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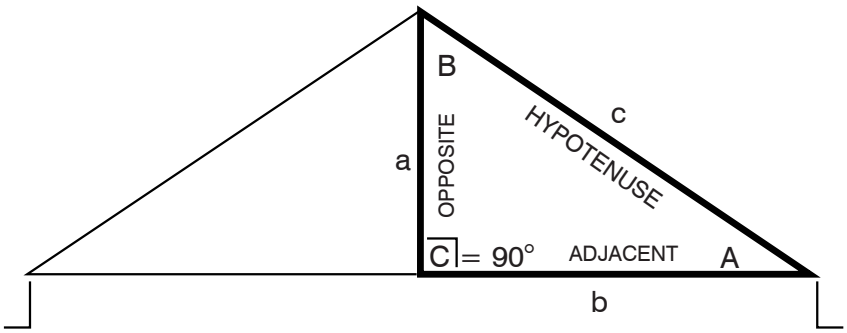
Formulae Guide

V4 I March 2016

CONTENTS

TRIGONOMETRY

REMEMBER SOH - CAH - TOA FROM SCHOOL
WE USE THE ABOVE FOR CALCULATING CONSERVATORY ROOFS.
BELOW WE HAVE HALF A CONSERVATORY ROOF.



IF ONE ANGLE IS A RIGHT (90°) ANGLE, THE TRIANGLE IS A RIGHT OR RIGHT ANGLED TRIANGLE. THE SUM OF THE THREE ANGLES IN EVERY RIGHT ANGLED TRIANGLE IS 180 DEGREES.

THE SIDES OF THE TRIANGLE ARE KNOWN AS
a = OPPOSITE b = ADJACENT c = HYPOTENUSE

A = THE PITCH OF THE ROOF

S SIN = SINE
SOH
SIN A = OPP ÷ HYP

C COS = COSINE
CAH
COS A = ADJ ÷ HYP

T TAN = TANGENT
TOA
TAN A = OPP ÷ ADJ

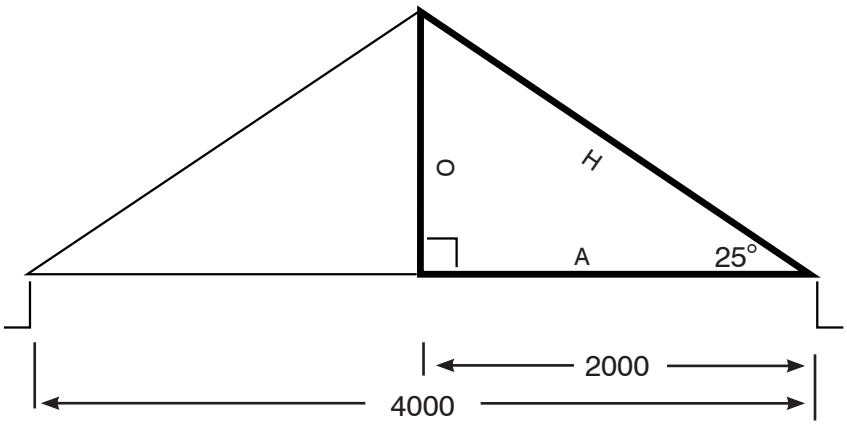
COSEC = COSECANT
COSEC A = HYP ÷ OPP

SEC = SECANT
SEC A = HYP ÷ ADJ

COT = COTANGENT
COT A = ADJ ÷ OPP

EXAMPLE

SCIENTIFIC CALCULATOR NEEDED
NOTE: THE SYMBOL DEG (DEGREES) NEEDS TO BE VISIBLE ON TOP LINE OF CALCULATOR OR SET TO DEG.



1. INTERNAL WIDTH OF CONSERVATORY = 4000MM
2. HALF INTERNAL WIDTH = 2000MM
3. KNOWN PITCH = 25°
4. HEIGHT OF TRIANGLE (OPPOSITE HEIGHT)

