



Roof Erector's Handbook

For the installation and bracing of
pre-fabricated timber roof trusses

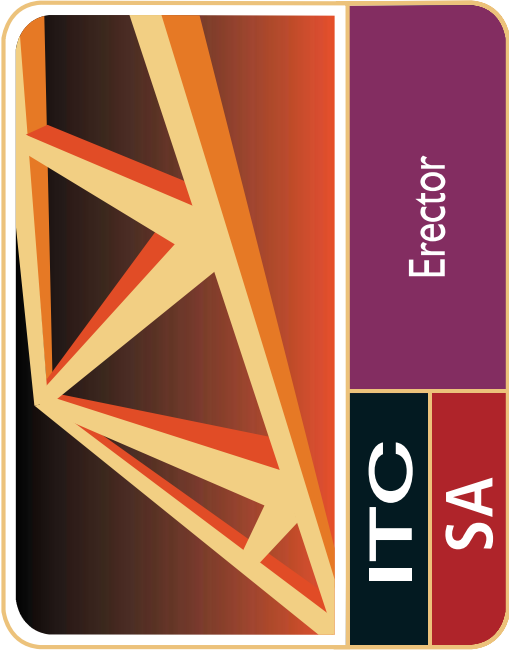
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For Spans Up To 9m



Institute for Timber Construction

Photo/
Company Stamp

Erector surname	
Region	
Cell number	
Email address	
Certificate of Competence no.	

Roof Erectors Handbook

FOR ERECTING PRE-FABRICATED TIMBER ROOF TRUSSES VOLUME ONE - INTRODUCTORY LEVEL

For Category C and D Roofs (see pg 75 - 76 ITC-SA Roof Categories)

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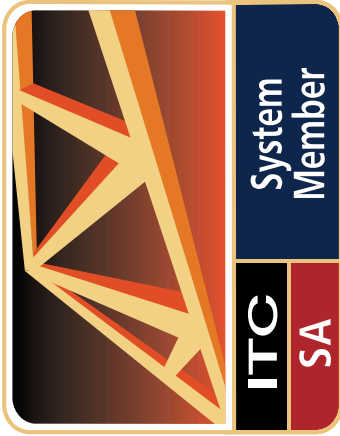
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FOREWORD



The Institute for Timber Construction – South Africa [ITC-SA] is an NPC registered and managed in terms of the Companies Act. It is also a SAQA recognised Professional Body with various Professional Designations as well as an ECSA recognised Voluntary Association for the sector.

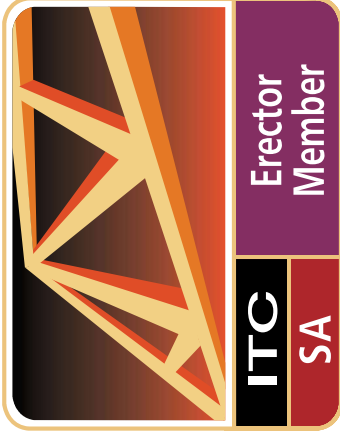
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INTRODUCTION

The details in this Handbook conform to the requirements of SANS 10243 "The manufacture and erection of timber trusses". However, when circumstances requires special details may be specified by a COMPETENT PERSON (Designer/Engineer).

In the event that the Roof Truss Fabricator does not provide adequate information regarding truss erection, the erector will, by following the details shown in this Handbook, be able to comply with the requirements of SANS 10243 with confidence.

Note: As this book covers the basics of roof erection, reference should be made to ROOF ERECTOR'S HANDBOOK - VOLUME TWO for more detailed information.

TOOLS OF THE TRADE

The minimum requirement of tools needed are as follows:

Basic Tools:

- | | | |
|--------------------------|------------------------|---|
| a. Nail pouch; | b. Claw hammer; | c. Ring spanners & socket
(at least two needed.) |
| d. Carpet knife; | e. Crosscut hand saw; | f. Spirit level; |
| g. 30m Tape measure; | h. 5m Tape measure; | i. Chalk and plumb line; |
| j. Nylon builder's line; | k. Carpenter's pencil; | l. 12.5mm Drill bit; |
| m. Metal punch; | n. Hand drill. | |

Optional (Power) Tools:

- | | | |
|------------------------|------------------|--------------------|
| o. Circular saw; | p. Hammer drill; | q. Safety goggles; |
| r. 50m Extension cord. | | |

TOOLS OF THE TRADE



PART ONE - THE BASIC CONNECTIONS

Each of the following details shows the correct way of connecting the different timber parts that make up the complete roof structure.

These connection details will be used in Part Two and Three to build hips, valleys, cranks and the bracing of any timber roof.

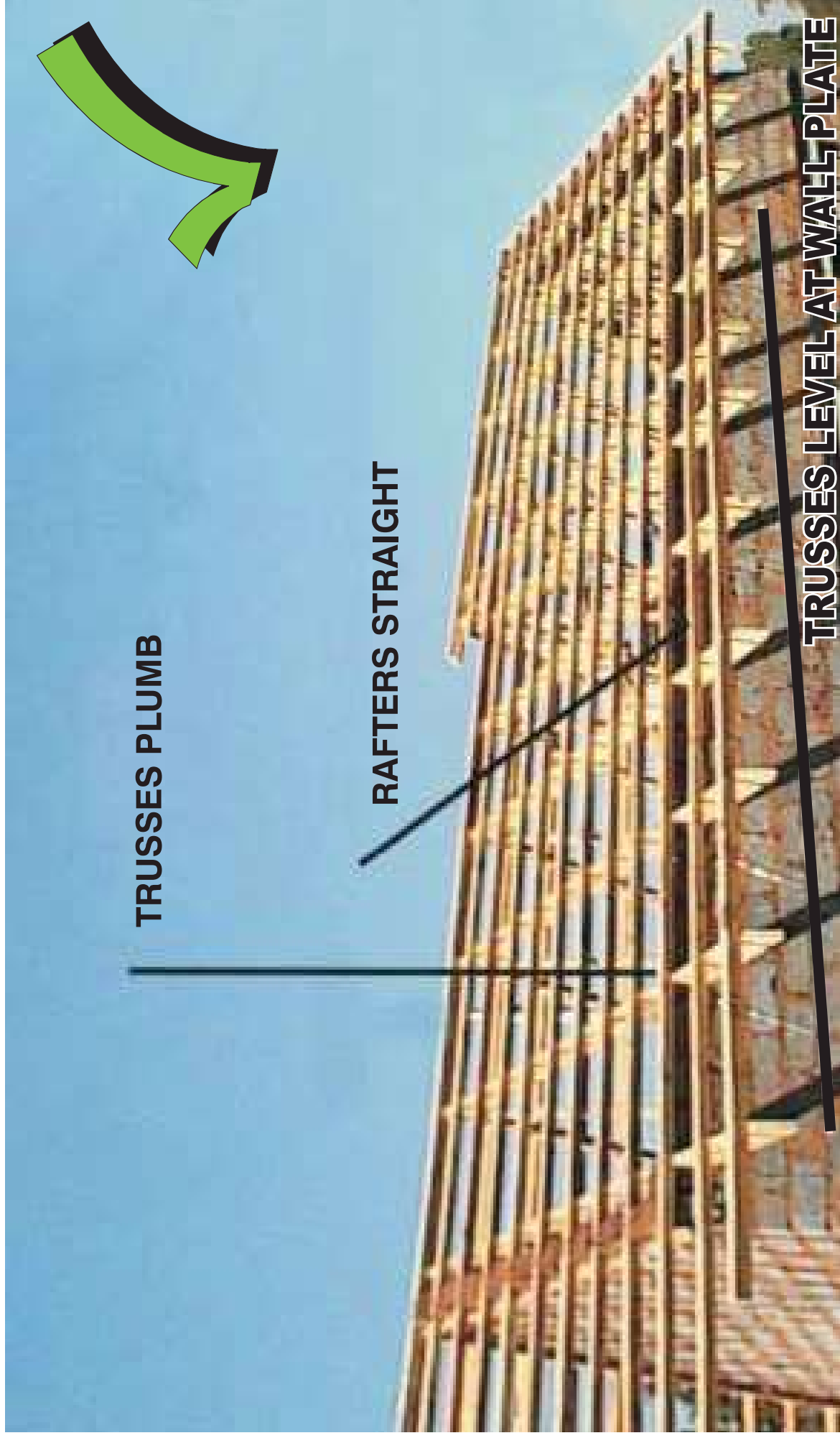


GREEN TICK = CORRECT WAY

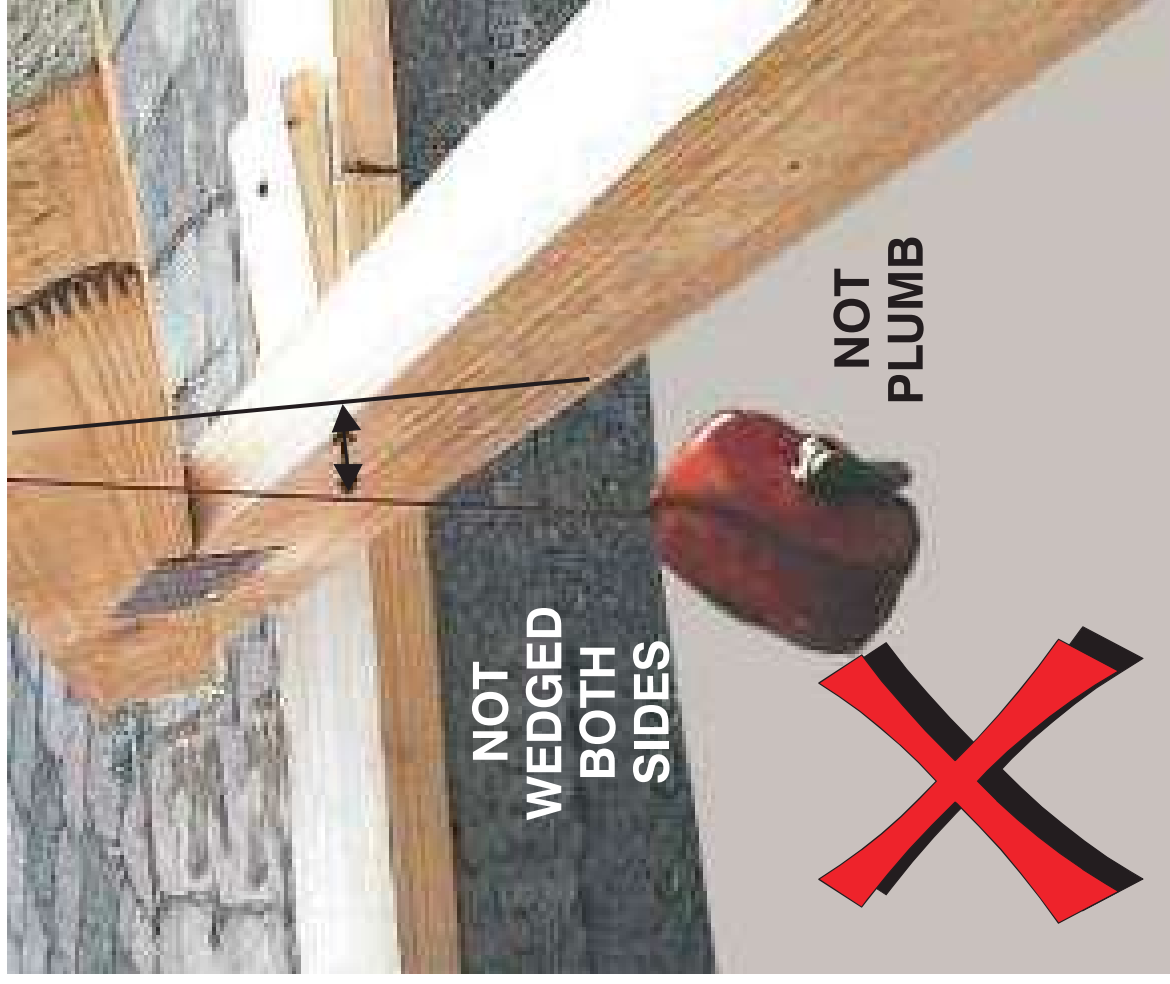
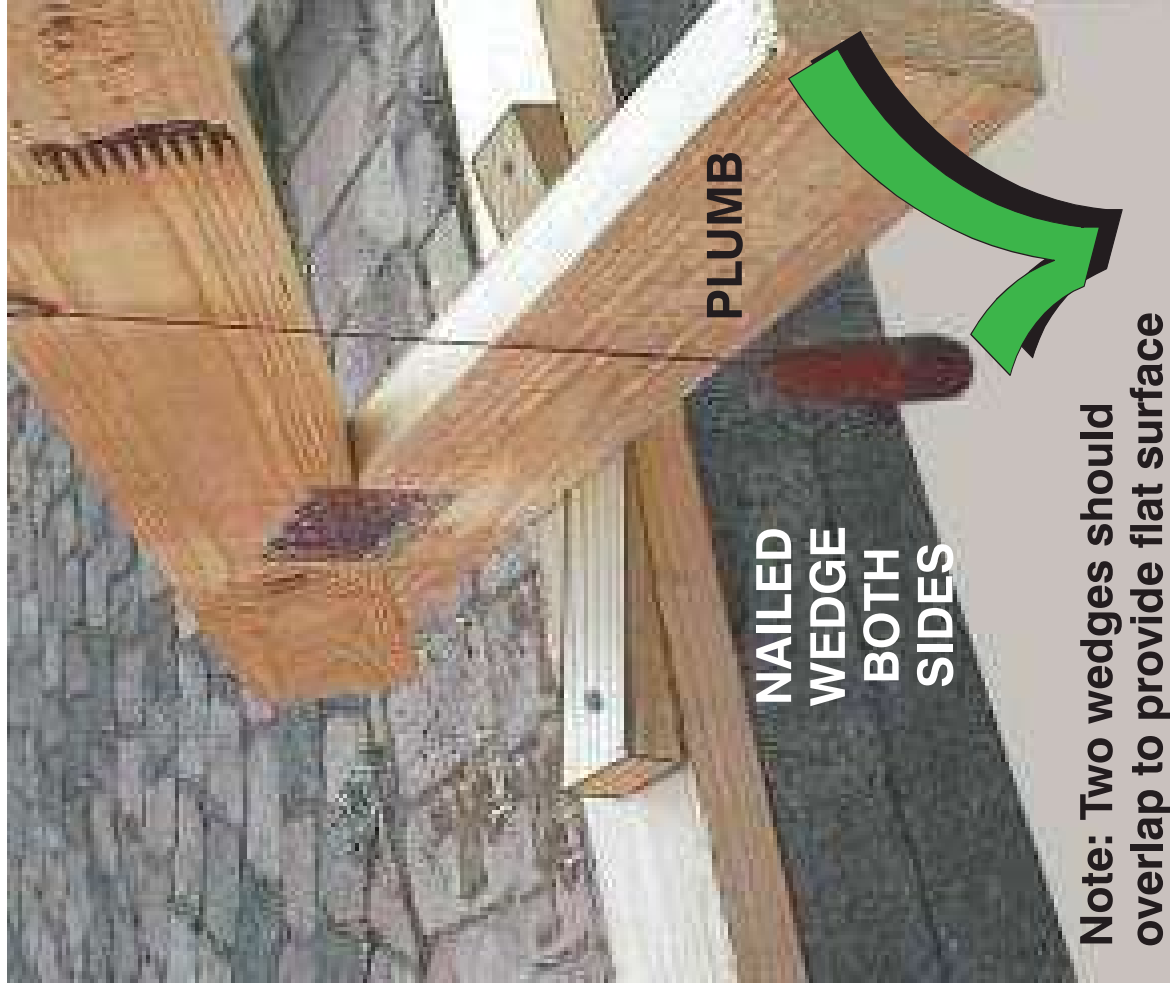


RED CROSS = INCORRECT WAY

TRUSSES MUST BE ERECTED PLUMB, STRAIGHT AND LEVEL



TRUSSES MUST BE ERECTED PLUMB AND LEVEL

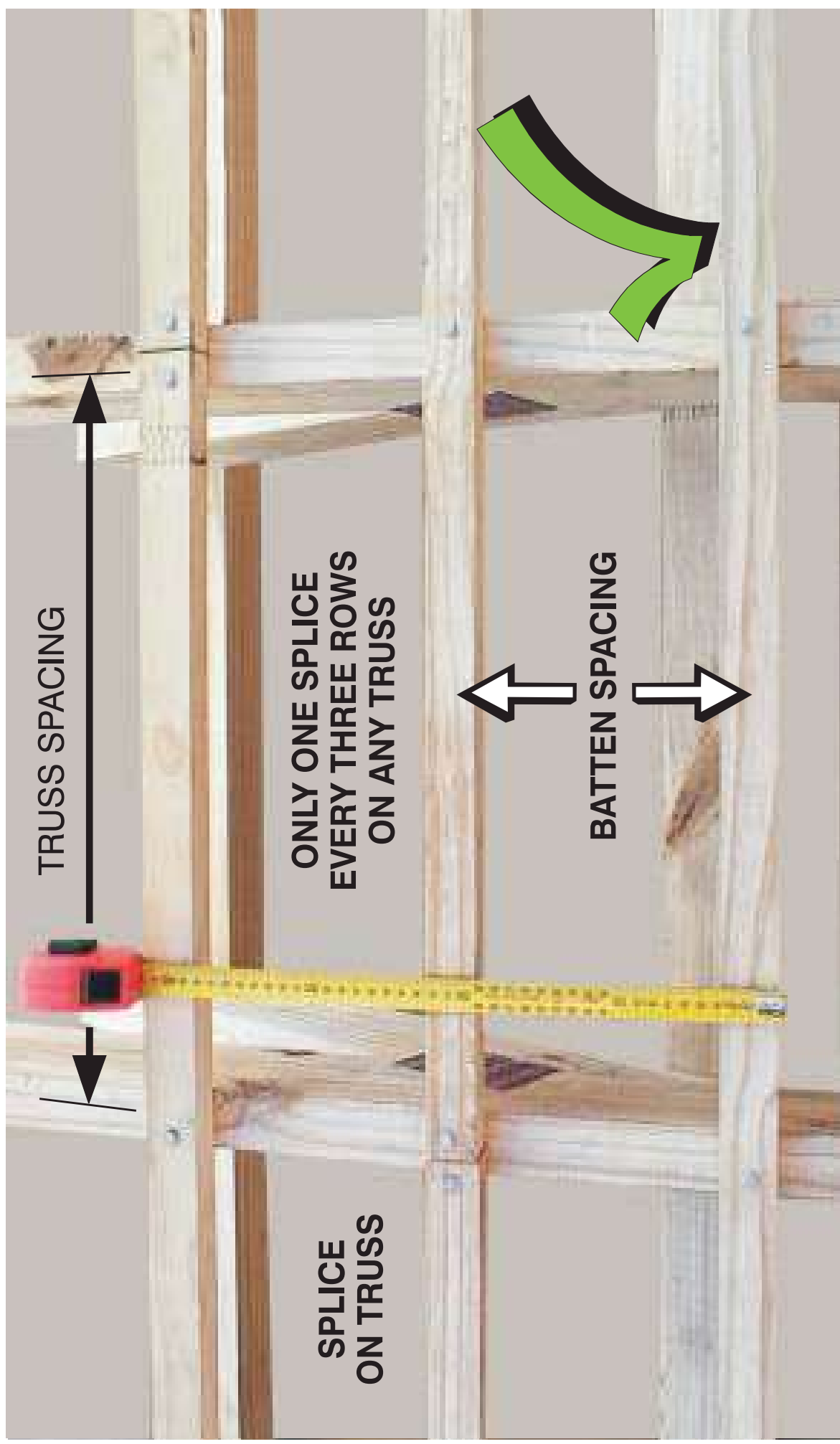


TRUSS TIE DOWN AND TRUSS LEVELLING WITH WEDGES

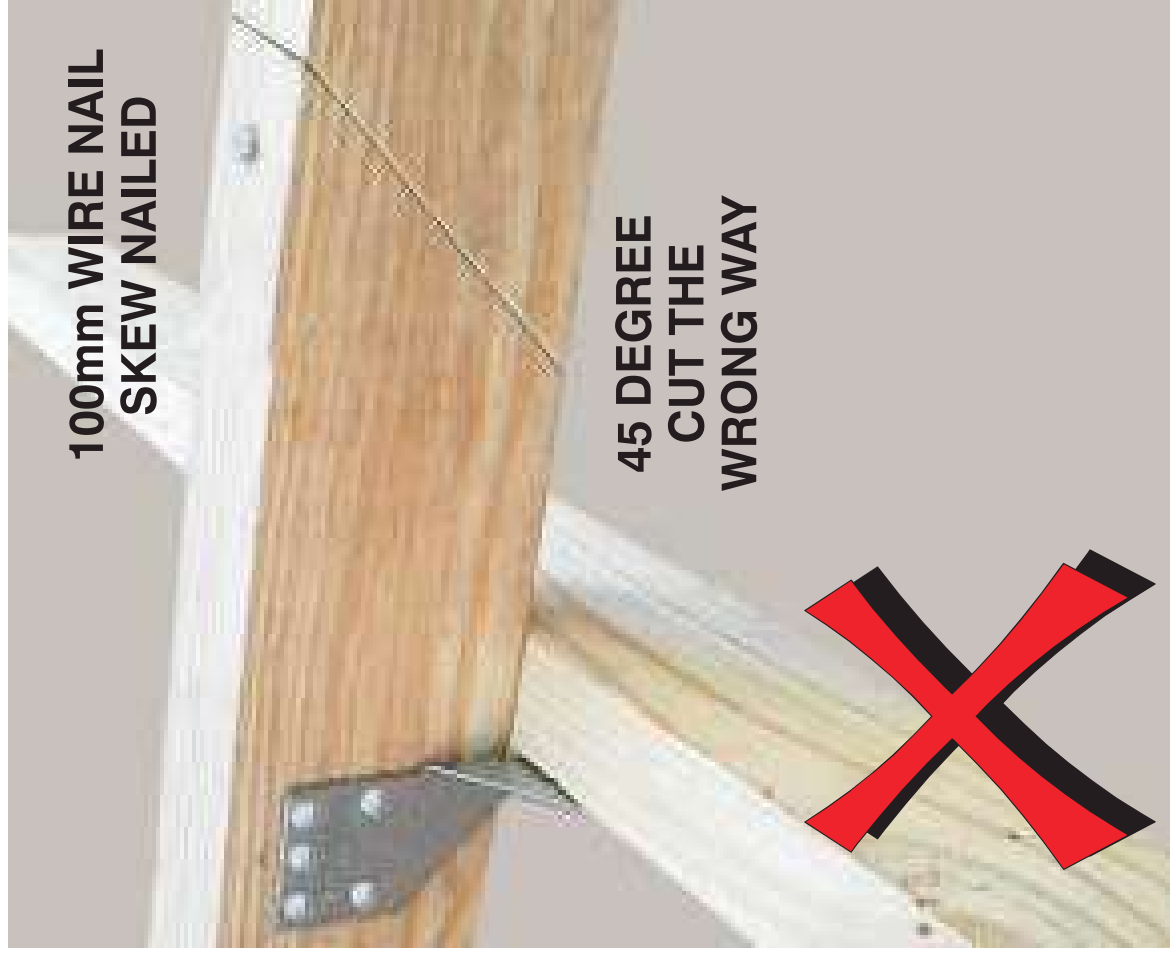
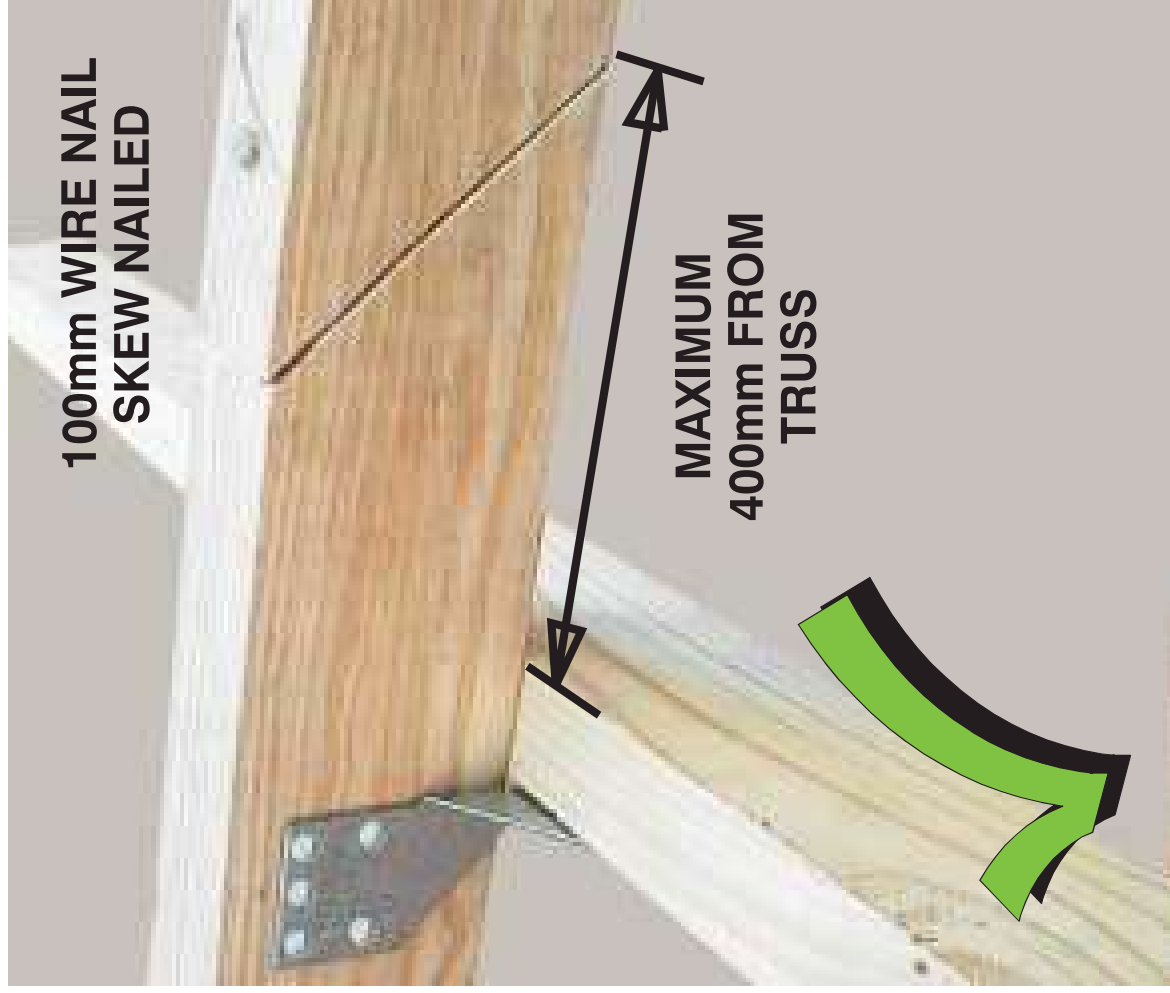


