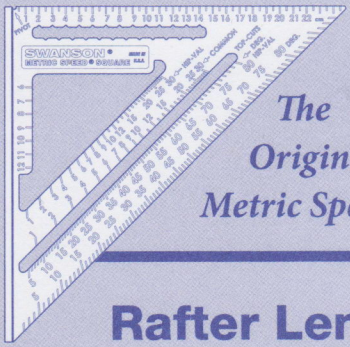

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Rafter Lengths and Roof Construction

One-Number™ Method

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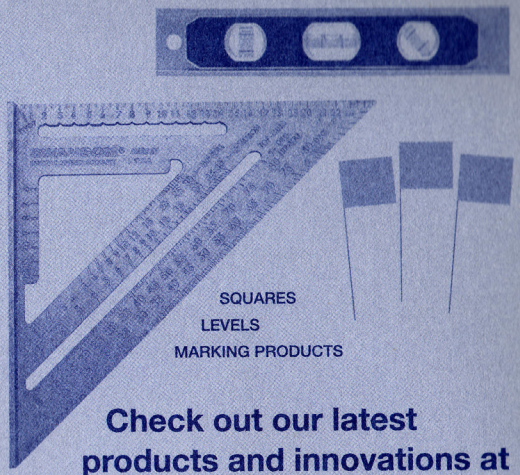

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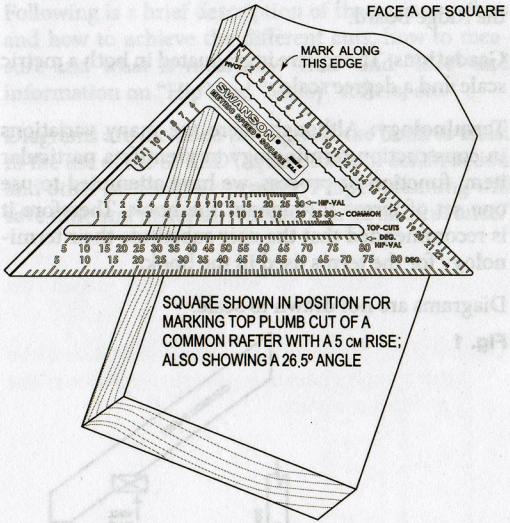

SQUARE SHOWN IN POSITION FOR MARKING TOP PLUMB CUT OF A COMMON RAFTER WITH A 5 CM RISE; ALSO SHOWING A 26,5° ANGLE

Please direct inquiries to:
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INTRODUCTION

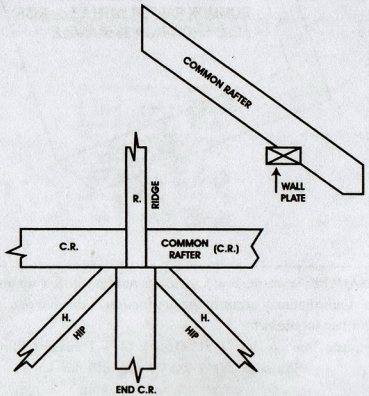
Method of construction: Only one of many methods of construction is presented in this book. The example in (Fig. 1) shows a rafter cut to fit over the exterior edge of the top plate of the wall. Also, it illustrates the intersection of Hip and Common rafters in relation to the Ridge Board.

Gradations: The square is graduated in both a metric scale and a degree scale.

Terminology: Although there are many variations in construction terminology to identify a particular item, function or process, we have attempted to use one set of terms throughout the book. Therefore it is recommended that the user substitute their terminology for the terms used in the book.

Diagrams are not drawn to scale.

Fig. 1



"ONE-NUMBER℠ METHOD"

The "ONE-NUMBER℠ METHOD" developed by the Swanson Tool Co., Inc. simplifies roof framing so that roofs may be framed as easy as wall studs or joists.

Following is a brief description of the various rafters and how to achieve the different cuts, how to measure and what is meant by "Run" and "Rise" and information on "Hip" and "Valley" rafters, etc.

Diagrams are included throughout the book to assist in the use of the SPEED® square for roof construction and other projects. Remember, Proper planning will save time and material. "Measure twice and cut once."

DESIGN OF THE SQUARE

The square is designed with two sets of scales for the Common, Hip and Valley rafters (Fig. 2). The inside scales with smaller sized numbers are for working with metric figures, while the outside scales are for working in degrees. The scale having a full 90° degrees allows the user to mark any angle in degrees as well as the angles represented in "*decimeter of rise per meter of run." You can easily convert degrees to decimeter of rise or vice versa at a glance. The square is marked exactly the same on both sides for use on either side of the rafter board. There are "Scribe Notches" positioned under the centimeter scale to permit the user to scribe a line up to 14 cm. in width along the length of a piece of lumber. The square can also be used as a stable guide for an electric saw. The size and features of the square lends it to multiple uses within the construction industry.

**Note:* For the purpose of this book we will consider the metric scales to represent decimeter of rise per meter of run.

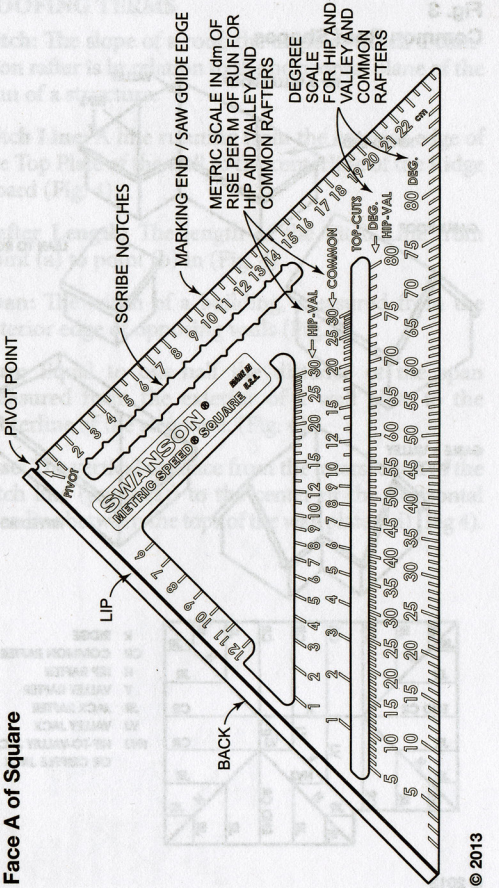
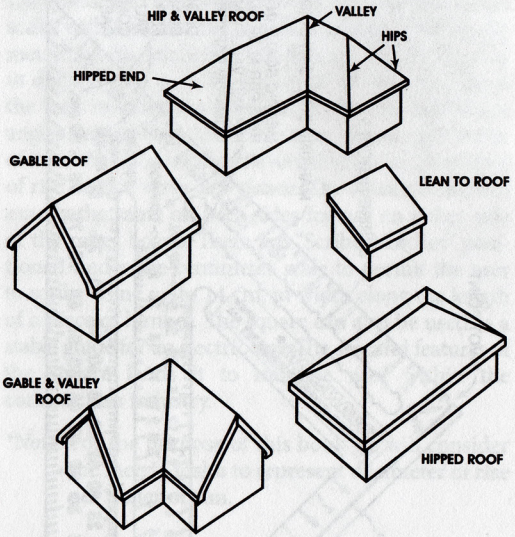
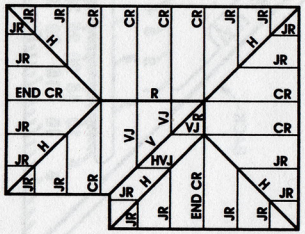


Fig. 2
Face A of Square

Fig. 3
Common Roof Shapes





R	RIDGE
CR	COMMON RAFTER
H	HIP RAFTER
V	VALLEY RAFTER
JR	JACK RAFTER
VJ	VALLEY JACK
HVJ	HIP-TO-VALLEY JACK OR CRIPPLE JACK

ROOFING TERMS

Pitch: The slope of a roof; the angle at which a common rafter is in relation to the horizontal plane of the Run of a structure.

