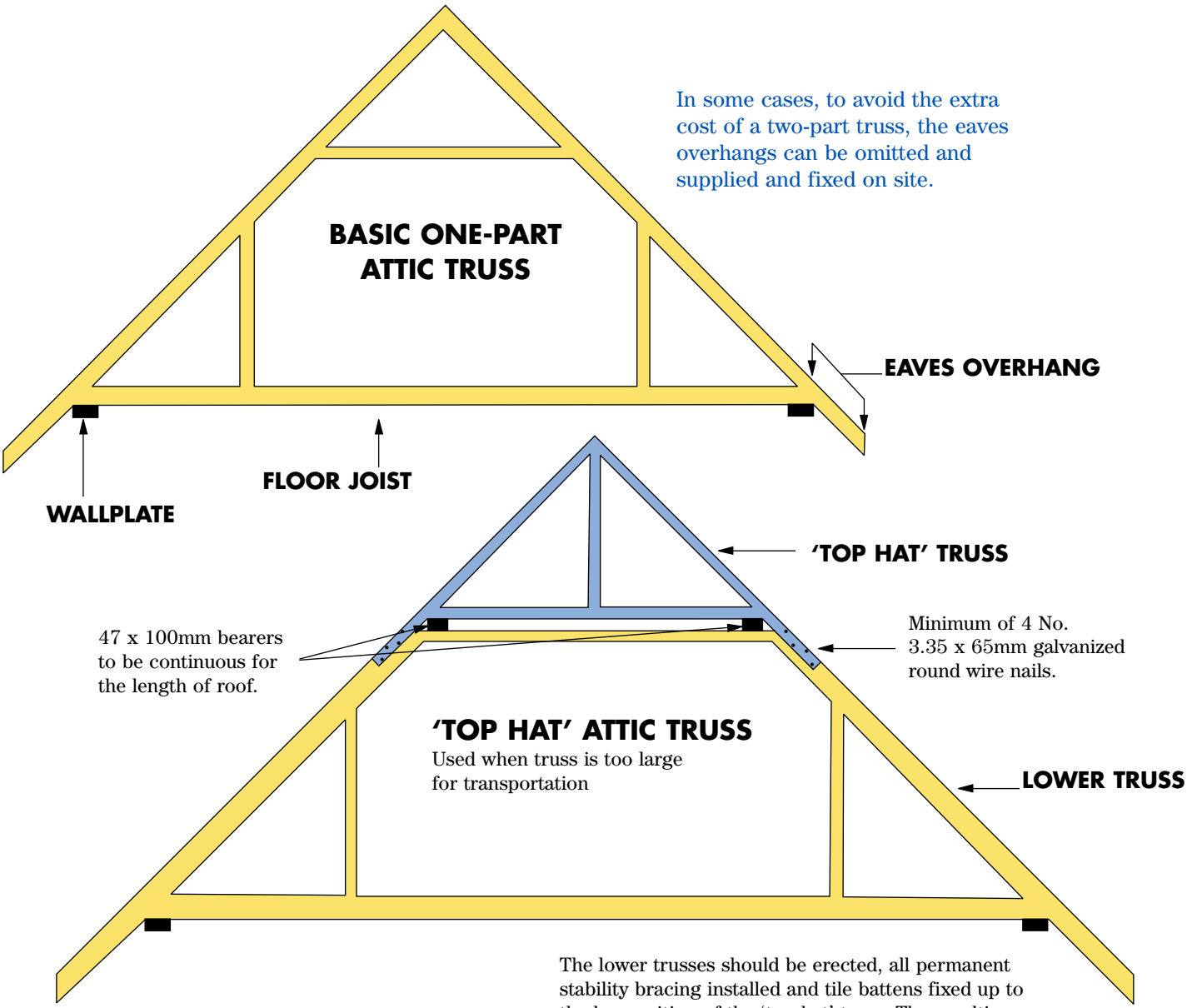
Roof space using attic trusses can achieve up to 50% more living area. Provision for creating extra rooms may be incorporated at the initial stage for immediate use, or conversion later into living accommodation to suit the house owner's changing circumstances. No extra strengthening of the trusses is required, although a central support might be needed for very large spans.

Spacing

Loadings to attic trusses are usually greater than normal trusses (see page 4). Consequently, timber sizes are larger and spacings may be reduced to 450mm centres.

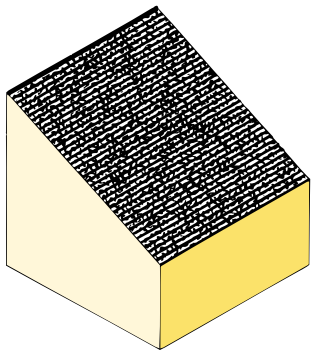
Stairwells, Rooflights and Dormers

Attic trusses will provide living accommodation in the roof space; therefore, care has to be taken with respect to stairwells, rooflights and dormers. Usually these are wider than the truss spacings, but difficulties can be overcome by grouping trusses together to form compound girder trusses on either side of the openings. Common rafters and floor joists can be supported by purlins and binders between the compound trusses. Stairwells should lie along the line of trusses to avoid cutting across them, and similarly, to avoid too many compound trusses, dormers and rooflights should be situated opposite each other.

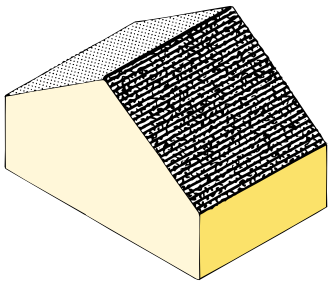


The lower trusses should be erected, all permanent stability bracing installed and tile battens fixed up to the lap position of the 'top hat' truss. The resulting structure then forms a safe, rigid working platform for the erection of the 'top hat' trusses. Tiling or loading of the base trusses should not proceed until the 'top hat' trusses are fully installed and braced.

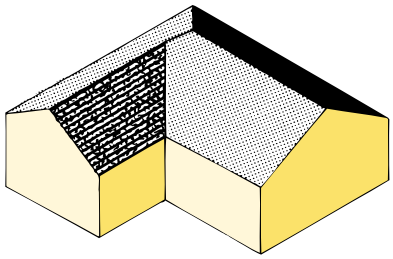
Common roof shapes



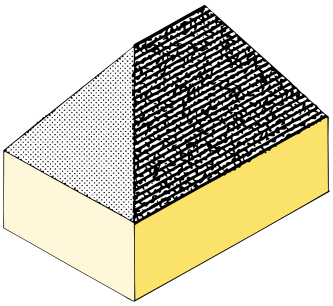
Mono-pitch



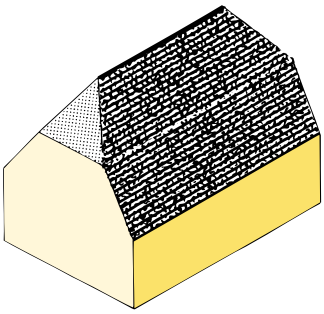
Duo-pitch



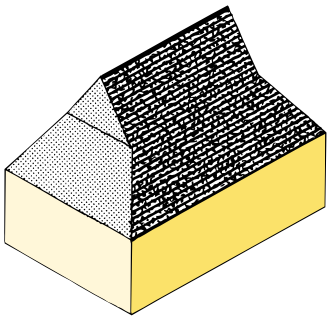
L return



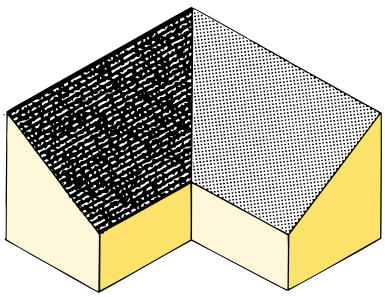
Hipped



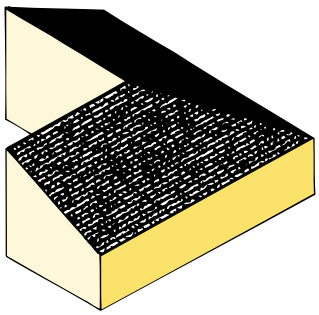
Dutch or Barn hip



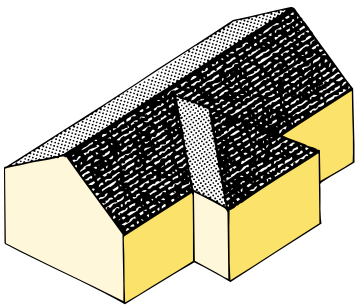
Gablet



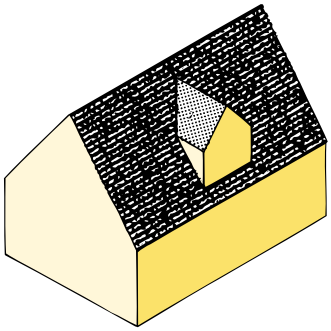
Mono L return



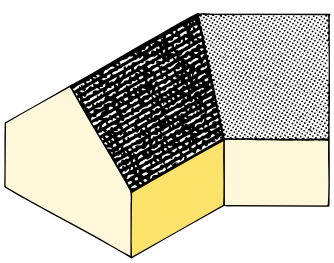
Mono L return/Mono hip



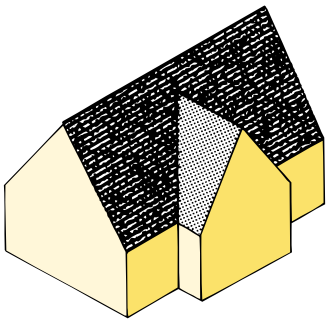
Overlaid hip



Dormer

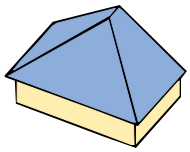


Dogleg



T-intersection

Flat top hip



The horizontal top chords to the flat top trusses are to be well braced together to resist lateral buckling

Hip Boards to be birdmouthed over the compound girder of flat top trusses and over the wallplate

Compound Girder of Flat Top Trusses permanently fixed together

Infill Ceiling Joists

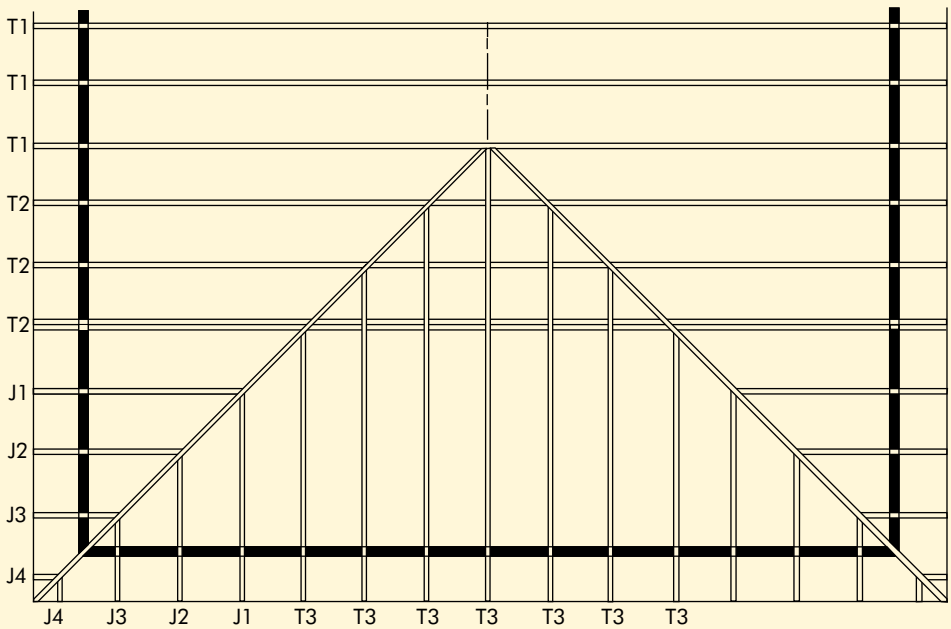
Infill Jack Rafters to be a minimum of 25mm deeper than trussed rafter members to allow for birdmouthing at wallplate

Mono Pitch Trusses supplied with extended rafters for site cutting to suit hip boards

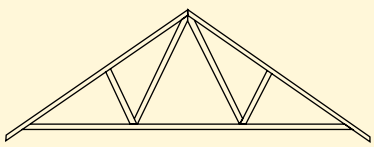
Noggings to be nailed to ceiling joist and side of jack rafter

Standard Trusses to Main Roof

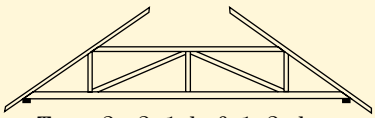
Flat Top Trusses supplied with extended rafters for site cutting to suit hip boards



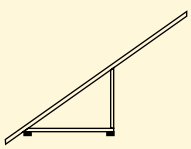
T = Truss
J = Jack Rafter



Truss 1 : 3 off



Truss 2 : 2x1ply & 1x2 ply



Truss 3 : 7 off

REF: FLAT TOP HIP	
DESIGNED BY:	
SITE:	
PLAN SCALE:	

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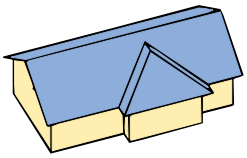
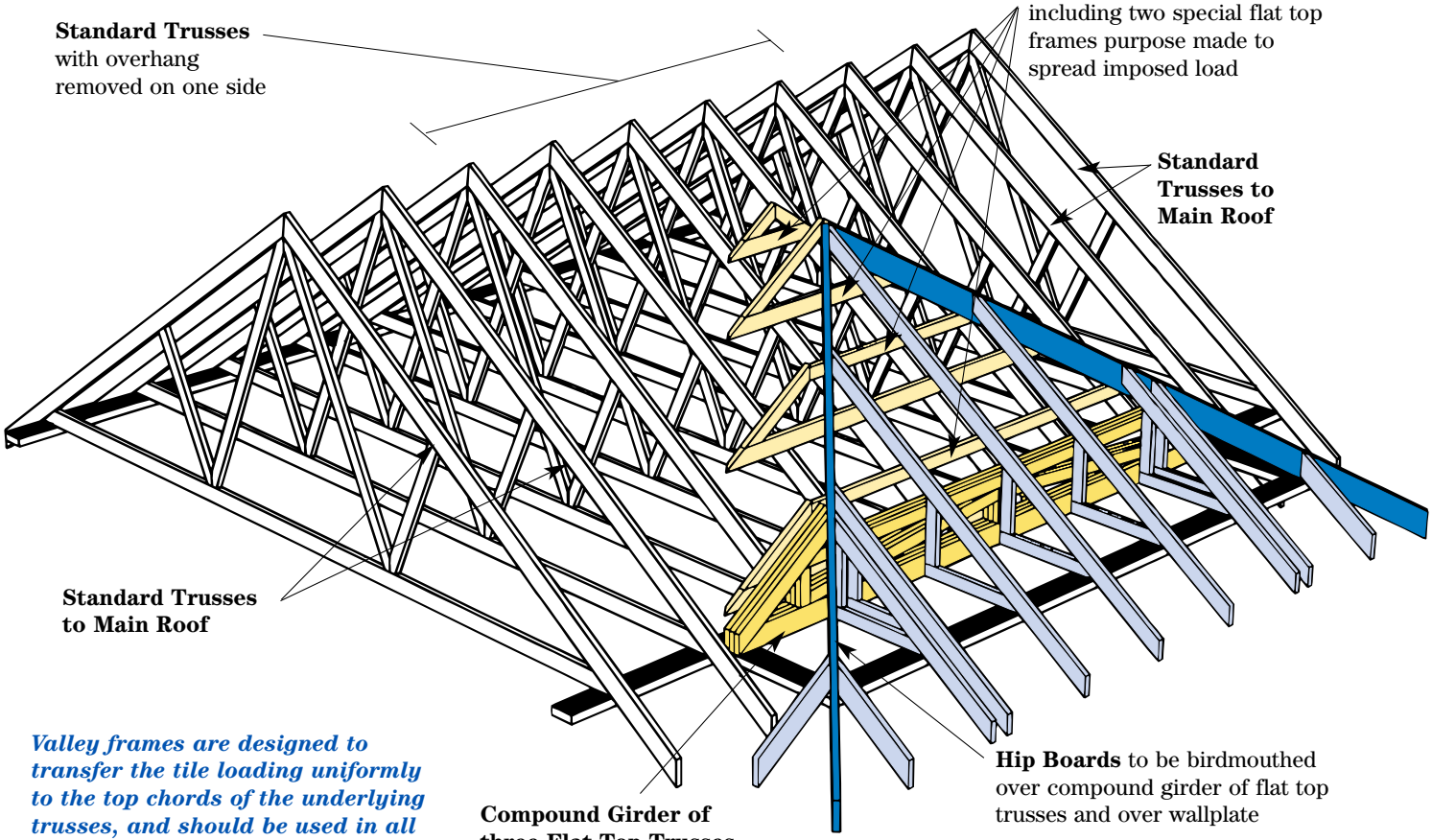
Overlaid hip