FIXING OF BATTENS

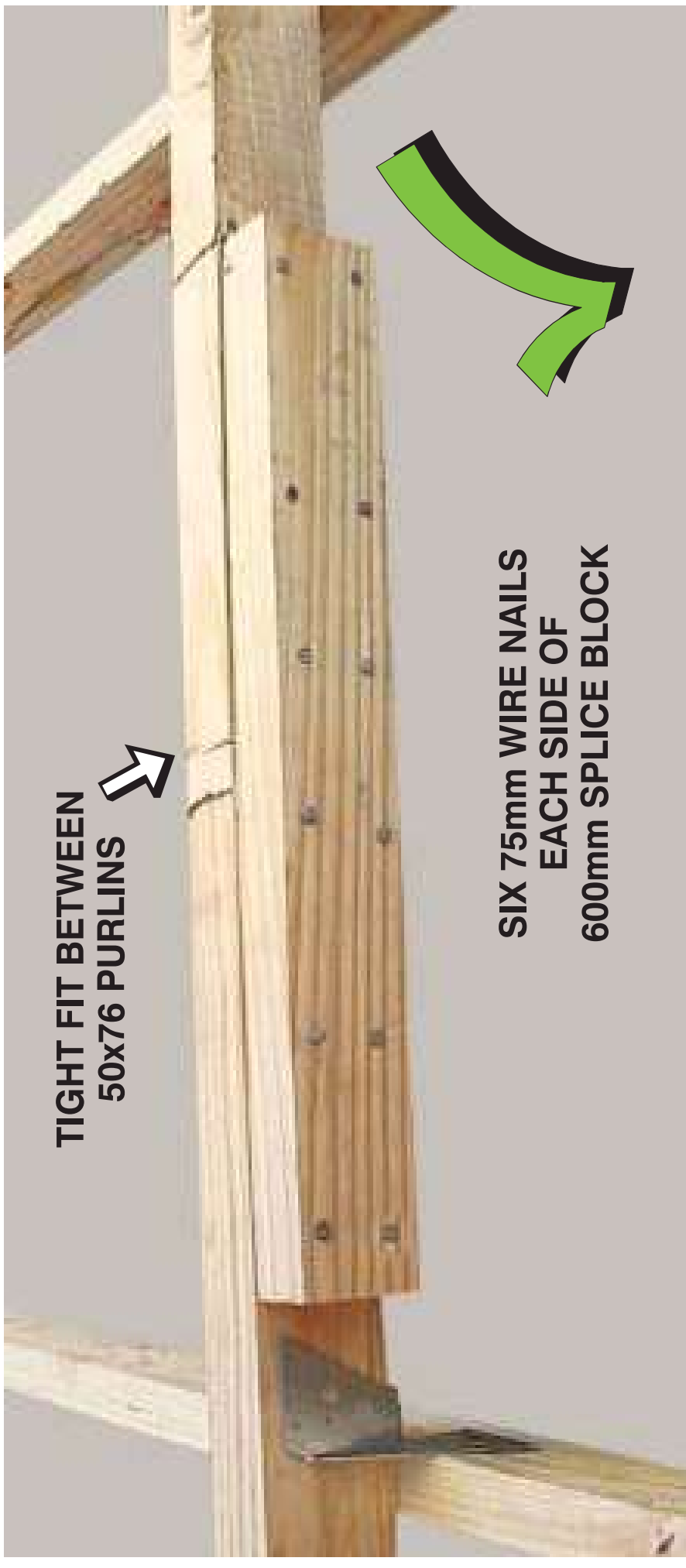
FOR 38X38 BATTENS USE 75mm WIRE NAILS
FOR 38X50 BATTENS ON EDGE USE 100mm NAILS



45 DEGREE CUT SPLICE FOR PURLINS



PURLIN BLOCK SPLICE - CAN BE ANYWHERE BETWEEN TRUSSES

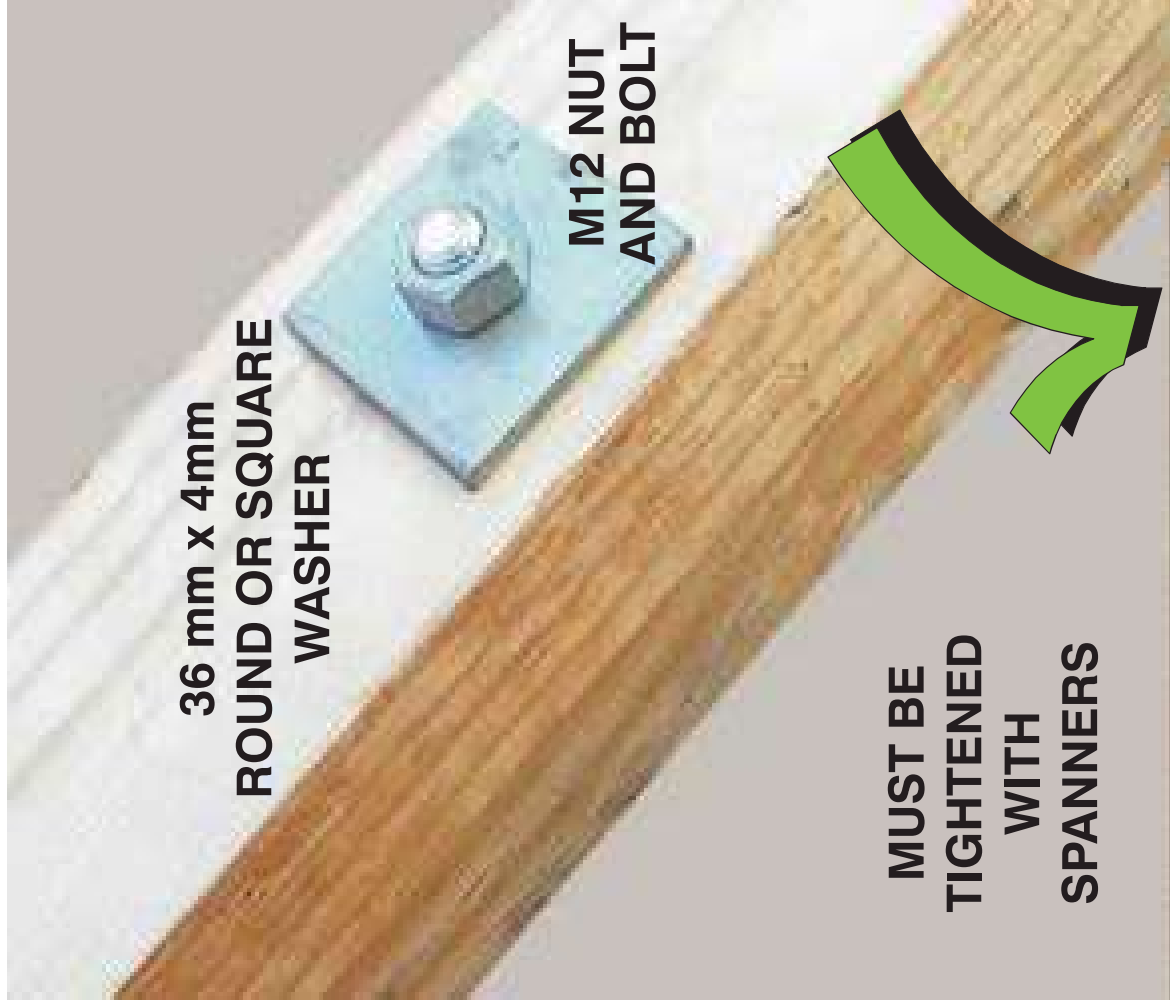


WRONG PURLIN SPLICE

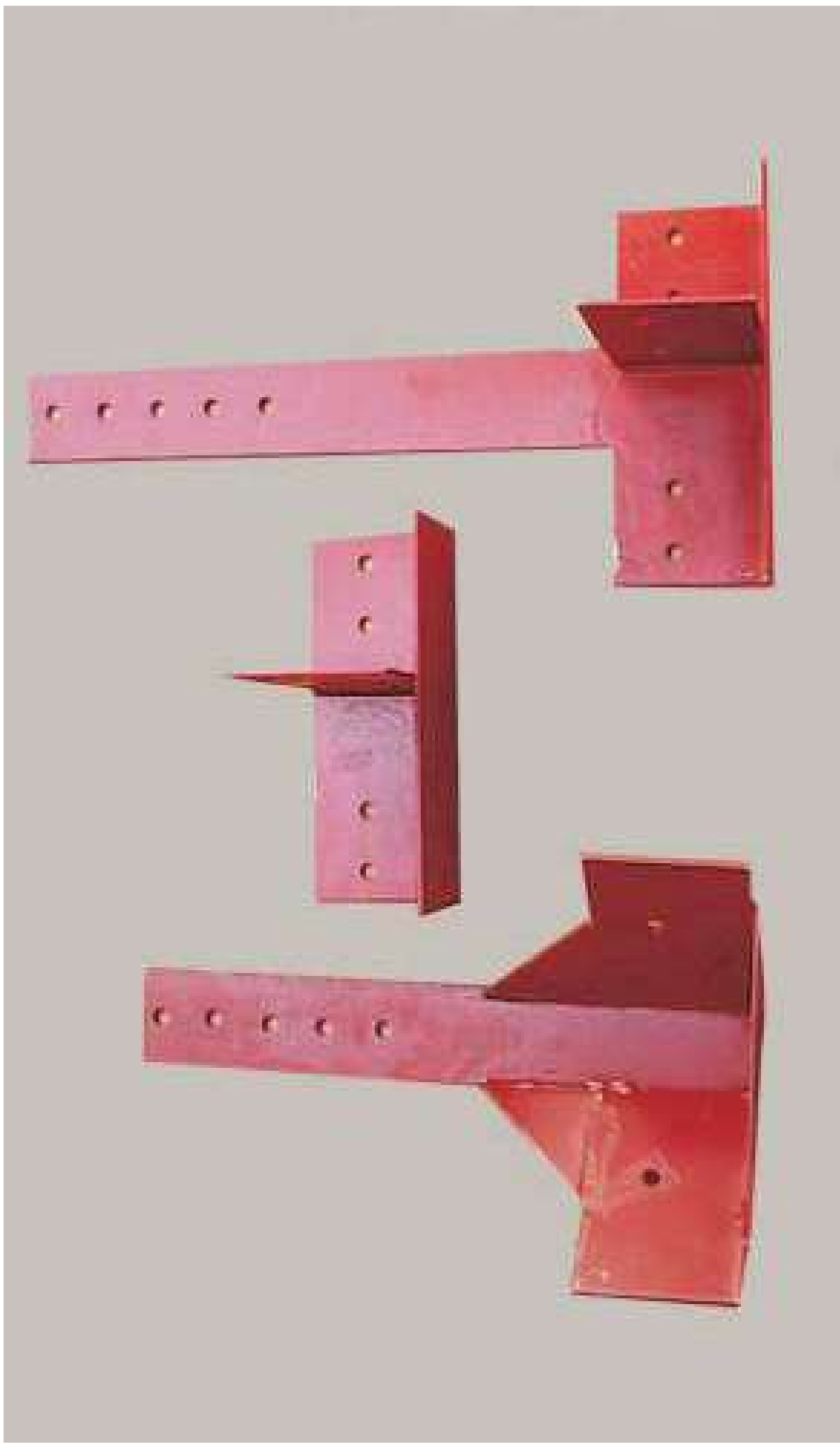
**NAIL TOO CLOSE TO END
TIMBER MAY SPLIT**



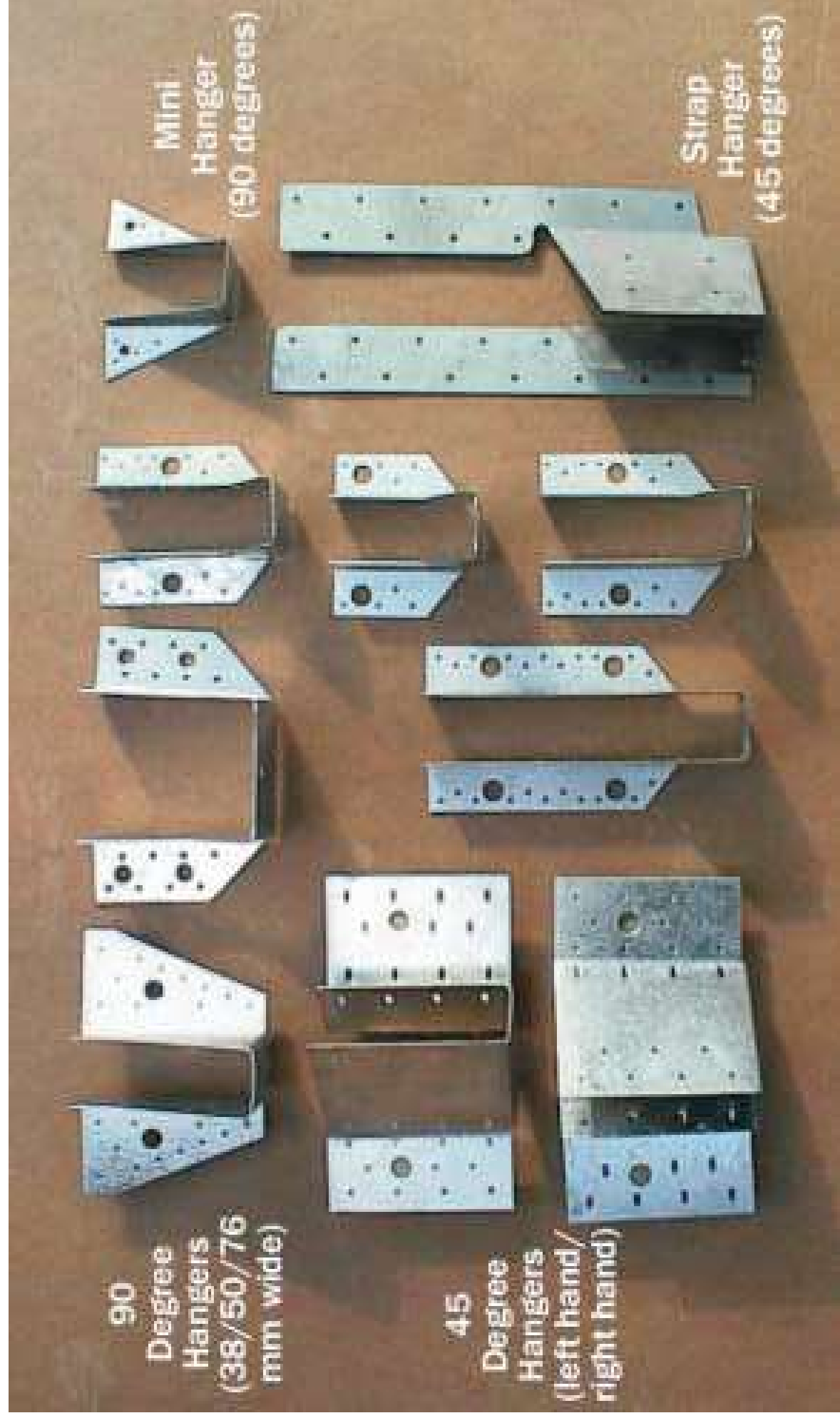
BOLTED CONNECTION - M12 BOLTS & 36x4mm WASHERS



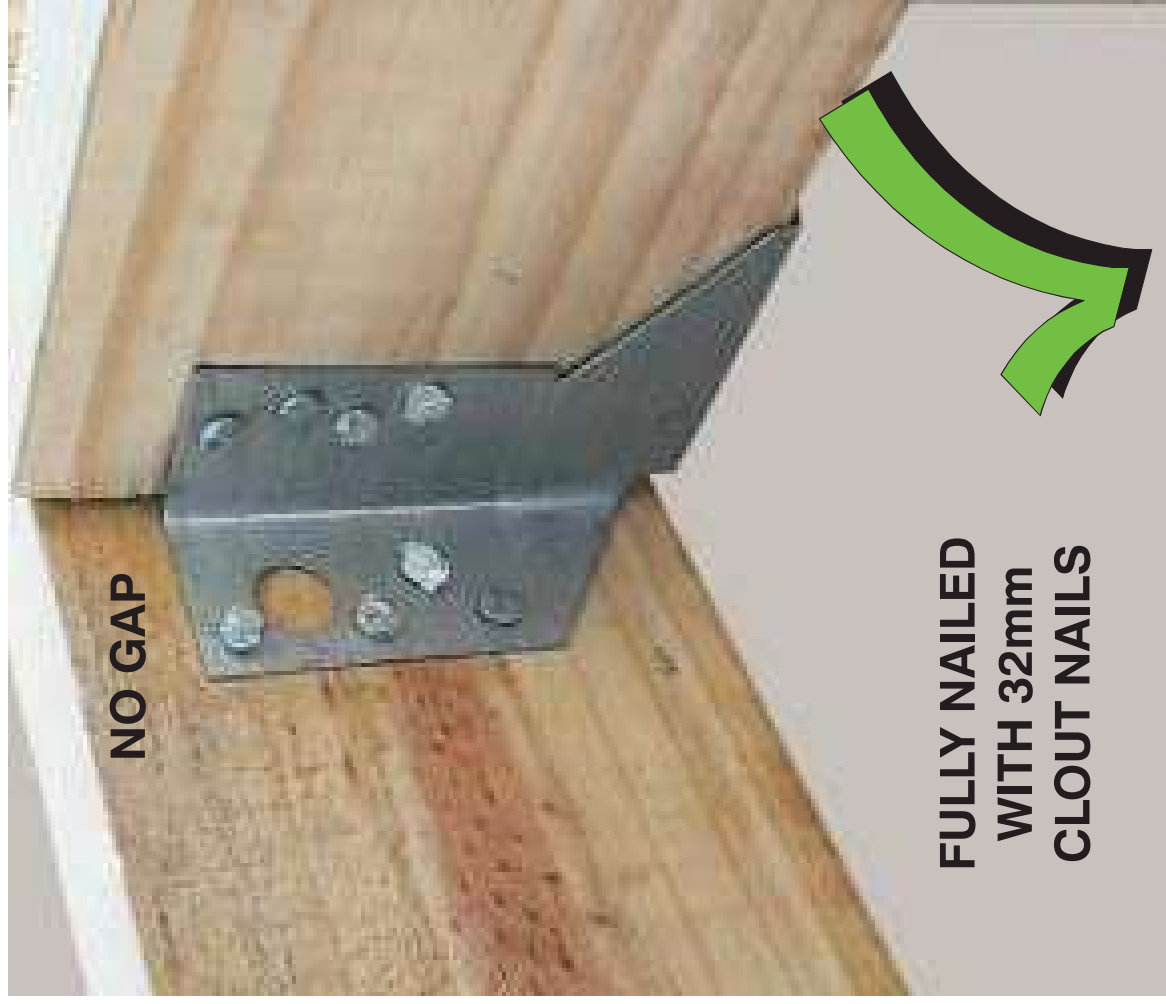
DIFFERENT TYPES AND SIZES OF MILD STEEL CLEATS