Pitch Line: A line running from the exterior edge of the Top Plate of the wall to the centerline of the Ridge Board (Fig. 4).

Rafter Length: The length of the Pitch Line from point (a) to point (b) in (Fig. 4).

Span: The width of a building, measured from the exterior edge of opposing walls (Fig. 4).

Run: Equal to one-half the distance of the span measured from the exterior of a wall plate to the centerline of the structure. (Fig. 4).

Rise: The vertical distance from the intersection of the pitch line (point (a)) to the center of the horizontal span line between the tops of the wall plates (d) (Fig 4).

Fig. 4
Roofing Terms

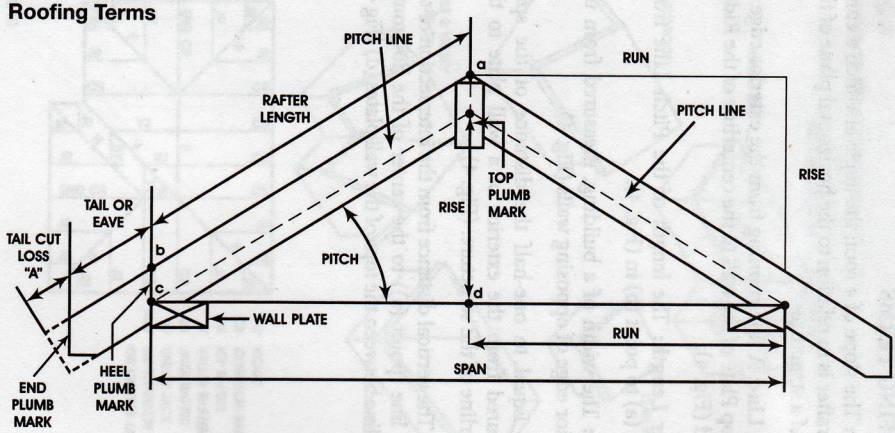
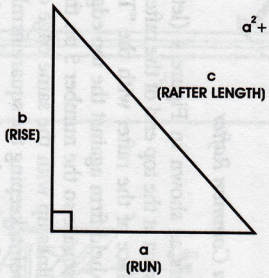


Fig. 5
Pythagoriean Theorem

THE THEOREM IS OF FUNDAMENTAL IMPORTANCE IN THE EUCLIDEAN GEOMETRY WHERE IT SERVES AS A BASIS FOR THE DEFINITION OF DISTANCE BETWEEN TWO POINTS



a AND b ARE THE SIDES OF A RIGHT TRIANGLE AND c IS THE HYPOTENUSE

EXAMPLE a=3M
b=4M
c=?M

RAFTER LENGTH = $c = \sqrt{a^2 + b^2}$

$c = \sqrt{3^2 + 4^2}$

$c = \sqrt{9 + 16}$

$c = \sqrt{25}$

$c = 5M$

COMMON RAFTER

A common rafter connects at 90° to the face of the Ridge Board and the Top Plate of the wall forming the hypotenuse of a 90° triangle. The Rise and the Run of the structure forms the 90° angle of the triangle (fig 5).

Fig. 4 shows the correct points from which to measure and can be used as a handy reference on the job. If the lumber is not straight (slightly curved or bowed), always position the rafter with the "crown" or bowed side facing up when laying out a rafter or Ridge Board.

Marking a pattern for a Common Rafter

When laying out rafters as shown in Figure 4 (let's assume a 5-dm. Rise), start at the top end of the rafter, lay the square on the face of the rafter with the "T" (lip) end of the square held firm against the top edge of the rafter. Pivot the square so the number 5 on the common metric scale lines up with the same edge of the rafter as the pivot point, keeping the square firmly positioned against the rafter (see drawing on page 1), mark a line (plumb line) along the edge of the square starting at the pivot point. This gives you the reference for the top plumb cut of the rafter to be positioned against the Ridge board.

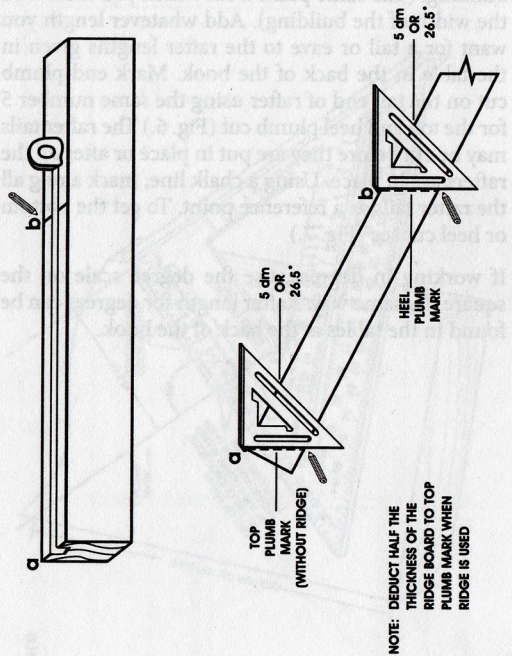


Fig. 6

Measure the rafter length along top edge of rafter. Mark another plumb cut same as above, (the heel plumb cut). This line represents outside wall of the building. (The same point from which you measured the width of the building). Add whatever length you want for a tail or eave to the rafter lengths given in the table in the back of the book. Mark end plumb cut on the tail end of rafter using the same number 5 for the top and heel plumb cut (Fig. 6.) The rafter tails may be cut before they are put in place or after *all* the rafters are in place. Using a chalk line, mark along all the rafter tails as a reference point. To get the bottom or heel cut see (Fig. 7.)

If working in degrees, use the degree scale on the square the same way. Rafter length for degrees can be found in the tables at the back of the book.