Standard Trusses with overhang removed on one side

Set of four Valley Frames including two special flat top frames purpose made to spread imposed load

Standard Trusses to Main Roof

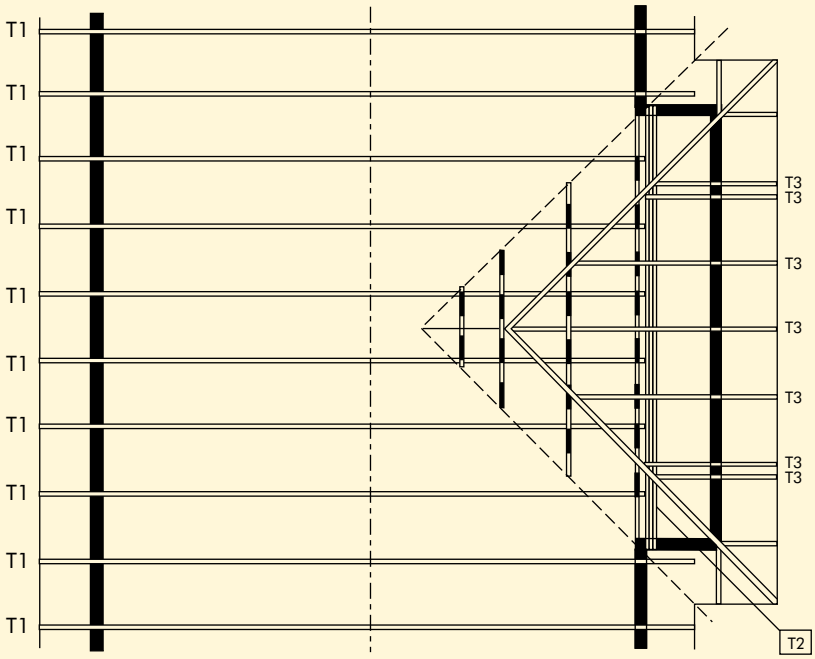


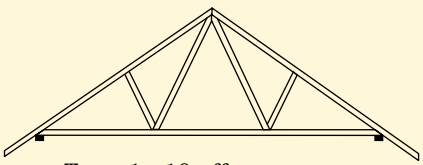
Standard Trusses to Main Roof

Valley frames are designed to transfer the tile loading uniformly to the top chords of the underlying trusses, and should be used in all cases rather than constructing this area with common infill timber.

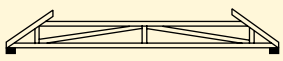
Compound Girder of three Flat Top Trusses permanently fixed together

Hip Boards to be birdmouthed over compound girder of flat top trusses and over wallplate

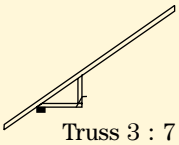




Truss 1 : 10 off



Truss 2 : 1x3 ply



Truss 3 : 7 off

REF: OVERLAID HIP	
DESIGNED BY:	
SITE:	
PLAN SCALE:	

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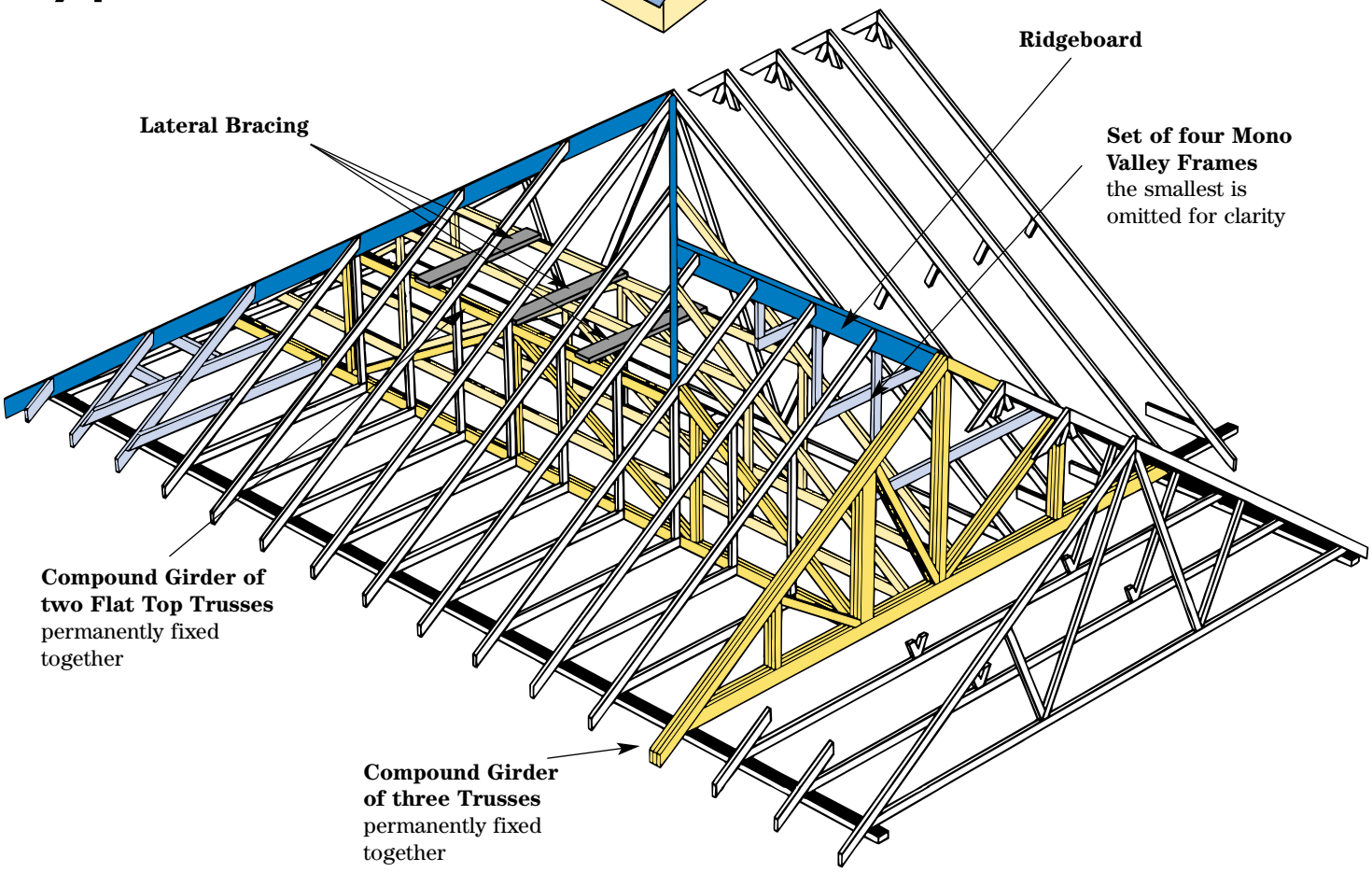
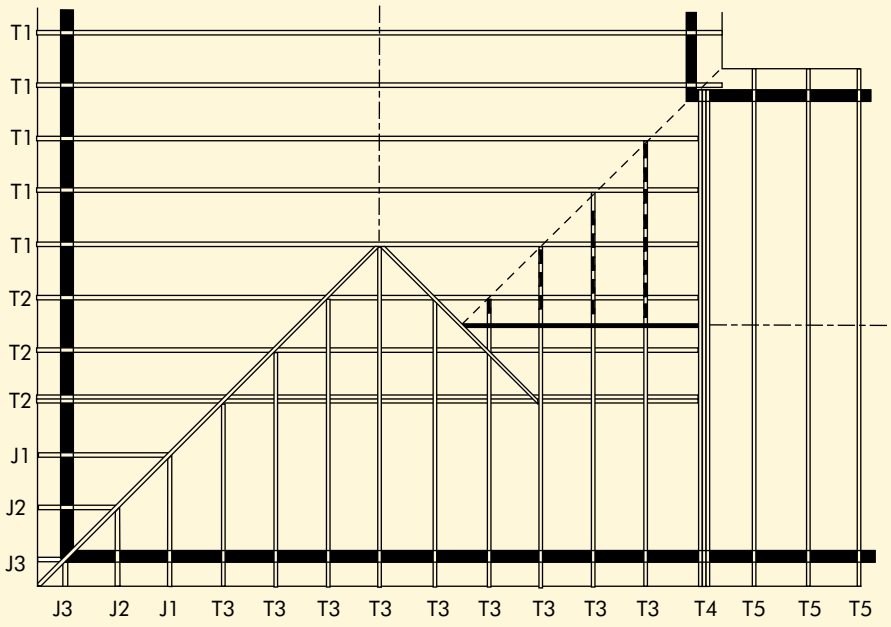
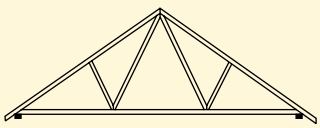
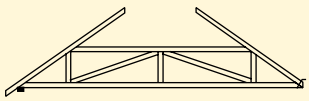
Typical L return

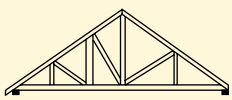


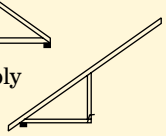


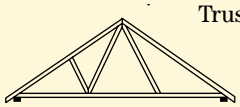
T = Truss
J = Jack Rafter


Truss 1 : 5 off


Truss 2 : 2x1 ply & 1x2 ply

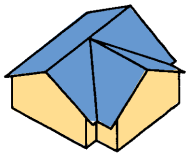

Truss 4 : 1x3 ply


Truss 3 : 9 off


Truss 5 : 3 off

REF: TYPICAL L RETURN	
DESIGNED BY:	
SITE:	
PLAN SCALE:	

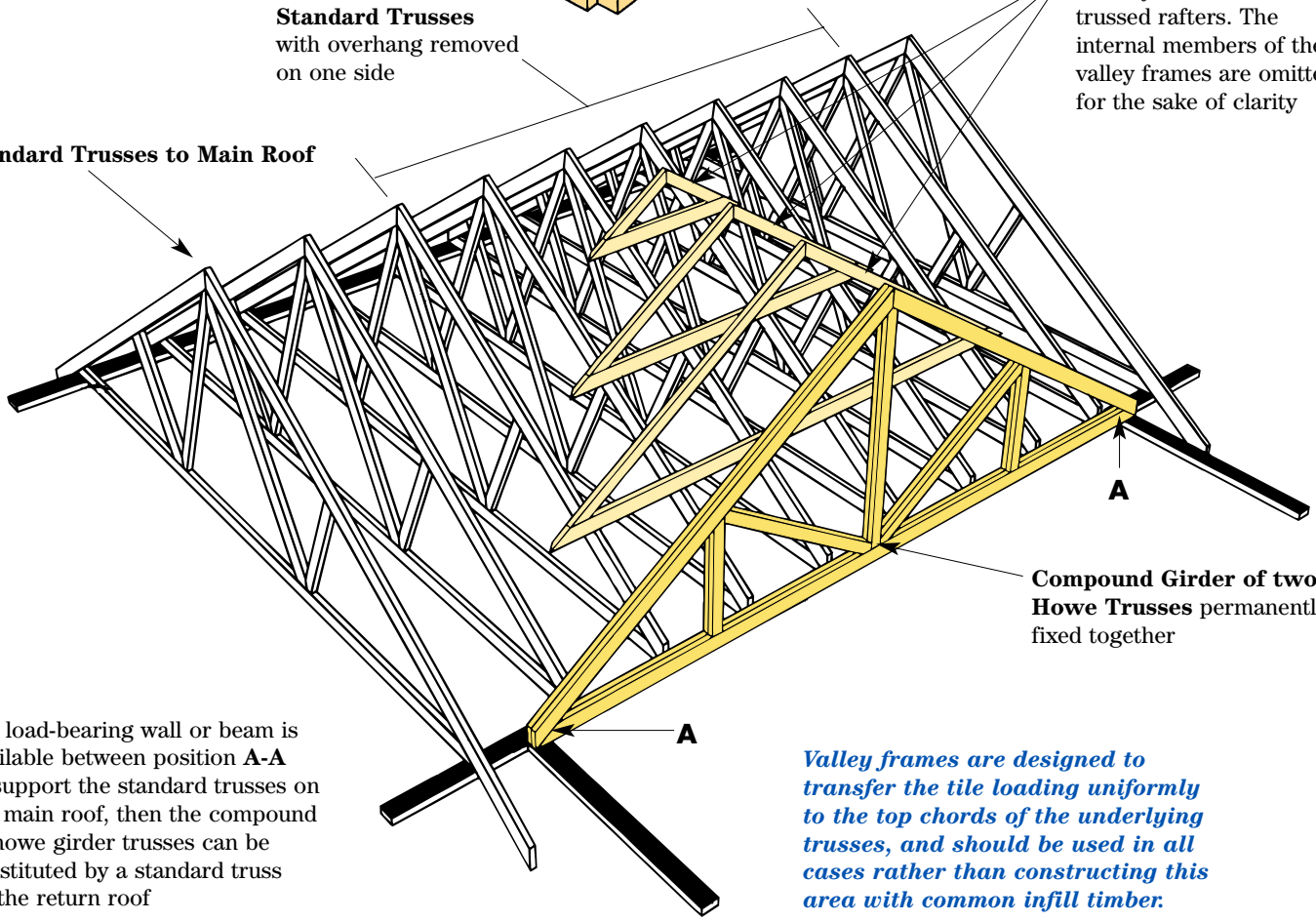
T-intersection



Standard Trusses with overhang removed on one side

Set of three diminishing Valley Frames nailed directly on to the main trussed rafters. The internal members of the valley frames are omitted for the sake of clarity