DIFFERENT TYPES AND SIZES OF TRUSS HANGERS



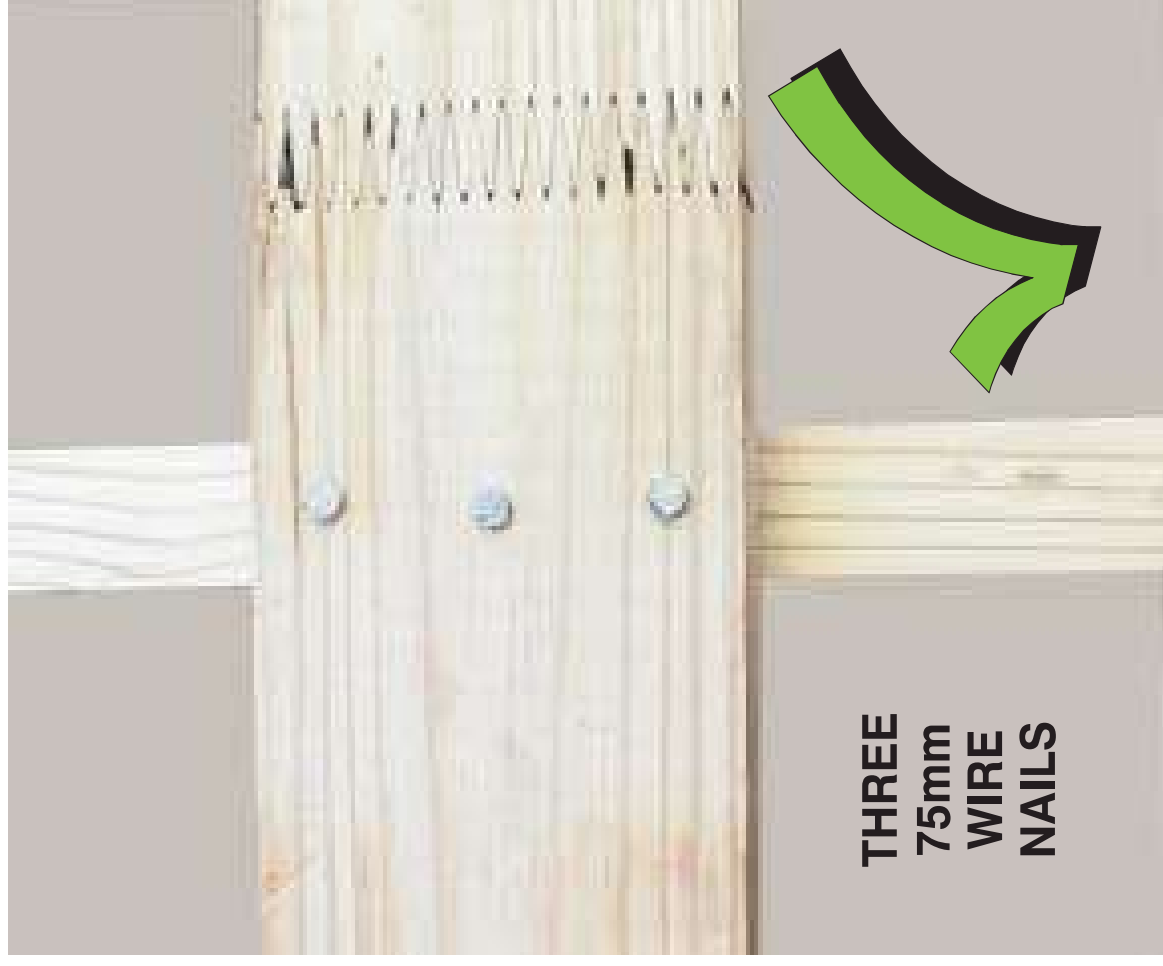
FIXING OF GALVANIZED TRUSS HANGERS



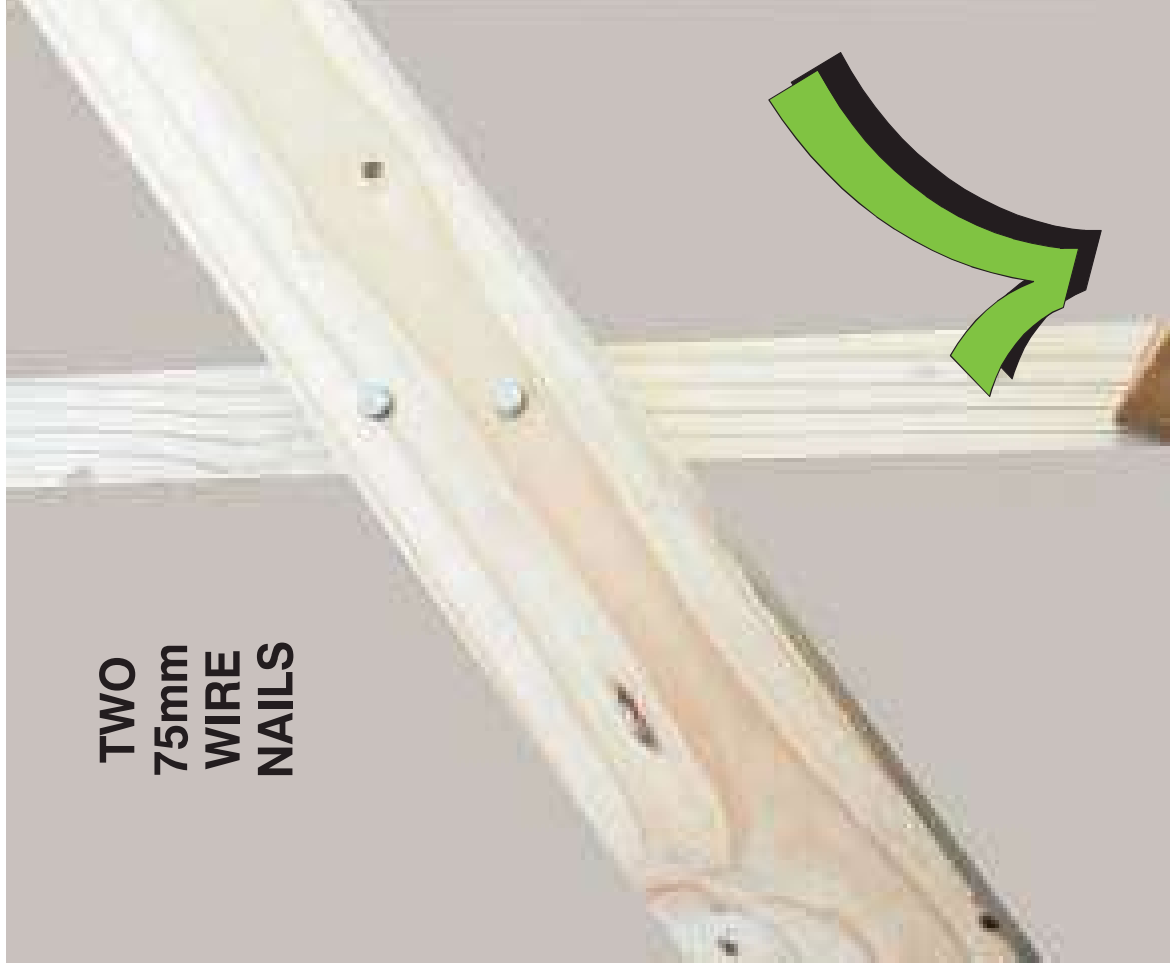
NAILING TOGETHER OF MULTIPLE PLYS OF TRUSSES & GIRDERS



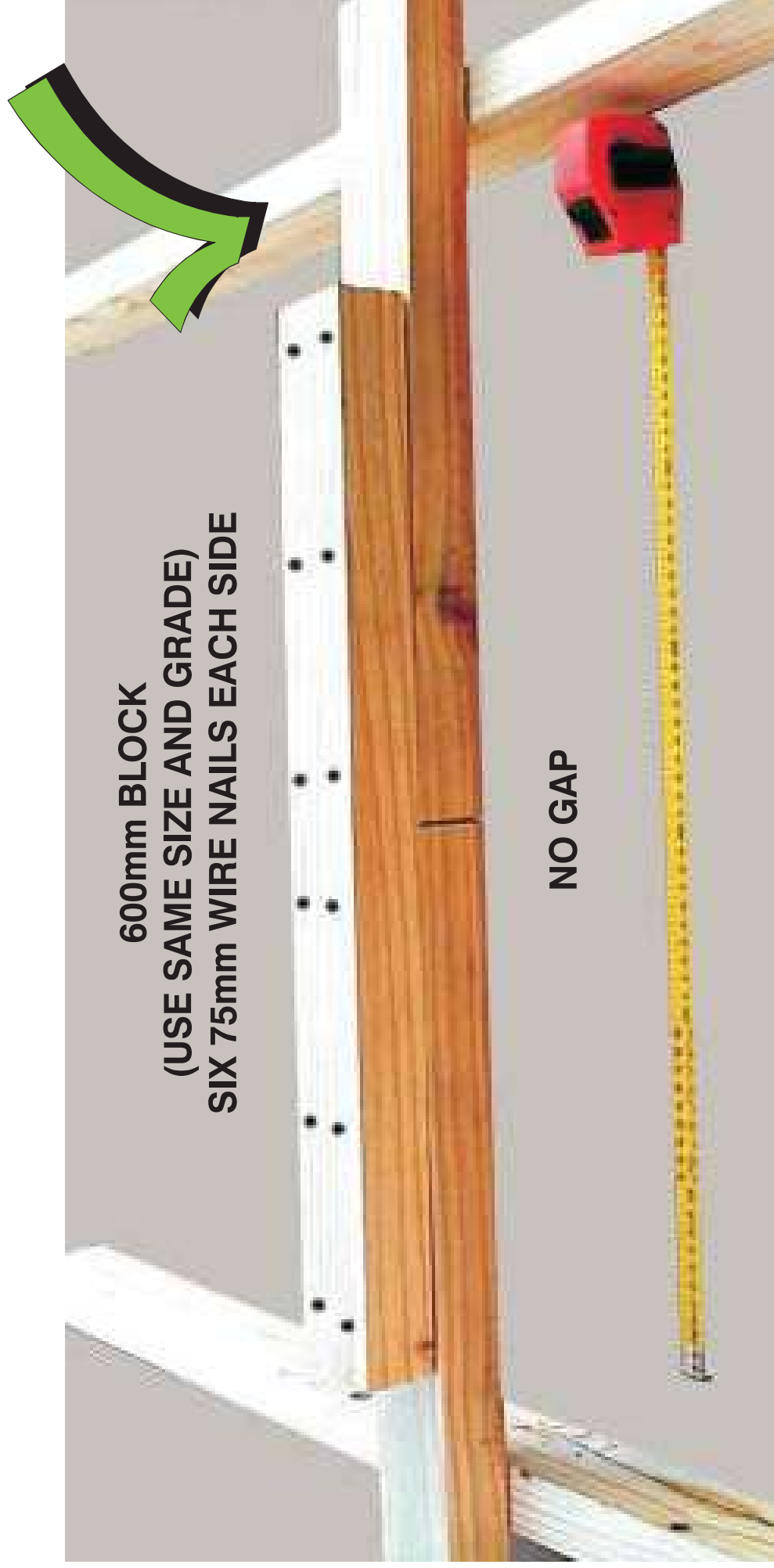
NAILING OF 36 x 111 TIMBER TO TRUSSES



NAILING OF 36 x 111 TIMBER TO TRUSSES



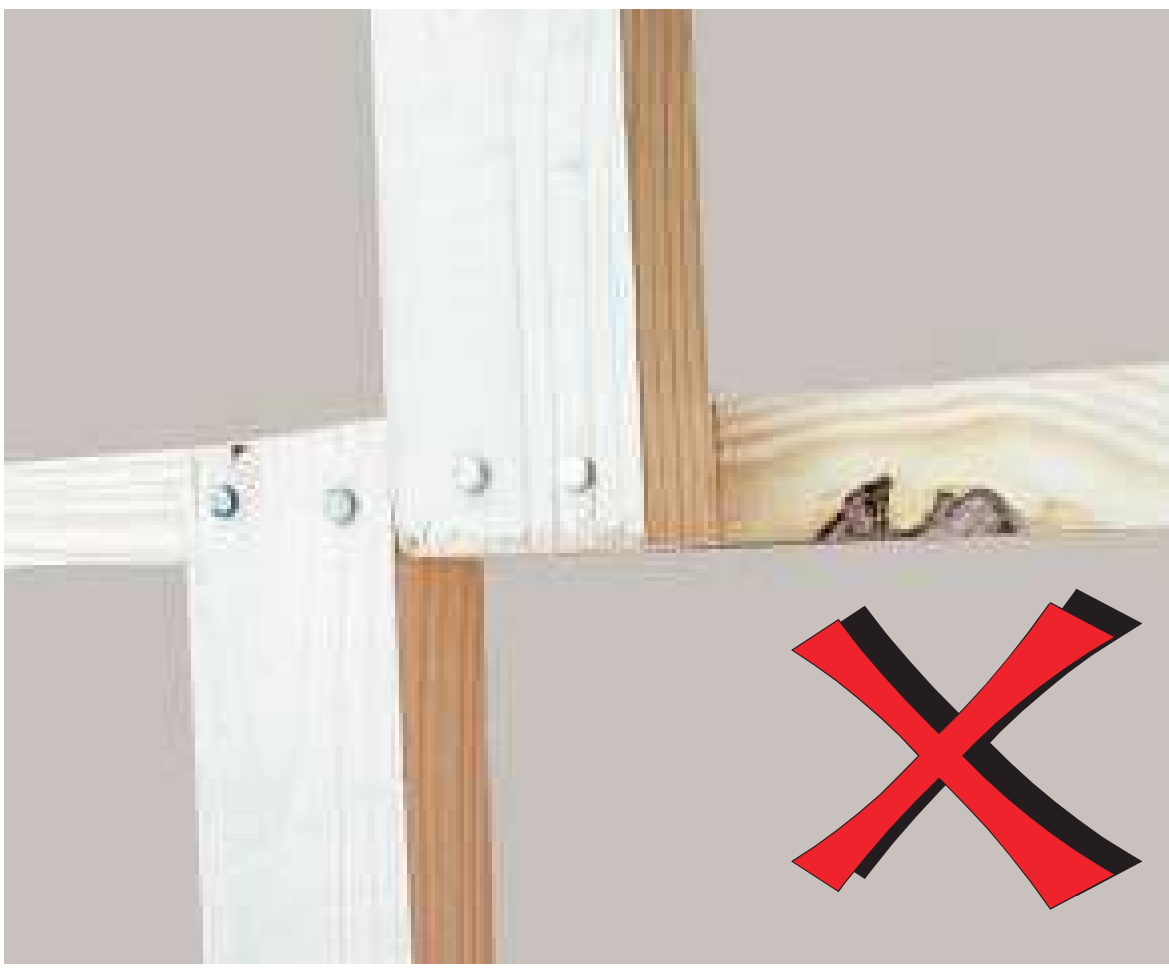
BLOCK SPLICE ON RUNNERS OR DIAGONAL CROSS BRACING



FIXING AND JOINING OF RUNNERS



WRONG RUNNER SPLICES



PART TWO - HIP, VALLEY, CRANK & GEYSER DETAILS

This section shows different hip types, valley and crank construction details.

Always follow the roof plan supplied by the fabricator.

Always use the correct types of hangers and cleats as shown on the roof plan.

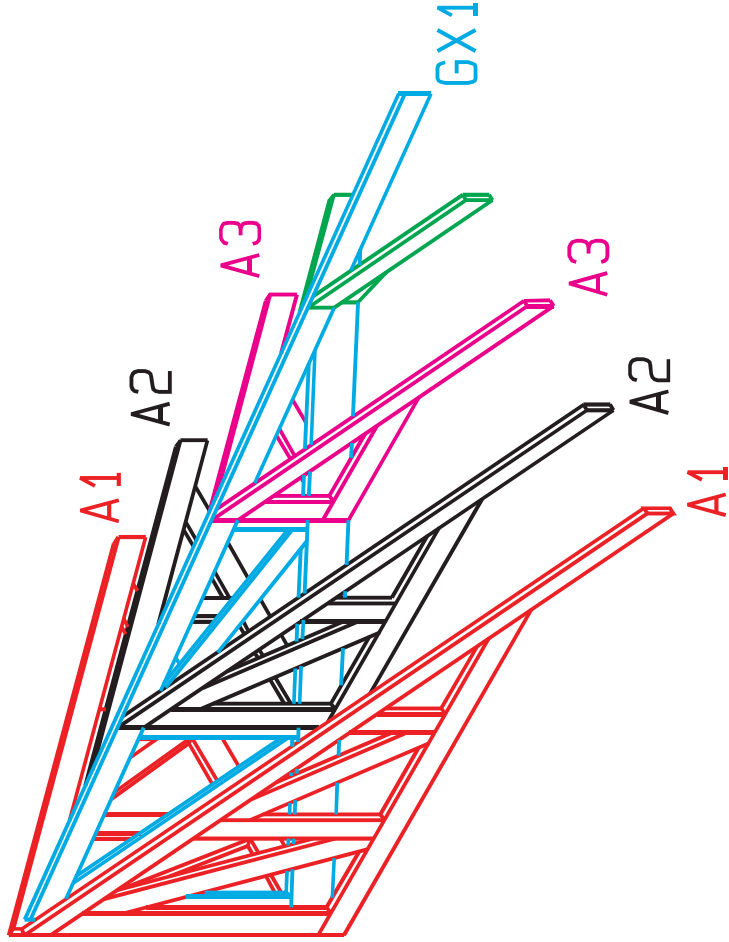
Always fully nail all hangers with 32mm clout nails or serrated nails.

Always put only M12 bolts in all the holes of the metal cleat.

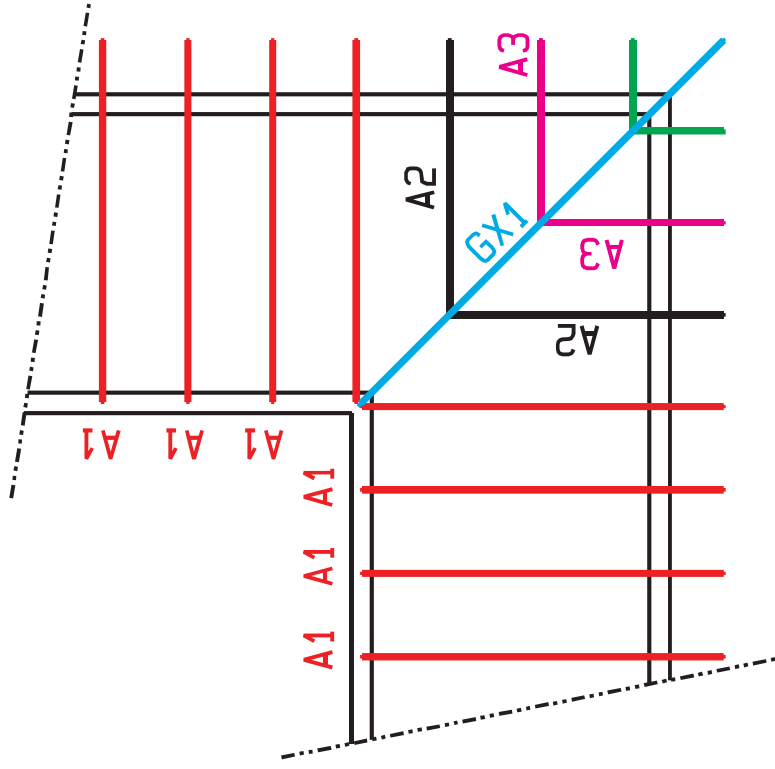
Always fully nail two, three and four ply girders together, and bolt together as shown on the roof plan details in accordance with the system details before any load is put on the trusses supported by the girder.

When ever possible the geyser should be supported on internal walls and not the trusses.

MONO-PITCH HIP - 45 DEGREE INFILL

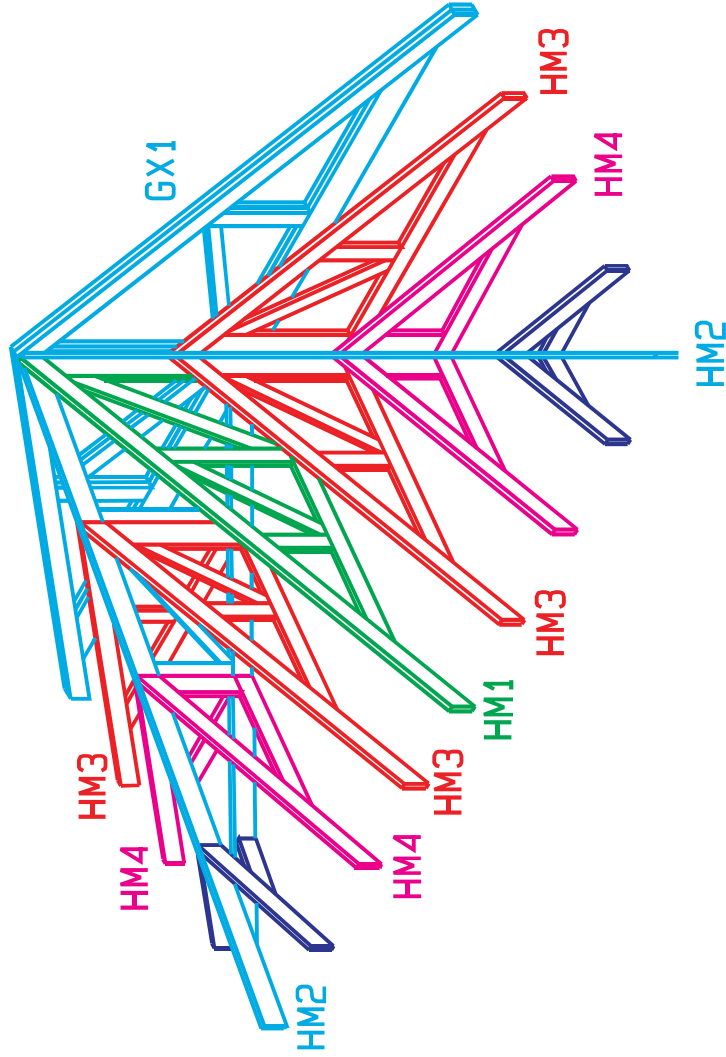


Rules: Use all hanger and cleat types as shown on the roof plan.
 All hangers to be fully nailed.
 All cleats to be fully bolted.

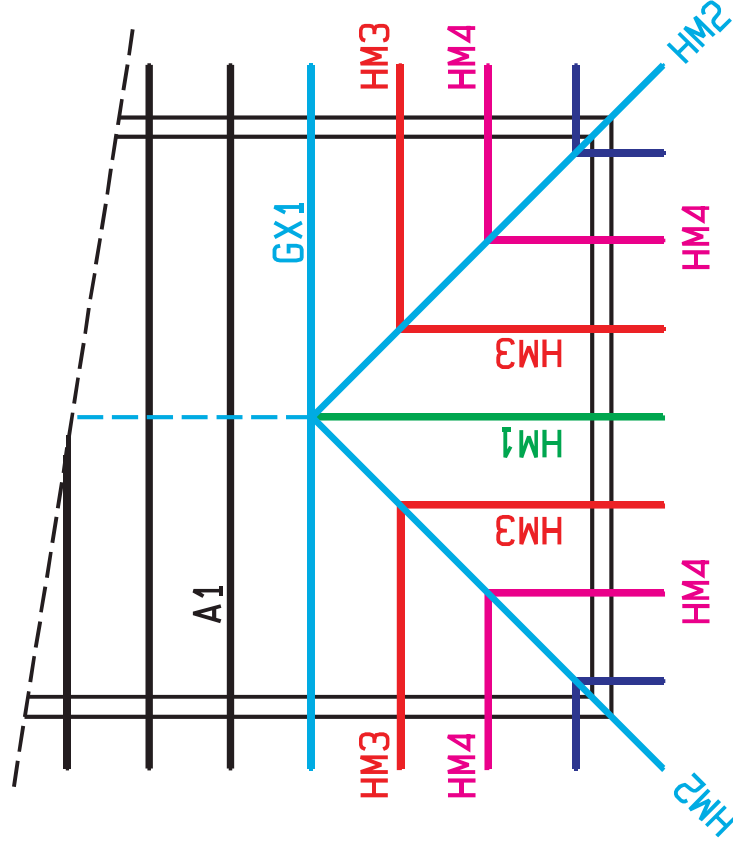


Truss Labels for this drawing only.

FULL HIP - 45 DEGREE INFILL

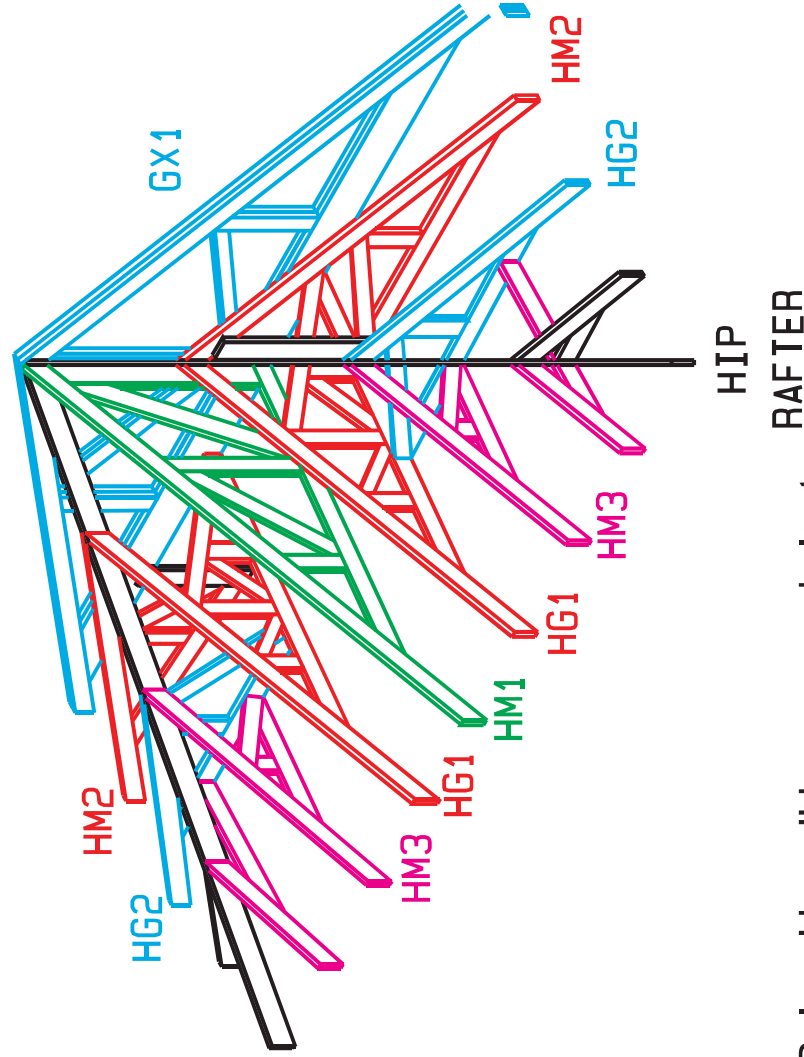


Rules: Use all hanger and cleat types as shown on the roof plan.
All hangers to be fully nailed.
All cleats to be fully bolted.

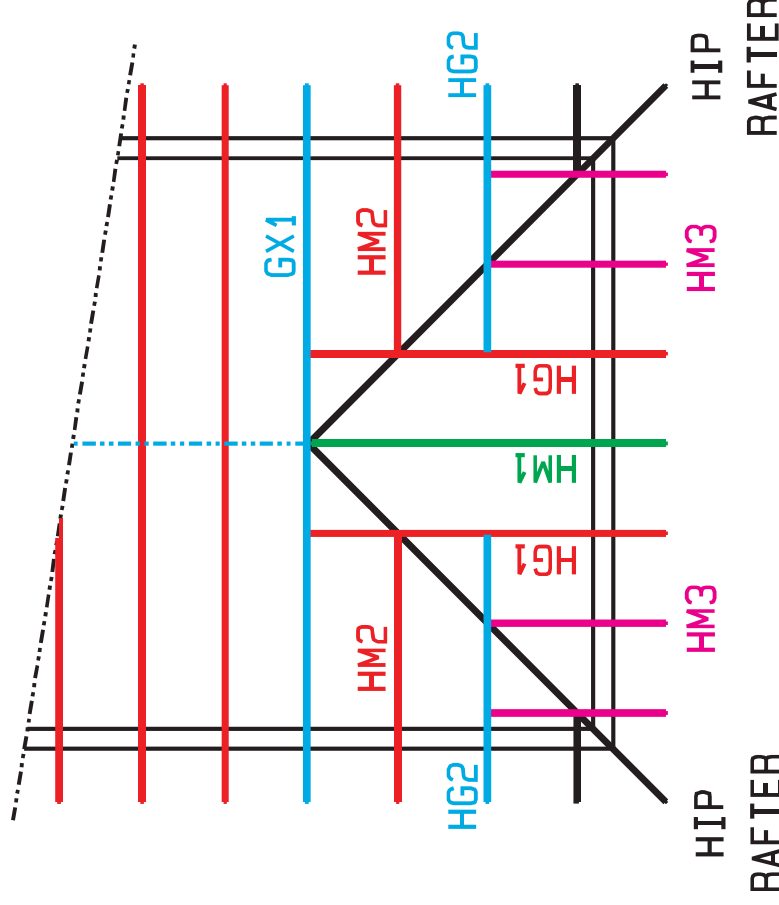


Truss Labels for this drawing only.

FULL HIP - 90 DEGREE INFILL

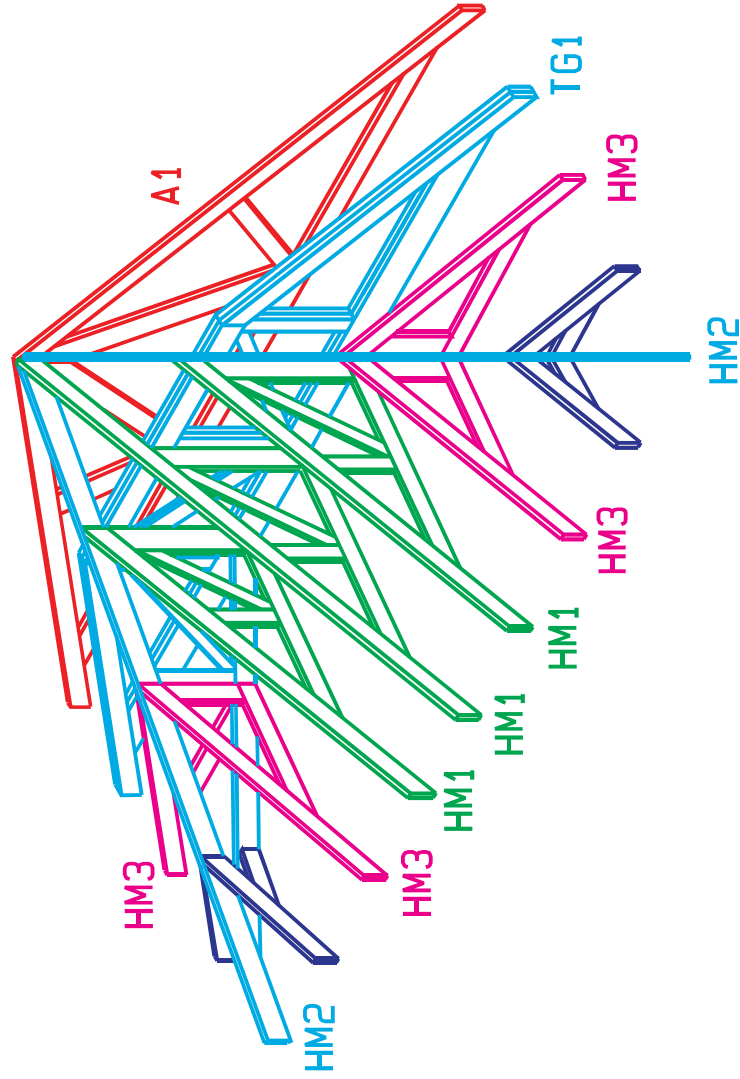


Rules: Use all hanger and cleat types as shown on the roof plan.
 All hangers to be fully nailed.
 All cleats to be fully bolted.

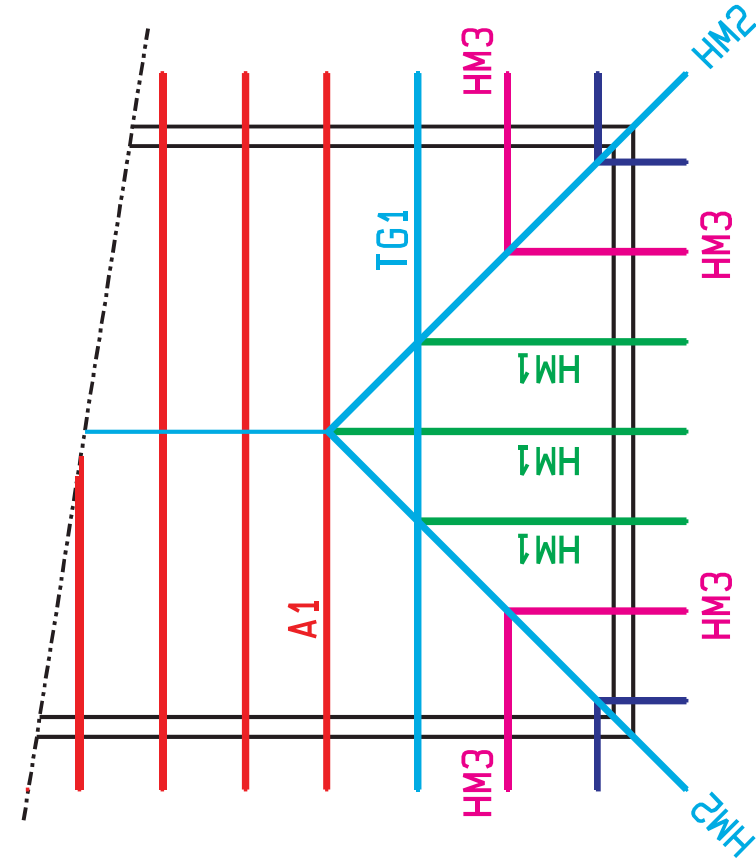


Truss Labels for this drawing only.

TRUNCATED HIP - 45 DEGREE INFILL

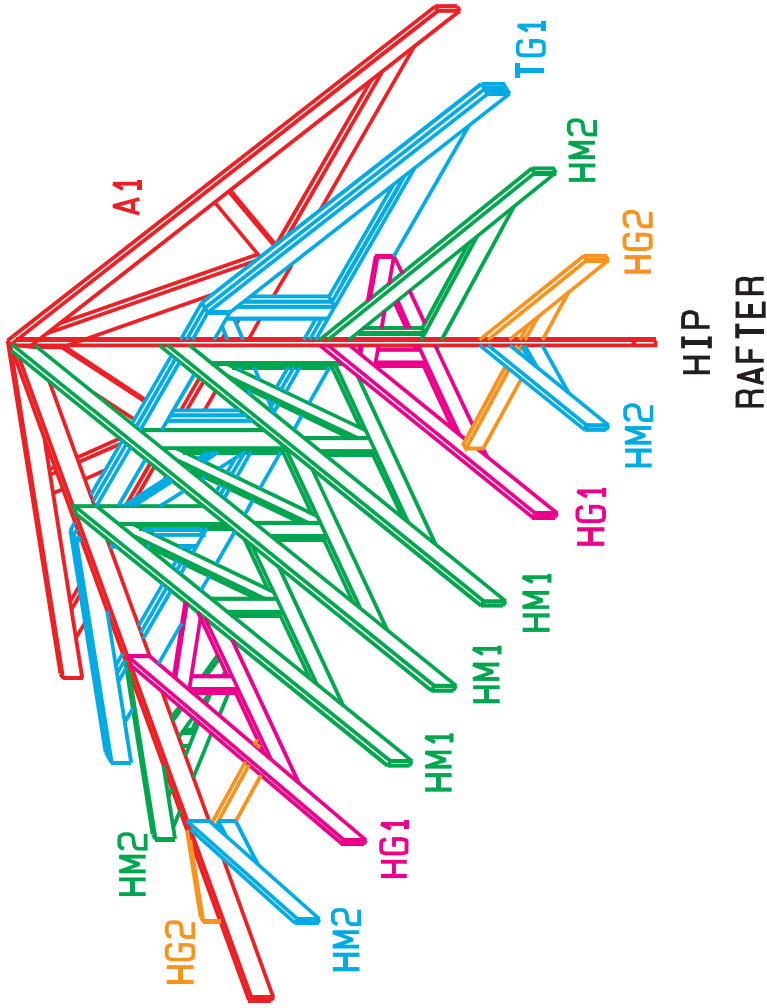


Rules: Use all hanger and cleat types as shown on the roof plan.
All hangers to be fully nailed.
All cleats to be fully bolted.
All fly rafters must be fixed to truncated trusses.