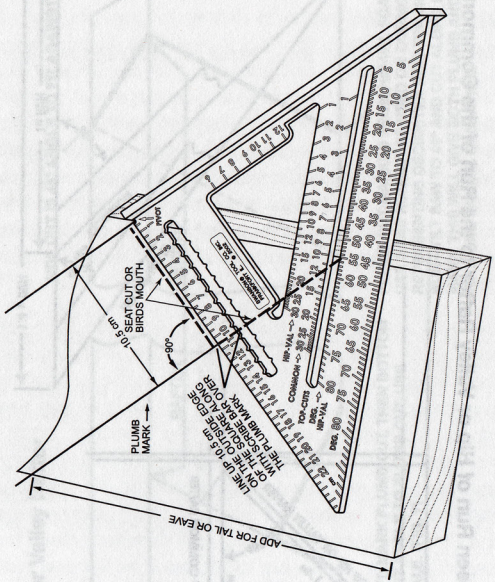


Fig. 7
Face B of Square

Fig. 8
Relationship Between Run of Hip or Valley Rafter to the Run of the Common Rafter

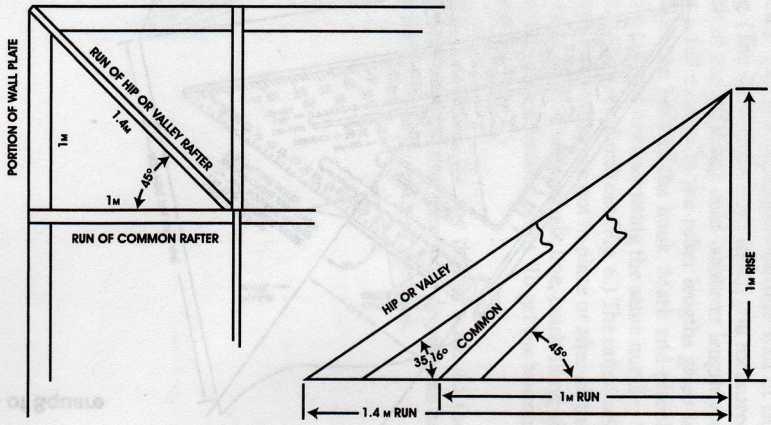
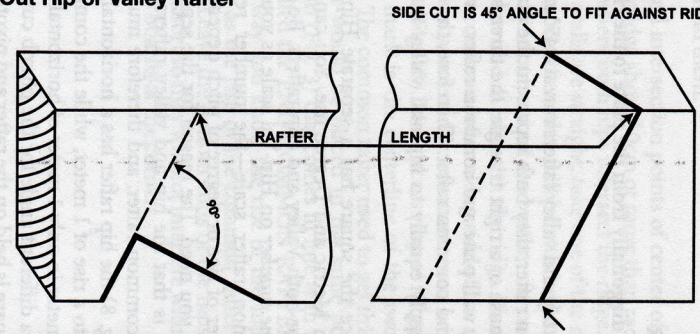


Fig. 9
Laying Out Hip or Valley Rafter



BOTTOM CUT: MARK PLUMB CUT, THEN BOTTOM CUT AT RIGHT ANGLE TO PLUMB CUT. USE HIP-VAL SCALE. (FIG. 7)

PLUMB CUT MARKED FROM *HIP-VAL SCALE.* USE *SAME NUMBER* AS USED ON COMMON-NUMBER REPRESENTING DECIMETER *RISE* PER METER RUN—TILT SAW TO 45° AND CUT ALONG PLUMB MARK. THIS WILL GIVE BOTH PLUMB AND SIDE CUT WITH ONE SAWING OPERATION.

VALLEY RAFTER

One running diagonally from the plate to the ridge at the intersection of a gable extension with the main roof (Fig. 3.)

HIP RAFTER

One running diagonally from the plate to the ridge (Fig. 3.)

Since both the hip and valley rafters run at a 45° angle to the common rafter, they both represent the diagonal or hypotenuse of a right triangle; the three sides being the hip, wall plate and common rafter, or the valley, ridge and common rafter. Therefore, the cuts and lengths apply equally to hip and valley rafters (Fig. 8.)

You will notice the square has a separate Hip-Val Scale for both Metric and Degree use. You can use these scales for both Valley and Hip rafters. Be sure to use the *same number* on Hip-Val scale as you use on the common rafter scale—the number represents decimeter of rise or degree of pitch depending on what scale you need. The reason for the separate Hip-Val scale is that the hip and valley rafters run at 45° to the common rafter, and therefore must be longer. In (Fig. 8) the hip rafter has a horizontal run of 1.4 meters to a rise of 1 meter, while the common rafter rises 1 meter in only 1 meter of horizontal run. This requires a different angle for the plumb cuts. In (Fig. 9) the square is held on the rafter and pivoted in the same manner as with a common rafter, but using the Hip-Val scale. If building is out of square, one hip

will be cut a little shorter, depending on how great the error is. Keep ridge and hip boards well supported until rafters are attached. Nail all rafters evenly so as not to put a bow in ridge or hip while nailing other rafters to them.

To find intersection points of center of hip on ridge, leave ridge about 30cm or more than required at each end where both hips intersect the ridge. Making sure your walls are straight, take one of the regular length common rafters that will be attached to the ridge on the main roof and set the bottom cut over the edge of the plate and in line with the ridge. Place the top end of the common rafter along side of the ridge aligning the top point of the common even with top of the ridge (Fig. 10). Mark across top of ridge at this point. This mark is the centerline of the two intersecting hips. The common rafter used to get this intersection point would be placed in the same position as the one in (Fig. 3) that comes in line with the ridge and is called the END COMMON RAFTER (END CR). This way you know the rise of the hips will be the same as the rise of the common rafter on the main roof. Leave the bottom ends of the hips (eave end) a little short so they will not interfere with lining up the fascia boards at the corners.

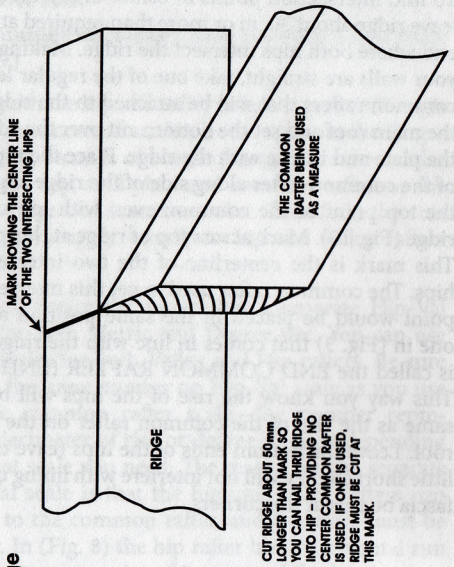


Fig. 10
Finding Intersecting Points of Hips on Ridge

JACK RAFTERS

One which does not extend from plate to ridge.

Hip Jack: one running from plate to hip at 90° to plate.

Valley Jack: one running from ridge to valley at 90° to ridge.

Hip-To-Valley Jack or Cripple Jack: one which neither touches the ridge nor plate, but runs from a hip rafter to a valley rafter at 90° to the ridge (Fig. 3).

The rise and run of a jack rafter are the same as that of a *common* rafter. When marking jacks use the *common* rafter scale and the same decimeter number of rise. Where the rafter rests against hip or valley, mark plumb cut, then cut at 45° angle along this mark. This will give both plumb cut and side cut (Fig. 9). When attaching "jack" to a ridge or plate, lay them out the same as a common rafter. For cripple jacks, mark plumb cuts on both ends and saw at 45° as above.