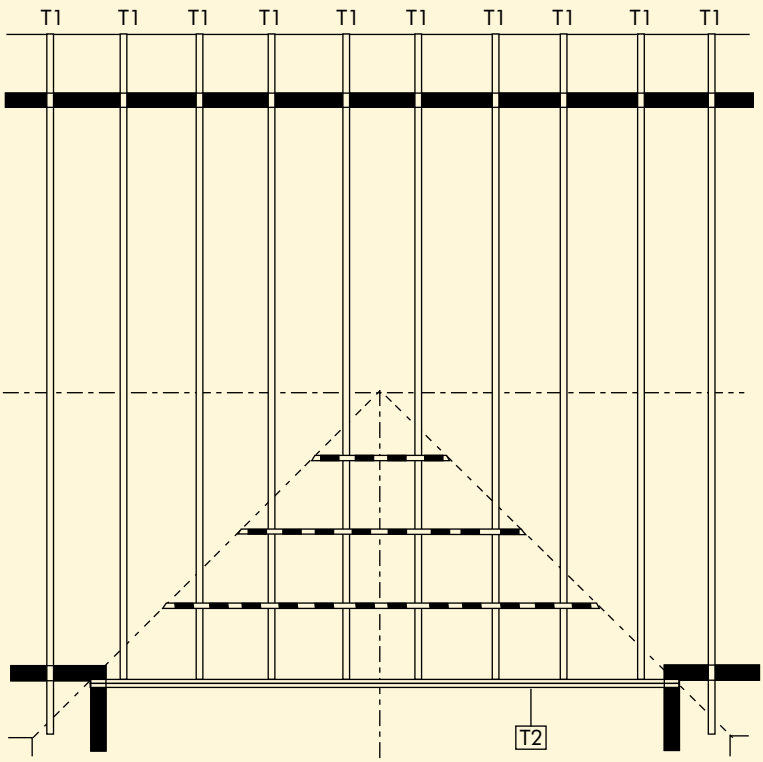
Standard Trusses to Main Roof

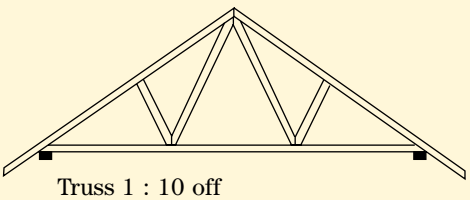


Compound Girder of two Howe Trusses permanently fixed together

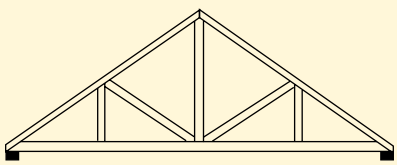
If a load-bearing wall or beam is available between position **A-A** to support the standard trusses on the main roof, then the compound of howe girder trusses can be substituted by a standard truss on the return roof

Valley frames are designed to transfer the tile loading uniformly to the top chords of the underlying trusses, and should be used in all cases rather than constructing this area with common infill timber.





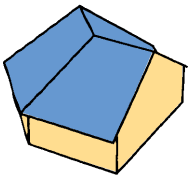
Truss 1 : 10 off



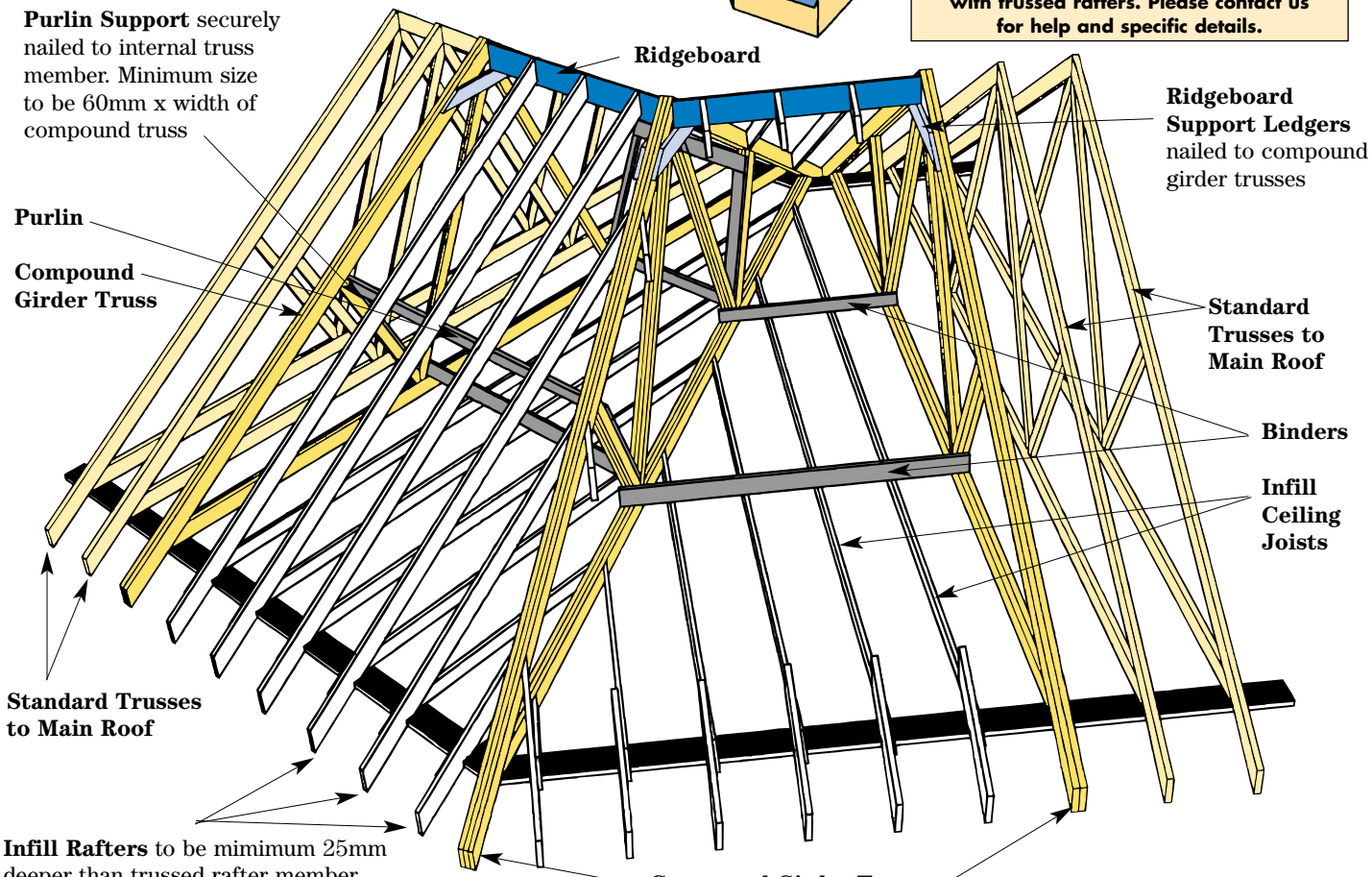
Truss 2 : 1x2 ply

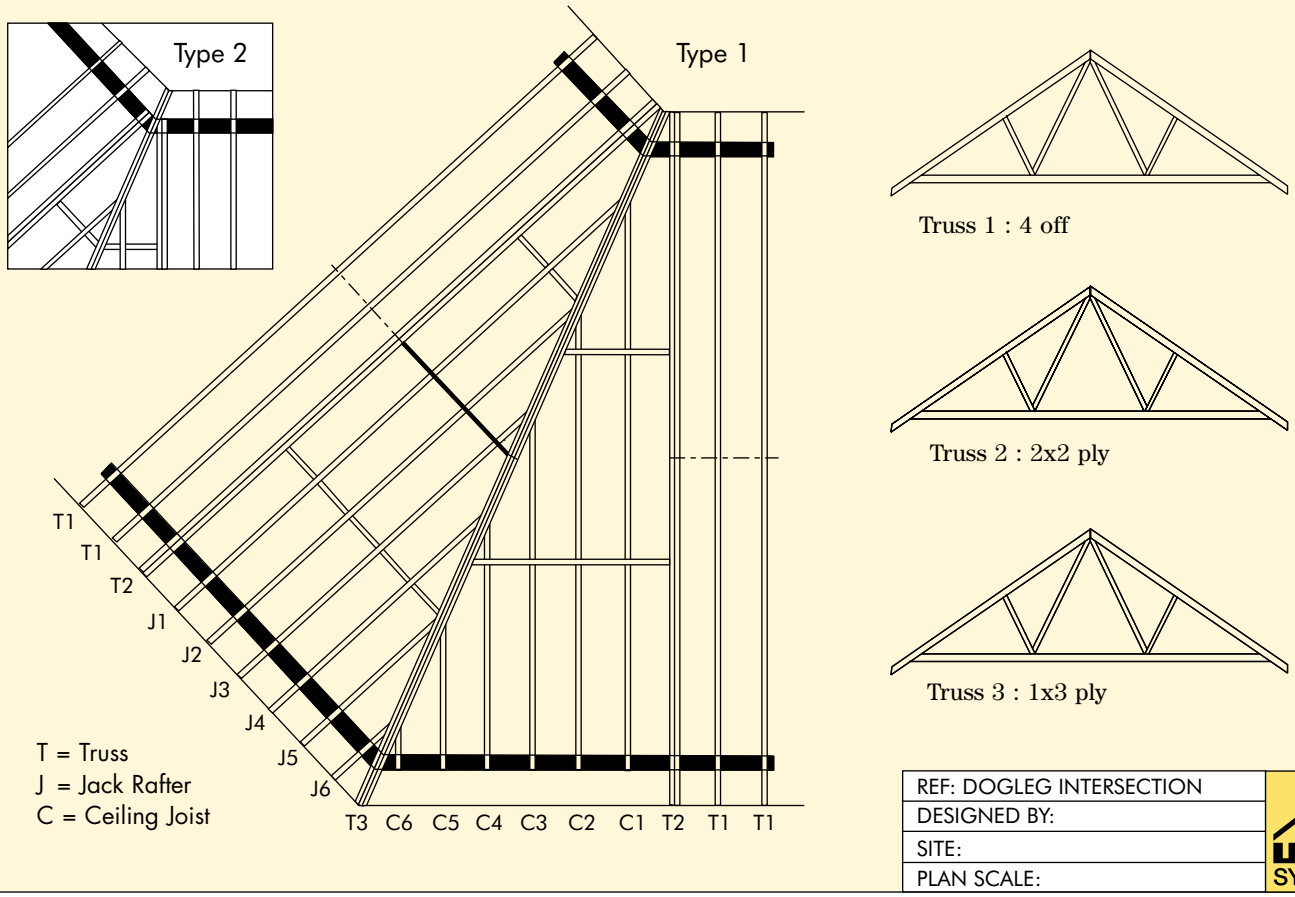
REF: T - INTERSECTION	
DESIGNED BY:	
SITE:	
PLAN SCALE:	

Dogleg intersection



The five roofscapes illustrated in this section are those most commonly constructed. There are many other ways of framing hips, corners, intersections etc. with trussed rafters. Please contact us for help and specific details.





REF: DOGLEG INTERSECTION	
DESIGNED BY:	
SITE:	
PLAN SCALE:	

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Storage and handling on site

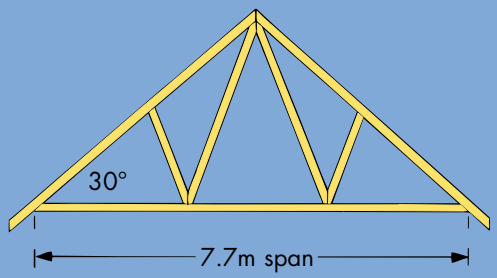
HANDLING

This information shows how trusses may be handled such that no structural damage occurs. It does not infer a safe lifting method for site staff who should take note of both H.S.E. Lifting Regulations and Construction (Design and Management) Regulations 1994. Mechanical handling for unloading and erecting trusses safely is strongly recommended.

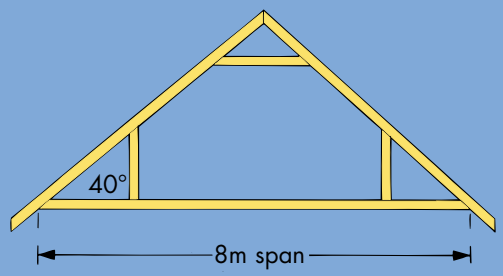
Trusses may become damaged by incorrect handling. During transportation, they may, of necessity, also be inverted. When mechanically handled, the trusses should be banded together in sets and supported when lifting utilizing a spreader bar, as shown in fig 2.

TYPICAL TRUSS WEIGHTS

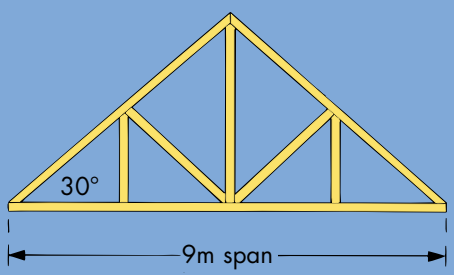
35mm thick fink truss = 35 kg



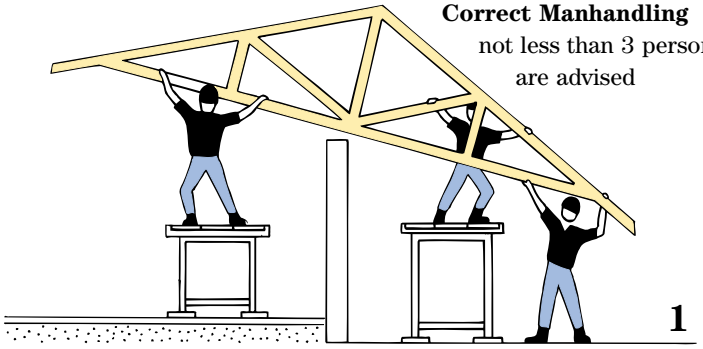
47mm thick attic truss = 110 kg



3 ply 35mm thick howe girder = 160 kg

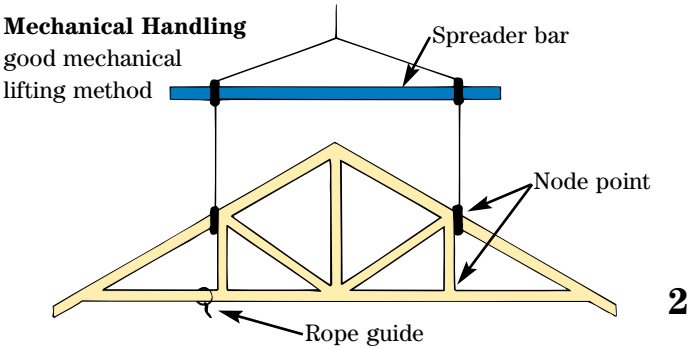


NB: Weights given are for guidance only.
For lifting and handling check actual truss weights



Correct Manhandling
not less than 3 persons are advised

1



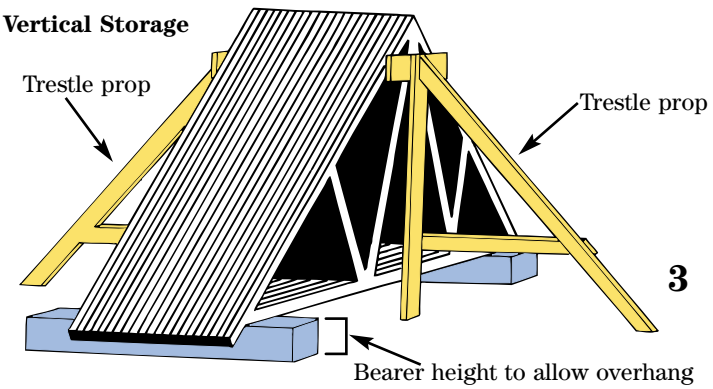
Mechanical Handling
good mechanical lifting method

2

STORAGE

It is imperative to prevent damage or deformation to trusses awaiting erection. They should be stored as illustrated (**3** & **4**) and protected from sun and rain. Adequate allowance must be made for ventilation.