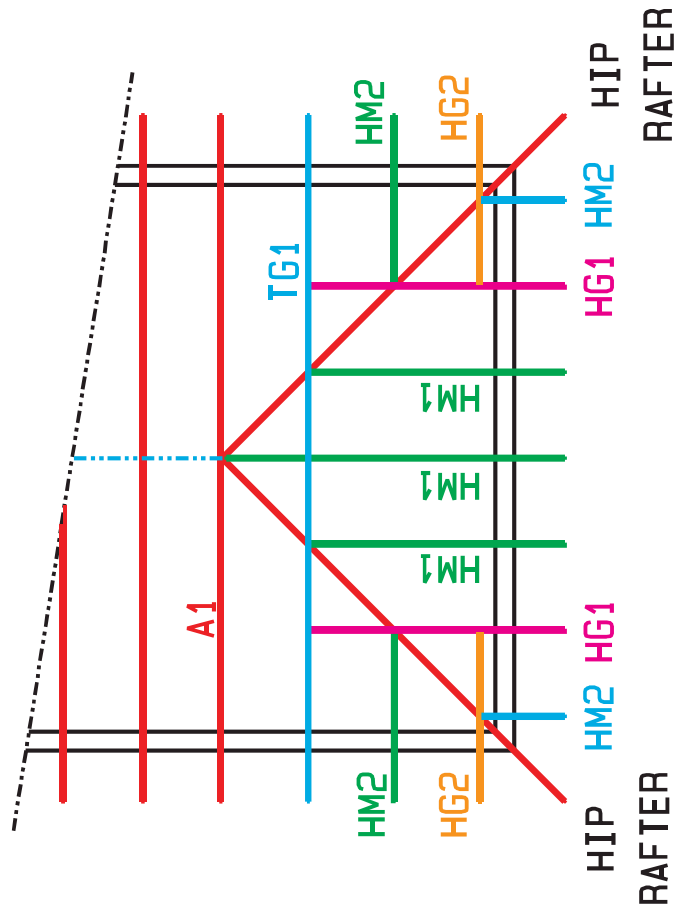


Truss Labels for this drawing only.

TRUNCATED HIP - 90 DEGREE INFILL

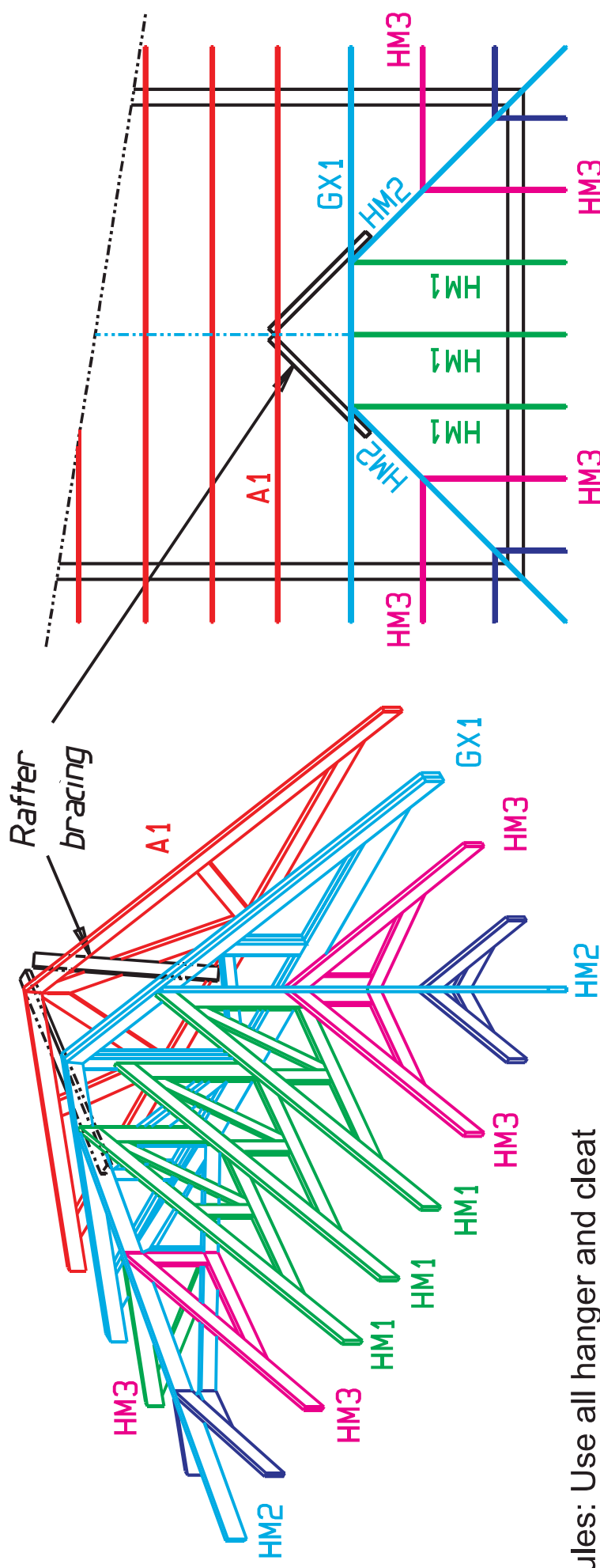


Rules: Use all hanger and cleat types as shown on the roof plan.
All hangers to be fully nailed.
All cleats to be fully bolted.
All fly rafters must be fixed to truncated trusses.



Truss Labels for this drawing only.

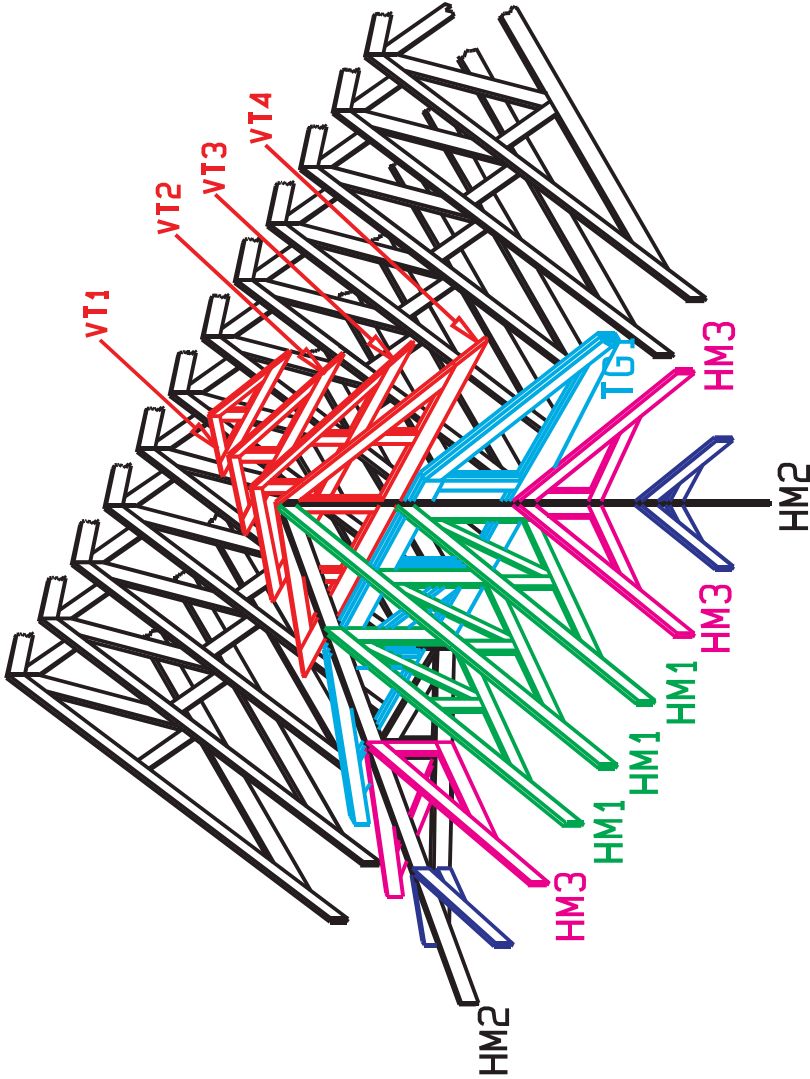
“DUTCH” HIP - 45 DEGREE INFILL



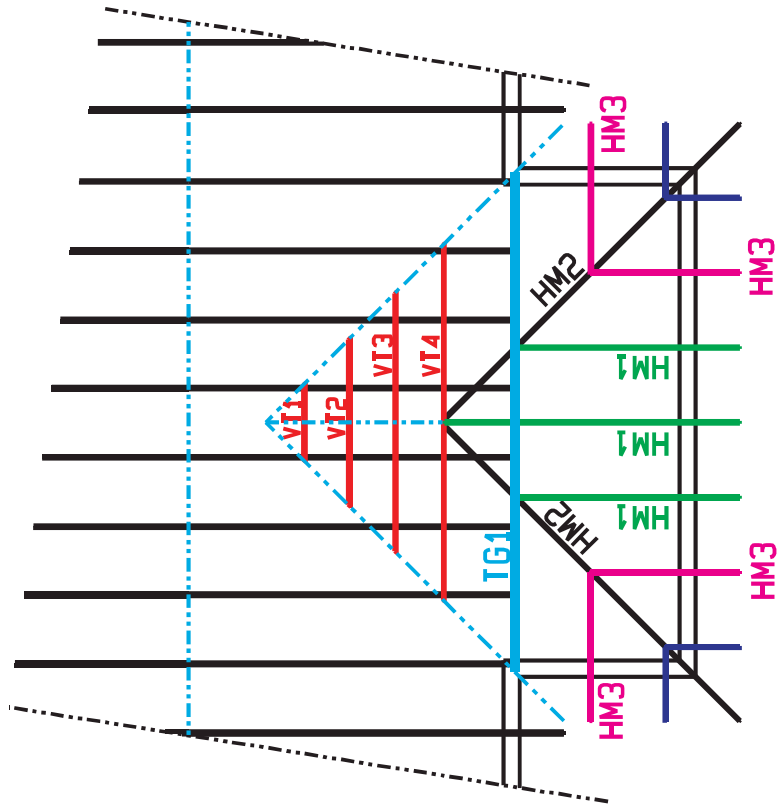
Rules: Use all hanger and cleat types as shown on the roof plan.
 All hangers to be fully nailed.
 All cleats to be fully bolted.
 Rafter bracing from hip girder to main truss apex must be installed.

Truss Labels for this drawing only.

TRUNCATED HIP WITH VALLEY - 45 DEGREE INFILL

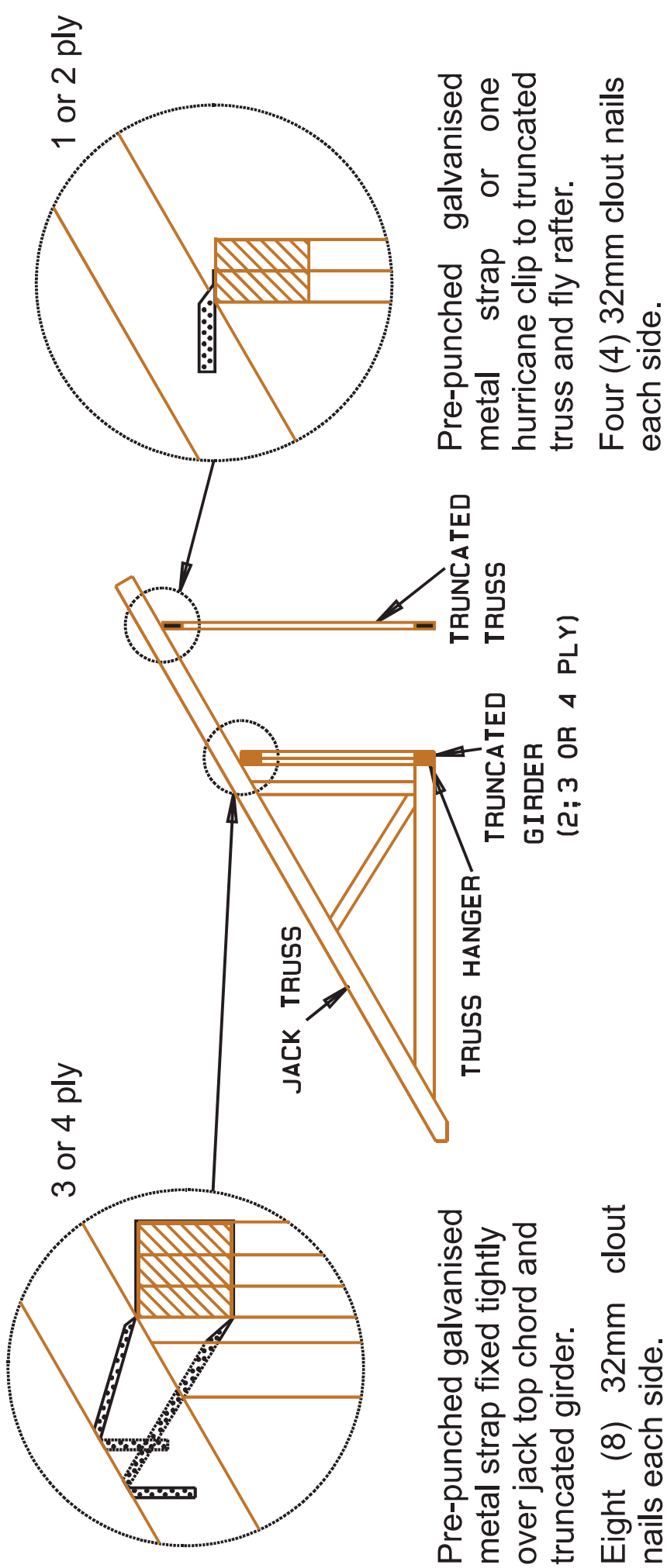


Rules: Use all hanger and cleat types as shown on the roof plan.
 All hangers to be fully nailed.
 All cleats to be fully bolted.
 All fly rafters must be fixed to truncated trusses.

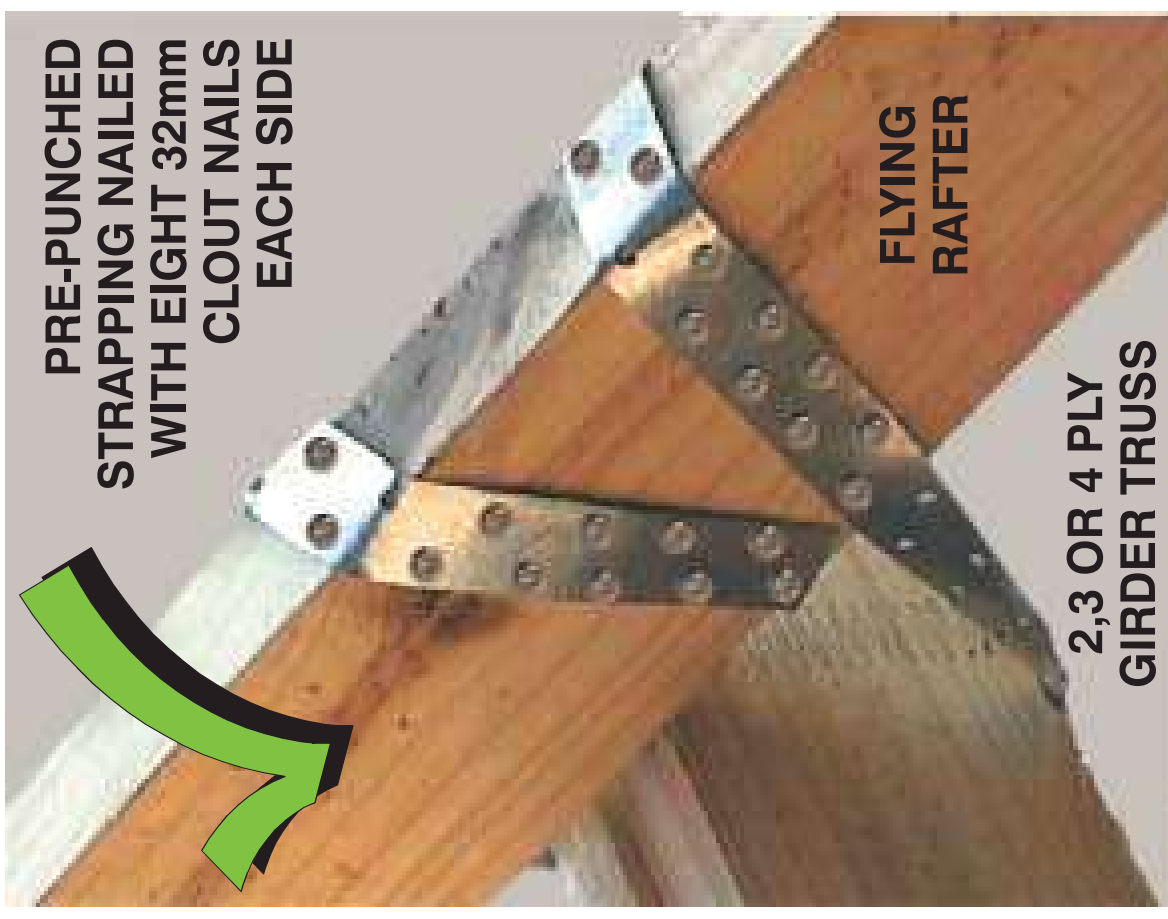
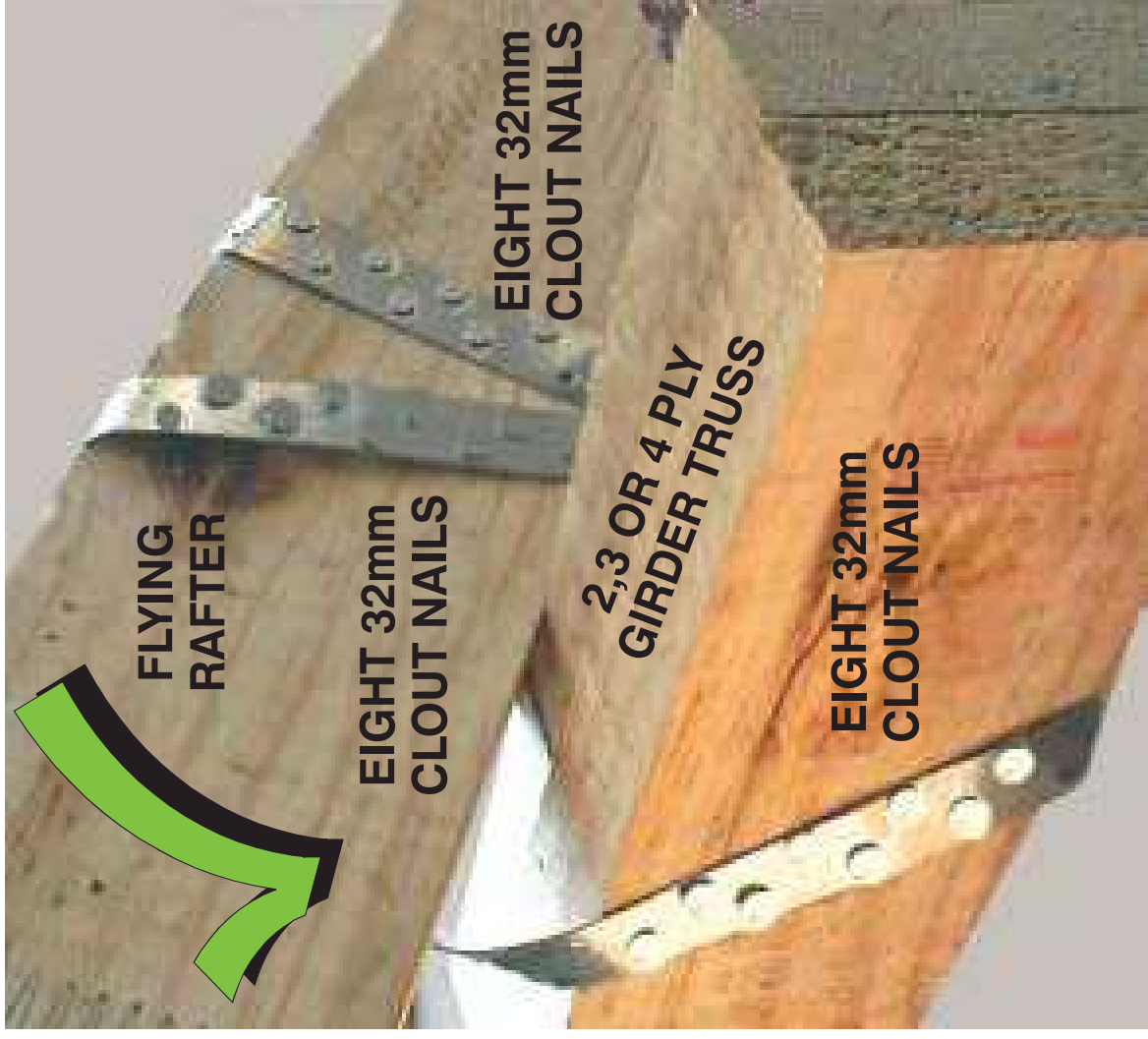


Truss Labels for this drawing only.

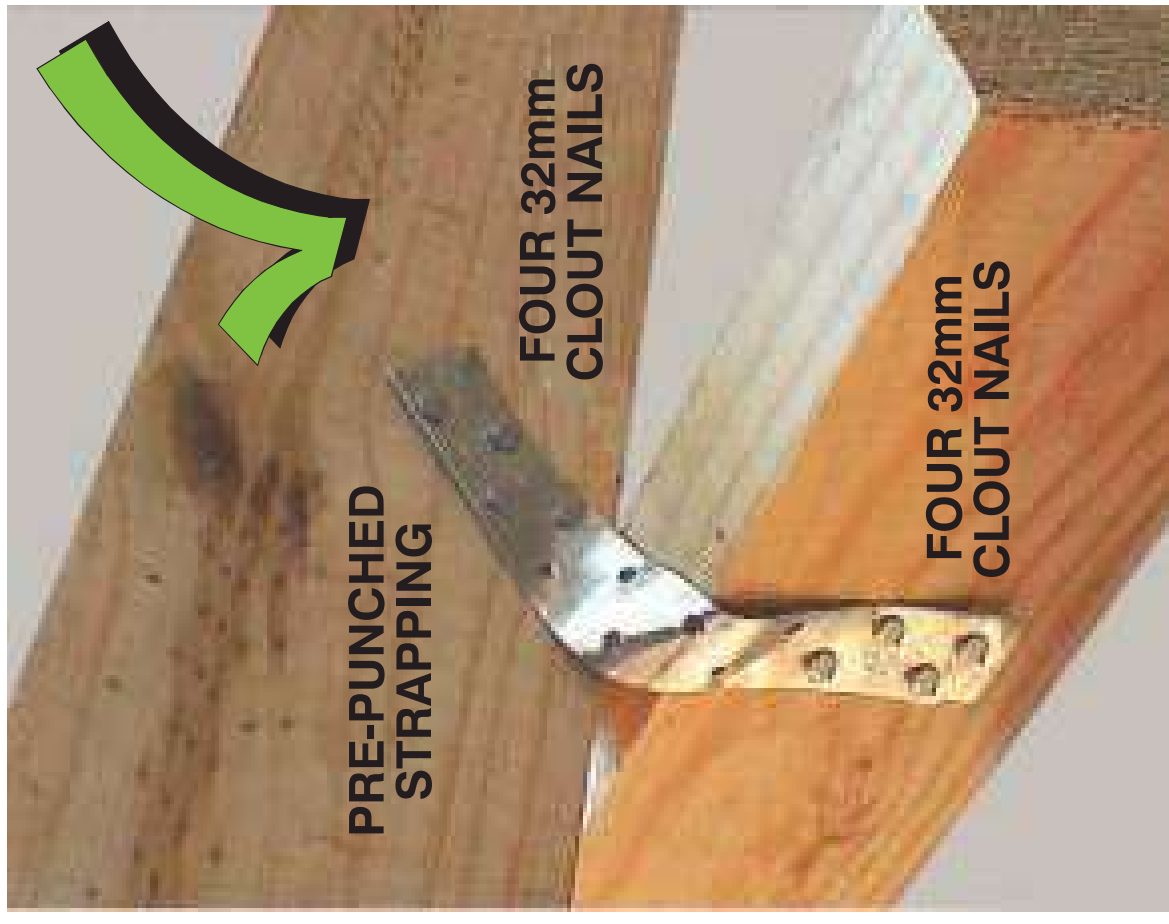
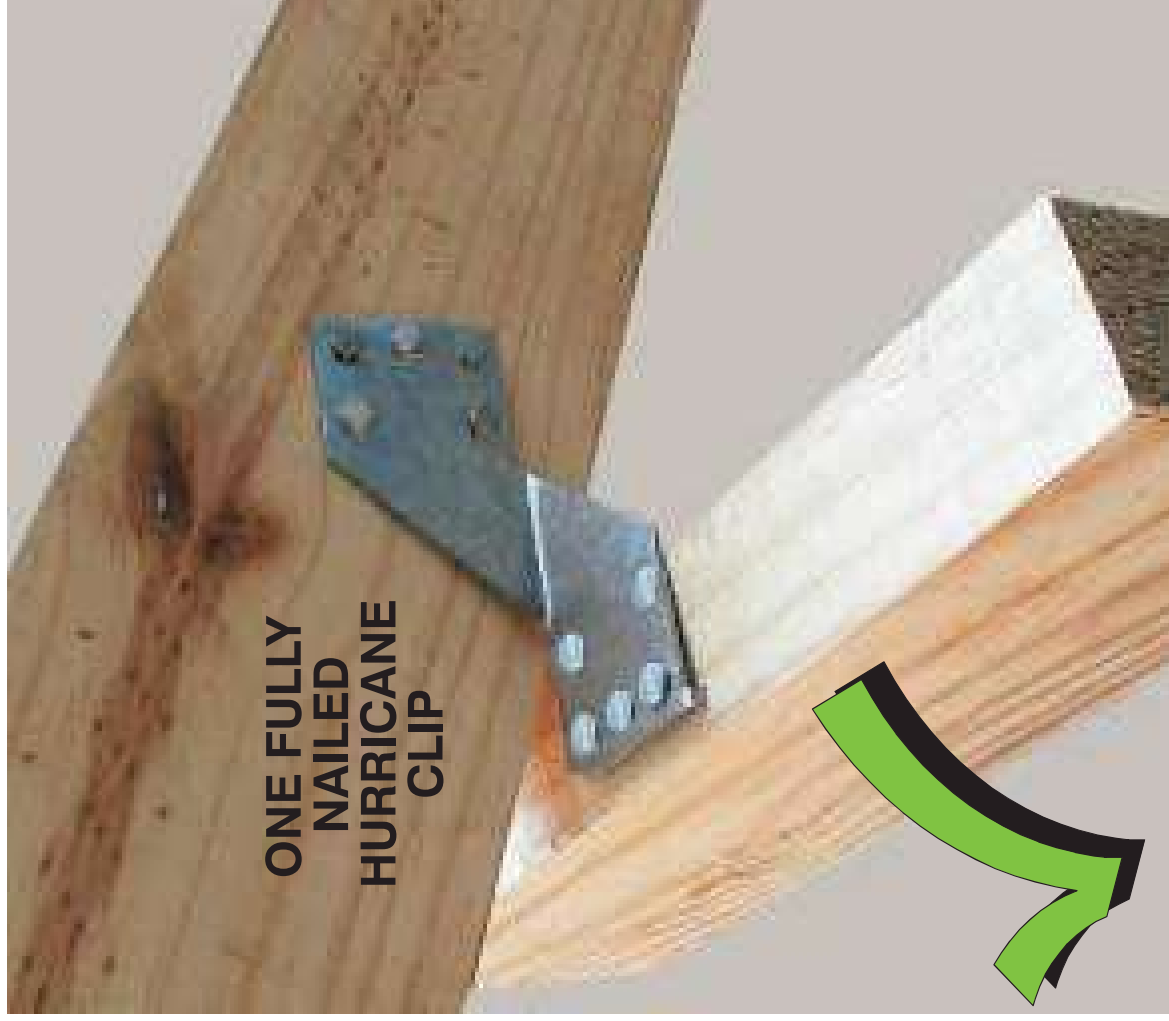
TRUNCATED HIP - FLY RAFTER CONNECTIONS