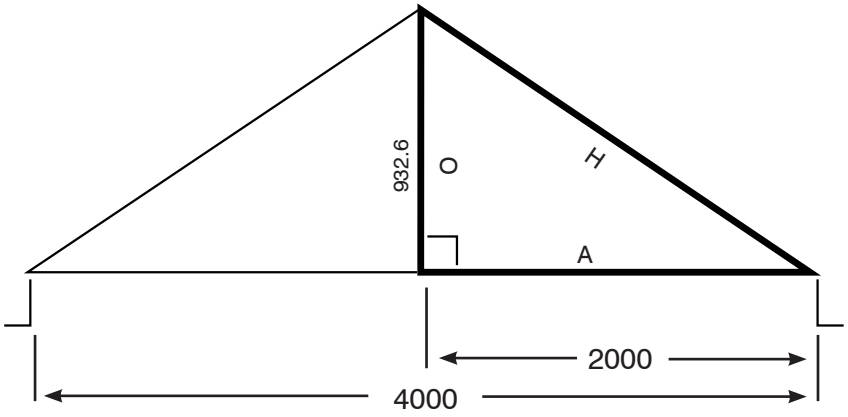
TO CALCULATE DIMENSION 'O'
TAN 25° = OPPOSITE ÷ ADJACENT
∴ O = A X TAN 25°
∴ O = 2000 X TAN 25° = 932.6
∴ O = 932.6MM

IF ANGLE 25° IS NOT KNOWN BUT DIMENSION O IS KNOWN THEN
TAN X = O ÷ A
∴ TAN X = 932.6 ÷ 2000 =
∴ 932.6 ÷ 2000 = 0.4663*
∴ TAN 0.4663 = 25°

COTAN OR TAN^{-1} NEEDS TO BE OBTAINED FROM A SCIENTIFIC CALCULATOR.
PLEASE NOTE: THE ORDER IN WHICH DIGITS ARE PRESSED ON A SCIENTIFIC CALCULATOR CAN VARY DEPENDING ON MODEL.

*PROCESS : 932.6 ÷ 2000 = 0.4663. NEXT PRESS 2ND F, SHIFT OR INV DIGIT. NEXT PRESS TAN DIGIT. NEXT PRESS = DIGIT.
ANSWER = 24.9996°