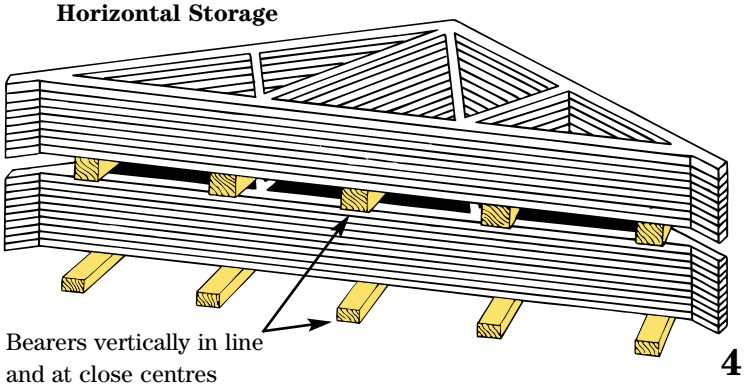
Vertical Storage



3

Bearer height to allow overhang to clear ground

Horizontal Storage

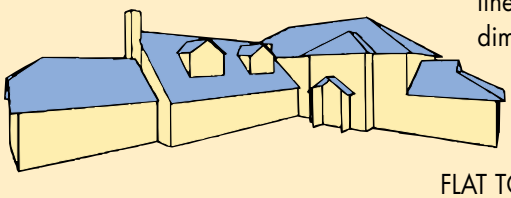


Bearers vertically in line and at close centres

4

Arrangement of roofing styles

Some structural features explained



The variation of roofing styles possible with truss rafters is unlimited. In this illustrated arrangement, we have shown some of the more popular constructions. The application of trussed rafters is efficient, safe and economical. Produced by precision manufacturing, all structural roofing timbers can be delivered to site for immediate erection thus obviating problems with site storage and deterioration, pilfering and damage. Tiling is often completed the same week as truss rafter deliveries.

Wolf Systems computer software generates layouts similar to this, as well as full working plan-drawings. Furthermore, the Wolf System also provides structural calculations and manufacturing details, as required by Building Control authorities.

N.B. In this layout all bracings and fixings, and some timbers have been omitted for the sake of clarity.

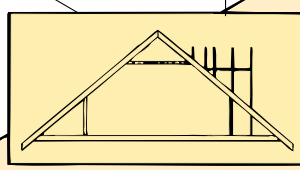
VALLEY SET
necessary to continue roof line at inter-sections, usually in diminishing sets.

FLAT TOP HIP

QUEEN POST TRUSSES
with infill around chimney

DUTCH OR BARN HIP

GABLE LADDERS cut to give 50mm min. clearance of chimney. They should be nailed directly to the face of the last positioned truss.



ATTIC TRUSSES WITH DORMERS & ROOFLIGHTS can achieve up to 50% more living space. Generally trusses are constructed of larger sized timbers, and spacings may be reduced.

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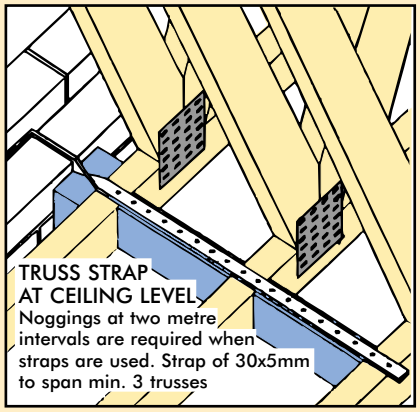
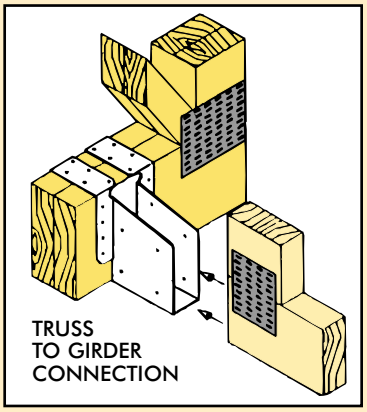
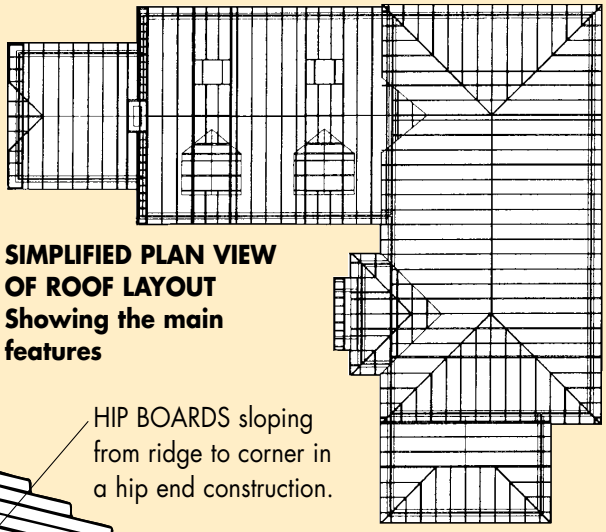


TRUSS STRAP AT CEILING LEVEL
Noggings at two metre intervals are required when straps are used. Strap of 30x5mm to span min. 3 trusses



TRUSS TO GIRDER CONNECTION

FINK TRUSSES are the most common type of truss, they are duo-pitched with the webs forming a letter W. Some of the trusses are cut away to show the water tank which is mounted on a platform with support bearers.



SIMPLIFIED PLAN VIEW OF ROOF LAYOUT Showing the main features

HIP BOARDS sloping from ridge to corner in a hip end construction.

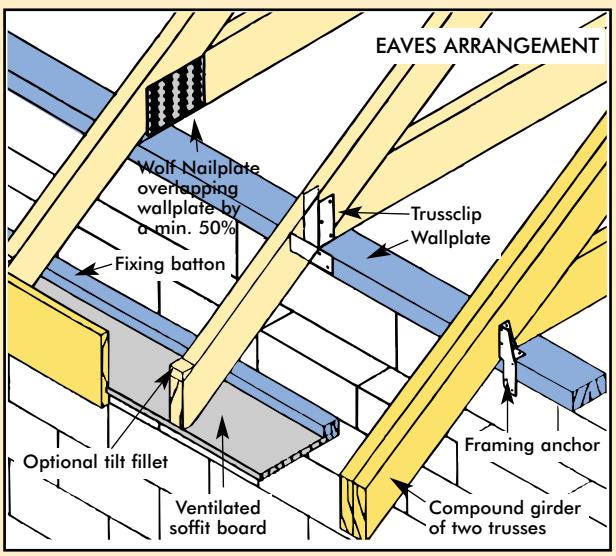
FLAT TOP HIP END showing compound girder of two flat top trusses permanently fixed together, and two further single flat top trusses behind.

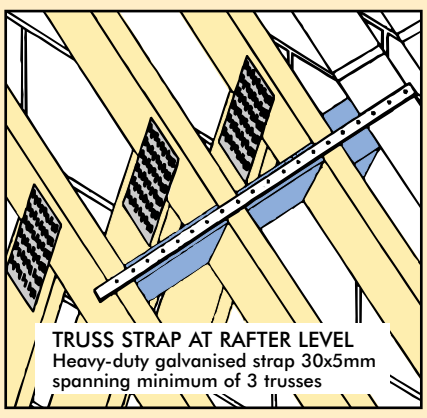
RAISED TIE TRUSSES OVER PORCH with incorporated gabble ladder

OVERLAID HIP with set of 3 valley frames and flat top compound girder.

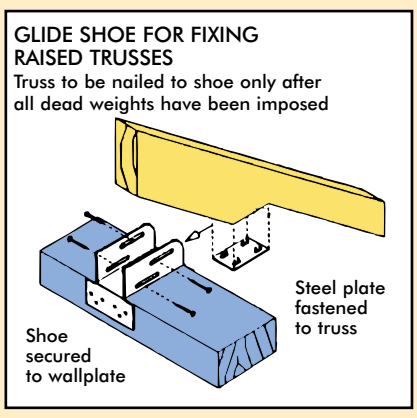
GABLET a vertical roof section set back from the slope of the hip end.

BARGEBOARD to conceal roof timbers, is usually secured to timbers at gable ends.





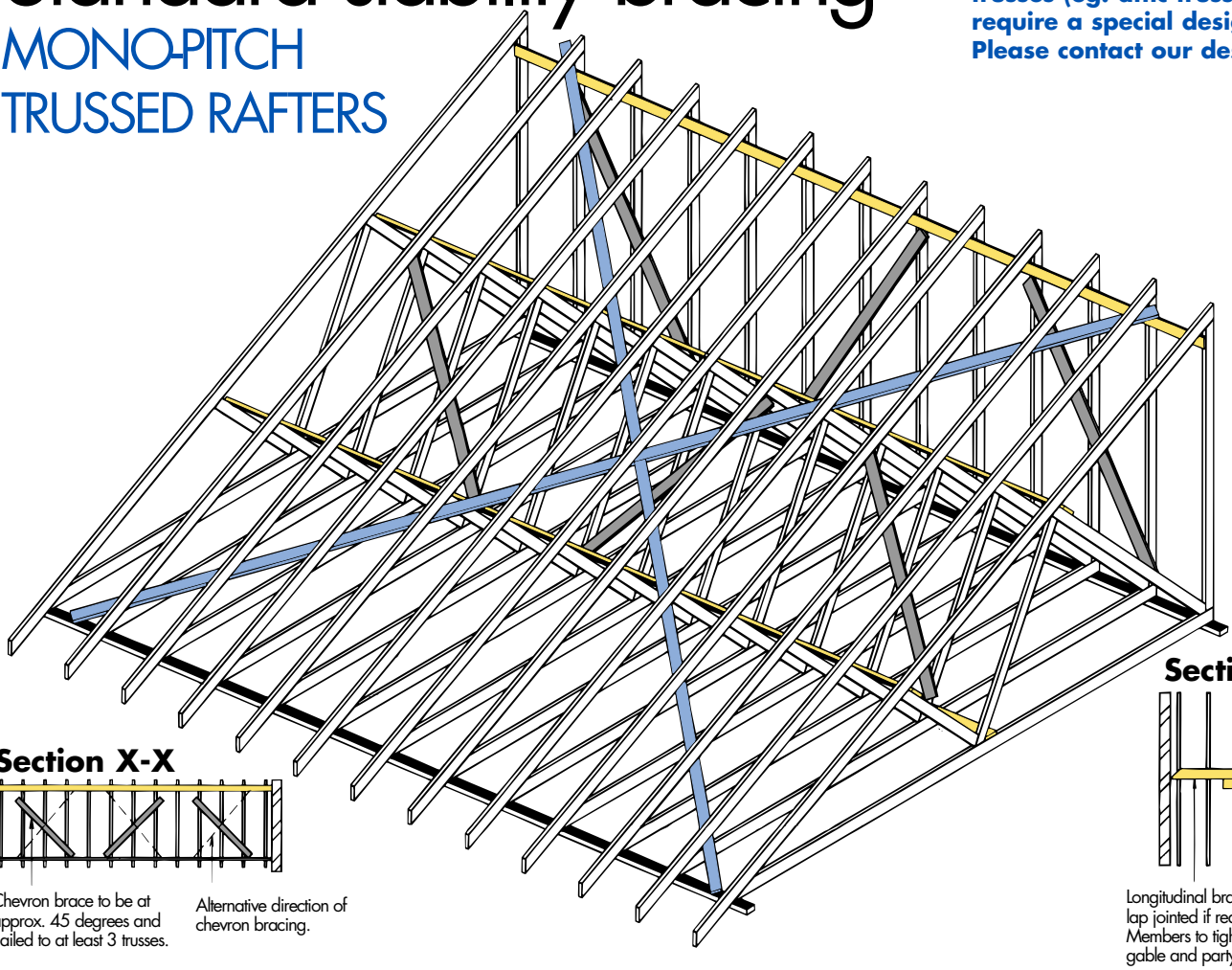
TRUSS STRAP AT RAFTER LEVEL
Heavy-duty galvanised strap 30x5mm spanning minimum of 3 trusses



Standard stability bracing

MONO-PITCH TRUSSED RAFTERS

Bracing for other types of roof trusses (eg. attic trusses) will require a special design. Please contact our design office.

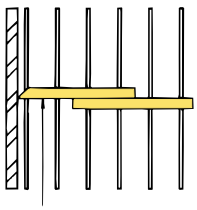


Section X-X

Chevron brace to be at approx. 45 degrees and nailed to at least 3 trusses.

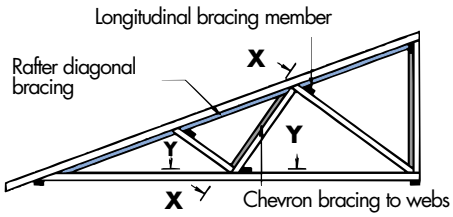
Alternative direction of chevron bracing.