When measuring the length of the jack rafter, measure from the longest corner (plumb cut on 45°) to other plumb cut mark, along *Top Side* (same as shown in Fig. 9 for the hip rafter). Cripple Jack rafters are measured diagonally from the long point to the long point. Measuring diagonally will compensate for ½ the thickness of the Ridge board (or for Jack rafters, ½ the thickness of the Hip or Valley rafter). There is no problem in laying out these angles on the rafters as long as you keep in mind which side of the Hip or Valley rafter you want the Jack rafter to fit against. Measure the shortest Jack rafter first (usually one running next to a ceiling joist), from the Top

Plate to the Hip rafter. The difference in length of the remaining Jack rafters is taken from the chart on Page 40 for Metric and pages 47, 48 for Degrees (there are two sets of Jack rafter charts, one for decimeter of rise and one for working in degrees of rise). Set each rafter alongside the ceiling joist and fasten securely. The ceiling joist now ties the roof together.

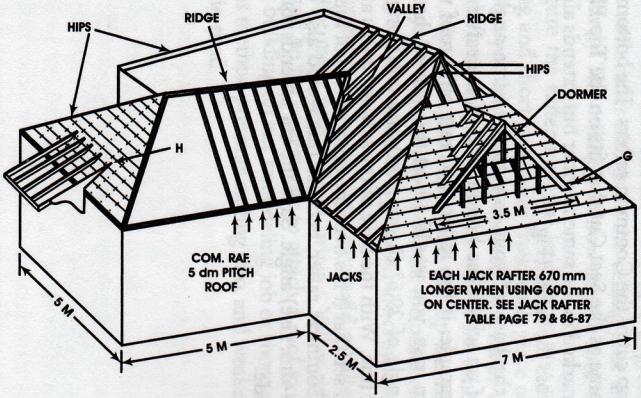
Figure the rafter material lengths so you can cut a long and short jack rafter from each piece of timber. When you have cut the shortest Jack rafter the angle of the long end of the timber will fit the other side of the Hip rafter. Do this all the way up the Hip rafter, always leaving the cut off end for the other side. If the timber has a crown in it position the crown facing up.

In some cases a carpenter may build a Valley on top of the main roof without using a Valley rafter. This would be the easiest way to attach a roof to an existing building on any remodeling job or room addition. This method prevents cutting into, and weakening the main roof.

Mark the location of the proposed Valley on the existing roof in a line 45° to the existing common rafters (see Dormer Fig. 11). Set the long point of the bottom end of the rafter even with this line ("G" of Fig. 11). The top plumb cut of the rafter is the same as the top cut of the Common rafters. The bottom cut is the same as the Seat Cut that fits on the Top Plates and is marked in the same manner but extends all the way across the rafter (Fig. 7).

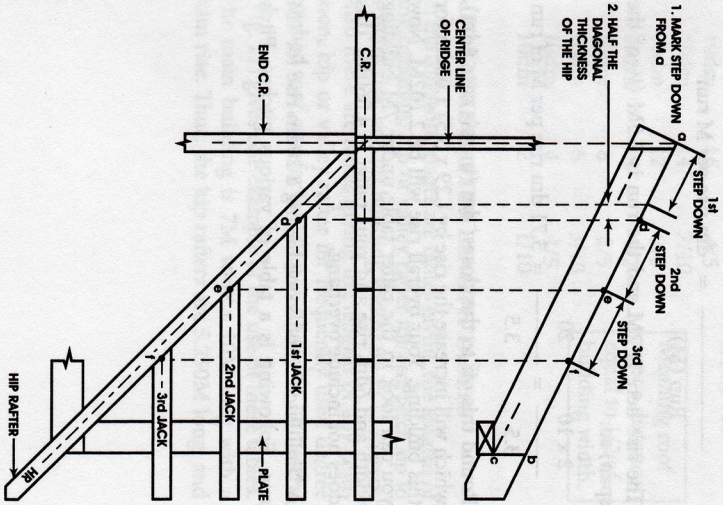
Adjust the base of your saw to the same angle as the roof on which the bottom end of the rafter will rest. Example; if the rafter is to rest on a roof with an 8-dm. rise, you would adjust the base of the saw to an angle of 29.5° (8-dm. rise) and cut along the seat cut line. With the base of the saw set at this angle you will see that it fits over the pointed end of the top of the Common rafter, because this would also be a 29.5° (8-dm. rise) angle. Save the cut off ends for the other side.

Fig. 11



ALL CUTS ON THIS ROOF MADE BY USING
THE NUMBER 5 (DECIMETER RUN)

MARK CENTERS OF JACK RAFTERS ON PATTERN COMMON RAFTER



DETERMINING THE RISE OF A ROOF

Assume your building has a 7M wide span and you want a 2M rise. Expressed as an equation:

$$\frac{\text{Rise (M)} \times 10}{\text{Run (M)}} = \text{dm rise per M run}$$

The rise here is 2M and the run is 3.5M (½ of the span) so:

$$\frac{2 \times 10}{3.5} = \frac{20}{3.5} = 5.71 \text{ dm rise per M of run}$$

Round this off to the closest dm (in this case 6dm), which will increase the rise by (.29 x 3.5) 1.02dm for this building. Your overall rise will be 2.102M. Now you can look in the rafter table under 7M building width and 6dm rise and your rafter is 4.060M. This does not include overhang.

A "Full Pitch" roof is one having a 20dm rise for 1M run. Following is a table of various pitches. Pitch equals rise divided by span; meaning the proportion the rise bears to the span.

dm Run	dm Rise	Pitch
10dm	18	9/10
10dm	16	4/5
10dm	14	7/10
10dm	12	3/5
10dm	10	1/2
10dm	8	2/5
10dm	6	3/10
10dm	4	1/5
10dm	2	1/10

Meaning roof rises a distance equal to 1/2 of building width.

USING THE RAFTER LENGTH TABLES

In the following pages are tables giving the lengths of any common, hip or valley rafter for any pitch up to a 30dm rise, and for building widths up to 12 meters. Also there are tables giving the lengths of any common, hip or valley rafter for frequently used degree pitched roof, and for building widths up to 12 meters.

(Fig. 11) gives one example of the use of these tables. The main building is 7M wide x 10M long with a 5dm rise. Thus, the hip rafters are 5.250M long, and

the common rafters 3.913M. The 5M x 5M addition, hips and valleys are 3.750M long and the commons 2.795M. For the 3.5M Gable Dormer on top of the roof boards, the longest rafters are 1.956M. (This is found by taking half of the difference from the 3M building width and the 4M building width. Then adding the number to the rafter length table of the 3M building).

It is best to use a steel tape when measuring the width of a building, measuring from the exterior edge of the bottom plate of a wall to the exterior edge of the bottom plate of the opposing wall. If a Ridge board is used, deduct its thickness from the building width.

For building widths greater than those listed in this book, use any two widths which when added together equal the width of the building desired. Example, if you require a 16M building, add the widths of a 10M building and a 6M building together.