FLYING RAFTER TO MULTIPLE-PLY TRUNCATED (FLAT) TOP CHORD



FIXING OF FLYING RAFTER TO TRUNCATED (FLAT) TOP CHORD



FIXING OF FLYING RAFTER TO TRUNCATED (FLAT) TOP CHORD

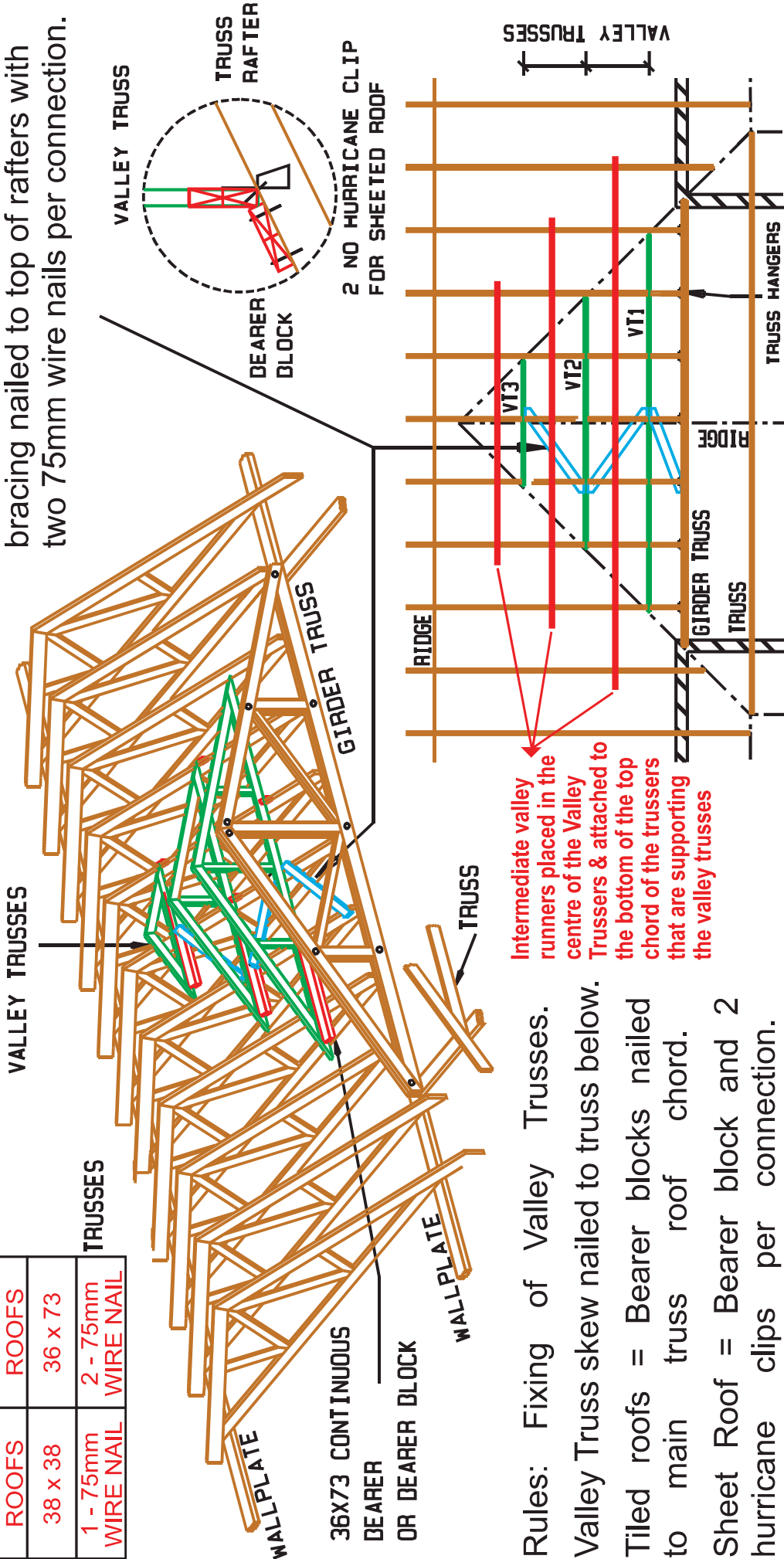


VALLEY FIXING DETAILS

IMPORTANT! INTERMEDIATE VALLEY RUNNERS NEED TO BE INSTALLED WHEN THE VALLEY TRUSS SPACING EXCEEDS THE BATTEN OR PURLIN SPACING

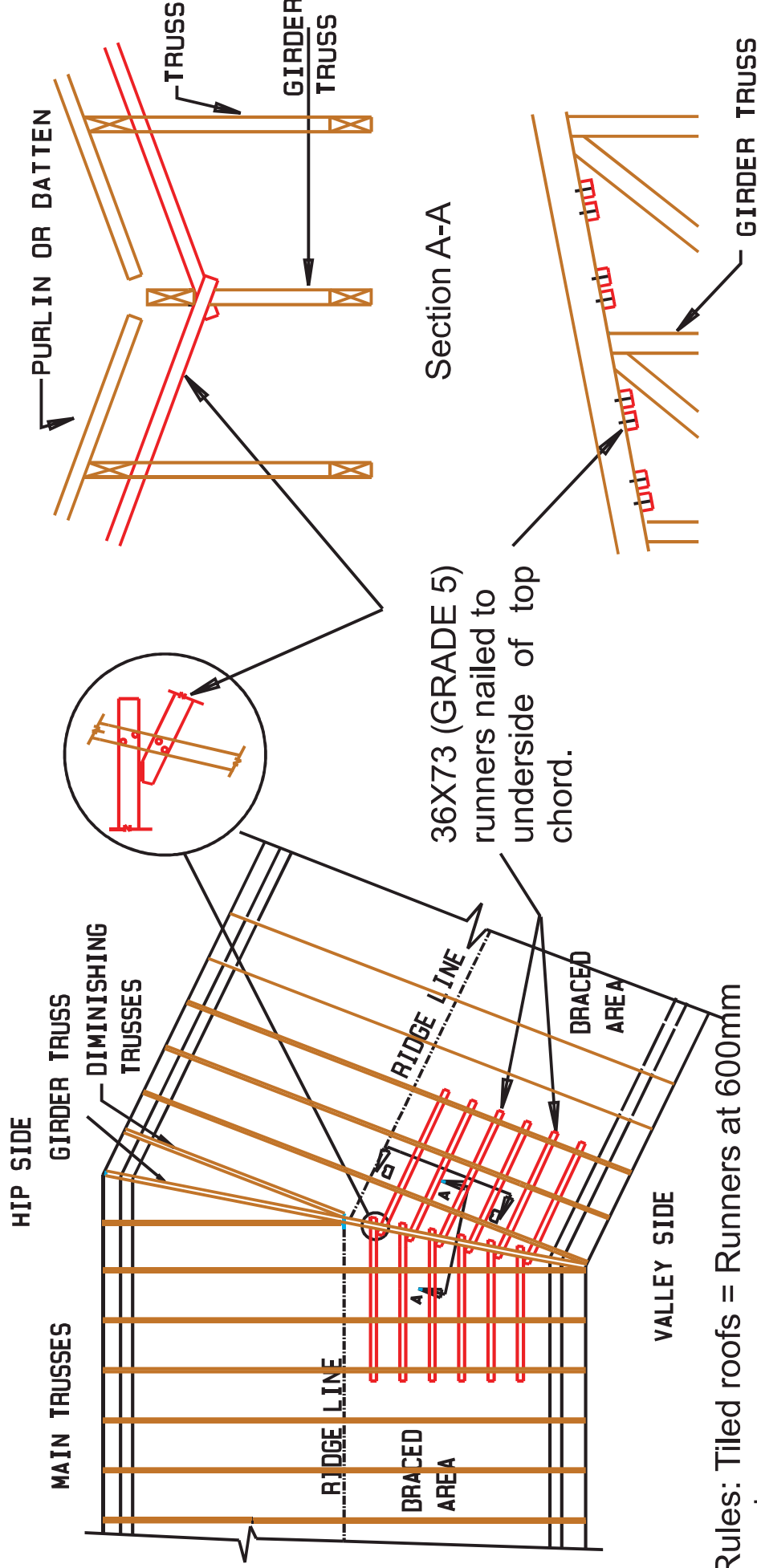
INTERMEDIATE VALLEY RUNNER SIZE / NAILING		
TILED ROOFS	SHEETED ROOFS	
38 x 38	36 x 73	
1 - 75mm WIRE NAIL	2 - 75mm WIRE NAIL	

36X73 (GRADE 5) “ZIG-ZAG” rafter bracing nailed to top of rafters with two 75mm wire nails per connection.



Rules: Fixing of Valley Trusses.
Valley Truss skew nailed to truss below.
Tiled roofs = Bearer blocks nailed to main truss roof chord.
Sheet Roof = Bearer block and 2 hurricane clips per connection.

CRANK CORNER - TOP CHORD RESTRAINTS ON VALLEY SIDE

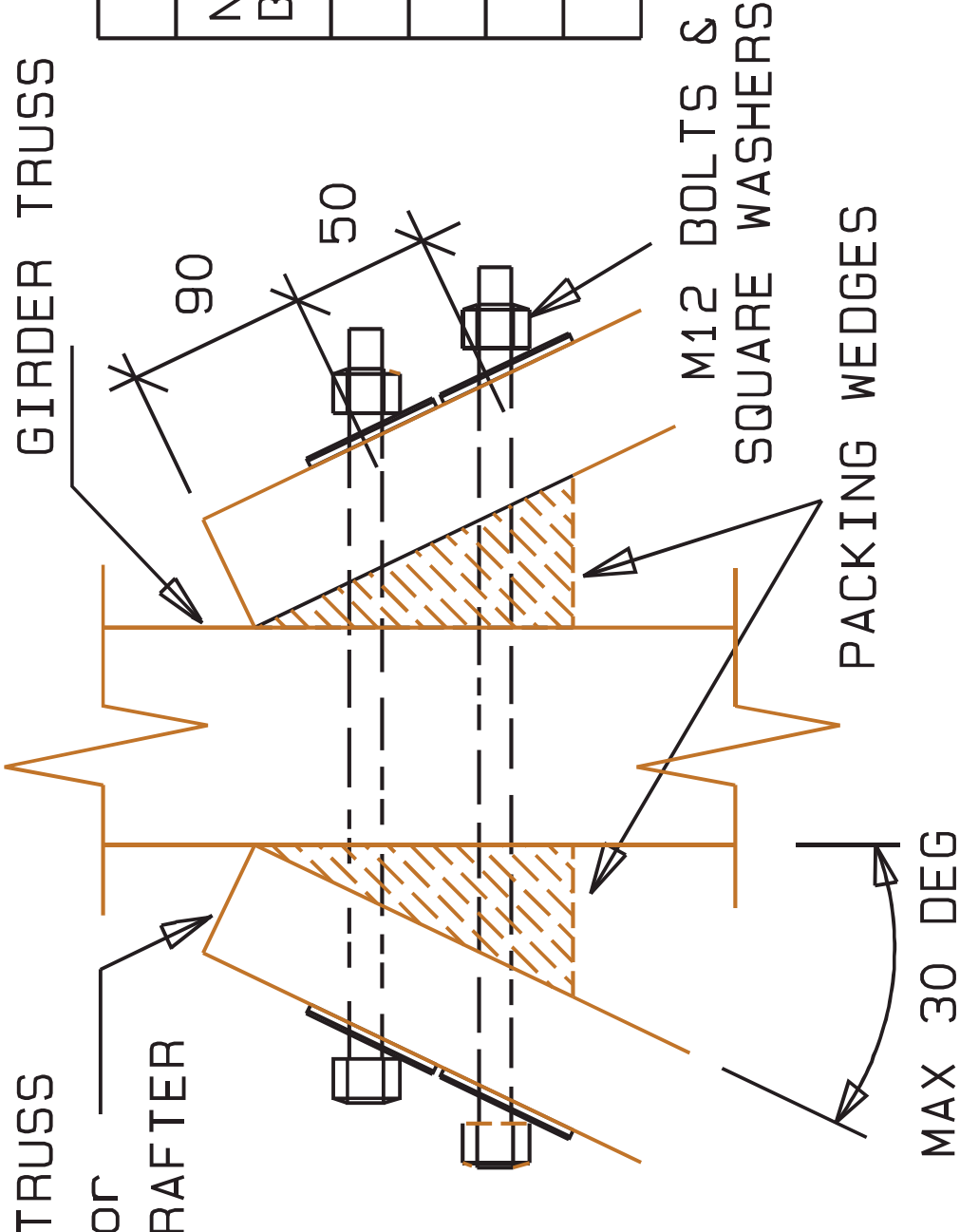


Rules: Tiled roofs = Runners at 600mm spacing.

Sheet roof = Runners at 1200mm spacing.

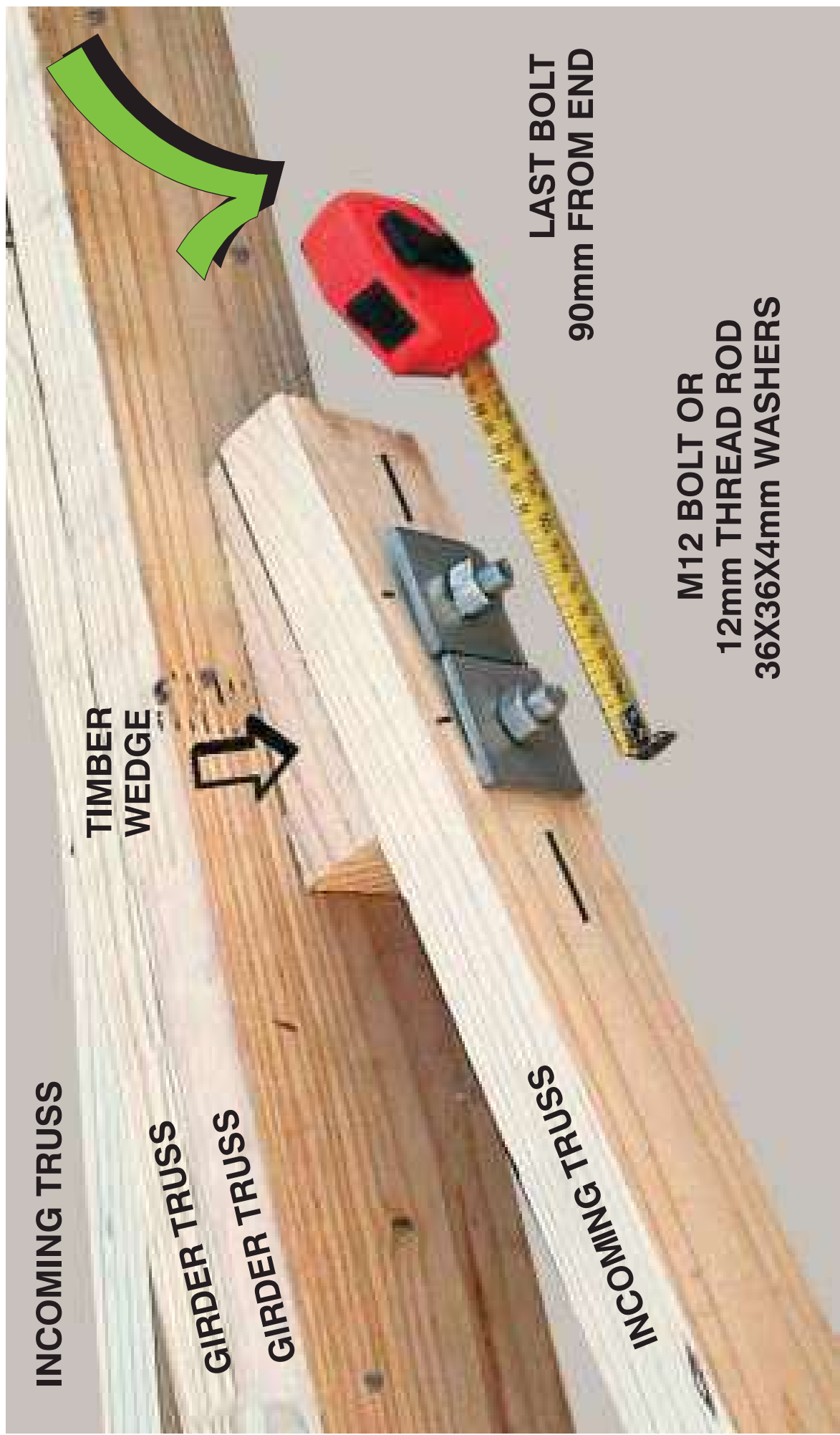
Each runner over THREE trusses.

CRANK TRUSS TO GIRDER CONNECTION



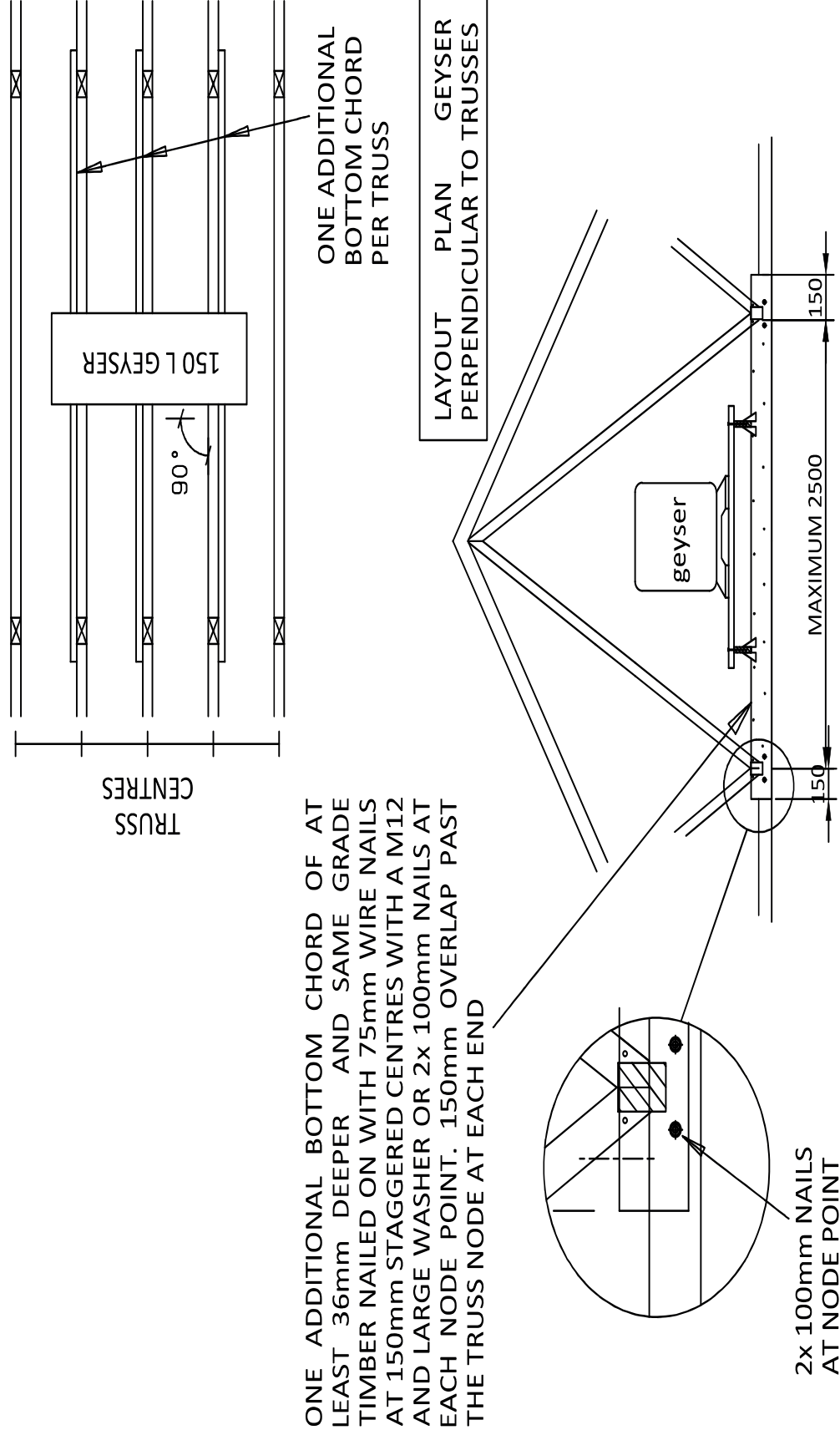
MAXIMUM TOTAL LOAD		
NO: OF BOLTS	NO: OF PLIES	FORCE IN (KN)
1	1	1.7
2	1	3.4
1	2	3.4
2	2	6.8

TRUSS BOLTING TO HIP/VALLEY GIRDER - CRANKED BUILDING



GEYSER PLATFORM DETAILS - UP TO 150 Litre GEYSERS ONLY

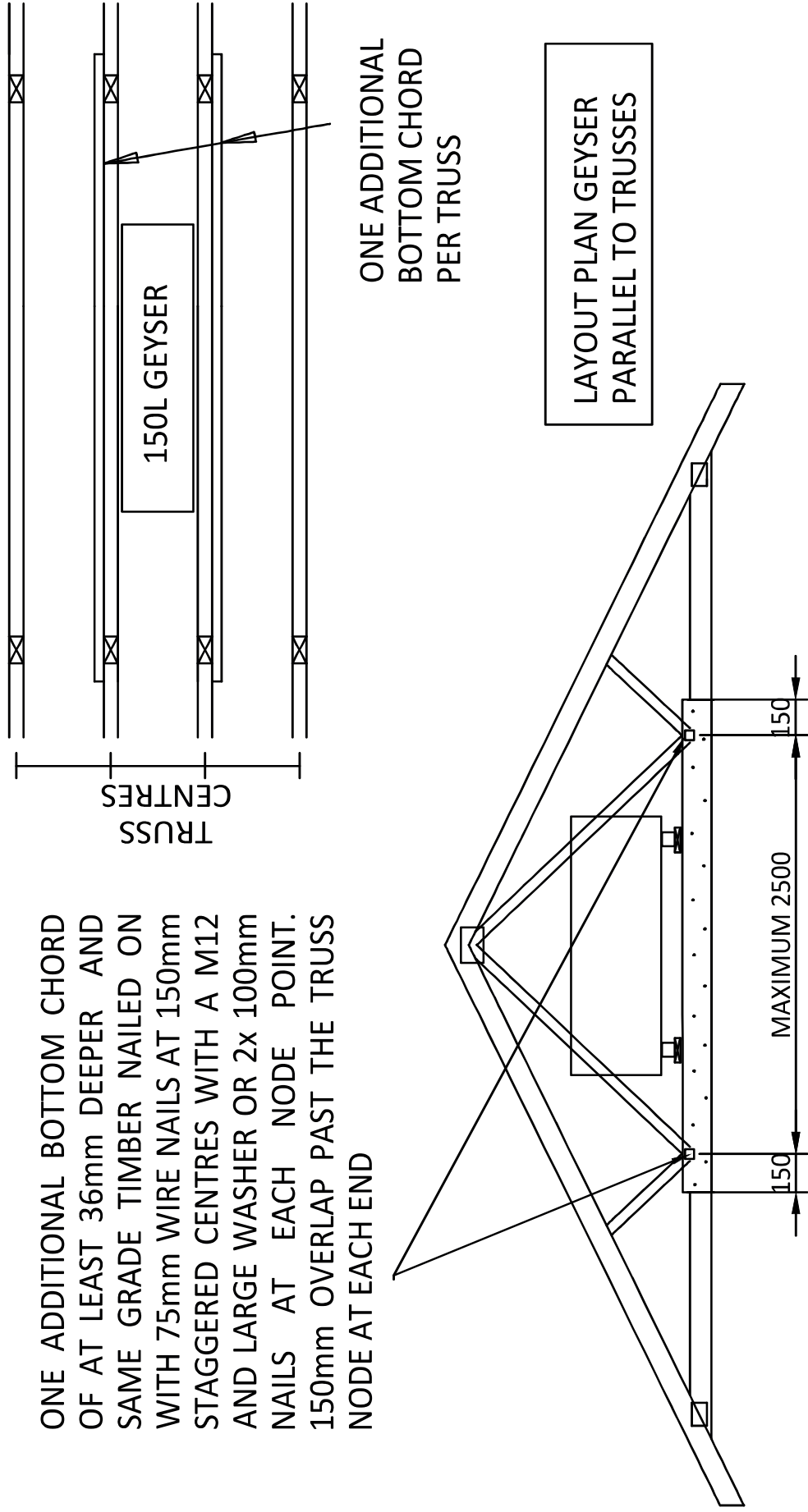
- UP TO 8.0m SPAN TRUSSES ONLY



Rule: Avoid supporting Geyser on trusses.
Whenever possible use internal walls.

GEYSER PLATFORM DETAILS - UP TO 150 Litre GEYSERS ONLY

- UP TO 8.0m SPAN TRUSSES ONLY



GEYSER SUPPORT DECK FOR GEYSERS UP TO 150 LITRES SUPPORTED ON TRUSSES

PART THREE - BRACING SYSTEMS

The roof is not complete without the correct bracing.

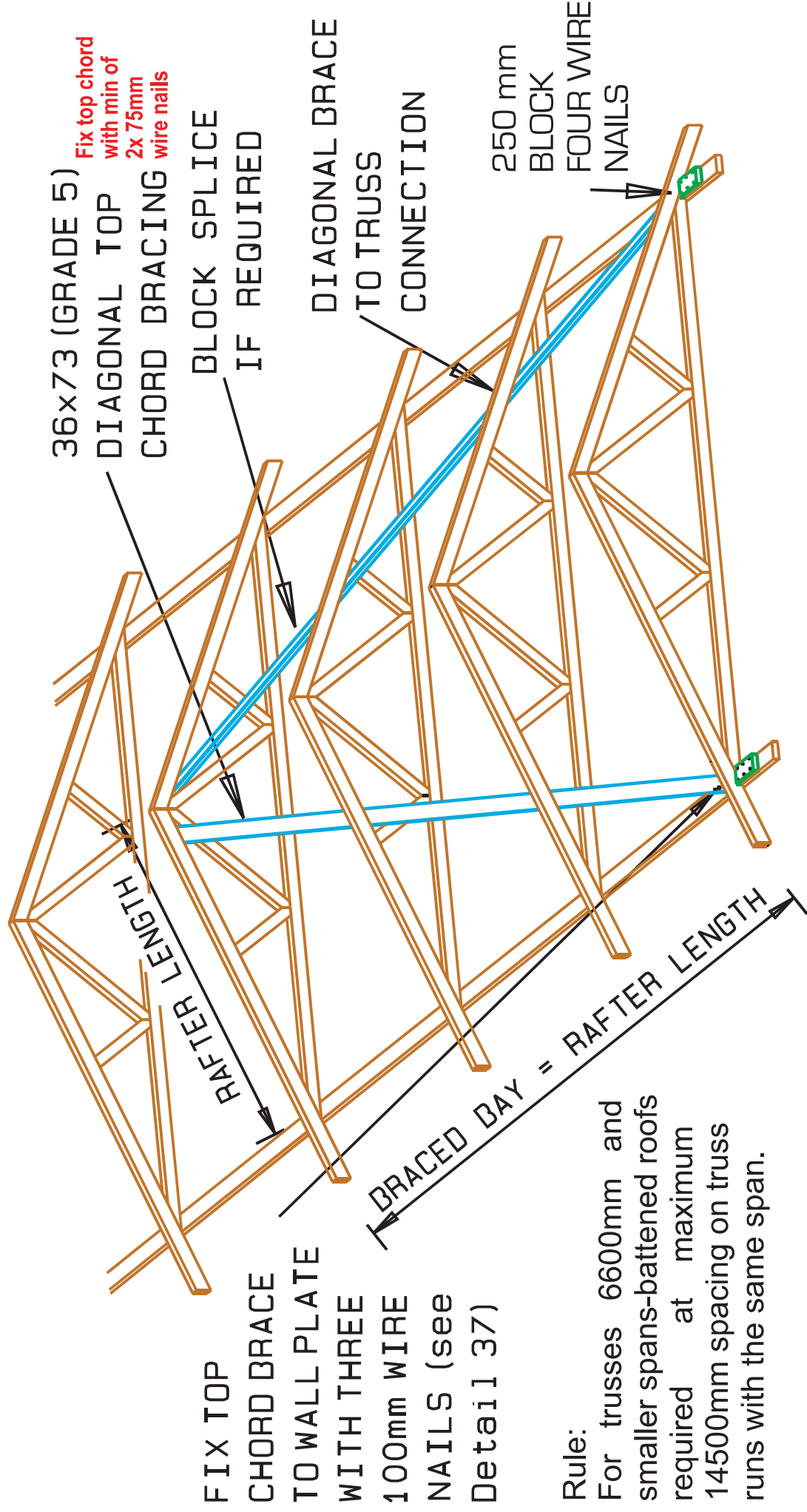
All parts of the bracing must be installed, if any part is missing or incorrect, then none of the bracing works.