Section Y-Y



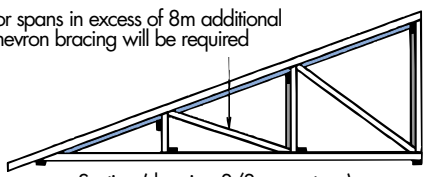
Longitudinal bracing member lap jointed if required. Members to tightly abut every gable and party wall

Section W-W

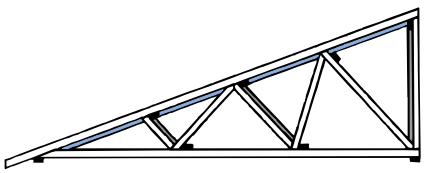


Section (showing 3/2 mono truss)

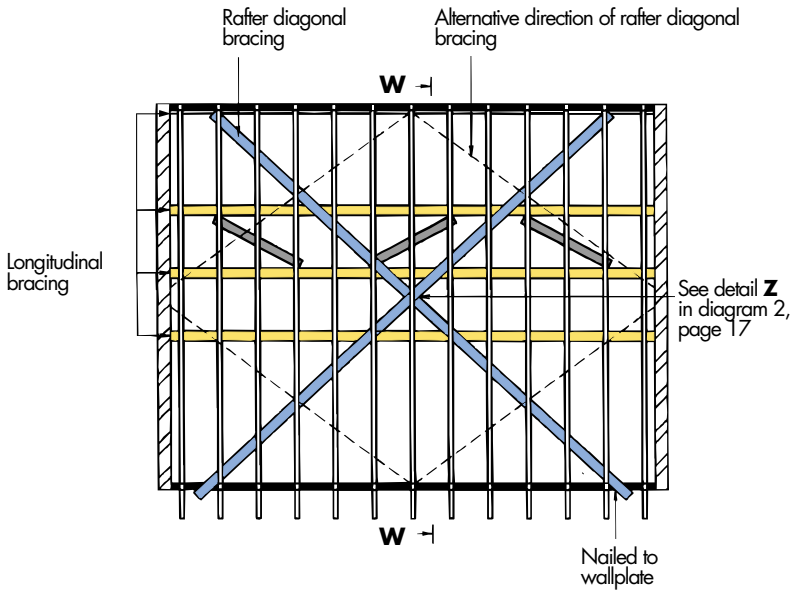
For spans in excess of 8m additional chevron bracing will be required



Section (showing 3/3 mono truss)



Section (showing 4/3 mono truss)



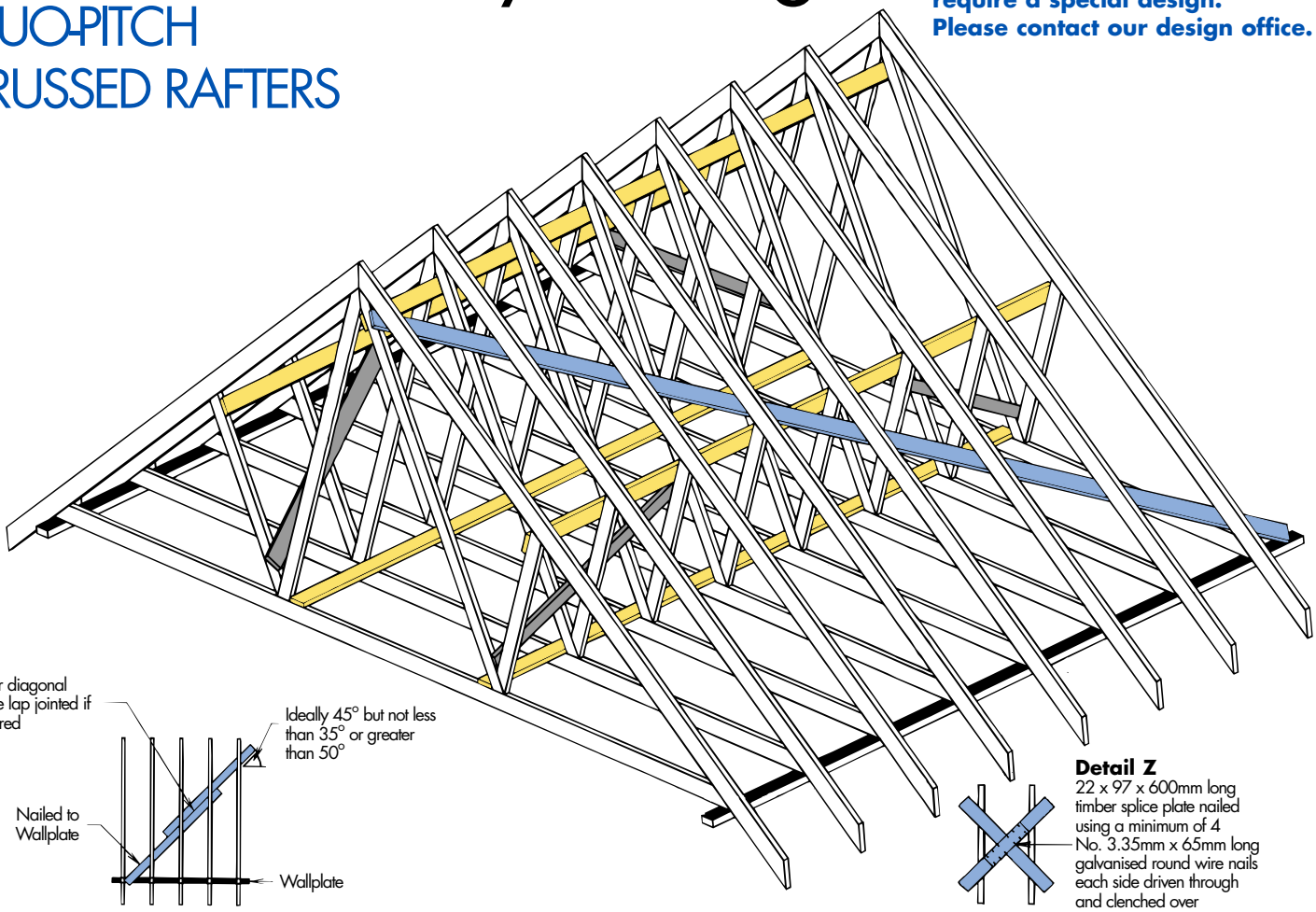
NOTE: Chevron bracing shown is not required on internal members of trusses for spans of **5m** or less

Diagram 1. Standard bracing for rafter and web members of mono-pitch trussed rafters.

Standard stability bracing

DUO-PITCH TRUSSED RAFTERS

Bracing for other types of roof trusses (eg. attic trusses) will require a special design. Please contact our design office.



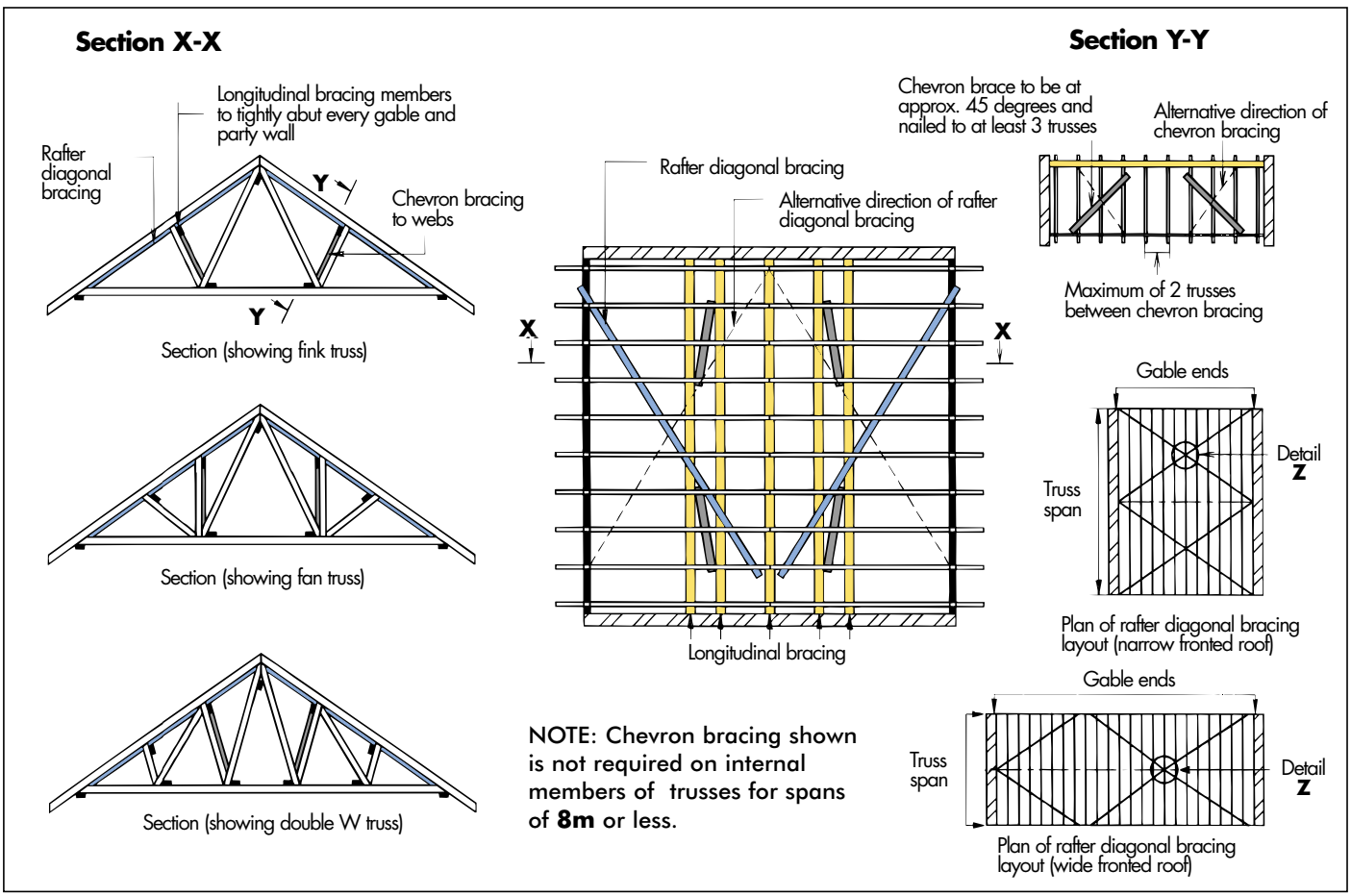
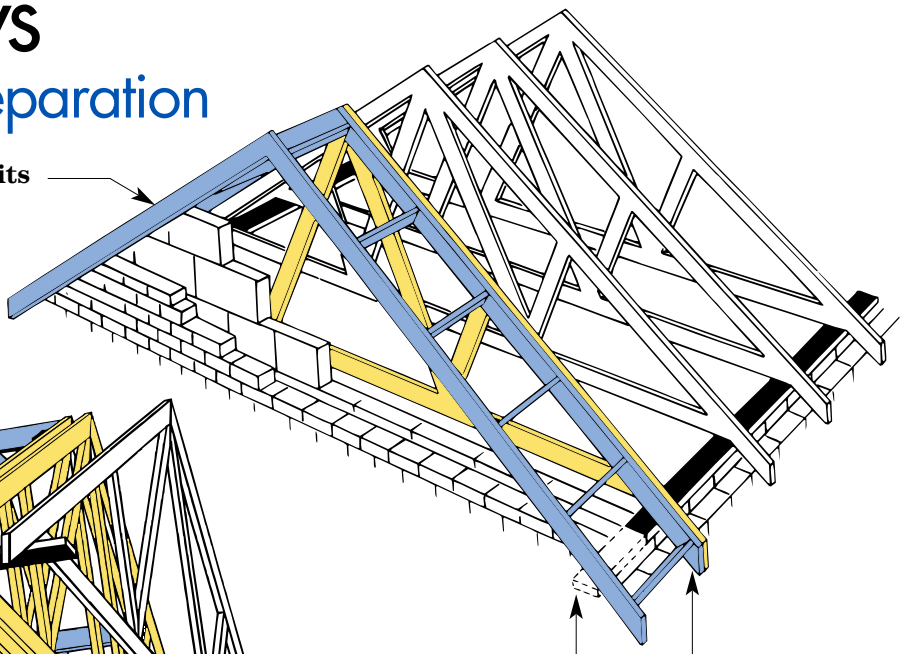


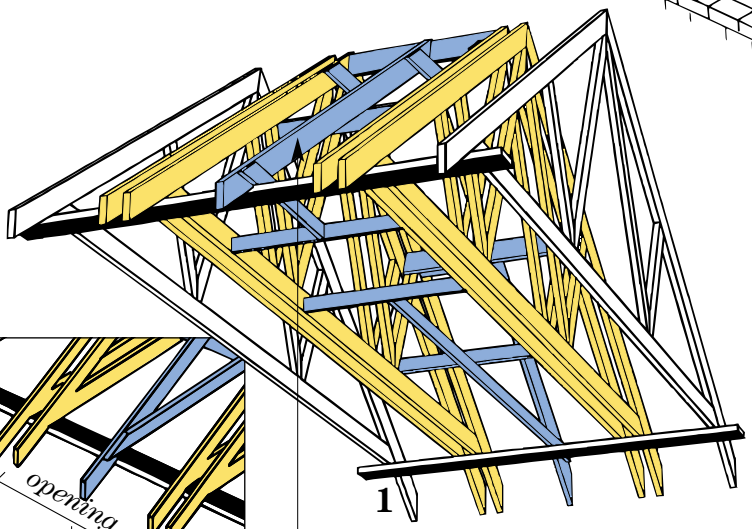
Diagram 2. Standard bracing for rafter and web members of duo-pitch trussed rafters.

Gable ladders, hatches and chimneys

Recommended preparation

Bargeboards and Soffits to be nailed directly to the gable ladder





1

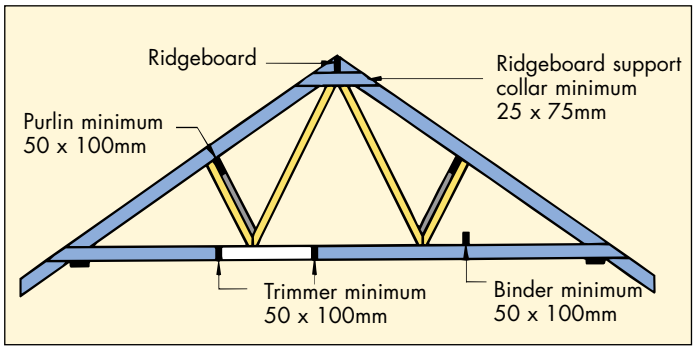
Gable Ladders to be fixed directly to last truss with nails at 400mm centres

Wallplate may be extended over the gable ladder width for added support if required

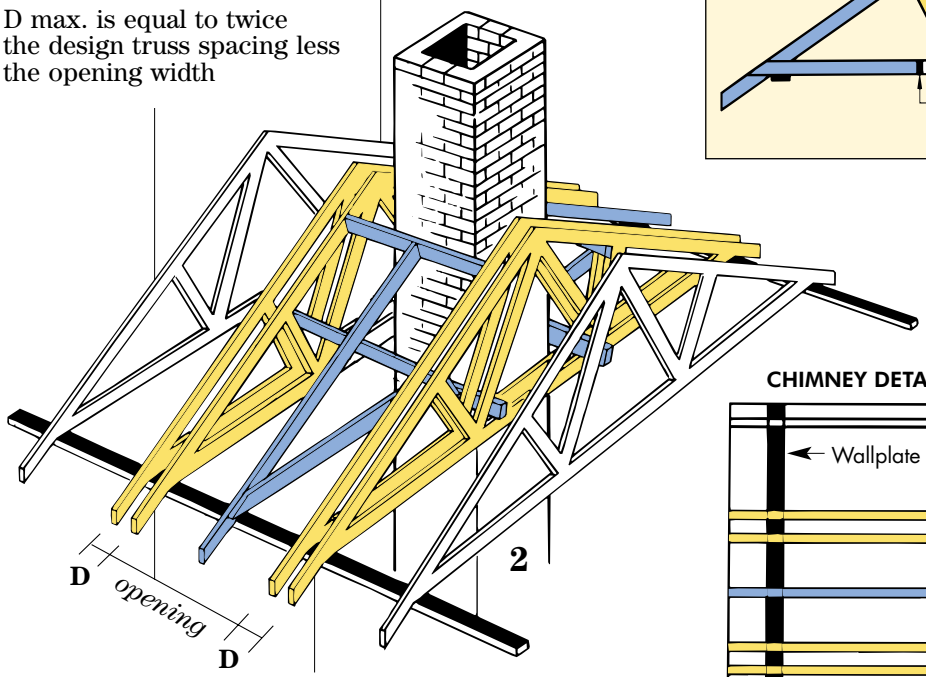
Jack Rafter 25mm deeper than trussed rafter and birdmouthed over wallplate