EXAMPLE



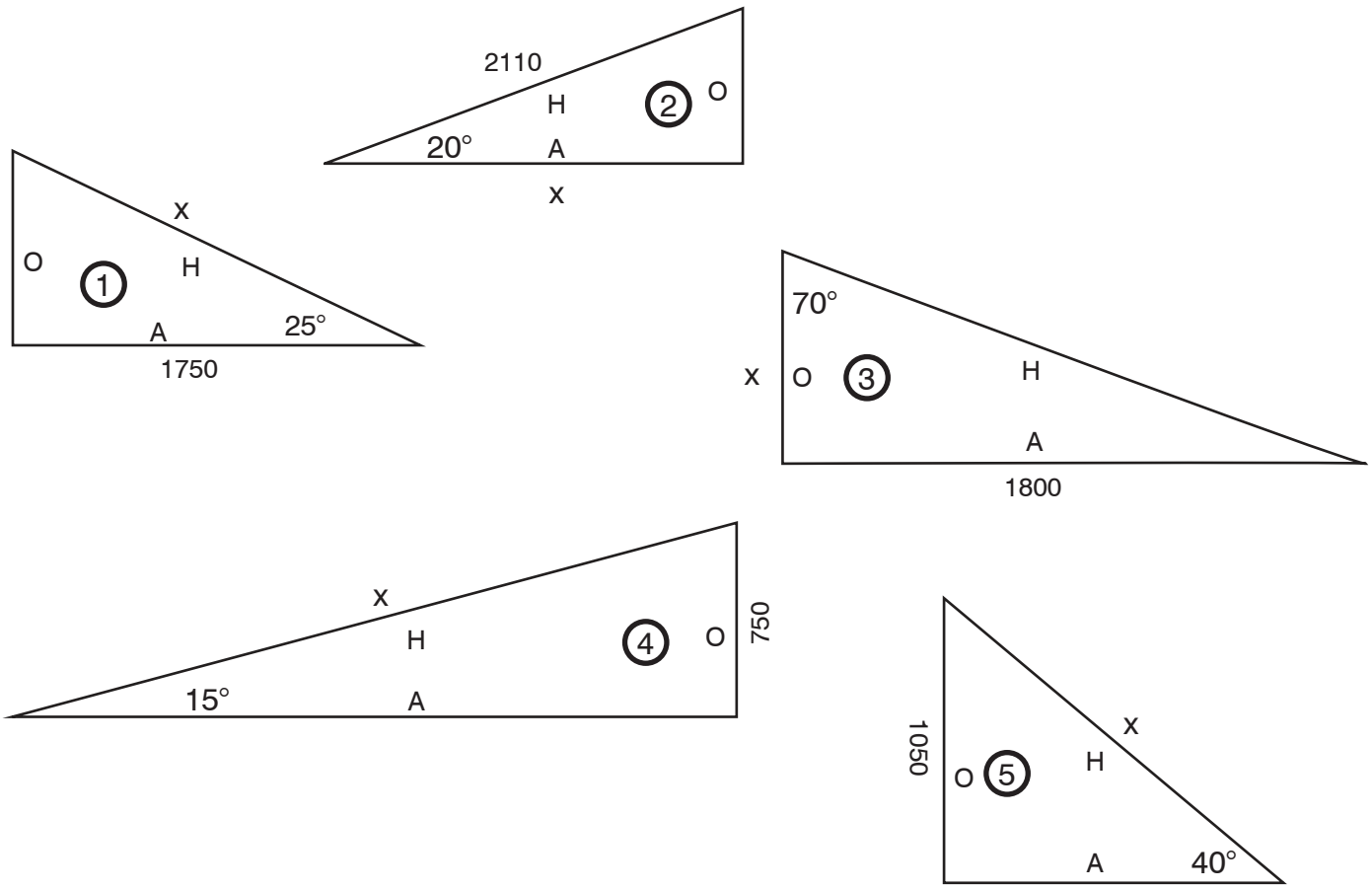
PYTHAGORAS THEOREM

THIS IS USED WHEN 2 SIDES ARE KNOWN IN A RIGHT ANGLED TRIANGLE AND YOU WANT TO KNOW THE THIRD

$H^2 = O^2 + A^2$
$O^2 = H^2 - A^2$
$A^2 = H^2 - O^2$

ON THE ABOVE EXAMPLE TO FIND LENGTH H
$H^2 = O^2 + A^2$
$H^2 = 932.6^2 + 2000^2$ (932.6 X 932.6+ 2000 X 2000)
$H^2 = 869742.76 + 4000000$
$H^2 = 4869742.76$
H = 4869742.76 (√ = SQUARE ROOT) PRESS √ SYMBOL
H = 2206.7

FIND DIMENSION X



1. COS P = A ÷ H ∴ H = A ÷ COS P ∴ H = 1750 ÷ COS 25 = (H = 1931)

2. COS P = A ÷ H ∴ A = H x COS P ∴ A = 2110 x COS 20 = (A = 1983)

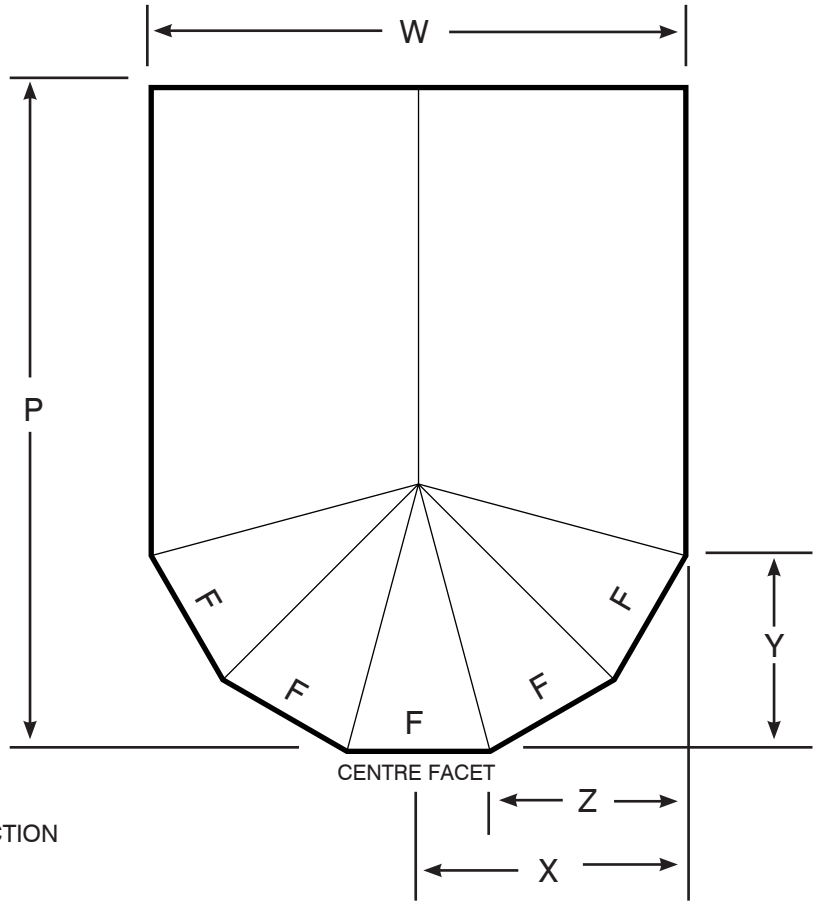
3. TAN P = O ÷ A ∴ O = A x TAN P ∴ O = 1800 x TAN 20 = (O = 655)