All bracing connections to be built as shown in Part One.

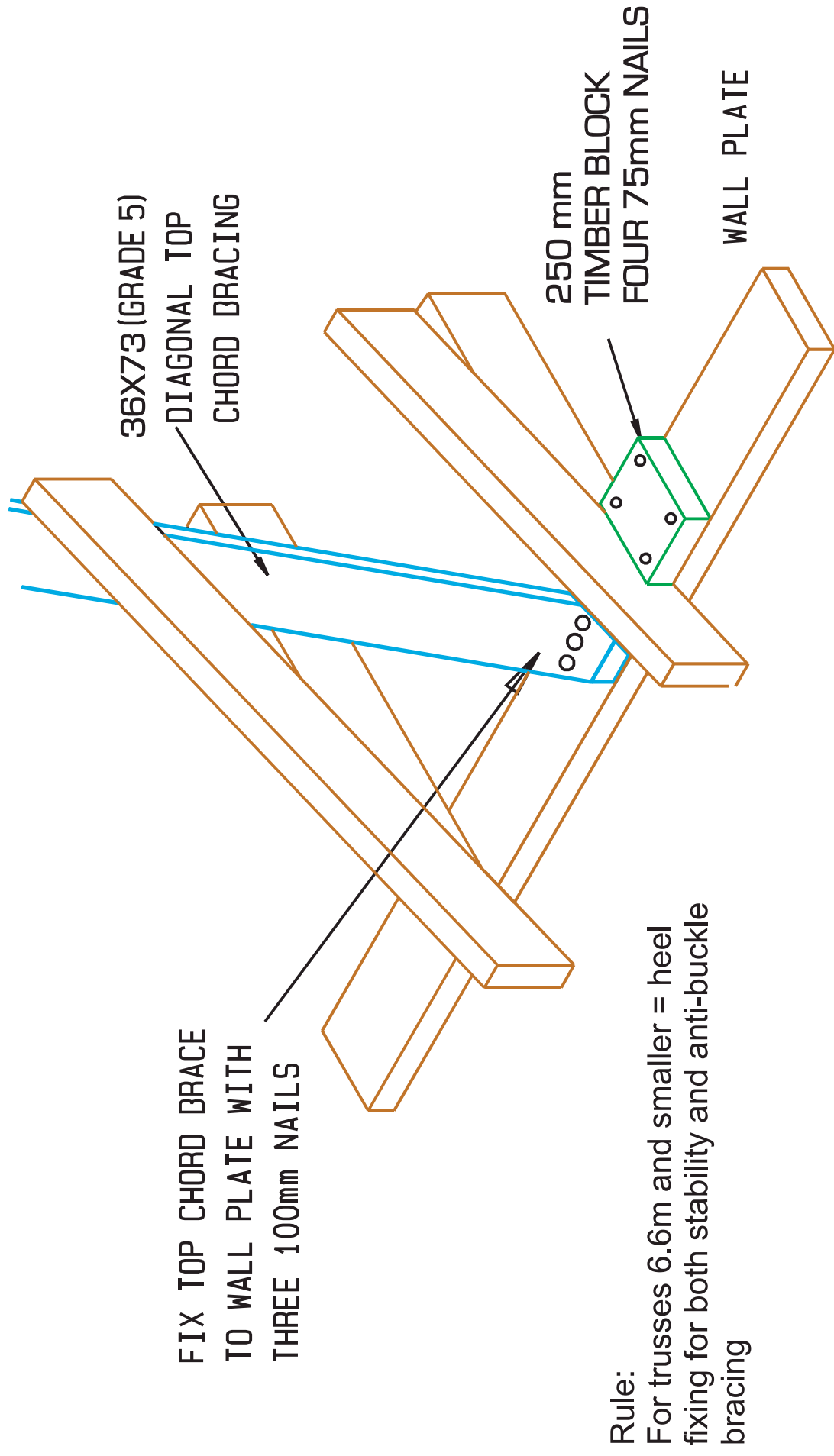
The trusses must be straight and plumb before the bracing parts are fixed.

All bracing must be fixed before any roof covering, ceilings or other loads are put onto the roof structure.

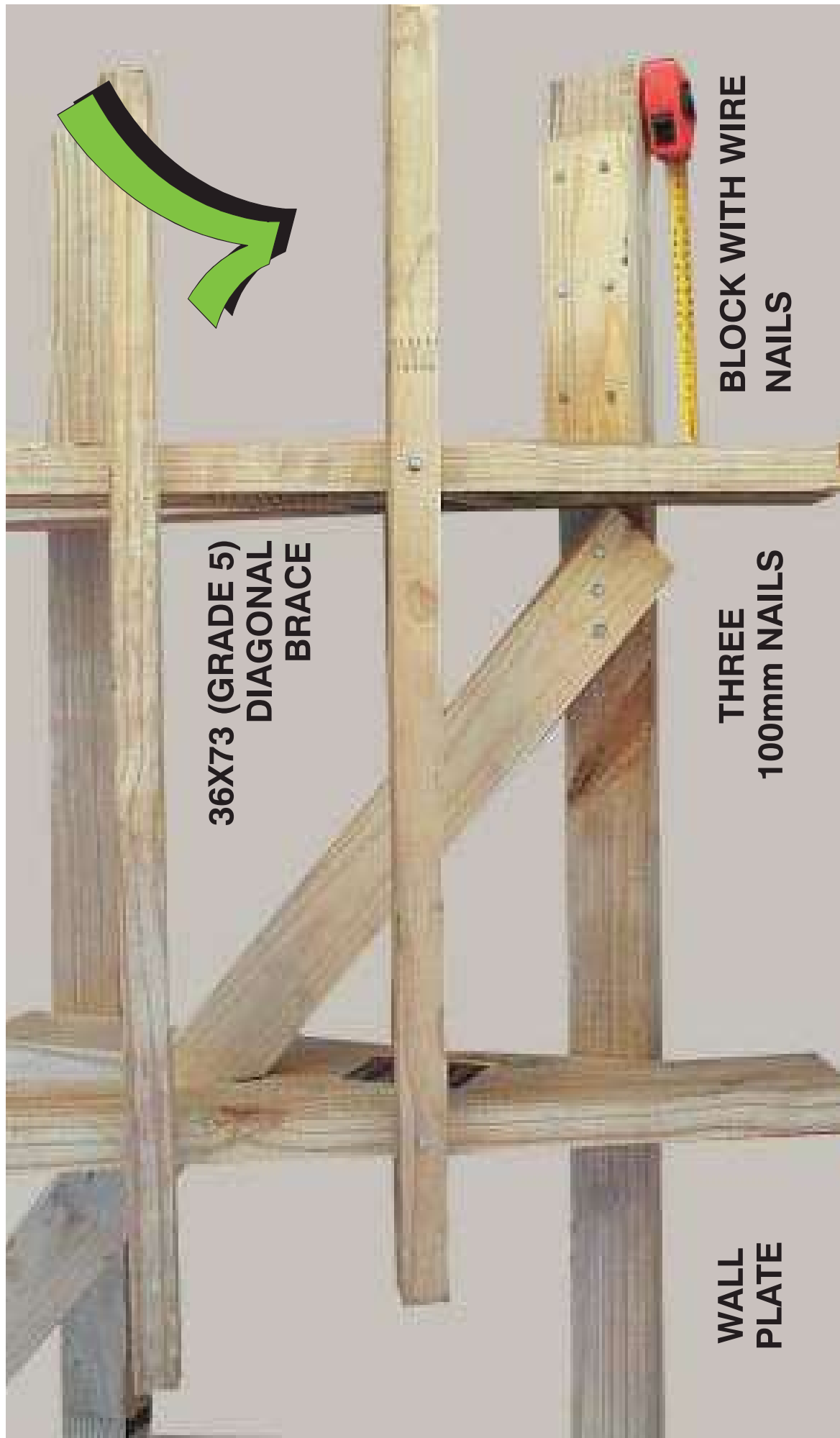
TOP CHORD STABILITY & ANTI-BUCKLE BRACING BATTENED ROOFS - 6.6m & SMALLER



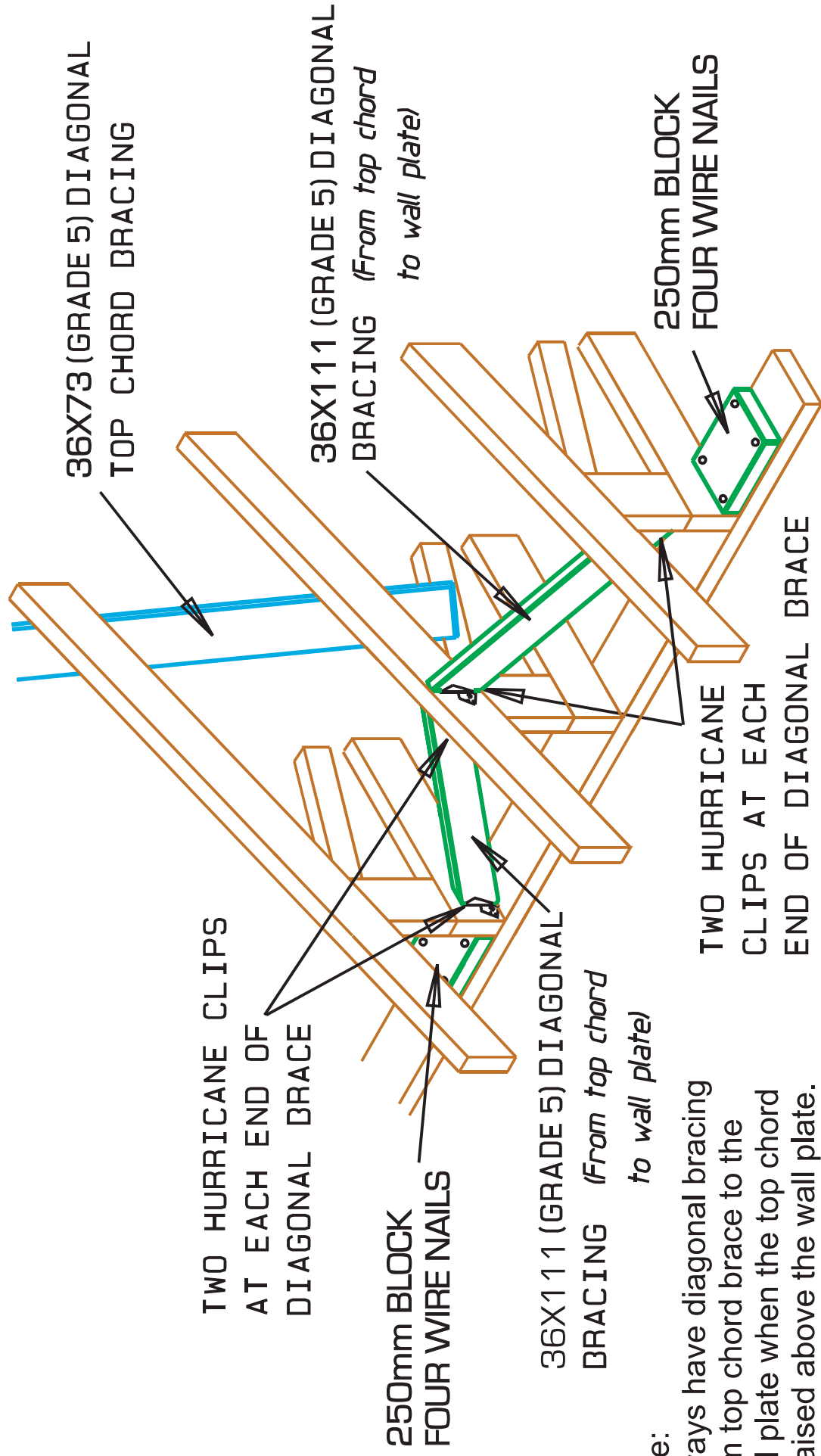
TOP CHORD BRACING - BATTENED ROOFS 6.6m SPAN & SMALLER



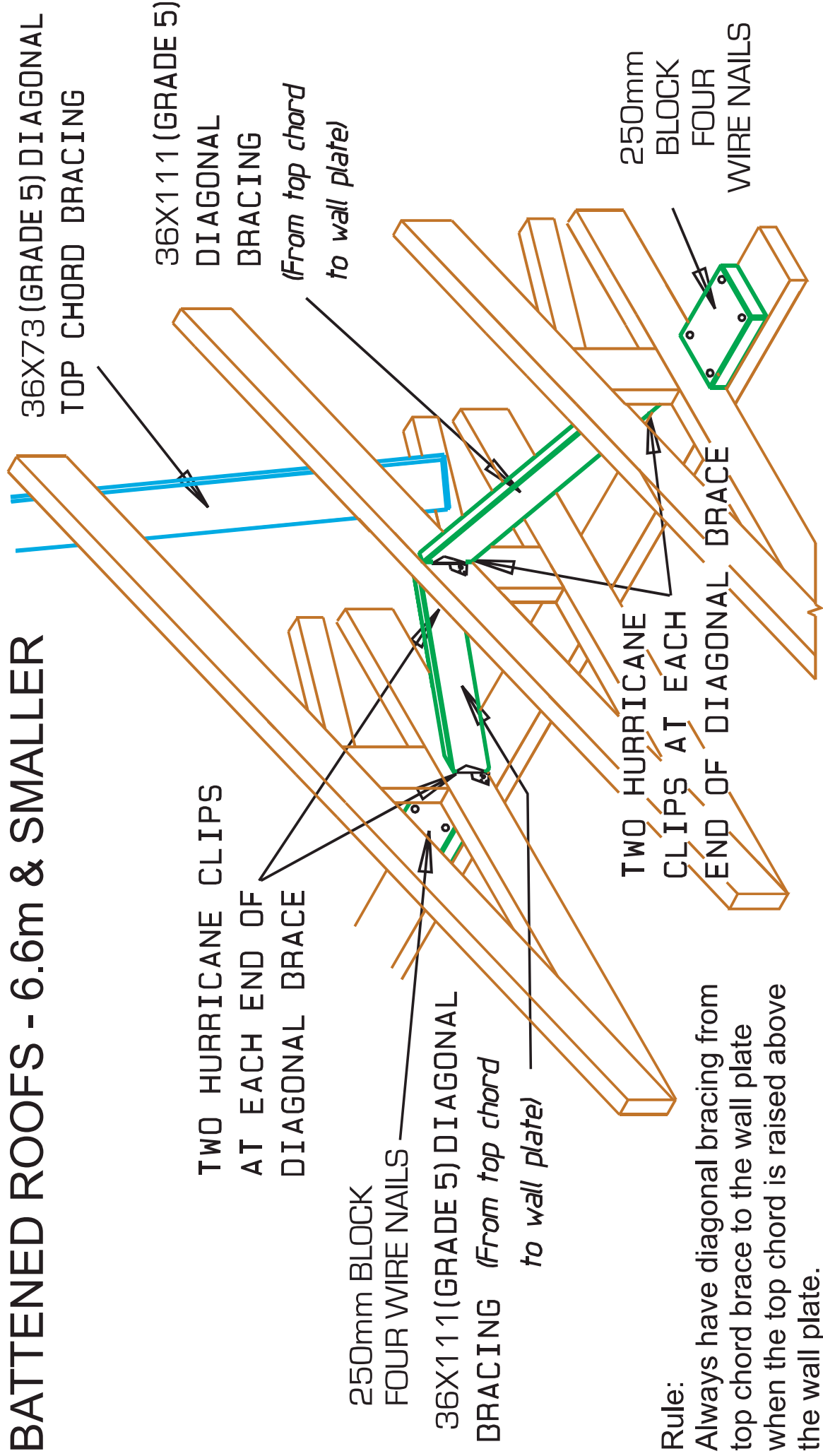
TOP CHORD BRACING AT WALL PLATE - 6.6m & SMALLER SPAN



TOP CHORD BRACING - STUB HEEL BATTENED ROOFS - 6.6m SPAN & SMALLER

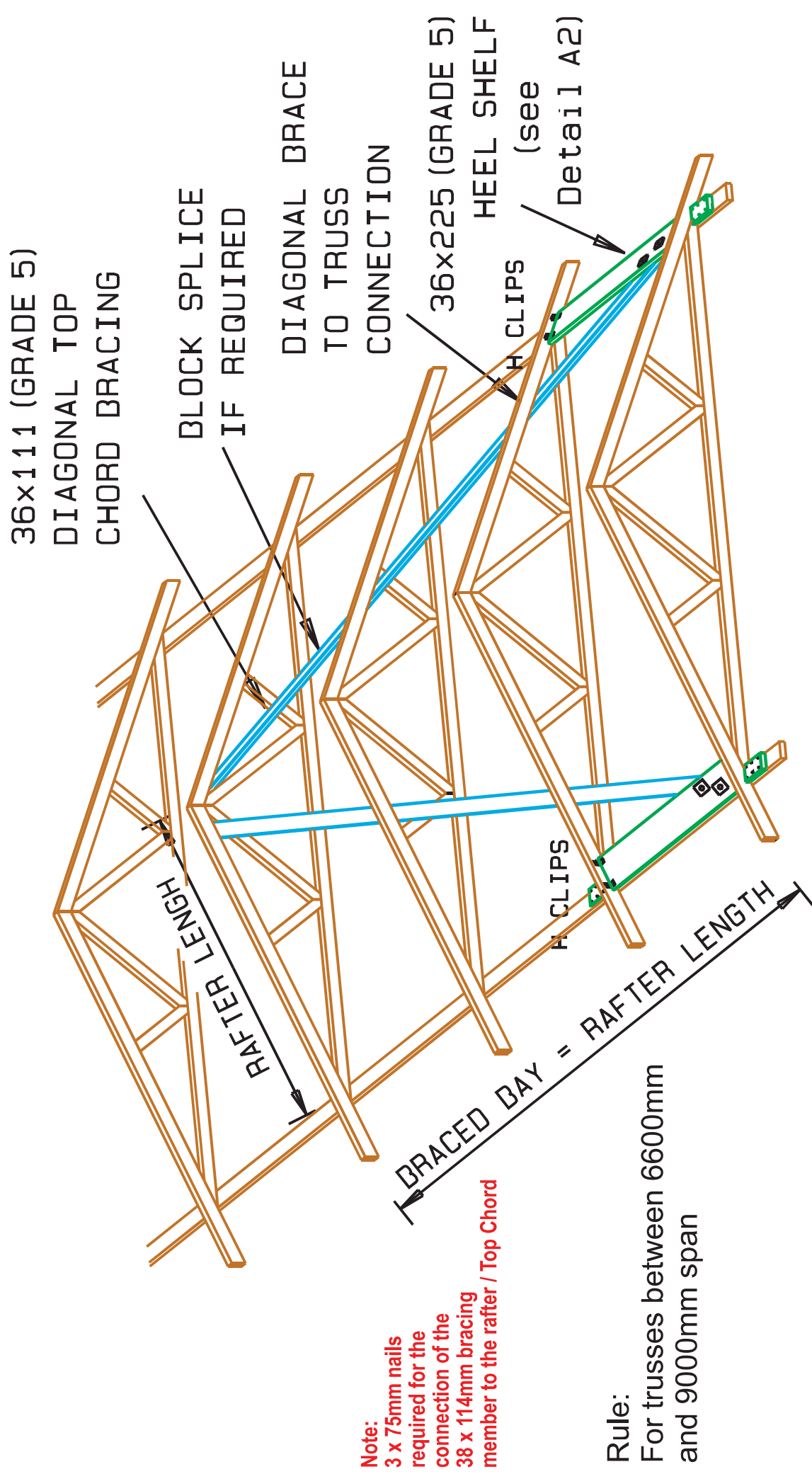


TOP CHORD BRACING - CANTILEVER HEEL BATTENED ROOFS - 6.6m & SMALLER

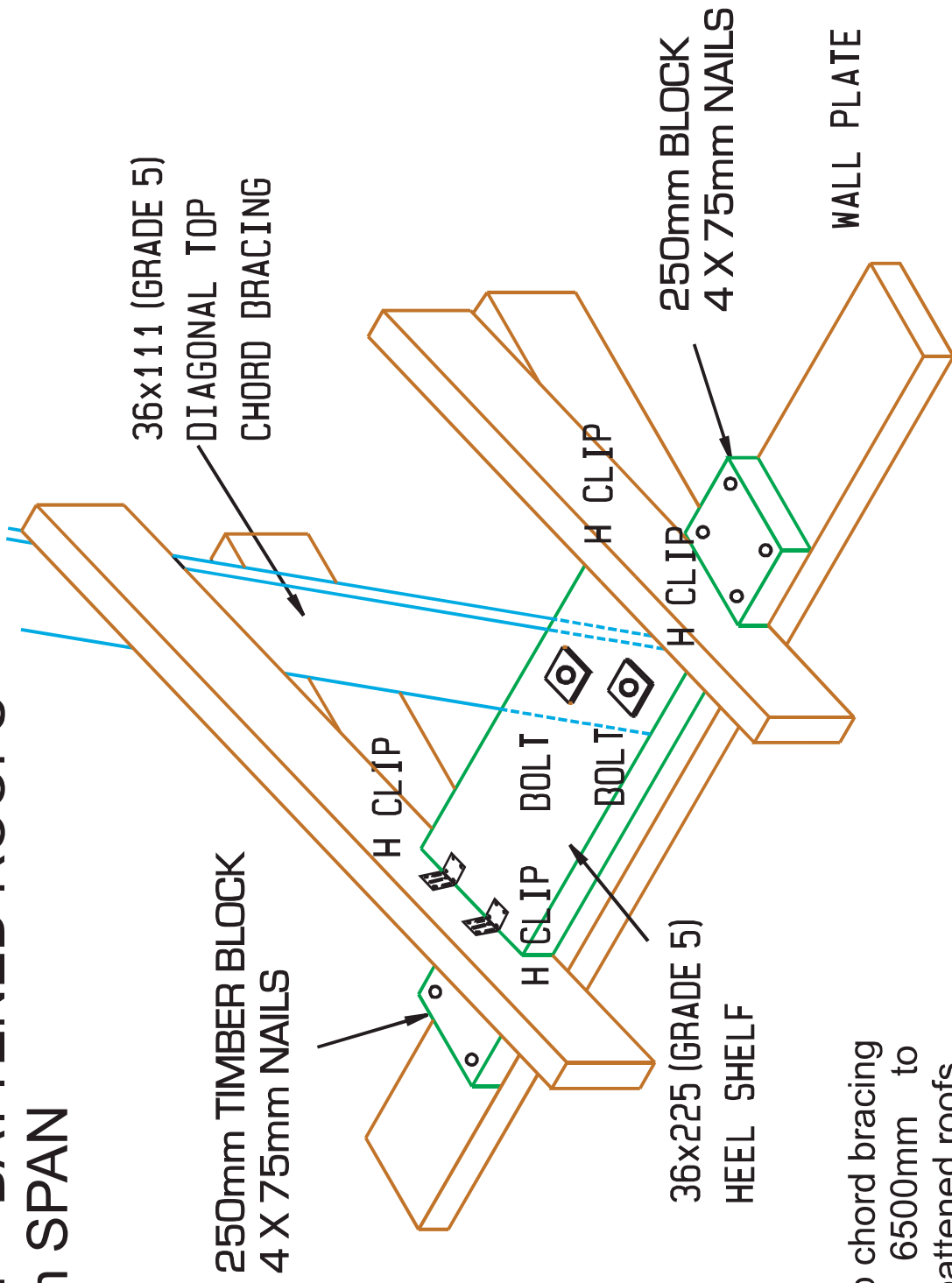


TOP CHORD BRACING - BATTENED ROOFS

6.6m to 9.0m SPAN

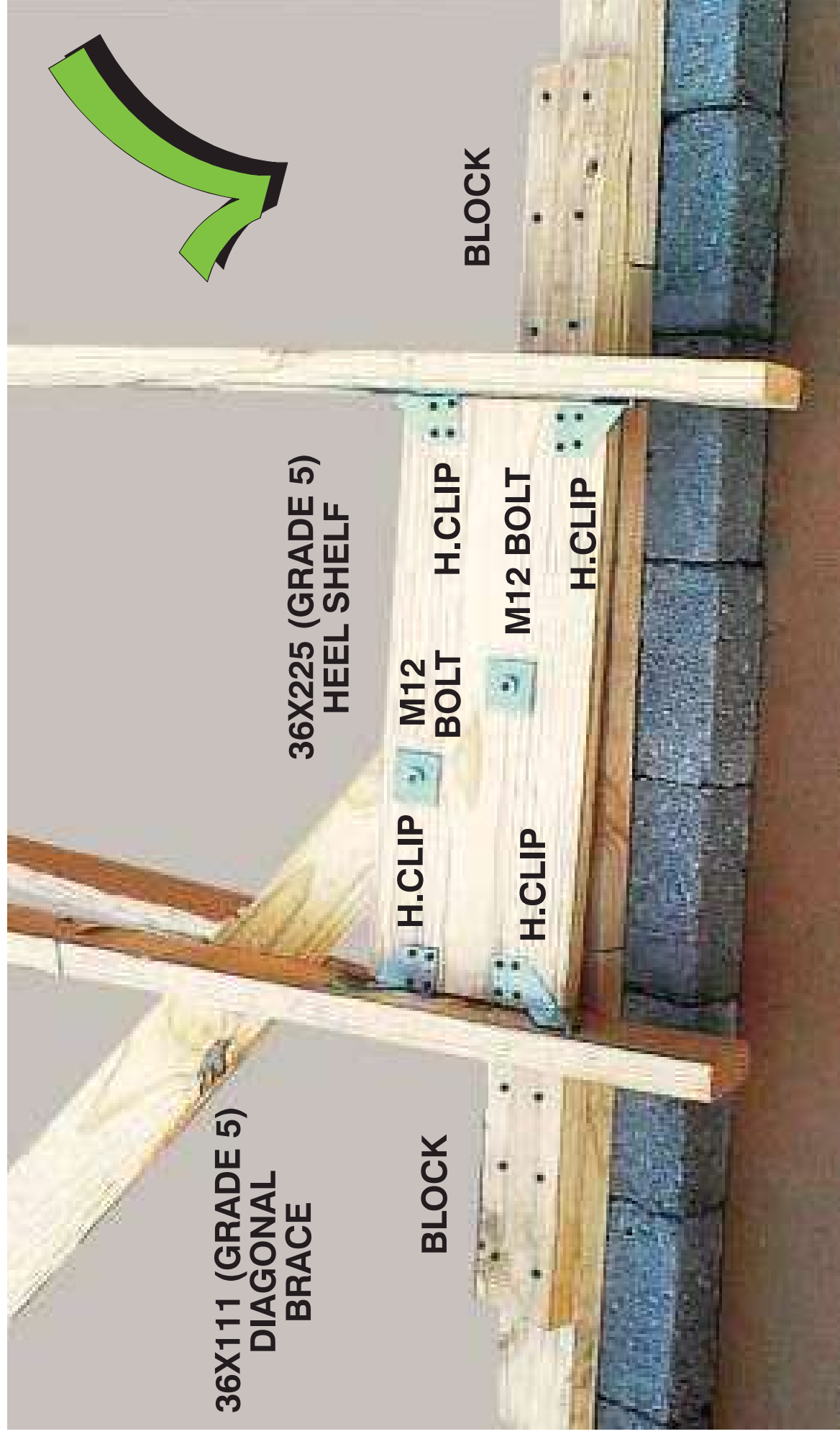


HEEL SHELF - BATTENED ROOFS 6.6m to 9.0m SPAN

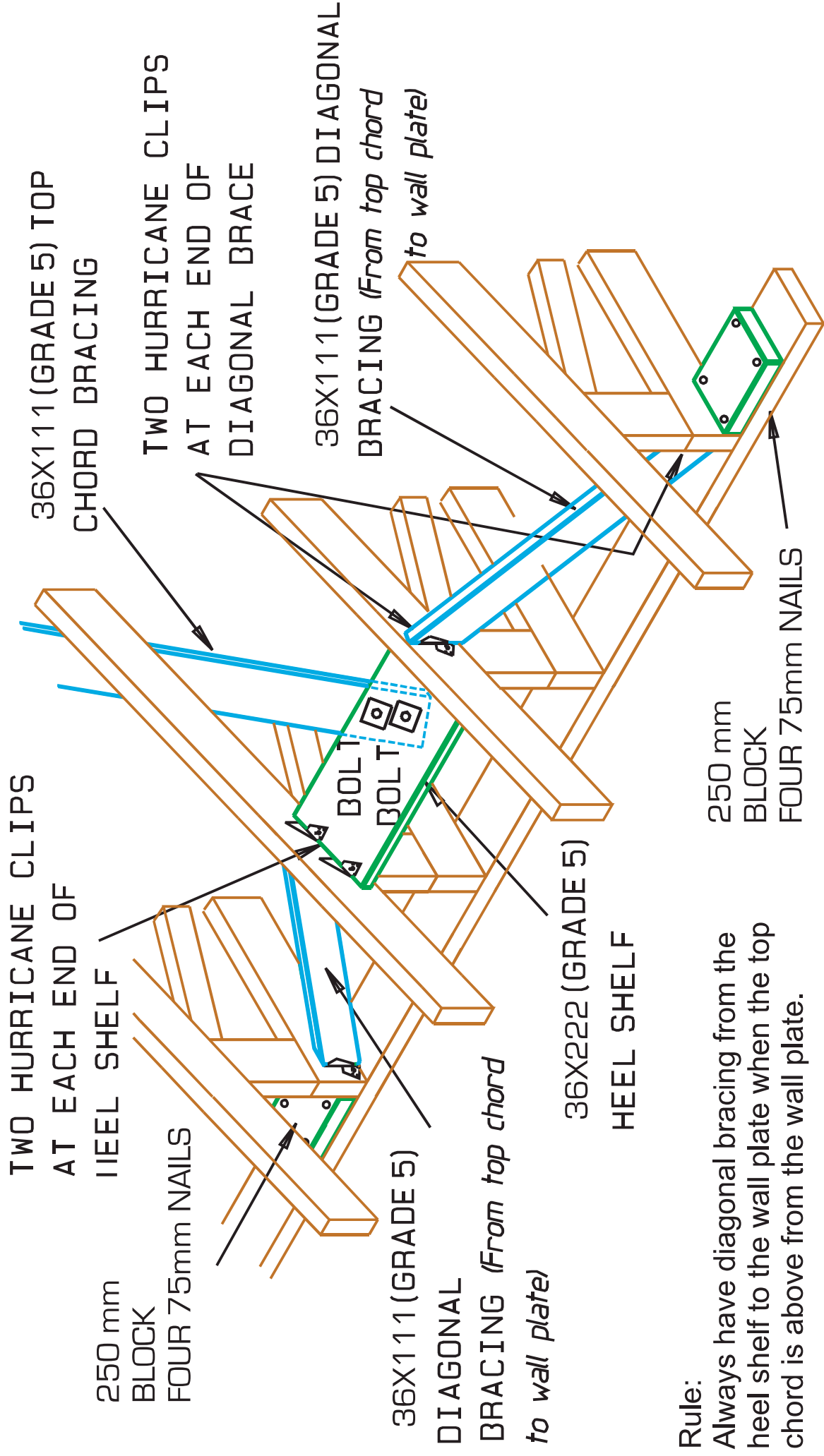


Rule:
Required on all top chord bracing
of trusses with 6500mm to
9000mm spans - batted roofs .