D max. is equal to twice the design truss spacing less the opening width

HATCH DETAIL

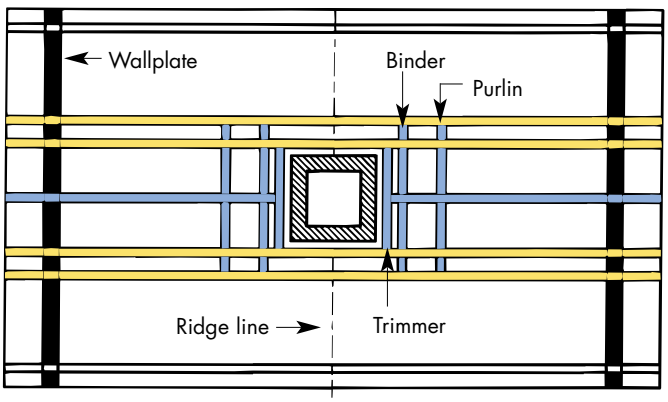


Hatch and chimney openings: *Whenever possible hatch openings should be accommodated within the trussed rafter design spacing. When this is not possible the method illustrated 1 and 2 should be used.*



2

CHIMNEY DETAIL

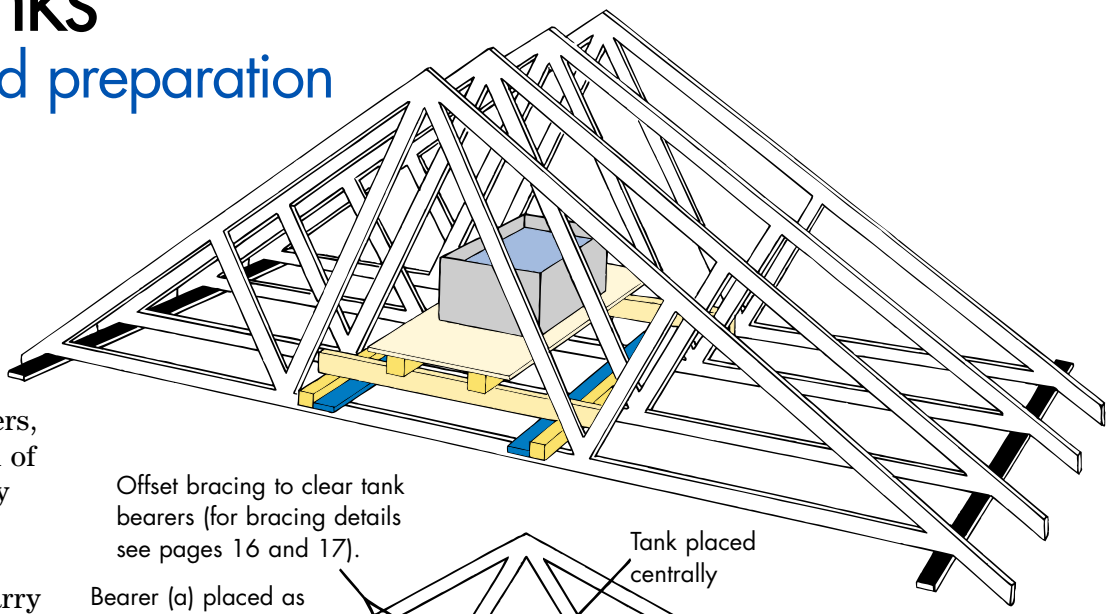


All timbers must be at least 50mm clear of the chimney brickwork

Jack Ceiling Joist nailed to side of jack rafter, size to match bottom chord of trussed rafter

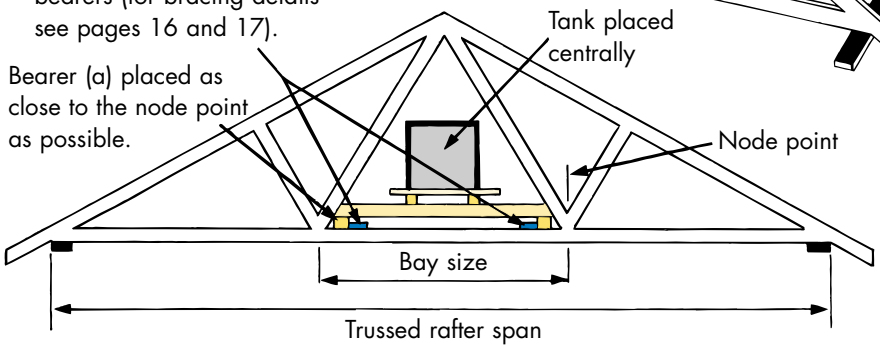
Water tanks

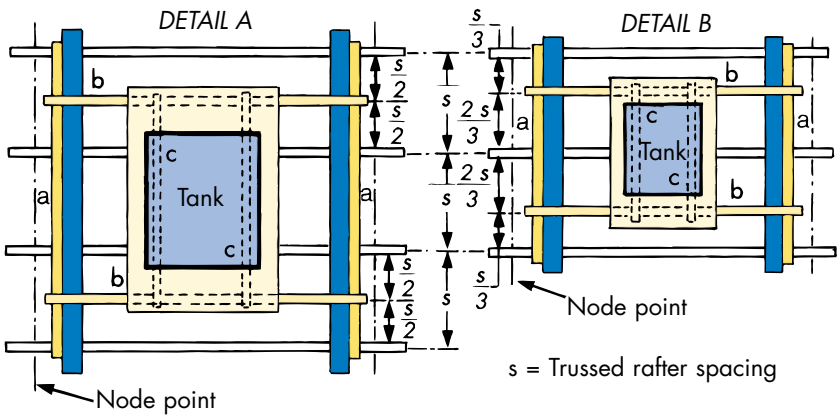
Recommended preparation

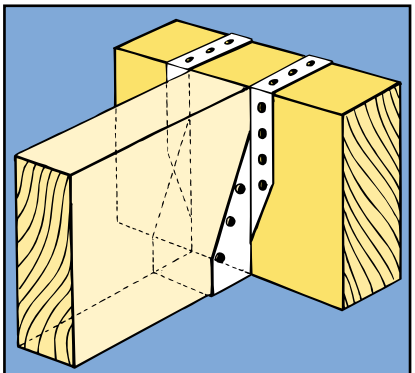


Where tanks are to be supported by trussed rafters, the size, type and position of the tanks should be clearly indicated.

The trusses must be specifically designed to carry the extra weight which should be distributed over three or more trusses by the use of spreader beams. The loads should be applied as close as possible to the node points on the ceiling ties. The maximum load imposed by the tank and its contents must not exceed 450N at each adjacent ceiling tie node point. In such cases, the support members should be in accordance with the table below. In other cases where applicable, the support spreader beams should be designed to BS 5268: Part 2.







ALTERNATIVE SUPPORT BETWEEN MEMBERS

Where space is limited this detail may be used between members (a) & (b) and (b) & (c) in order to gain head room. However a minimum clearance of 25mm above the ceiling lining should be allowed for possible deflection.

TABLE: SIZES FOR SUPPORT MEMBERS

Total tank capacity to marked waterline	*Min. member sizes*		*Max. trussed rafter span for fink configuration*	*Max. bay size for other configurations*
	a and c	*b*		
	mm		*m*	*m*
DETAIL A				
Not more than 300 L supported on four trussed rafters	47 x 72	2/35 x 97 or 1/47 x 120	6.50	2.20
	47 x 72	2/35 x 120 or 1/47 x 145	9.00	2.80
	47 x 72	2/35 x 145	12.00	3.80
DETAIL B				
Not more than 230 L supported on three trussed rafters	47 x 72	1/47 x 97	6.50	2.20
	47 x 72	2/35 x 97 or 1/47 x 120	9.00	2.80
	47 x 72	2/35 x 120 or 1/47 x 145	12.00	3.80

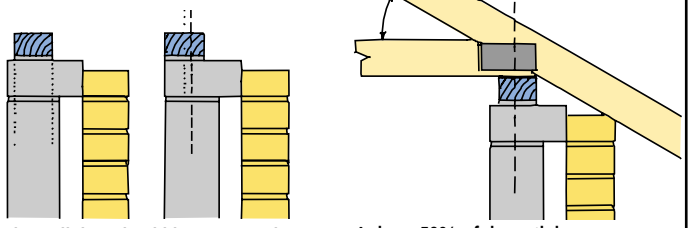
NOTE: Support members may be of any species with a perissable bending stress not less than that of European redwood/whitewood of GS or C16 stress grade.

Fixings: anchorage, wallplate positions, care in preparation

Application details

Careful erection, fixing and strapping is essential if a trussed rafter roof is to provide a sound platform for roof coverings and contribute effectively to the stability of the roof and gable ends.

Position of wallplate



The wallplate should be positioned centrally on the inner load bearing wall. It is acceptable to move the wallplate a maximum of 20mm to the left or right of the centre line of the inner wall.

At least 50% of the nailplate must overlap the wallplate and should certainly not oversail by more than 50mm. Do not pack up under ceiling ties. Use a deeper wallplate or adjust where the wall is lower.

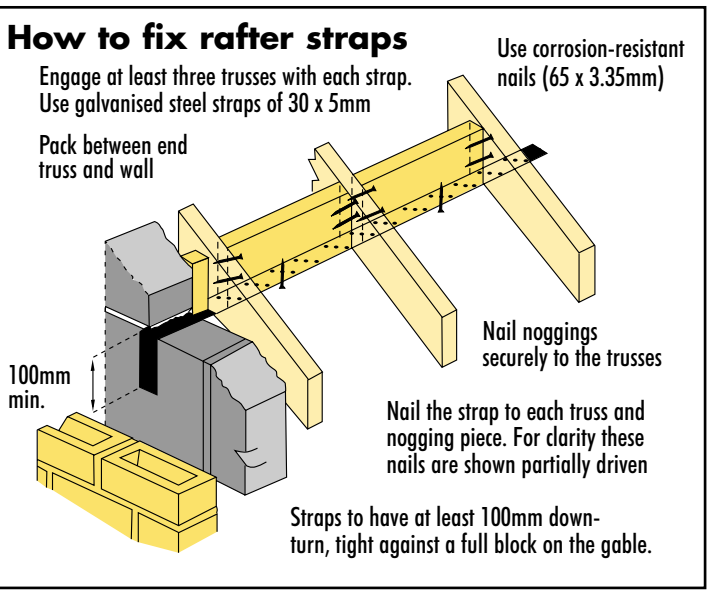
Strapping gables to ceiling ties

Ceiling tie straps may be excluded from the specification if roof pitches are below 20°. Check with the building designer. If they are needed, fix as shown for truss straps, but attach to upper edge of the ceiling tie. Use a cranked strap to engage a vertical joint if horizontal courses do not coincide.

Strapping at the separating wall

In addition to the normal strapping to walls, additional straps may have been specified to provide longitudinal bracing between roofs, these should be run over the top of the separating wall and fixed to the specified number of trusses on each side. Include nogging and packing to transmit loads properly.

How to fix rafter straps



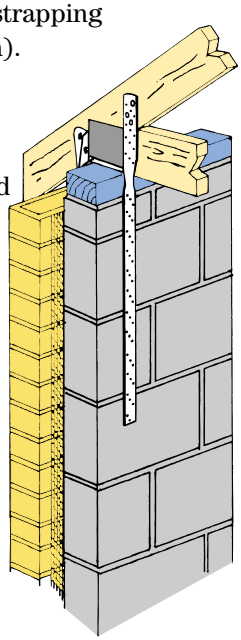
Checks before erecting trussed rafters

- The cavity must be closed along the eaves line, either stopped with masonry or a cavity barrier.
- The wallplate is a minimum of 75mm x 50mm.
- That timber members and nailplates are not damaged.
- That trussed rafters are the correct span and can be fitted to wallplates without cutting.
- That truss weight information is known.
- That the timber is dry and sound, and the nailplates are free of corrosion.
- That there are no missing nailplates.
- None of the trussed rafters are visibly distorted.
- That there are no unapproved site repairs to trussed rafters. Or that any such repairs have been carried out under the direction of the truss designer.
- That positions for water tank and for chimney, and access openings are all clearly identified.
- That clear guidance is given on the number, size and corrosion resistance of straps, clips and all other fixings.

Holding down roofs to walls

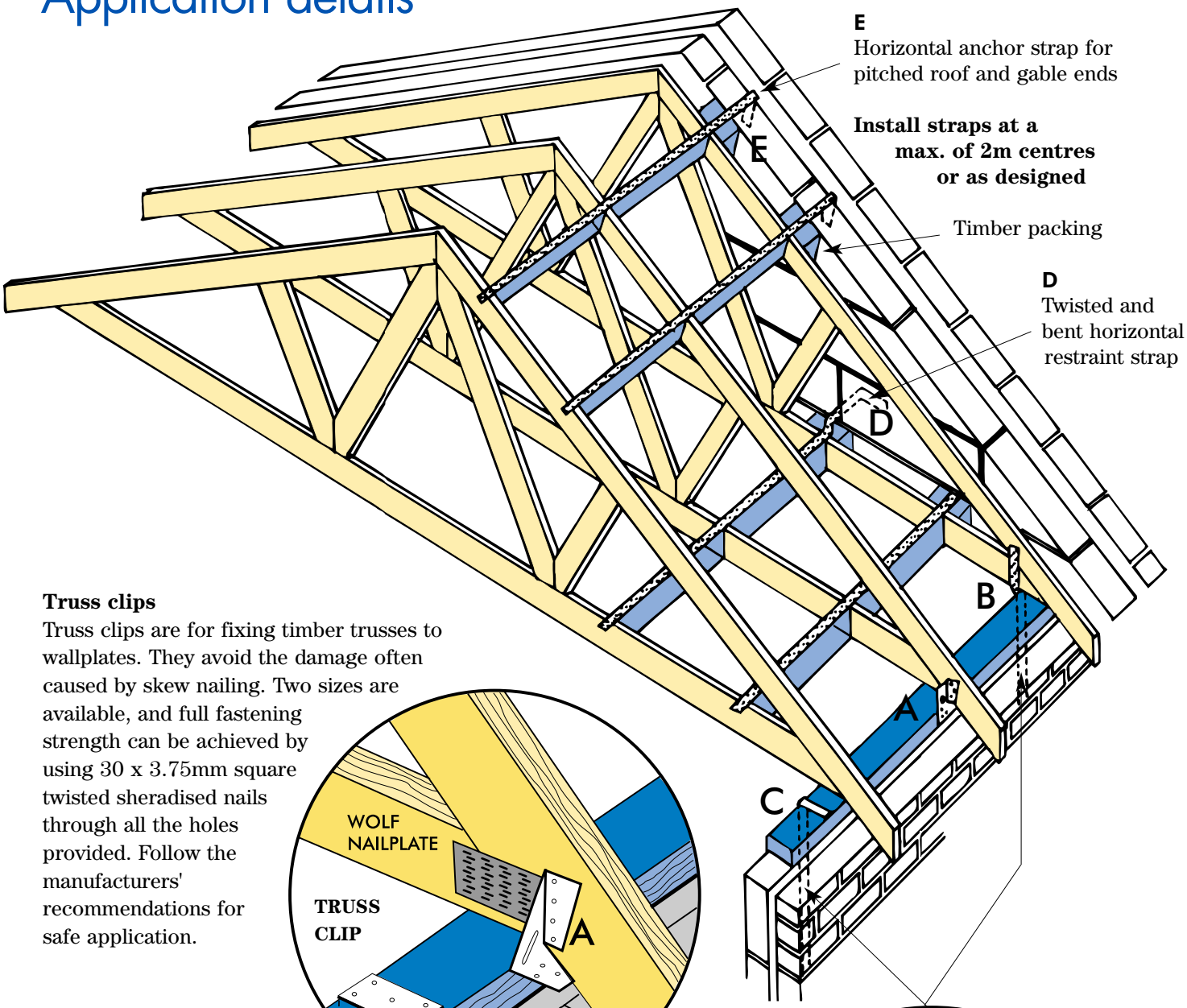
Roof to wall (vertical) strapping is not required unless the location of building construction is known to be wind stressed, then it is essential to carry out the roof designer's specifications. Lighter roof coverings in areas of higher wind load, require holding down straps as may be specified for brick/block construction. In extreme cases, the design may call for direct strapping of rafters to the walls (see illustration).