4. SIN P = O ÷ H ∴ H = O ÷SIN P ∴ H = 750 ÷ SIN 15 = (H = 2898)

5. SIN P = O ÷ H ∴ H = O ÷ SIN P∴ H = 1050 ÷ SIN 40 = (H = 1633)

HOW TO CALCULATE

EQUAL INTERNAL ANGLES, FACET SIZES & BAY PROJECTIONS ASSUMING EQUAL FACET SIZES WITH EQUAL INTERNAL ANGLES



W = INTERNAL WIDTH
P = INTERNAL PROJECTION

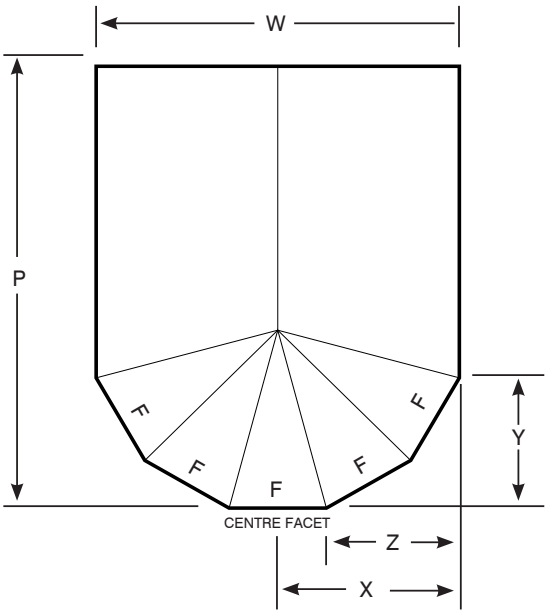
NOTE: IF ODD NO OF FACETS SELECTED (IE 5, 7 ETC) DIMENSION Y & Z ARE THE SAME. IF EVEN NUMBER OF FACETS SELECTED (IE 6, 8 ETC) DIMENSION X ALWAYS HALF INTERNAL WIDTH. FOR DIMENSION Y, USE THE FORMULA ON PAGE 9.

HOW TO CALCULATE

EQUAL INTERNAL ANGLES

FOR EACH ADDITIONAL FACET ADD 180° THEN DIVIDE BY THE NUMBER OF INTERNAL ANGLES

1 FACET = 180°	STRAIGHT LINE
2 FACETS = 360°	3 INTERNAL ANGLES @ 120.0°
3 FACETS = 540°	4 INTERNAL ANGLES @ 135.0°
4 FACETS = 720°	5 INTERNAL ANGLES @ 144.0°
5 FACETS = 900°	6 INTERNAL ANGLES @ 150.0°
6 FACETS = 1080°	7 INTERNAL ANGLES @ 154.3°
7 FACETS = 1260°	8 INTERNAL ANGLES @ 157.5°
8 FACETS = 1440°	9 INTERNAL ANGLES @ 160.0°
9 FACETS = 1620°	10 INTERNAL ANGLES @ 162.0°
10 FACETS = 1800°	11 INTERNAL ANGLES @ 163.6°
11 FACETS = 1980°	12 INTERNAL ANGLES @ 165.0°
12 FACETS = 2160°	13 INTERNAL ANGLES @ 166.2°
13 FACETS = 2340°	14 INTERNAL ANGLES @ 167.1°
14 FACETS = 2520°	15 INTERNAL ANGLES @ 168.0°



OR ALTERNATIVELY DIVIDE 180 BY THE NUMBER OF INTERNAL ANGLES AND SUBTRACT THE RESULT FROM 180, FOR EXAMPLE: 7 FACETS - 8 INTERNAL ANGLES