HEEL SHELF - BATTENED ROOFS - 6.6m to 9.0m SPAN

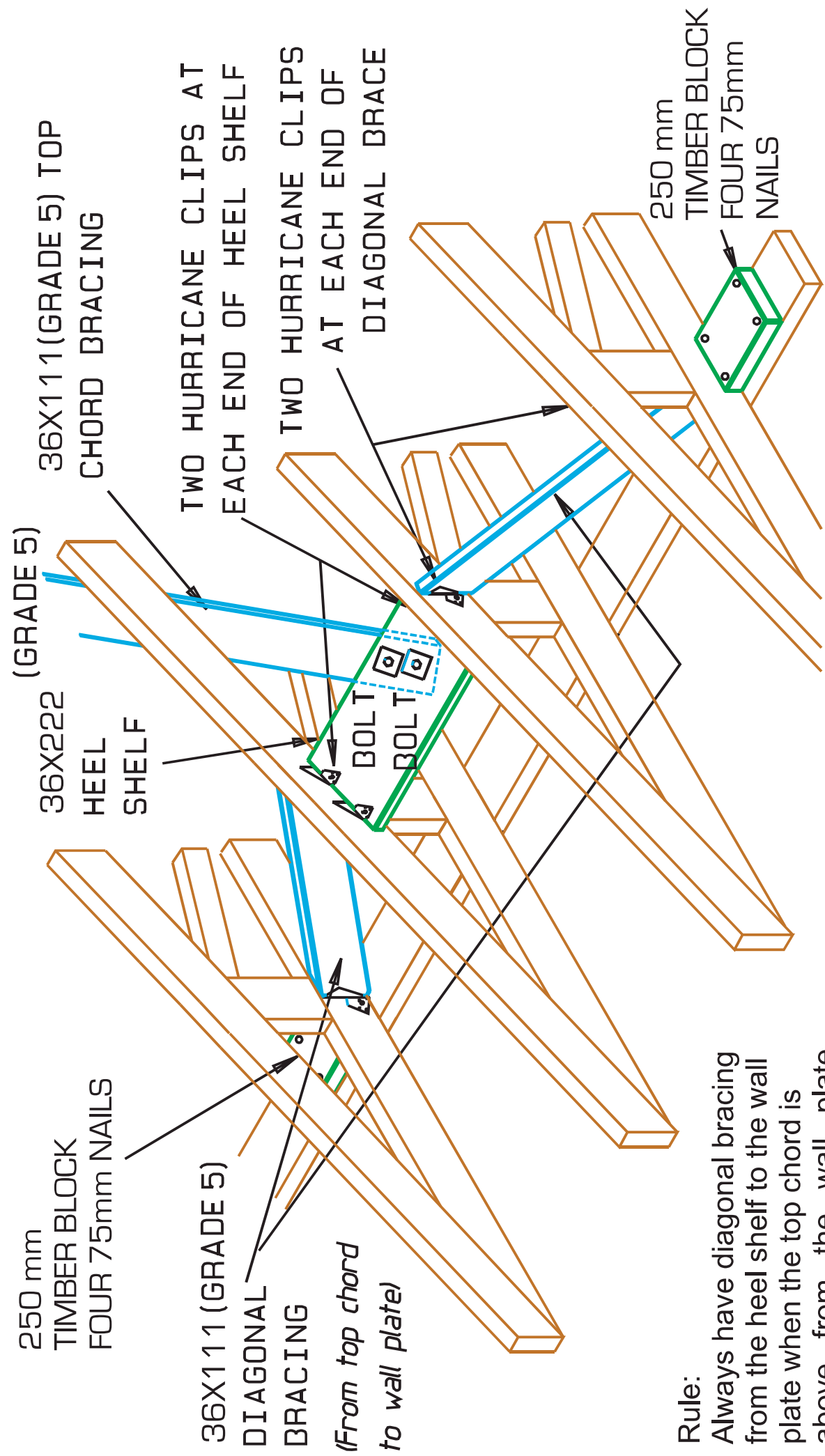


STUB HEEL SHELF - BATTENED ROOFS 6.6m to 9.0m SPAN



Rule:
Always have diagonal bracing from the heel shelf to the wall plate when the top chord is above from the wall plate.

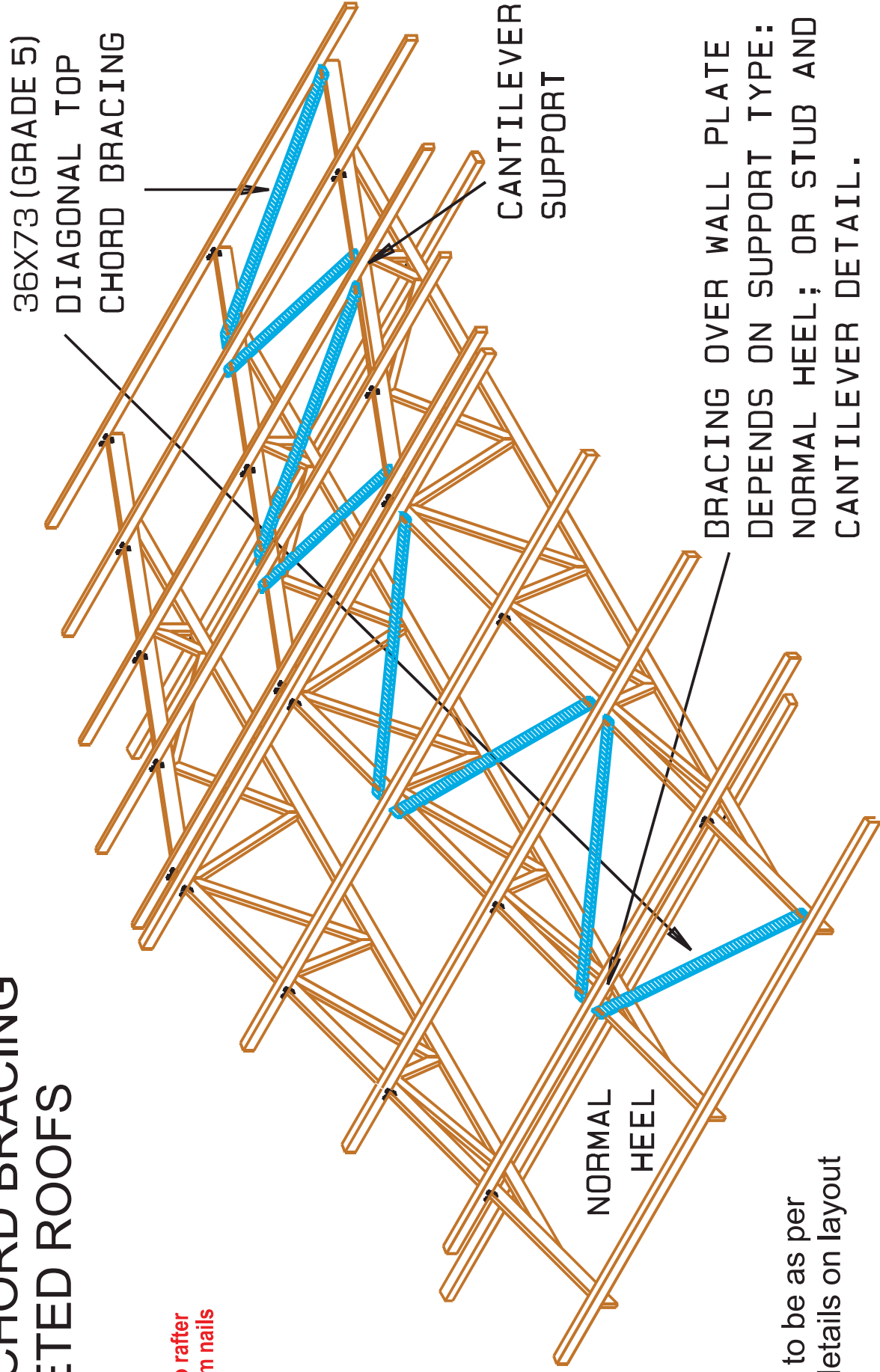
CANTILEVER HEEL SHELF - BATTENED ROOFS - 6.6m to 9.0m SPAN



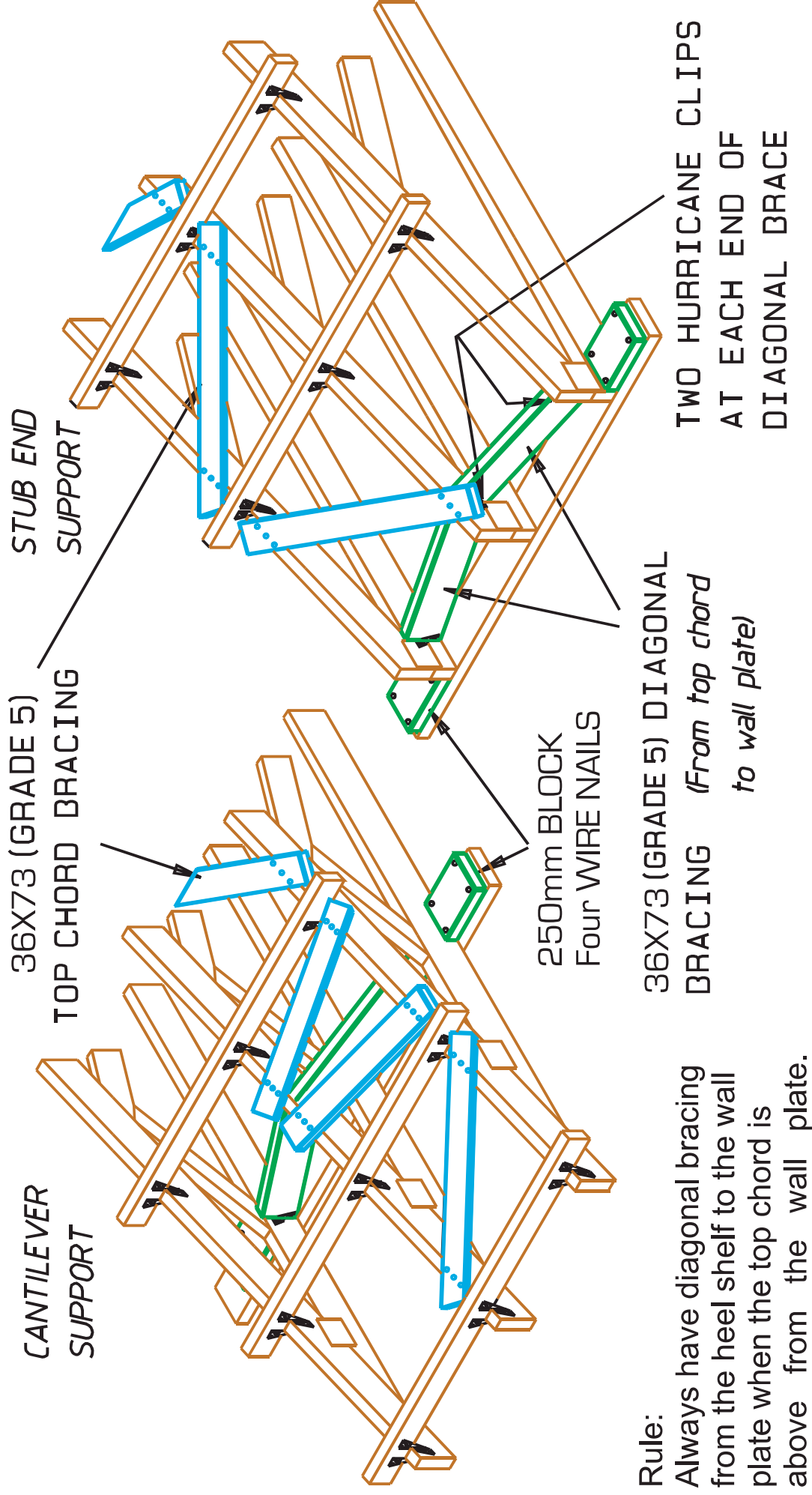
Rule:
Always have diagonal bracing from the heel shelf to the wall plate when the top chord is above from the wall plate.

TOP CHORD BRACING SHEETED ROOFS

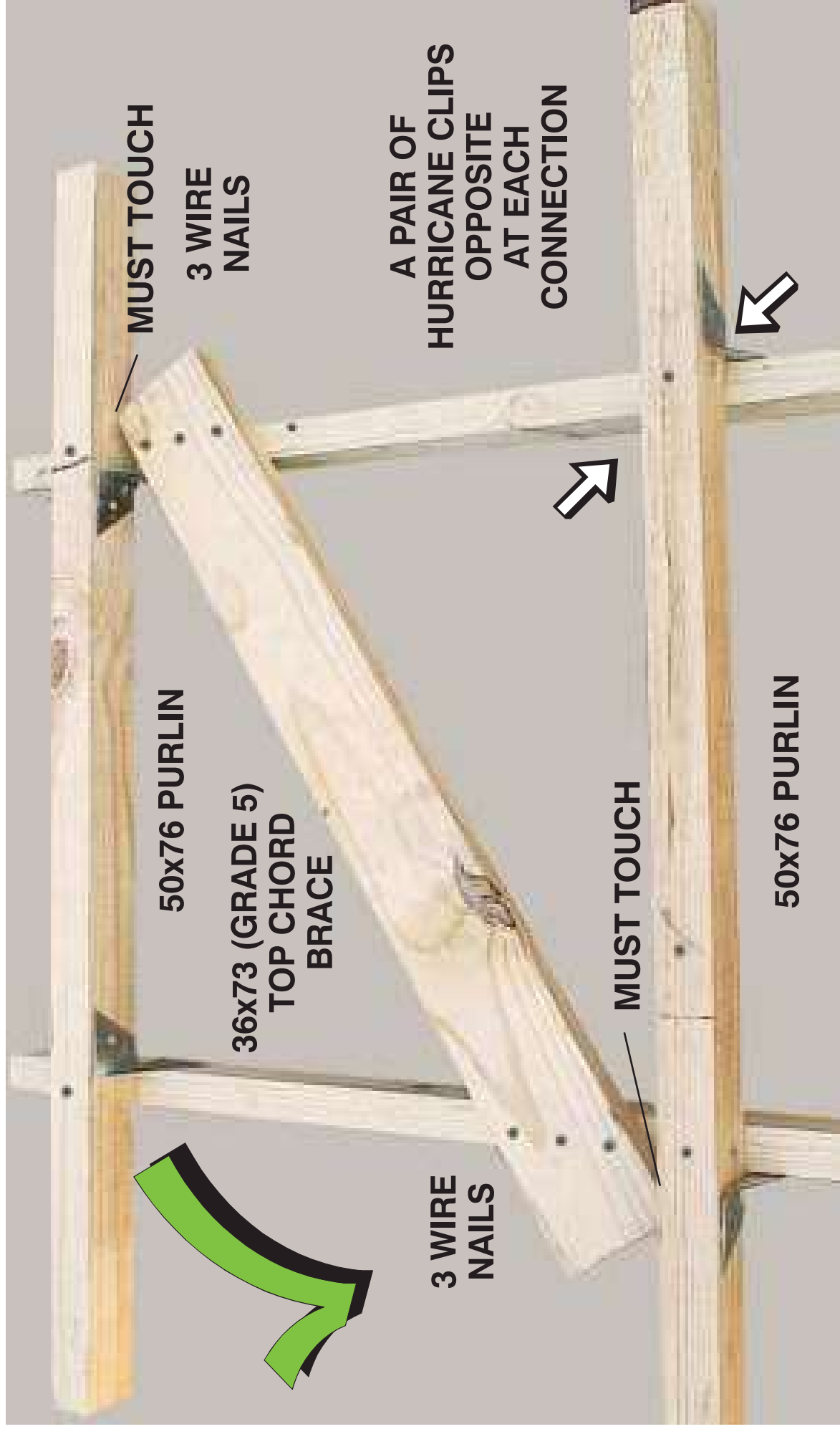
Note:
Connection to rafter
to be 3 x 75mm nails



CANTILEVER & STUB HEELS - SHEETED ROOFS

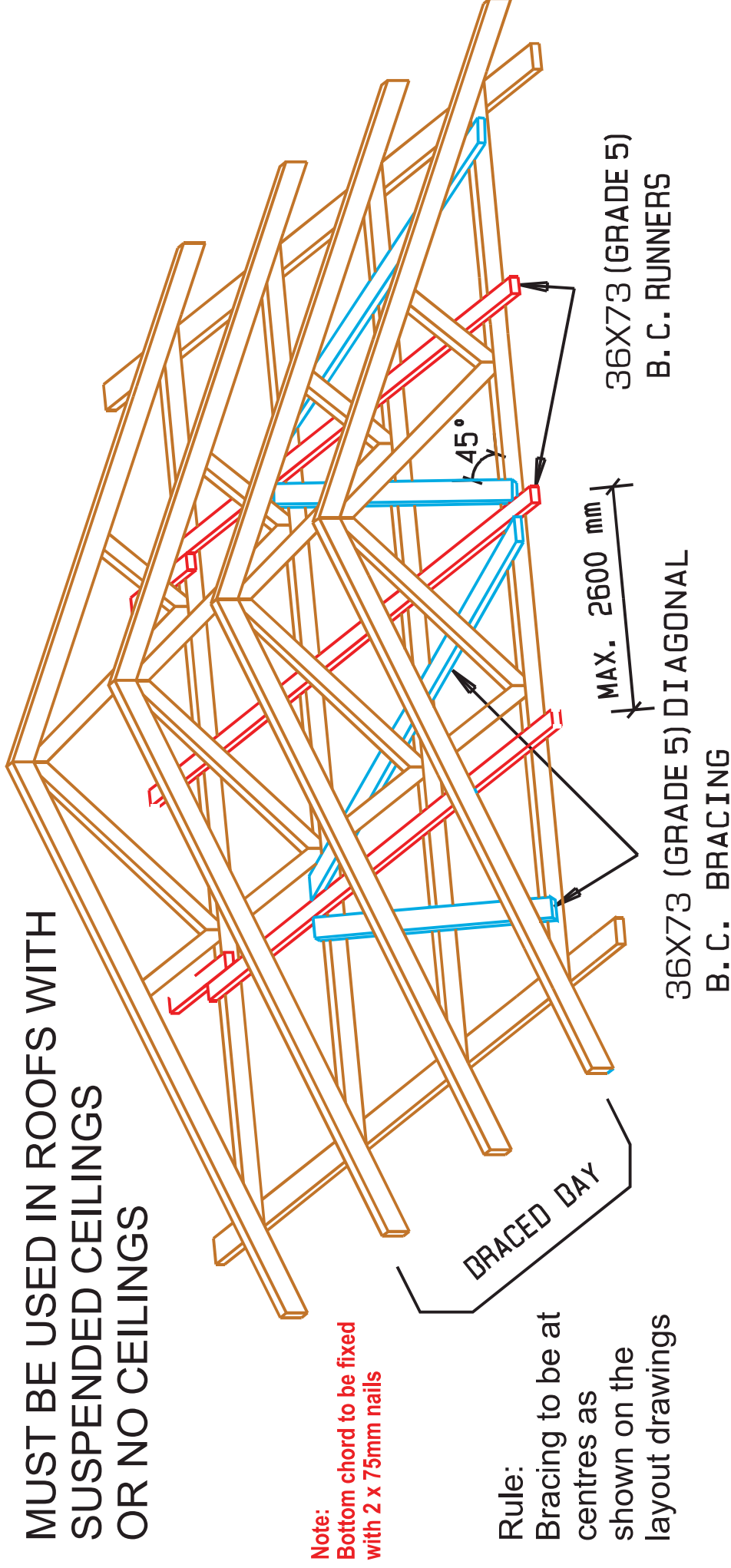


TOP CHORD BRACING FOR SHEETED ROOF



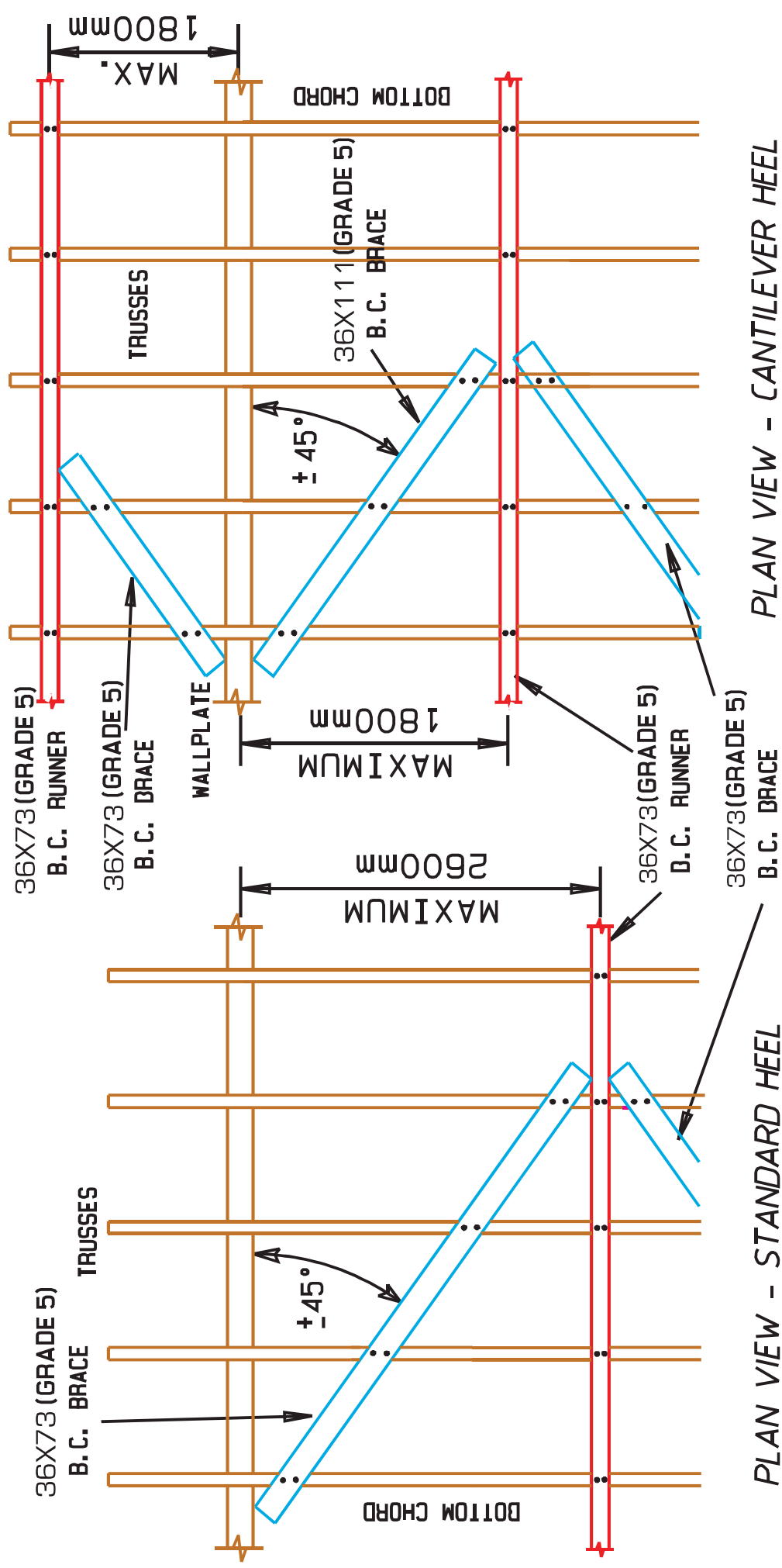
BOTTOM CHORD RUNNERS & BRACING

MUST BE USED IN ROOFS WITH
SUSPENDED CEILINGS
OR NO CEILINGS

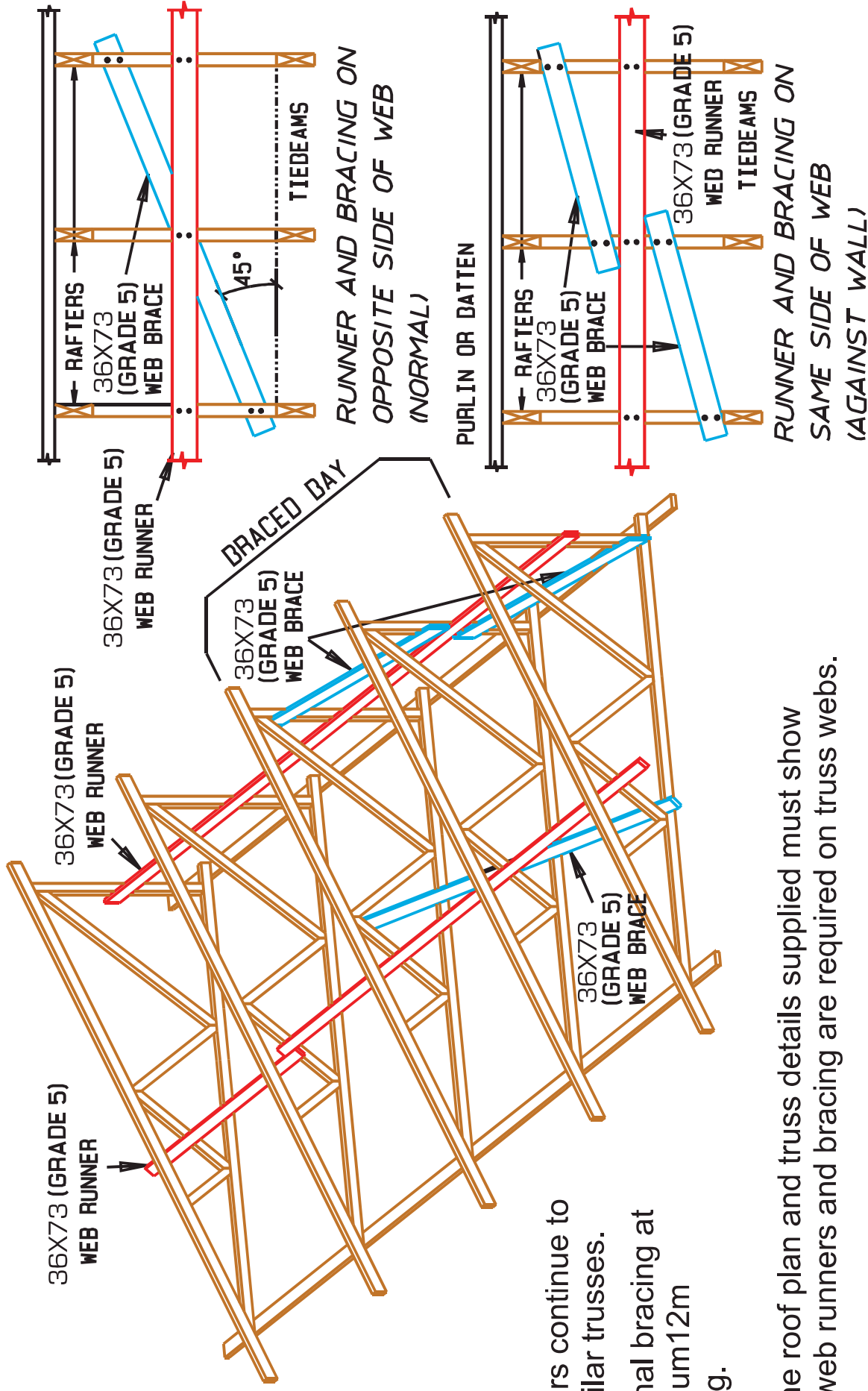


NB! The roof plan and truss details supplied must show when and where bottom chord runners and bracing are required for trusses.