Straps are normally a minimum 30 x 2.5mm section galvanised steel, but any higher specification should be followed. The tops of straps should be nailed (three 30 x 3.75mm nails or more) to the wall plate, or the rafter in the case of a rafter to wall strap. When fixing to the wall, it is critical that the straps are long enough to run over the specified number of blocks, and that at least two of the fixings engage the last full block at the base of the strap.

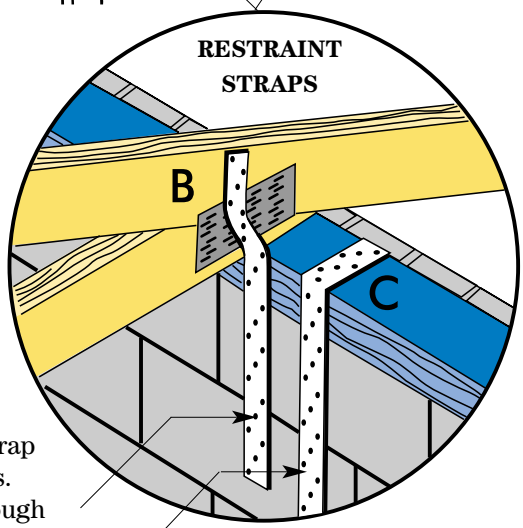


Fixings: straps and clips

Application details



Truss clips
Truss clips are for fixing timber trusses to wallplates. They avoid the damage often caused by skew nailing. Two sizes are available, and full fastening strength can be achieved by using 30 x 3.75mm square twisted sheradised nails through all the holes provided. Follow the manufacturers' recommendations for safe application.



Horizontal and vertical restraint straps
All straps are manufactured from galvanised steel with holes punched at regular intervals along their length. Horizontal straps usually have 30 x 5mm section, and may also feature a combination of bends and edge twists according to requirements. Vertical straps have lighter loads and are usually 30 x 2.5mm section. They should all be used in accordance with Building Regulations and BS 5268 Part 3.

B
Vertical anchor strap for trussed rafters. Avoid nailing through the nailplate.

C
Vertical restraint strap for wallplate anchorage

Fixings: shoes and hangers

Application details

Heavy-duty joist hanger to BS6178 Part 1

These are generally used to carry trusses or joists at masonry load bearing or fire break walls where careful consideration must always be given to the method of support. We would recommend that advice is obtained from the responsible Building Designer or Structural Engineer since in a number of cases special hangers may have to be manufactured. The Building Designer may also specify high density brick courses above and below the hangers to avoid crushing of blocks. The bearing length for these joist hangers is approx. 90mm.

Heavy-duty girder to girder truss shoes

These are designed to support a secondary girder off the main girder ensuring that the loads are transferred efficiently. The shoe is usually fixed to the main girder **(A)** by means of 20mm bolts with washers under the bolt heads and nuts. The bearing length for these shoes is approx. 120mm.
NB. refer to manufacturers instructions for the correct application and procedure.

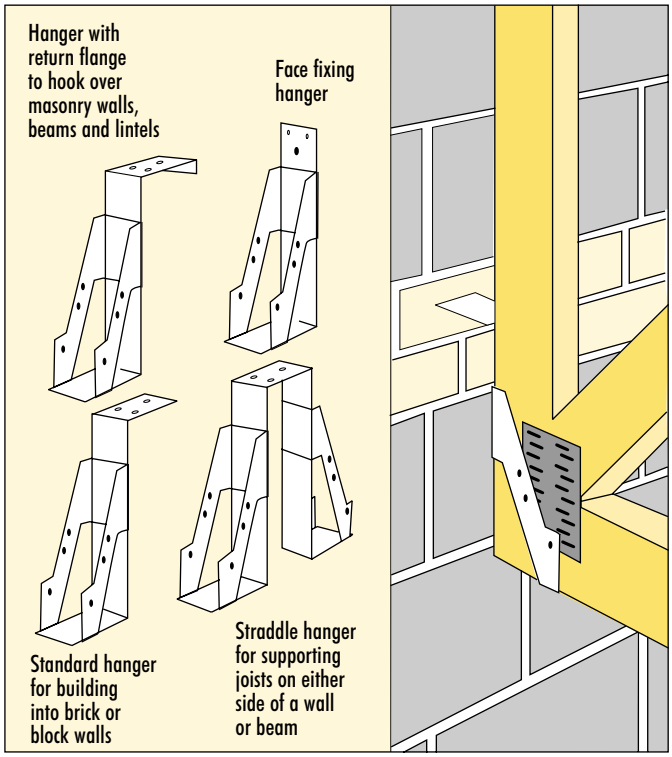
Girder truss shoe and long legged hangers

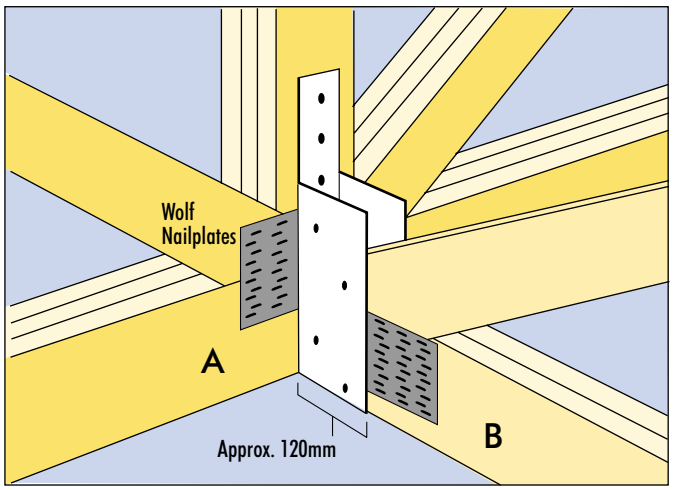
Girder truss shoes are used to fix single trusses to compound girders or for other truss to truss connections. The bearing length is approx. 95mm.

When the girder chord supporting the shoe or hanger is less than the length of its side flanges, then a block must be introduced as shown **(C)** to prevent buckling. Long legged joist hangers **(D)** are used for timber to timber, or timber to truss connections. They are not suitable for truss to truss connections, and should NEVER be used for this purpose. The bearing length is up to 50mm.

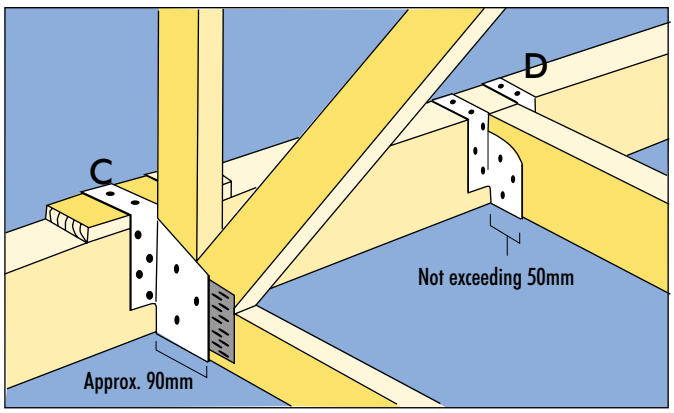
Metal fixings used in timber roof structures should have safe working loads which can be substantiated by freely available technical reports in accordance with BS 6178 and TRADA recommendations. **They should always have a manufacturer's mark and show the certified safe working load.**

It is strongly recommended that timber to timber fixings and timber to brick fixings should be supplied by the Roof Truss Fabricator, and delivered to site with the trusses.





Incoming trusses (B) supported by heavy duty shoes and hangers, should be notched to provide a smooth ceiling line.



N.B. For all the hangers and shoes described above, every fixing hole requires either a 30 x 3.75mm square twisted sheradised nail, or a 20mm bolt.

Ventilation and insulation

Construction details

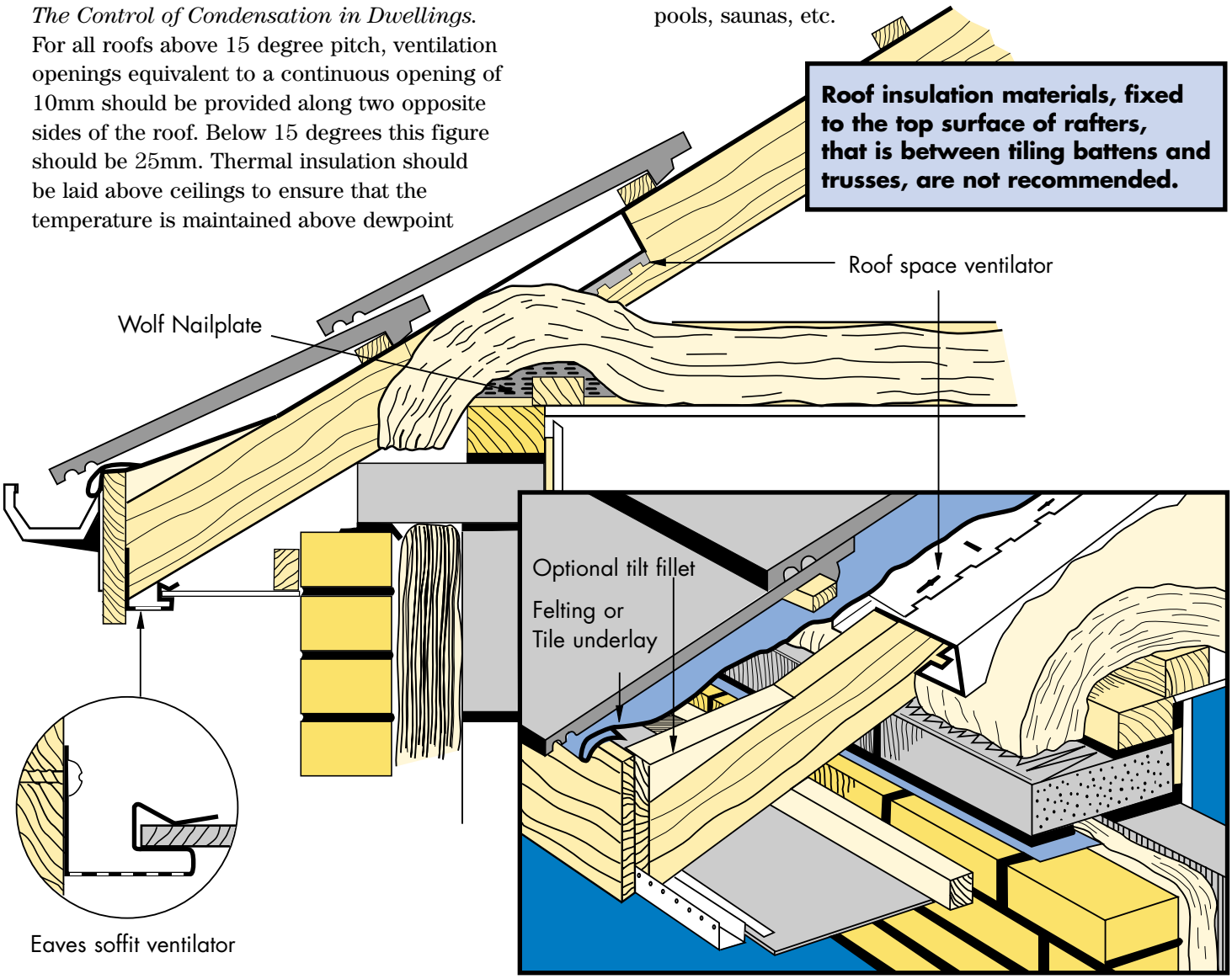
When warm, moist air comes into contact with cold surfaces, condensation occurs. Because of the changes in house design, central heating and some of the building materials used, roof spaces have a tendency to become colder and less ventilated. This has resulted in an increase in water vapour in them. The problem is that trussed rafters do not behave well under damp conditions, and there is a danger that after a prolonged period in these conditions the timber strength will reduce, rot will be encouraged in the members and the nailplates could be adversely affected.

In order to reduce water vapour in the roof space, two methods can be employed.

Firstly, to remove water vapour which has gained access to the roof space, there must be adequate ventilation. Useful information can be obtained from the current issue of BS 5250: *The Control of Condensation in Dwellings.* For all roofs above 15 degree pitch, ventilation openings equivalent to a continuous opening of 10mm should be provided along two opposite sides of the roof. Below 15 degrees this figure should be 25mm. Thermal insulation should be laid above ceilings to ensure that the temperature is maintained above dewpoint at ceiling level. Although the insulation should be laid right up to the eaves, a gap should be left to ensure that free flow of air is not hindered. This can be achieved by an insulation overlay tray. It is possible to permit a certain amount of extra ventilation if the felting or tile underlays are permeable to water vapour or laid such that vapour can pass through the joints.

Secondly, a continuous vapour barrier should be fixed to ceiling level beneath the insulation to prevent water vapour entering the roof through the ceiling of the upper floor. At the same time, all access hatches, pipe and ceiling light holes should be sealed with a suitable filler. Wall head cavities should be closed to prevent water vapour entering either through the inner leaf or by evaporation of rain water through the outer leaf. All water tanks and holes through which pipes pass, should be covered and sealed. This procedure is particularly recommended for indoor swimming pools, saunas, etc.

Roof insulation materials, fixed to the top surface of rafters, that is between tiling battens and trusses, are not recommended.



Glossary of terms

APEX/PEAK
The uppermost point of a TRUSS.

ATTIC TRUSS/ROOM-IN-THE-ROOF
A truss which forms the top storey of a dwelling, but allows the area to be habitable by leaving it free of internal WEB members. This will be compensated by larger timber sizes elsewhere (see page 10).

BARGEBOARD
Board fitted to conceal roof timbers at GABLE END.

BATTENS
Small timber members spanning over trusses to support tiles, slates, etc.

BEARER
A member designed to distribute loads over a number of trusses.

BEARING
The part of a truss receiving structural support. This is usually a WALLPLATE but can be an internal wall etc.

BINDER
A longitudinal member nailed to trusses to maintain correct spacing.

BIRDSMOUTH
A notch in the underside of a RAFTER to allow a horizontal seating at the point of support (usually used with RAISED TIE TRUSSES - see page 9).

BLOCKING
Short timbers fixed between chords to laterally brace them. They should be at least 70% of the depth of the CHORDS.

BOBTAIL
A truss type formed by truncating a normal triangular truss.

BOTTOM CHORD
See CEILING TIE.

BRACING
This can be Temporary, Stability or Wind Bracing which are described under these headings.

BUILDING DESIGNER
The person responsible for the structural stability and integrity of the building as a whole.

CAMBER
An upward vertical displacement built into a truss in order to compensate for deflection which might be caused by the loadings.