THE DEGREE SCALE

The pivoting method used to determine rafter cuts with decimeter of rise is used the same way with the degree scale. The outside scale is the common rafter scale in degrees and the inner scale is used for hip valley rafter cuts. By remembering that the square forms a 45° right triangle, it can be used to measure any angle with the use of the degree scale.

A study of the following diagrams will show the principles used. These principles can be applied in different ways to address various problems.

To mark degrees on a flat surface see (Fig. 12 and 13). To find degrees in an upright of vertical position, refer to (Fig. 14).

To find degrees in a upright or vertical position, (Fig.14) shows two methods by which a plumb line can be used on the square. (Fig. 15) gives illustrations of the use of a plumb line on the square.

(Fig. 15A)—With plumb line AB set on 45° mark, the square is now positioned so that the bottom (long side) of square is running level, 90° to plumb line.

By pivoting the square up to the line XY, the plumb line has shifted 15° (Fig. 15B). Thus the unknown angle in (15A) was 15°, with angle ABX = 60°. This same 15° reading also indicates bottom edge of square is setting at a 15° incline.

In looking at (Fig.15A and B), it is possible that sometimes the plumb line will not fall from pivot point to a point on the degree scale due to the position of line XY. In this case, rather than setting the *edge* of the square to line XY, simply turn the square over and let line XY run *behind* the square. Line XY will then run from pivot point to some point on the degree scale; as shown in (Fig. 15C). Setting plumb line AB on the square, the number of degrees on scale between plumb line and angle line indicates measured angle.

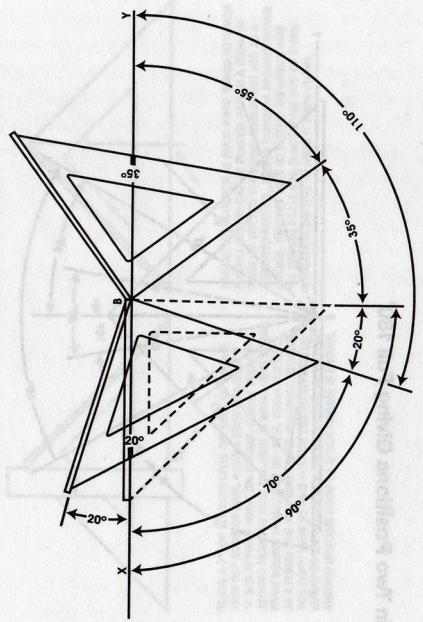
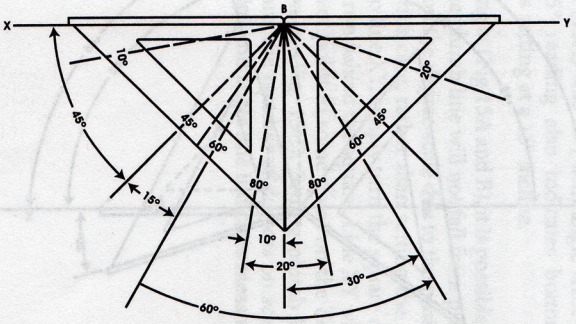


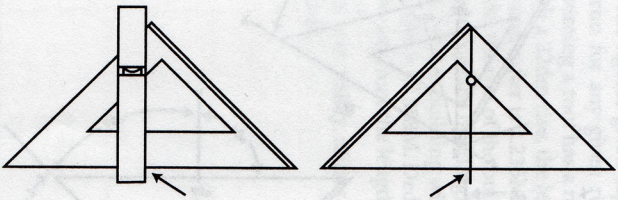
Fig. 12
Square Shown in Three Different Positions with the Resulting Angles Being Found by Pivoting Square at Point B on Line X-Y

Fig. 13
Square Used in Two Positions Giving Full 180°



LINE X-Y REPRESENT EDGE OF MATERIAL, POINT B IN PIVOT POINT OF SQUARE. HERE SQUARE IS NOT PIVOTED. POINTS ARE MARKED ON MATERIAL AT POINT B, AND AT DESIRED ANGLE. LINE DRAWN THRU THE TWO POINTS GIVES THE ANGLE WANTED.

Fig. 14



PLACE A 7" (OR LONGER) LEVEL ON FACE OF SQUARE WITH TOP EDGE OF LEVEL ALWAYS RESTING AGAINST "T" BAR AT PIVOT POINT ON SQUARE. *BUBBLE SHOULD ALWAYS INDICATE THAT THE LEVEL IS BEING HELD PLUMB.* PIVOT SQUARE FROM EDGE OF LEVEL. USING THE LEVEL AS A PLUMB LINE WILL GIVE FASTER READINGS BECAUSE YOU DON'T HAVE TO WAIT FOR THE SWINGING MOTION OF THE STRING (AS USED IN THE NEXT METHOD) TO STOP. ARROWS INDICATE POINT AT WHICH DEGREE IS SHOWN.

SQUARE HAS A NOTCH AT PIVOT POINT THROUGH WHICH A SMALL STRING CAN BE PLACED. ATTACH A STRAIGHT PIECE OF WIRE TO THE STRING WHICH WILL ACT AS A WEIGHTED POINTER. ALWAYS HANGING STRAIGHT DOWN (PLUMB). YOU MAY WISH TO EXTEND THE STRING PAST THE DEGREE SCALE AND PLACE SOME TYPE OF SMALL WEIGHT ON THE END TO MAKE IT HANG PLUMB.

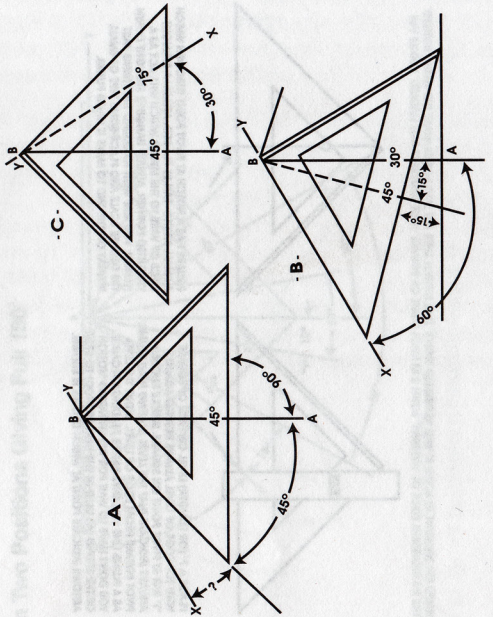


Fig. 15

RAFTER LENGTHS PER METER RUN

Seldom does the roof of a building have greater than a ½ pitch (10dm. rise per 1M run). For a steeper roof, a table is provided that gives any rise from 1-dm. to 30dm. The figures given represent the length per meter of run for any given rise (see table on next page). Assuming a roof has a rise of 22dm per meter of run, with a 22dm rise, the length per meter of run for a common rafter is 2.236M. Assuming a building is 16M wide, the run of the building would be 8M (½ the span/width of the building). The length of a common rafter for this building with a 22dm. rise would be 8 X 2.236M = 17.888M. Deduct ½ the thickness of the ridge board from the length of the rafter.

Hip rafters and Valley rafters are calculated in the same manner.