BOTTOM CHORD RUNNERS & DIAGONAL BRACING



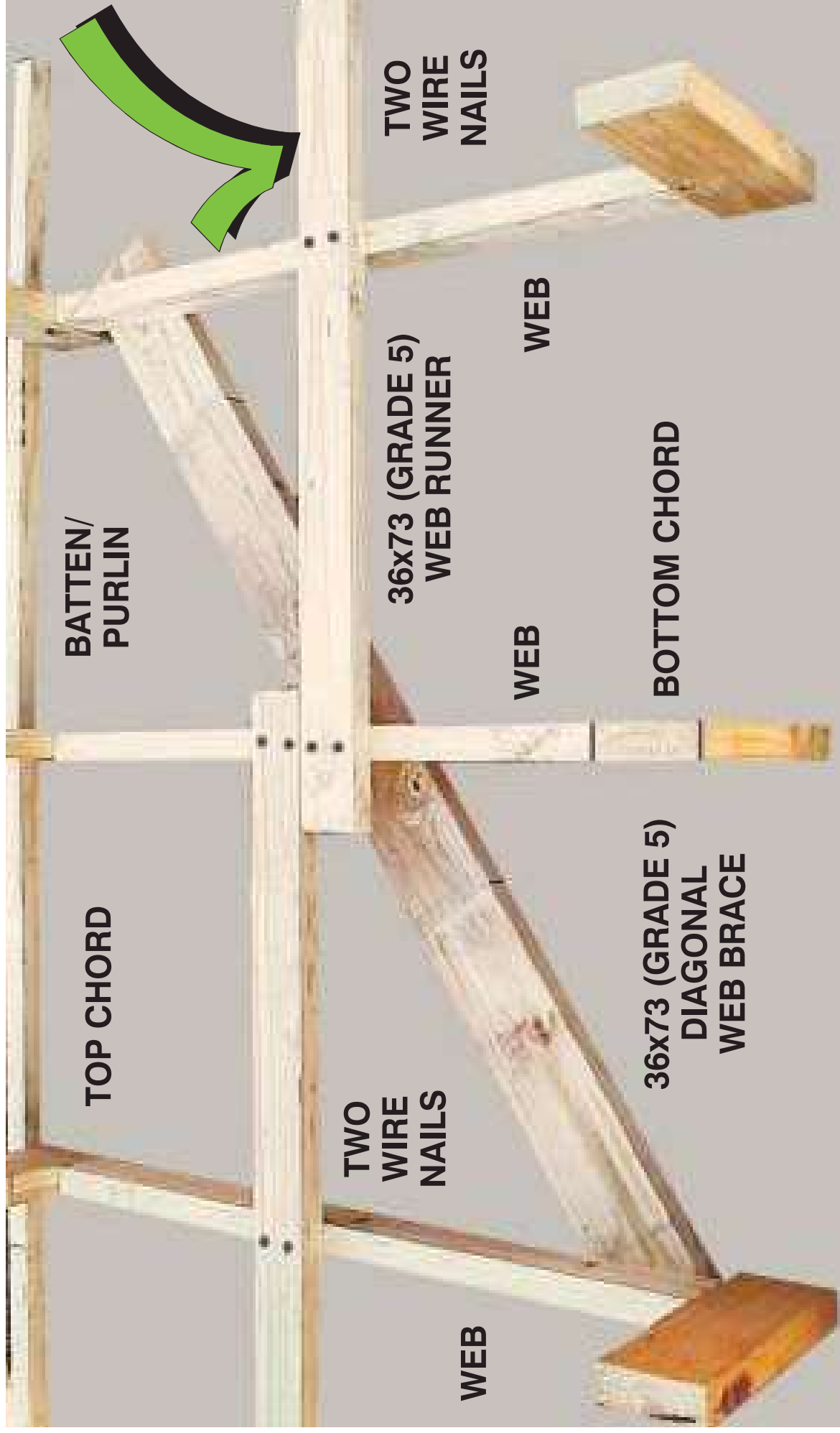
WEB RUNNERS & DIAGONAL CROSS BRACING



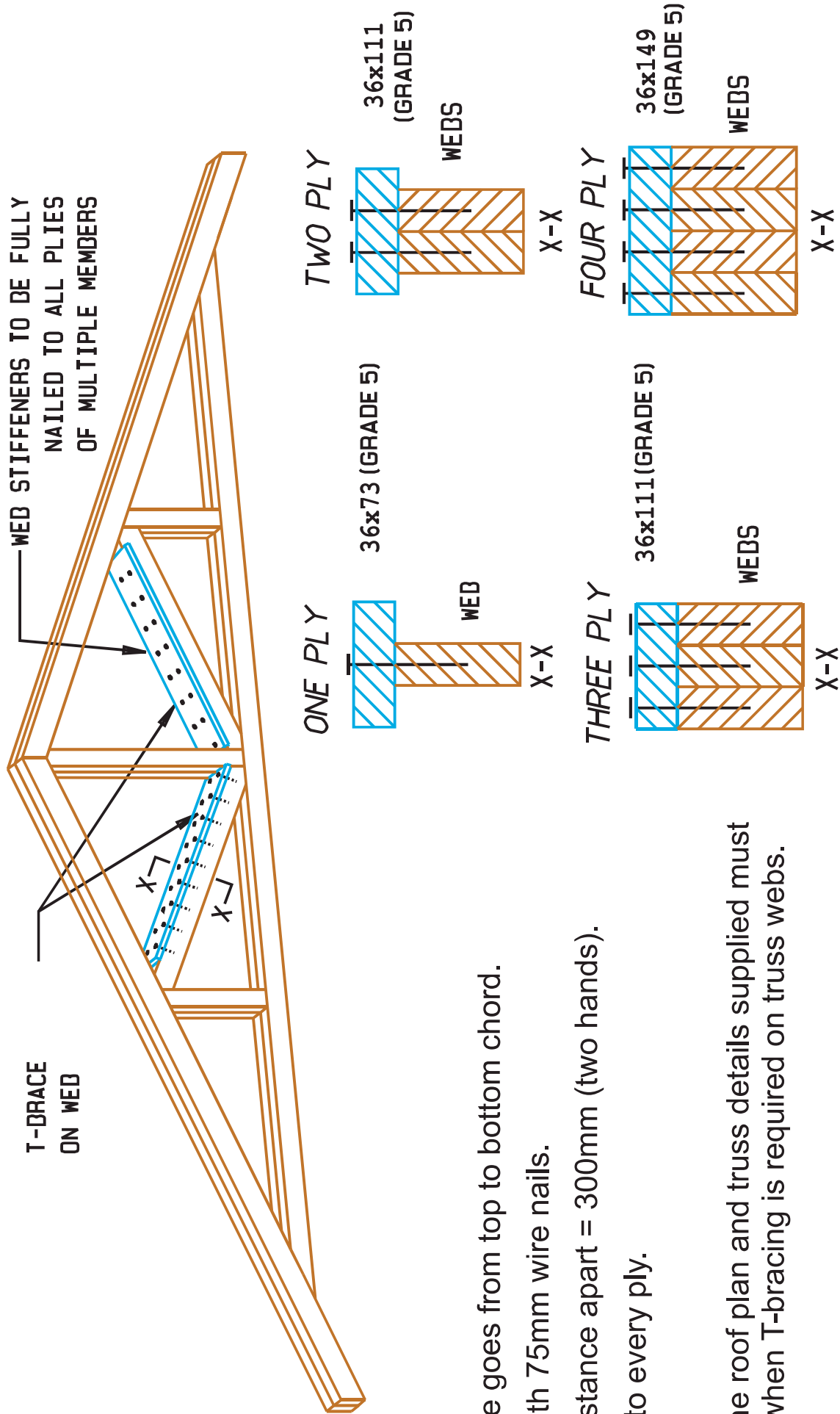
Rule:
Runners continue to all similar trusses.
Diagonal bracing at maximum 12m spacing.

NB! The roof plan and truss details supplied must show when web runners and bracing are required on truss webs.

WEB RUNNERS AND DIAGONAL BRACING



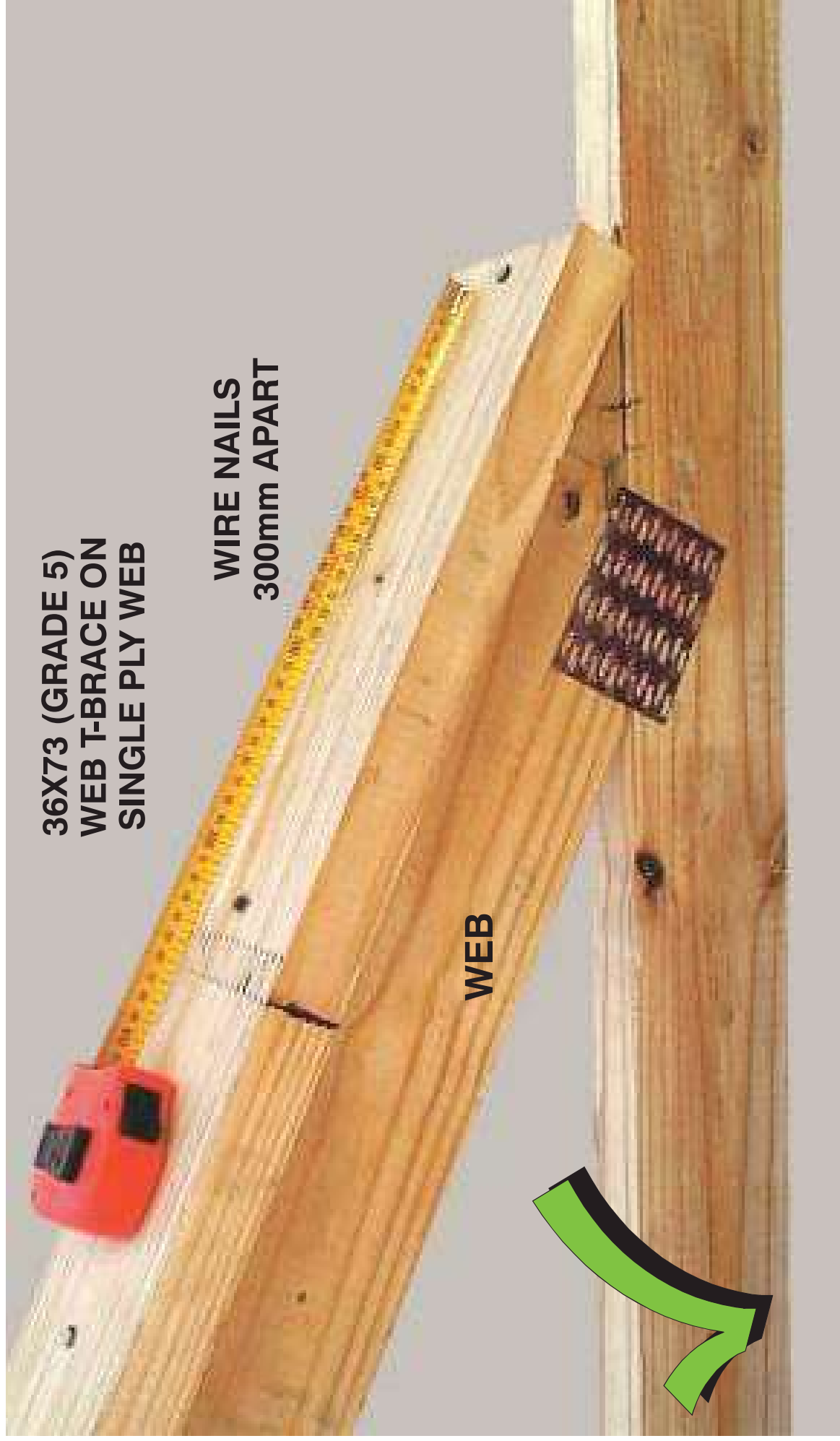
“T” BRACING ON TRUSS WEBS



Rule:
T-brace goes from top to bottom chord.
Nail with 75mm wire nails.
Nail distance apart = 300mm (two hands).
Nail into every ply.

NB! The roof plan and truss details supplied must show when T-bracing is required on truss webs.

"T" BRACING ON WEBS - LESS THAN THREE TRUSSES IN A ROW



PART FOUR - CHECK LIST

DONE CORRECTLY	
	Drawings on site Truss spacings correct Top and bottom chords straight Trusses plumb and level Trusses tied down and wedges nailed Girders (correct ply),fully nailed & bolted @ each node Required bolts and washers in & tightened Hangers fully nailed and when required, bolted Battens / Purlins correctly spliced Purlins fixed with hurricane clips / wire Hips correctly installed Valleys installed Top chord bracing installed (incl. Heel shelf) Bottom chord runners and bracing installed Web runners and bracing installed “T” bracing on webs installed

GLOSSARY OF TERMS AND DEFINITIONS

Apex:	The top of the truss where the two rafters meet. (Page 74)
Batten:	Small timber sections (usually 38x38 or 38x50) nailed across the top chords at small spacings to carry concrete tiles, slates, metal tiles etc. (Page 14)
Binder:	See runner.
Block splice:	Nailed timber block used to join butting bracing members and purlins. (Page 16, 25)
Bottom chord:	Also tie-beam. That part of the truss that forms the bottom edge, and connects the two heel joints, usually flat, and supports the ceiling. Sloped in scissor trusses. Abbreviated B.C. (Page 74)
Braced Bay:	That section of roof where the diagonal bracing members are fixed. (Page 47, 52, 57, 60, 62)
Bracket:	See cleat.
Bracing:	Timber (or other) members fixed to several trusses, usually at a 45 degree angle to make the roof stable, and to prevent buckling. (Page 47, 52, 57, 60, 62)

Branderling:	Similar to battens, but fixed to the bottom chord, to which the ceiling is nailed.(Page 74)
Cantilever:	When the truss support on the bottom chord is some distance inside the heel joint. (Page 75)
Clear span:	The distance between the supporting walls. (See span) (Pg. 74)
Cleat:	Mild steel heavy-duty bracket fixed with bolts and used to support large heavy trusses on a girder.(Page 19)
Crank:	When the support wall direction change is less than 90 degrees. The roof forms a bastard hip on one side, and a valley on the other in double-pitched roofs. (Page 41)
Clout nails:	Wire nails 32mm long, 2mm thick, with a large head used to fix hangers, hurricane clips and pre-punched strapping.
Double pitch:	Trusses where the top chords slope up at the same angle from both ends. (Page 74)
Dual pitch:	The top chords slope at different angles from each end.
Dutch hip:	A hip end where the side slope does not reach the apex, but the top part of the hip forms a small gable. (Page 34)

Fly rafter:	That part of the mono pitch jack truss top chord which extends over the truncated hip girder and trusses. (Page 32, 33, 36)
Gable:	When the building end is vertical, the same shape as the truss, usually brickwork.
Girder truss:	A truss (single or multiple ply) used to support other trusses.
Hanger:	A U-shaped bracket made of thin galvanized mild steel used to support trusses on a girder, usually fixed with 32mm clout nails or similar. Sometimes also fixed with bolts and washers. (Page 20)
Heel:	The truss end joint where the top and bottom chords connect, or where the end web joins the bottom chord in stub and mono-pitch trusses. (Page 74)
Heel shelf:	A means of fixing the diagonal top chord bracing at the wall plate using timber, bolts and hurricane clips. (Pages 52 to 56)
Hip:	When the building ends in a sloped roof. (Page 29 to 35)
Hoop iron:	Galvanized metal strips built into brickwork used to hold down trusses. (Page 13)

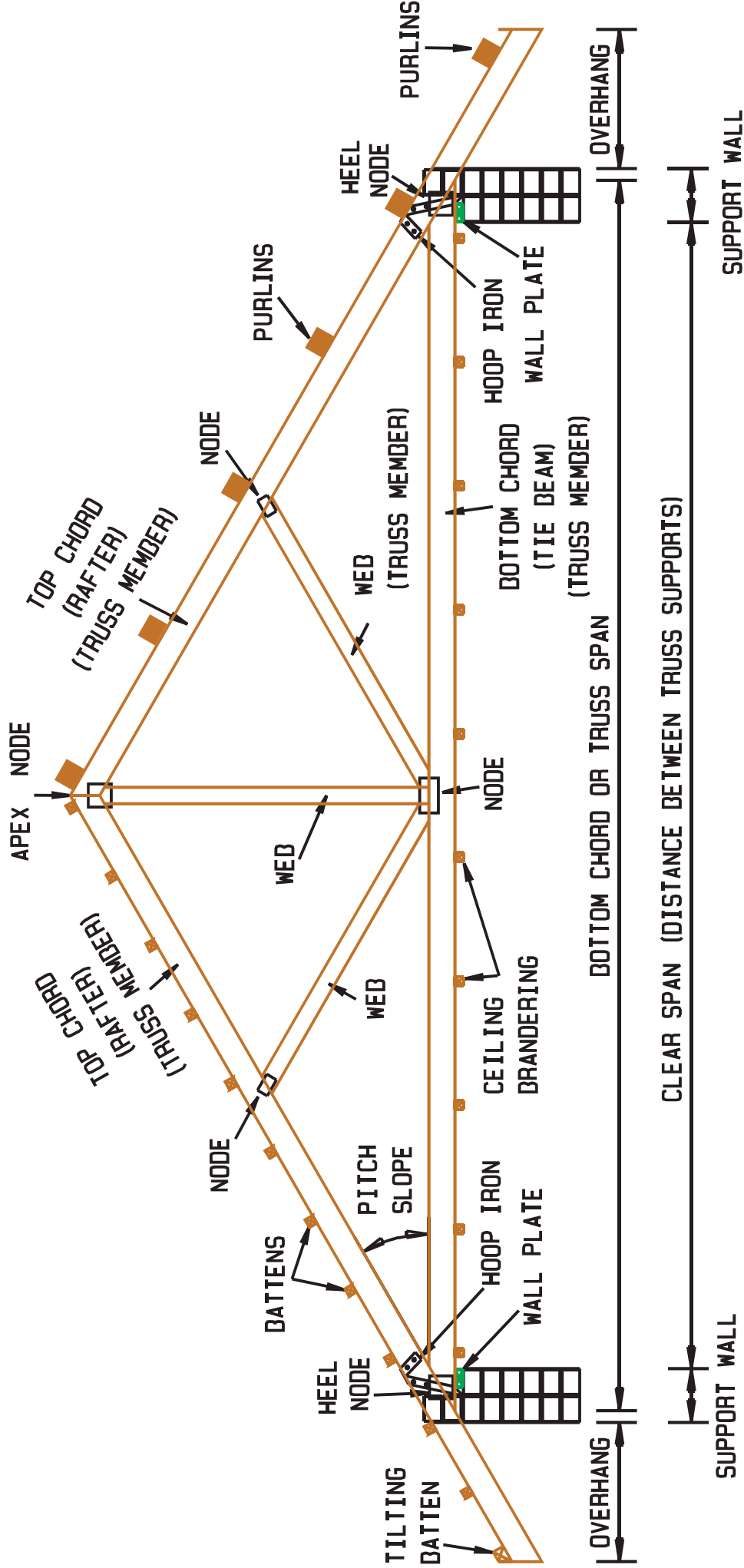
Hurricane clip:	A thin galvanized mild steel angle bracket used to fix two timber members at 90 degrees to each other. (Page 15, 38, 50, 54)
Jack rafter:	The smallest end part of a hip construction using only single pieces of timber. (Page 29 to 35)
Jack truss:	The mono pitch trusses of the hip, which are supported at the high end by the hip girders. (Page 29 to 35)
Member:	A part, or component, which together with other members make up the structure. (i.e. truss members are the top chords, bottom chords and webs which form the truss) (Page 74)
Mono pitch:	A truss where there is only one rafter slope. (half of a double pitch truss)
Multiple plies:	Two to four trusses nailed and bolted together to form one unit. Usually girders. (Page 22)
Nails:	See Clout nails and Wire nails.
Nib:	Extensions of the bottom chord past the truss end, usually to support in brickwork or on a truss hanger.

Node:	Also node point. The places on the truss where two or more truss members are connected to each other (but not chord splices) (Page 74)
Overhang:	That part of the truss top chord that extends past the truss heel. Measured horizontally from the truss heel on the truss, but also from the outside wall face on the building. (Page 74)
Pitch:	Also slope, the angle between the top chord and the horizontal line from the support point. (Page 74)
Plumb:	Trusses to be in a vertical line, i.e. 90 degrees to the floor (horizontal) level and parallel to the gable wall. (Page 12)
Plumb cut:	Top chord overhangs cut off vertical, i.e. Up / down.
Purlin:	Timber members (50x76) fixed across the top chords at up to 1.15m spacings to carry metal and fibre cement sheeting. (Page 15 to 17)
Rafter:	See top chord.
Runner:	Also binder. Bracing members that run continuously through the entire roof or set of the same trusses, to connect the same point of each truss. (Page 59 to 63)

Spacing:	The distance between the centres of two of the same elements, i.e. trusses and bracing members. (Page 14)
Span:	Truss span is the distance along the bottom chord between the truss ends (heels) See also clear span. (Page 74)
Stub end:	Also stub heel. Where the top and bottom chords are some distance apart and connected by the first truss web. (Page 75)
Support:	The position where the truss is supported on the load-bearing wall, (or a beam, truss hanger or cleat), usually on a timber wall plate. There must always be a node at the support point of the truss. (Page 74)
Top chord:	Also rafter. That part of the truss, which forms the top edge, usually at a slope, and has the battens or purlins fixed to it to carry the roof covering. Abbreviated: T.C. (Page 74)
Truncated:	When a hip truss or girder has a part flat top chord, at a height so that the fly rafters of the jack trusses can just pass over the top. (Page 32, 33, 36 to 39)

Truss:	A number of timber members joined together in a triangular pattern to form a sturdy frame to carry the roof covering and all other loads that it is designed for. (Page 74)
Truss Labels:	All trusses should be labelled on the roof layout and the truss itself. Common labels are A1, TR1, GX1, TG1, HG1, HM1, etc.
Valley:	A set of special trusses with decreasing spans which are supported on the length of the bottom chord by the trusses underneath, fixed at 90 degrees to these trusses. (Page 40)
Valley truss:	A truss, which is supported by other trusses underneath.
Wall plate:	A timber member laid flat over the supporting wall to level and spread the truss load onto the bearing surface. (Page 74)
Webs:	The truss members that connect the top and bottom chords, usually in a triangular pattern. (Page 74)
Wedges:	Triangular timber block used in pairs to level the truss. (Page 12)
Wire Nails:	75mm or 100mm long, 3 to 4mm thick wire nails with a head used to connect two timber members together.
Wire ties:	Two strands of wire built into the brickwork to hold down trusses.

TYPICAL DOUBLE PITCH TRUSS



TYPICAL CANTILEVER HEEL

ITC-SA ROOF CATEGORIES

ROOF CATEGORY A

Very Complex roofs, including

1. Scissors Trusses > 5 meters
2. Site Splicing
3. Attics and Dormers
4. Very large spans greater than 10 meters
5. Piggy Back Trusses
6. Cantilevers > 2 meters
7. Complex Industrial
8. Complex Commercial
9. Laminated Timber Roof Structures
10. Public Buildings & Schools
11. Large Shallow Pitched Roof. Span > 5 meters

ROOF CATEGORY B

Complex Domestic and Simple Industrial and Commercial Roofs, including up to 10 meter span:

1. Hips and Valleys up to 10 meter span
2. Non standard Loads
3. Scissor Trusses up to 5 meters

ITC-SA ROOF CATEGORIES

ROOF CATEGORY C

Simple roofs up to and including 9.0 metre spans with standard loadings, and including the following:

1. Valleys.
2. Girders with hangers and/or metal cleats.
3. Stub ends.
4. Cantilevers up to a span of 2.0 metres.
5. Simple hips up to a span of 9.0 metres.
6. Minimum pitch 5 degrees.

ROOF CATEGORY D

Simple roofs up to and including 6.6 metre spans with standard loadings, and including the following:

1. Small valleys up to a span of 3.0 metres.
2. No hips

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Institute for Timber Construction

Information contained in this Handbook has been compiled by a Working Group with many years experience in the timber roofing industry. Their input and hard work in this regard is much appreciated. We wish to thank, Stefan Münster, Roly Adams, Victor Booth, Ken Downhams, Mike Hull, Gert de Jager, Tom Harper, Graham Retief, Eddie Bock and Ralph Sorensen. This revision was edited by Errol Hobden, Walter Burdzik and Mike Newham.

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