CANTILEVER
The part of a structural member or TRUSS which extends beyond its bearing.

CEILING TIE
The lowest member of a truss, usually horizontal which carries the ceiling construction, storage loads and water tank.

CHEVRON BRACING
Diagonal bracing nailed to the truss in the plane of the specified webs to add stability.

CHORDS
Refer to the Top and Bottom Chords which are respectively the RAFTER and CEILING TIE.

CONCENTRATED LOAD
A load applied at a point.

CONNECTOR PLATE/FASTENER
See NAILPLATE.

CRIPPLE RAFTER
See JACK RAFTER.

DEAD LOAD
The load produced by the fabric of the building, always long term, (see DESIGN LOADS).

DEFLECTION
The deformation caused by the loads.

DESIGN LOADS
The loads for which the unit is designed. These consider the duration of the loads – long term, medium term, short term and very short term.

DUO/DUAL PITCH TRUSS
A truss with two rafters meeting at the APEX but not necessarily having the same PITCH on both sides.

DWANGS
See NOGGINGS.

EAVES
The line where the rafter meets the wall.

EAVES JOINT/HEEL
The part of the truss where the rafter and the ceiling tie intersect. This is usually where the truss is supported.

Glossary

EXTENDED RAFTER
See RAISED TIE TRUSS.

FASCIA
Horizontal board fitted along the length of the building to the edge of the truss overhangs.

FASTENER
See NAILPLATE.

FINK TRUSS
The most common type of truss used for dwellings. It is duo-pitch, the rafters having the same pitch. The webs form a letter W.

FIRRING PIECE
A tapered timber member used to give a fall to flat roof areas.

FRENCH HEEL
An EAVES joint where the rafter sits on the ceiling tie.

GABLE END
The end wall which is parallel to the trusses and which extends upwards vertically to the rafters.

GABLE LADDER
Components used to form an overhang at the gable end.

GIRDER TRUSS
A truss made up of two or more fixed together and designed to take exceptional loads, such as those imposed by other trusses fixed to it.

HEEL
See EAVES JOINT.

HIP BOARD
A member sloping from ridge to corner in a HIP END construction.

HIP END
An alternative to a GABLE END where the end wall finishes at the same height as the adjacent walls. The roof inclines from the end wall, usually (but not always) at the same PITCH as the main trusses.

HIP SET
The trusses, girders and loose timbers required to form a hip end.

HORN/NIB
An extension of the ceiling tie of a truss (usually monos or bobtailed trusses) which is built into masonry as a bearing.

IMPOSED LOAD
The load produced by occupancy and use including storage, inhabitants, moveable partitions and snow, but not wind. Can be long, medium or short term.

INTERNAL MEMBER
See WEB.

INTERSECTION
The area where roofs meet.

JACK RAFTER
An infill rafter completing the roof surface in areas such as corners of HIP ENDS or around chimneys.

LIVE LOAD
Term sometimes used for IMPOSED LOADS.

LONGITUDINAL BRACING
Component of STABILITY BRACING.

LOOSE TIMBER
Timbers not part of a truss but added to form the roof in areas where trusses cannot be used.

MONO-PITCH TRUSS
A truss in the form of a right-angled triangle with a single rafter.

NAILPLATE
Metal PLATE having integral teeth punched from the plate material. It is used for joining timber in one plane with no overlap. It will have an Agrément Certificate and will be manufactured, usually, from galvanised steel. It is also available in stainless steel.

NIB
See HORN.

NODE
Point on a truss where the members intersect.

NOGGINGS
Timber pieces fitted at right angles between the rafters and ceiling ties to form fixing points.

OVERHANG
The extension of a rafter or ceiling tie of a truss beyond its support or bearing.

Glossary

PART PROFILE
See BOBTAIL.

PEAK
See APEX.

PERMISSIBLE STRESSES
Design Stresses for grades of timber published in BS 5268: Part 2: 1988.

PITCH
The angle of the rafter to the horizontal, measured in degrees.

PLATE
See NAILPLATE.

PLATE LOCATION/POSITION TOLERANCE
Acceptable deviation from specified location for the plate on a truss. This is usually 5mm but can be specified greater.

POLE PLATE
Timber used in cantilevered hips to support loose timbers.

PURLINS
Timber members spanning over trusses to support cladding or between trusses to support loose timbers.

QUARTER POINT
The point on a rafter where the strut intersects in a FINK TRUSS.

QUEEN
Internal member (web) which connects the APEX to a third point on a FINK TRUSS.

RAFTER
The uppermost member of a truss which normally carries the roof covering.

RAFTER DIAGONAL BRACING
Component of STABILITY BRACING.

RAISED TIE TRUSS
A truss which is supported at a point on the rafter which is beyond the point where the rafter meets the ceiling tie.

REDUCING TRUSSES
See VALLEY FRAMES.

REMEDIAL DETAIL
A modification produced by the TRUSSED RAFTER DESIGNER to overcome a problem with the truss after its manufacture.

RETURN SPAN
The span of a truss being supported by a girder.

RIDGE
The line formed by the truss apexes.

RIDGEBOARD
Timber running along a ridge and sandwiched between loose rafters.

ROOF DESIGNER
The person responsible for the roof structure as a whole, and who takes into account its stability and capability of transmitting wind forces on the roof to suitable load-bearing walls.

ROOM-IN-THE-ROOF
See ATTIC TRUSS.

SCAB
Additional timber fitted to the side of a truss to effect a local reinforcement, particularly in RAISED TIE TRUSSES.

SETTING-OUT-POINT
The point on a truss where the undersides of the rafter and ceiling tie meet.

SKEW NAILING
A method of fixing trusses to the WALLPLATE by driving nails at an angle through the truss into the wallplate which is generally not recommended. (See TRUSS CLIP.)

SOFFIT
Board fixed underneath EAVES overhang along the length of the building to conceal timbers.

SPAN
Span over wallplates is the distance between the outside edges of the two supporting wallplates. This is usually the overall length of the ceiling tie.

SPANDREL PANEL
A timber frame, triangular panel forming gable wall above ceiling line.

SPLICE
A joint between two members in line using a NAILPLATE or glued finger joint

SPREADER BEAM
See BEARER.

Glossary

STABILITY BRACING
An arrangement of additional timbers fixed in the roof space to provide lateral support to the trusses.

STRAP
Metal component designed to fix trusses and wallplates to walls.

STRUT
Internal member connecting the third point and the quarter point on a FINK TRUSS.

STUB END
See BOBTAIL.

TEMPORARY BRACING
An arrangement of diagonal loose timbers installed for safety during erection. Often incorporated with permanent STABILITY and WIND BRACING structures.

THIRD POINT
Point on the ceiling tie where the internal webs meet in a FINK TRUSS.

TIMBER STRESS GRADING
The classification of timber into different structural qualities based on strength (see BS 4978: 1988).

TOP CHORD
See RAFTER.

TRADA QUALITY ASSURANCE SCHEME
Quality control method in truss manufacture administered by the Timber Research and Development Association.

TRIMMER
A piece of timber used to frame around openings.

TRUSS/TRUSSED RAFTER
A lightweight framework, generally but not always triangulated, placed at intervals of 600mm to support the roof. It is made from timber members of the same thickness, fastened together in one plane using nailplates or plywood gussets.

TRUSSED RAFTER DESIGNER
The person responsible for the design of the TRUSSED RAFTER as a component, and for specifying the points where bracing is required.

TRUSS CLIP
A metal component designed to provide a safe structural connection of trusses to wallplates. Also to resist wind uplift and to remove the damage caused by SKEW NAILING.

TRUSS SHOE
A metal component designed to provide a structural connection and support for a truss to a girder or beam.

UNIFORMLY DISTRIBUTED LOAD
A load that is uniformly spread over the full length of the member.

VALLEY BOARD
A member raking from incoming RIDGE to corner in a valley construction.

VALLEY FRAMES/SET
Infill frames used to continue the roofline when roofs intersect.

VERGE
The line where the trussed rafters meet the gable wall.

WALLPLATE
A timber member laid along the length of the load-bearing walls to support the trusses. This must be at least 75mm wide.

WEBS
Timber members that connect the rafters and the ceiling tie together forming triangular patterns which transmit the forces between them.

WIND BRACING
An arrangement of additional timbers, or other structural elements in the roof space, specially designed to transmit wind forces to suitable load-bearing walls.

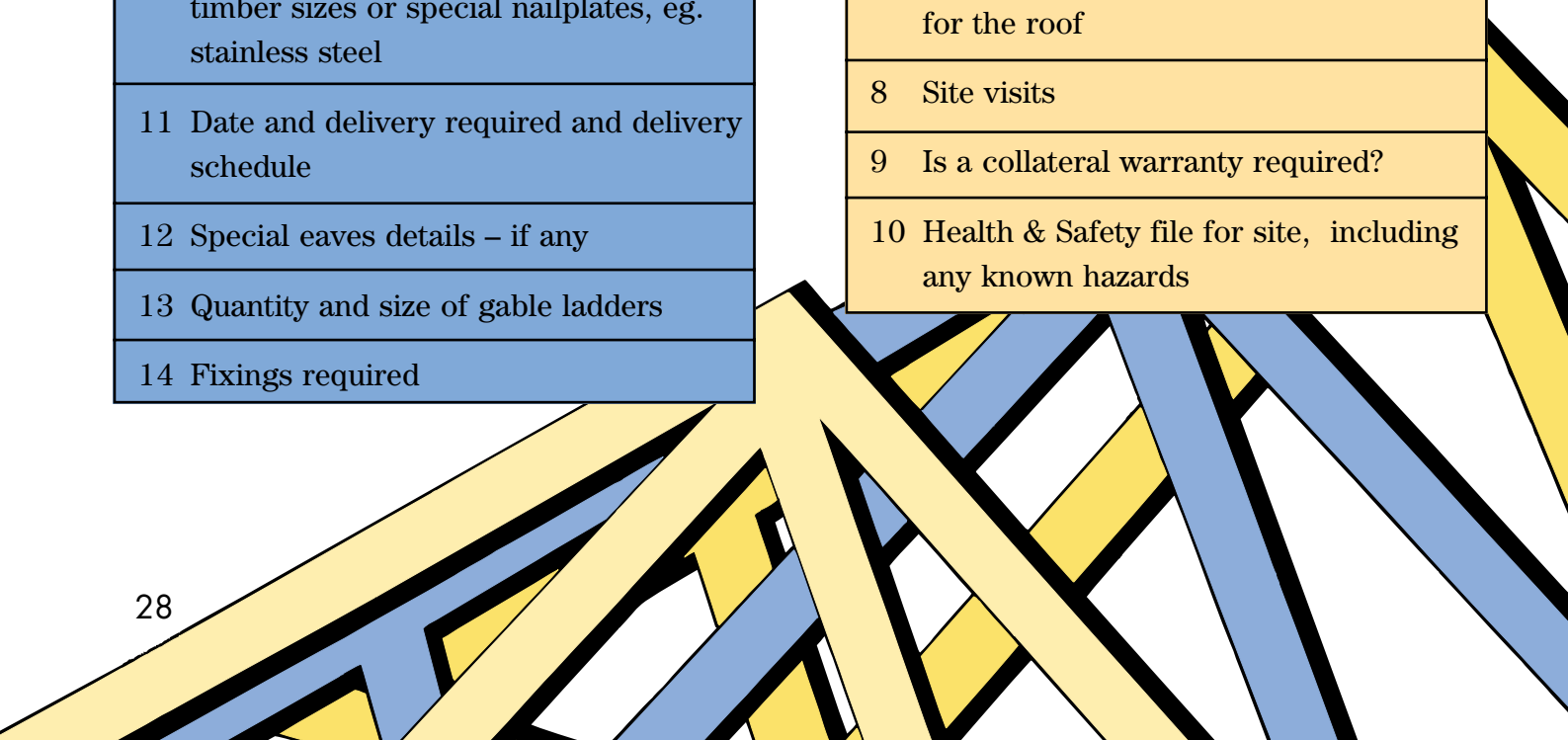
WOLFCHORDS
Are composite beams consisting of two timbers, plated together to form a deeper section. They can be used as simple beams or incorporated into a trussed rafter to reinforce a highly stressed member. They are often used in raised tie trusses. They are sometimes referred to by others as 'Superchords, Stackchords or Twinachords'.

Information required

Certain information is required by us so that we can produce accurate and economical designs to your exact requirements. All you need do is to send us the drawings of a scheme. These may be sent as a DXF (or RCS) file. Failing this, your sketches or advanced drawings should contain dimensions, and show elevations, plans etc. Site plans are also helpful to show any relationship between the different building designs conceived.

	A If a Component Only Service is required, the following information will be necessary:
1	Number of trusses
2	Spacing
3	Span over wallplates
4	Pitch, pitches or rise
5	Type and size of overhangs
6	Profile and camber – if required
7	Type or weights of roof covering including tiles, sarking, insulation and ceiling materials
8	Water tank size and position
9	Preservative treatment
10	Whether there is a need for special timber sizes or special nailplates, eg. stainless steel
11	Date and delivery required and delivery schedule
12	Special eaves details – if any
13	Quantity and size of gable ladders
14	Fixings required

	B If a whole Roof Design Service is required, the following extra details will be necessary:
1	Roof or house style reference
2	Requirements for clear roof space
3	Eaves height and location of building together with any unusual wind and weather conditions. Also Ordinance Survey reference if known
4	Types of Hip System or other roofscape required including gable ends and verges
5	Extra loads to be considered for service pipes, ducting etc.
6	Positions and sizes of hatches, chimneys, dormers and other openings
7	Details and positions of the supports for the roof
8	Site visits
9	Is a collateral warranty required?
10	Health & Safety file for site, including any known hazards



Wolf Group of Companies

Wolf Systembau was started by Johann Wolf in 1966 in Scharnstein, Austria. The original activities of the company were construction within the agricultural industry. This consisted of concrete silos and buildings constructed of timber, steel and concrete. The company then expanded into other areas of the construction industry such as industrial, commercial and domestic buildings, manufacturing machinery for sawmills, timber frame wall panels and roof trusses, as well as harvesting timber from their own forests.

The company is now located in over 20 countries worldwide, and is still privately owned by Johann Wolf and his family. All of the Group's operations are construction related.

Wolf Systems has a network of over 50 experienced Trussed Rafter manufacturers in the United Kingdom and Ireland, supported by our comprehensive design and software, and specialist engineering office. These manufacturers will be pleased to assist in resolving any design or supply issues for any complexity of roof, large or small.

Other Products and Services

easi-joist® metal web floor joists

Metal web joists with open web design for easier, cheaper and faster installation of services. Improved engineered designs, and site specific joists meaning faster erection and no site wastage. Reduced timber content gives minimal shrinkage, therefore a quieter, longer lasting floor system. Overall cost savings through design and erection time as well as service installation.

KeyBuild® Timber Frame Software

KeyBuild® from Keymark is the only software that integrates and automates all of the major functions that take place when specifying and engineering the building components and materials in timber frame construction.

From design through engineering to final output and management information, KeyBuild® does it all.

smartroof®

smartroof® is an evolutionary interlocking panel system that will change future thinking on room in the roof design and construction. Conceived specifically to solve the problems associated with traditional room in the roof techniques it offers the designer, the builder and the homeowner:

100% roof space utilisation, unique window versatility & rapid erection.

A Member of UKTFA

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