Rafter Length Table for dm of Rise

dm Rise	Pitch	Common Rafter	Hip or Valley Rafter
1		1.005	1.418
2	– 1/10	1.020	1.428
3		1.044	1.446
4	– 1/5	1.077	1.470
5		1.118	1.500
6	3/10	1.160	1.536
7		1.221	1.578
8	– 2/5	1.281	1.625
9		1.345	1.676
10	– 1/2	1.414	1.732
11		1.487	1.792
12	– 3/5	1.562	1.855
13		1.640	1.921
14	– 7/10	1.720	1.990
15		1.803	2.061
16	– 4/5	1.887	2.135
17		1.972	2.211
18	– 9/10	2.059	2.289
19		2.147	2.368
20	– FULL	2.236	2.449
21		2.326	2.532
22		2.417	2.615
23		2.508	2.700
24		2.600	2.785
25		2.693	2.872
26		2.786	2.960
27		2.879	3.048
28		2.973	3.137
29		3.068	3.226
30		3.162	3.317

Length per Meter of Run

	3 meter building		4 meter building	
dm rise	Common	Hip-val	Common	Hip-val
1	1.508	2.127	2.010	2.836
2	1.530	2.142	2.040	2.856
3	1.566	2.169	2.088	2.892
4	1.616	2.205	2.154	2.940
5	1.677	2.250	2.236	3.000
6	1.740	2.304	2.320	3.072
7	1.832	2.367	2.442	3.156
8	1.922	2.438	2.562	3.250
9	2.018	2.514	2.690	3.352
10	2.121	2.598	2.828	3.464
11	2.231	2.688	2.974	3.584
12	2.343	2.783	3.124	3.710
13	2.460	2.882	3.280	3.842
14	2.580	2.985	3.440	3.980
15	2.705	3.092	3.606	4.122
16	2.831	3.203	3.774	4.270
17	2.958	3.317	3.944	4.422
18	3.089	3.434	4.118	4.578
19	3.221	3.552	4.294	4.736
20	3.354	3.674	4.472	4.898
21	3.489	3.798	4.652	5.064
22	3.626	3.923	4.834	5.230
23	3.762	4.050	5.016	5.400
24	3.900	4.179	5.200	5.572
25	4.040	4.308	5.386	5.744
26	4.179	4.440	5.572	5.920
27	4.319	4.572	5.758	6.096
28	4.460	4.706	5.946	6.274
29	4.602	4.839	6.136	6.452
30	4.743	4.976	6.324	6.634

Length per Meter of Run

dm rise	5 meter building		6 meter building	
	Common	Hip-val	Common	Hip-val
1	2.513	3.545	3.015	4.254
2	2.550	3.570	3.060	4.284
3	2.610	3.615	3.132	4.338
4	2.693	3.675	3.231	4.410
5	2.795	3.750	3.354	4.500
6	2.900	3.840	3.480	4.608
7	3.053	3.945	3.663	4.734
8	3.203	4.063	3.843	4.875
9	3.363	4.190	4.035	5.028
10	3.535	4.330	4.242	5.196
11	3.718	4.480	4.461	5.376
12	3.905	4.638	4.686	5.565
13	4.100	4.803	4.920	5.763
14	4.300	4.975	5.160	5.970
15	4.508	5.153	5.409	6.183
16	4.718	5.338	5.661	6.405
17	4.930	5.528	5.916	6.633
18	5.148	5.723	6.177	6.867
19	5.368	5.920	6.441	7.104
20	5.590	6.123	6.708	7.347
21	5.815	6.330	6.978	7.596
22	6.043	6.538	7.251	7.845
23	6.270	6.750	7.524	8.100
24	6.500	6.965	7.800	8.358
25	6.733	7.180	8.079	8.616
26	6.965	7.400	8.358	8.880
27	7.198	7.620	8.637	9.144
28	7.433	7.843	8.919	9.411
29	7.670	8.065	9.204	9.678
30	7.905	8.293	9.486	9.951

Length per Meter of Run

dm rise	7 meter building		8 meter building	
	Common	Hip-val	Common	Hip-val
1	3.518	4.963	4.020	5.672
2	3.570	4.998	4.080	5.712
3	3.654	5.061	4.176	5.784
4	3.770	5.145	4.308	5.880
5	3.913	5.250	4.472	6.000
6	4.060	5.376	4.640	6.144
7	4.274	5.523	4.884	6.312
8	4.484	5.688	5.124	6.500
9	4.708	5.866	5.380	6.704
10	4.949	6.062	5.656	6.928
11	5.205	6.272	5.948	7.168
12	5.467	6.493	6.248	7.420
13	5.740	6.724	6.560	7.684
14	6.020	6.965	6.880	7.960
15	6.311	7.214	7.212	8.244
16	6.605	7.473	7.548	8.540
17	6.902	7.739	7.888	8.844
18	7.207	8.012	8.236	9.156
19	7.515	8.288	8.588	9.472
20	7.826	8.572	8.944	9.796
21	8.141	8.862	9.304	10.128
22	8.460	9.153	9.668	10.460
23	8.778	9.450	10.0321	10.800
24	9.100	9.751	10.400	11.144
25	9.426	10.052	10.772	11.488
26	9.751	10.360	11.144	11.840
27	10.077	10.668	11.516	12.192
28	10.406	10.980	11.892	12.548
29	10.738	11.291	12.272	12.904
30	11.067	11.610	12.648	13.268

Length per Meter of Run

dm rise	9 meter building		10 meter building	
	Common	Hip-val	Common	Hip-val
1	4.523	6.381	5.025	7.090
2	4.590	6.426	5.100	7.140
3	4.698	6.507	5.220	7.230
4	4.847	6.615	5.385	7.350
5	5.031	6.750	5.590	7.500
6	5.220	6.912	5.800	7.680
7	5.495	7.101	6.105	7.890
8	5.765	7.313	6.405	8.125
9	6.053	7.542	6.725	8.380
10	6.363	7.794	7.070	8.660
11	6.692	8.064	7.435	8.960
12	7.029	8.348	7.810	9.275
13	7.380	8.645	8.200	9.605
14	7.740	8.955	8.600	9.950
15	8.114	9.275	9.015	10.305
16	8.492	9.608	9.435	10.675
17	8.874	9.950	9.860	11.055
18	9.266	10.301	10.295	11.445
19	9.662	10.656	10.735	11.840
20	10.062	11.021	11.180	12.245
21	10.467	11.394	11.630	12.660
22	10.877	11.768	12.085	13.075
23	11.286	12.150	12.540	13.500
24	11.700	12.537	13.000	13.930
25	12.119	12.924	13.465	14.360
26	12.537	13.320	13.930	14.800
27	12.956	13.716	14.395	15.240
28	13.379	14.117	14.865	15.685
29	13.806	14.517	15.340	16.130
30	14.229	14.927	15.810	16.585

Length per Meter of Run

dm rise	11 meter building		12 meter building	
	Common	Hip-val	Common	Hip-val
1	5.528	7.799	6.030	8.508
2	5.610	7.854	6.120	8.568
3	5.742	7.953	6.264	8.676
4	5.924	8.085	6.462	8.820
5	6.149	8.250	6.708	9.000
6	6.380	8.448	6.960	9.216
7	6.716	8.679	7.326	9.468
8	7.046	8.938	7.686	9.750
9	7.398	9.218	8.070	10.056
10	7.777	9.526	8.484	10.392
11	8.179	9.856	8.922	10.752
12	8.591	10.203	9.372	11.130
13	9.020	10.566	9.840	11.526
14	9.460	10.945	10.320	11.940
15	9.917	11.336	10.818	12.366
16	10.379	11.743	11.322	12.810
17	10.846	12.161	11.832	13.266
18	11.325	12.590	12.354	13.734
19	11.809	13.024	12.882	14.208
20	12.298	13.470	13.416	14.694
21	12.793	13.926	13.956	15.192
22	13.294	14.383	14.502	15.690
23	13.794	14.850	15.048	16.200
24	14.300	15.323	15.600	16.716
25	14.812	15.796	16.158	17.232
26	15.323	16.280	16.716	17.760
27	15.835	16.764	17.274	18.288
28	16.352	17.254	17.838	18.822
29	16.874	17.743	18.408	19.356
30	17.391	18.244	18.972	19.902

Jack Rafter Step Downs

Difference in length (mm) of jack rafters of various spacing

dm rise	300 mm on center	600mm on center	900mm on center
1	302	604	906
2	306	612	918
3	313	626	939
4	323	646	969
5	335	670	1005
6	348	696	1044
7	366	732	1098
8	384	768	1152
9	403	806	1209
10	424	848	1272
11	446	892	1338
12	469	938	1407
13	492	984	1476
14	516	1032	1548
15	541	1082	1623
16	566	1132	1698
17	592	1184	1776
18	618	1236	1854
19	644	1289	1933
20	671	1342	2013
21	698	1396	2094
22	725	1450	2175
23	752	1504	2256
24	780	1560	2340
25	808	1616	2424
26	836	1672	2508
27	864	1728	2592
28	892	1784	2676
29	920	1840	2760
30	949	1898	2847

Rafter Length in meters for degree pitch

Degree	Common Rafter	Hip or Valley Rafter
10	1.0154	1.4252
12.5	1.0243	1.4315
15	1.0353	1.4394
17.5	1.0485	1.4489
20	1.0642	1.4603
22.5	1.0824	1.4736
25	1.1034	1.4891
27.5	1.1274	1.507
30	1.1547	1.5275
32.5	1.1857	1.5511
35	1.2208	1.5781
37.5	1.2605	1.609
40	1.3054	1.6444
42.5	1.3563	1.6851
45	1.4142	1.7321
47.5	1.4802	1.7863
50	1.5557	1.8494
52.5	1.6427	1.9231
55	1.7434	2.0099
57.5	1.8612	2.1128
60	2	2.2361
62.5	2.1657	2.3854
63	2.2027	2.4191
65	2.3662	2.5688
65.5	2.4114	2.6105
67.5	2.6131	2.7979
70	2.9238	3.0901
72	3.2361	3.3871
72.5	3.3255	3.4726
75	3.8637	3.991
75.5	3.9939	4.1172
76	4.1336	4.2528
76.5	4.2837	4.3988
77	4.4454	4.5565

	3 meter building		4 meter building	
Degree	Common	Hip-val	Common	Hip-val
10	1.5231	2.1378	2.0308	2.8504
12.5	1.53645	2.14725	2.0486	2.863
15	1.55295	2.1591	2.0706	2.8788
17.5	1.57275	2.17335	2.097	2.8978
20	1.5963	2.19045	2.1284	2.9206
22.5	1.6236	2.2104	2.1648	2.9472
25	1.6551	2.23365	2.2068	2.9782
27.5	1.6911	2.2605	2.2548	3.014
30	1.73205	2.29125	2.3094	3.055
32.5	1.77855	2.32665	2.3714	3.1022
35	1.8312	2.36715	2.4416	3.1562
37.5	1.89075	2.4135	2.521	3.218
40	1.9581	2.4666	2.6108	3.2888
42.5	2.03445	2.52765	2.7126	3.3702
45	2.1213	2.59815	2.8284	3.4642
47.5	2.2203	2.67945	2.9604	3.5726
50	2.33355	2.7741	3.1114	3.6988
52.5	2.46405	2.88465	3.2854	3.8462
55	2.6151	3.01485	3.4868	4.0198
57.5	2.7918	3.1692	3.7224	4.2256
60	3	3.35415	4	4.4722
62.5	3.24855	3.5781	4.3314	4.7708
63	3.30405	3.62865	4.4054	4.8382
65	3.5493	3.8532	4.7324	5.1376
65.5	3.6171	3.91575	4.8228	5.221
67.5	3.91965	4.19685	5.2262	5.5958
70	4.3857	4.63515	5.8476	6.1802
72	4.85415	5.08065	6.4722	6.7742
72.5	4.98825	5.2089	6.651	6.9452
75	5.79555	5.9865	7.7274	7.982
75.5	5.99085	6.1758	7.9878	8.2344
76	6.2004	6.3792	8.2672	8.5056
76.5	6.42555	6.5982	8.5674	8.7976
77	6.6681	6.83475	8.8908	9.113

	5 meter building		6 meter building	
Degree	Common	Hip-val	Common	Hip-val
10	2.5385	3.563	3.0462	4.2756
12.5	2.56075	3.57875	3.0729	4.2945
15	2.58825	3.5985	3.1059	4.3182
17.5	2.62125	3.62225	3.1455	4.3467
20	2.6605	3.65075	3.1926	4.3809
22.5	2.706	3.684	3.2472	4.4208
25	2.7585	3.72275	3.3102	4.4673
27.5	2.8185	3.7675	3.3822	4.521
30	2.88675	3.81875	3.4641	4.5825
32.5	2.96425	3.87775	3.5571	4.6533
35	3.052	3.94525	3.6624	4.7343
37.5	3.15125	4.0225	3.7815	4.827
40	3.2635	4.111	3.9162	4.9332
42.5	3.39075	4.21275	4.0689	5.0553
45	3.5355	4.33025	4.2426	5.1963
47.5	3.7005	4.46575	4.4406	5.3589
50	3.88925	4.6235	4.6671	5.5482
52.5	4.10675	4.80775	4.9281	5.7693
55	4.3585	5.02475	5.2302	6.0297
57.5	4.653	5.282	5.5836	6.3384
60	5	5.59025	6	6.7083
62.5	5.41425	5.9635	6.4971	7.1562
63	5.50675	6.04775	6.6081	7.2573
65	5.9155	6.422	7.0986	7.7064
65.5	6.0285	6.52625	7.2342	7.8315
67.5	6.53275	6.99475	7.8393	8.3937
70	7.3095	7.72525	8.7714	9.2703
72	8.09025	8.46775	9.7083	10.1613
72.5	8.31375	8.6815	9.9765	10.4178
75	9.65925	9.9775	11.5911	11.973
75.5	9.98475	10.293	11.9817	12.3516
76	10.334	10.632	12.4008	12.7584
76.5	10.70925	10.997	12.8511	13.1964
77	11.1135	11.39125	13.3362	13.6695

	7 meter building		8 meter building	
Degree	Common	Hip-val	Common	Hip-val
10	3.5539	4.9882	4.0616	5.7008
12.5	3.58505	5.01025	4.0972	5.726
15	3.62355	5.0379	4.1412	5.7576
17.5	3.66975	5.07115	4.194	5.7956
20	3.7247	5.11105	4.2568	5.8412
22.5	3.7884	5.1576	4.3296	5.8944
25	3.8619	5.21185	4.4136	5.9564
27.5	3.9459	5.2745	4.5096	6.028
30	4.04145	5.34625	4.6188	6.11
32.5	4.14995	5.42885	4.7428	6.2044
35	4.2728	5.52335	4.8832	6.3124
37.5	4.41175	5.6315	5.042	6.436
40	4.5689	5.7554	5.2216	6.5776
42.5	4.74705	5.89785	5.4252	6.7404
45	4.9497	6.06235	5.6568	6.9284
47.5	5.1807	6.25205	5.9208	7.1452
50	5.44495	6.4729	6.2228	7.3976
52.5	5.74945	6.73085	6.5708	7.6924
55	6.1019	7.03465	6.9736	8.0396
57.5	6.5142	7.3948	7.4448	8.4512
60	7	7.82635	8	8.9444
62.5	7.57995	8.3489	8.6628	9.5416
63	7.70945	8.46685	8.8108	9.6764
65	8.2817	8.9908	9.4648	10.2752
65.5	8.4399	9.13675	9.6456	10.442
67.5	9.14585	9.79265	10.4524	11.1916
70	10.2333	10.81535	11.6952	12.3604
72	11.32635	11.85485	12.9444	13.5484
72.5	11.63925	12.1541	13.302	13.8904
75	13.52295	13.9685	15.4548	15.964
75.5	13.97865	14.4102	15.9756	16.4688
76	14.4676	14.8848	16.5344	17.0112
76.5	14.99295	15.3958	17.1348	17.5952
77	15.5589	15.94775	17.7816	18.226

	9 meter building		10 meter building	
Degree	Common	Hip-val	Common	Hip-val
10	4.5693	6.4134	5.077	7.126
12.5	4.60935	6.44175	5.1215	7.1575
15	4.65885	6.4773	5.1765	7.197
17.5	4.71825	6.52005	5.2425	7.2445
20	4.7889	6.57135	5.321	7.3015
22.5	4.8708	6.6312	5.412	7.368
25	4.9653	6.70095	5.517	7.4455
27.5	5.0733	6.7815	5.637	7.535
30	5.19615	6.87375	5.7735	7.6375
32.5	5.33565	6.97995	5.9285	7.7555
35	5.4936	7.10145	6.104	7.8905
37.5	5.67225	7.2405	6.3025	8.045
40	5.8743	7.3998	6.527	8.222
42.5	6.10335	7.58295	6.7815	8.4255
45	6.3639	7.79445	7.071	8.6605
47.5	6.6609	8.03835	7.401	8.9315
50	7.00065	8.3223	7.7785	9.247
52.5	7.39215	8.65395	8.2135	9.6155
55	7.8453	9.04455	8.717	10.0495
57.5	8.3754	9.5076	9.306	10.564
60	9	10.06245	10	11.1805
62.5	9.74565	10.7343	10.8285	11.927
63	9.91215	10.88595	11.0135	12.0955
65	10.6479	11.5596	11.831	12.844
65.5	10.8513	11.74725	12.057	13.0525
67.5	11.75895	12.59055	13.0655	13.9895
70	13.1571	13.90545	14.619	15.4505
72	14.56245	15.24195	16.1805	16.9355
72.5	14.96475	15.6267	16.6275	17.363
75	17.38665	17.9595	19.3185	19.955
75.5	17.97255	18.5274	19.9695	20.586
76	18.6012	19.1376	20.668	21.264
76.5	19.27665	19.7946	21.4185	21.994
77	20.00143	20.50425	22.227	22.7825

Degree	11 meter building Common	Hip-val	12 meter building Common	Hip-val
10	5.5847	7.8386	6.0924	8.5512
12.5	5.63365	7.87325	6.1458	8.589
15	5.69415	7.9167	6.2118	8.6364
17.5	5.76675	7.96895	6.291	8.6934
20	5.8531	8.03165	6.3852	8.7618
22.5	5.9532	8.1048	6.4944	8.8416
25	6.0687	8.19005	6.6204	8.9346
27.5	6.2007	8.2885	6.7644	9.042
30	6.35085	8.40125	6.9282	9.165
32.5	6.52135	8.53105	7.1142	9.3066
35	6.7144	8.67955	7.3248	9.4686
37.5	6.93275	8.8495	7.563	9.654
40	7.1797	9.0442	7.8324	9.8664
42.5	7.45965	9.26805	8.1378	10.1106
45	7.7781	9.52655	8.4852	10.3926
47.5	8.1411	9.82465	8.8812	10.7178
50	8.55635	10.1717	9.3342	11.0964
52.5	9.03485	10.57705	9.8562	11.5386
55	9.5887	11.05445	10.4604	12.0594
57.5	10.2366	11.6204	11.1672	12.6768
60	11	12.29855	12	13.4166
62.5	11.91135	13.1197	12.9942	14.3124
63	12.11485	13.30505	13.2162	14.5146
65	13.0141	14.1284	14.1972	15.4128
65.5	13.2627	14.35775	14.4684	15.663
67.5	14.37205	15.38845	15.6786	16.7874
70	16.0809	16.99555	17.5428	18.5406
72	17.79855	18.62905	19.4166	20.3226
72.5	18.29025	19.0993	19.953	20.8356
75	21.25035	21.9505	23.1822	23.946
75.5	21.96645	22.6446	23.9634	24.7032
76	22.7348	23.3904	24.8016	25.5168
76.5	23.56035	24.1934	25.7022	26.3928
77	24.4497	25.06075	26.6724	27.339

Jack Rafter Step Downs
Difference in length (mm) of jack rafters of various spacing

Degree	300 mm on center	600mm on center	900mm on center
10	305	610	915
12.5	307	614	921
15	311	622	933
17.5	315	630	945
20	319	638	957
22.5	325	650	975
25	331	662	993
27.5	338	676	1014
30	346	692	1038
32.5	356	712	1068
35	366	732	1098
37.5	378	756	1134
40	392	784	1176
42.5	407	814	1221
45	424	848	1272
47.5	444	888	1332
50	467	934	1401
52.5	493	986	1479

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Jack Rafter Step Downs
Difference in length (mm) of jack rafters of various spacing

Degree	300 mm on center	600mm on center	900mm on center
55	523	1046	1569
57.5	558	1116	1674
60	600	1200	1800
62.5	650	1300	1950
63	661	1322	1983
65	710	1420	2130
65.5	723	1446	2169
67.5	784	1568	2352
70	877	1754	2631
72	971	1942	2913
72.5	998	1996	2994
75	1159	2318	3477
75.5	1198	2396	3594
76	1240	2480	3720
76.5	1258	2516	3774
77	1334	2668	4002

Notes

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