180 ÷ 8 = 22.5. 180 - 22.5 = 157.5

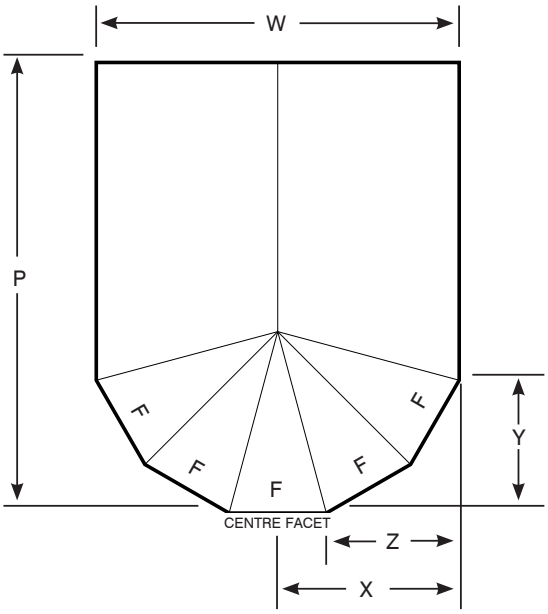
HOW TO CALCULATE

EQUAL FACET SIZES ‘F’

THE FORMULA FOR EQUAL FACET SIZES IS:
180 DIVIDED BY THE NUMBER OF INTERNAL ANGLES =
DIVIDED BY 2 = TAN = x THE INTERNAL WIDTH

EXAMPLE: TO FIND THE FACET LENGTHS ON A 3 FACET VICTORIAN CONSERVATORY
180 ÷ 4 = 45 ÷ 2 = 22.5. PRESS TAN = 0.4142 X THE INTERNAL WIDTH (EG. 3000MM)
GIVES THE INTERNAL FACET SIZE OF 1242.6MM

2 FACETS	INTERNAL WIDTH x 0.5774
3 FACETS	INTERNAL WIDTH x 0.4142
4 FACETS	INTERNAL WIDTH x 0.3249
5 FACETS	INTERNAL WIDTH x 0.2679
6 FACETS	INTERNAL WIDTH x 0.2282
7 FACETS	INTERNAL WIDTH x 0.1989
8 FACETS	INTERNAL WIDTH x 0.1763
9 FACETS	INTERNAL WIDTH x 0.1584
10 FACETS	INTERNAL WIDTH x 0.1437
11 FACETS	INTERNAL WIDTH x 0.1316
12 FACETS	INTERNAL WIDTH x 0.1214
13 FACETS	INTERNAL WIDTH x 0.1127
14 FACETS	INTERNAL WIDTH x 0.1051



HOW TO CALCULATE

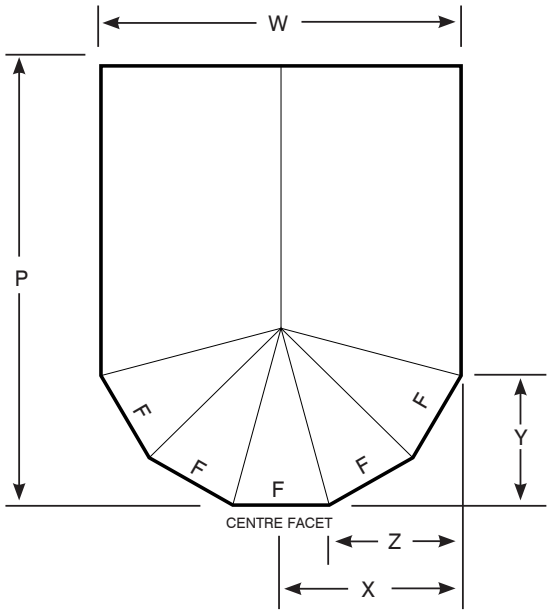
BAY PROJECTION - DIMENSION ‘Y’

IF ODD NUMBER OF FACETS IS SELECTED (IE. 5, 7) THE BAY PROJECTION ‘Y’ AND DIMENSION ‘Z’ ARE THE SAME. IF EVEN NUMBER OF FACETS SELECTED (IE. 6, 8) FOR BAY PROJECTION ‘Y’ USE THE FORMULA BELOW.

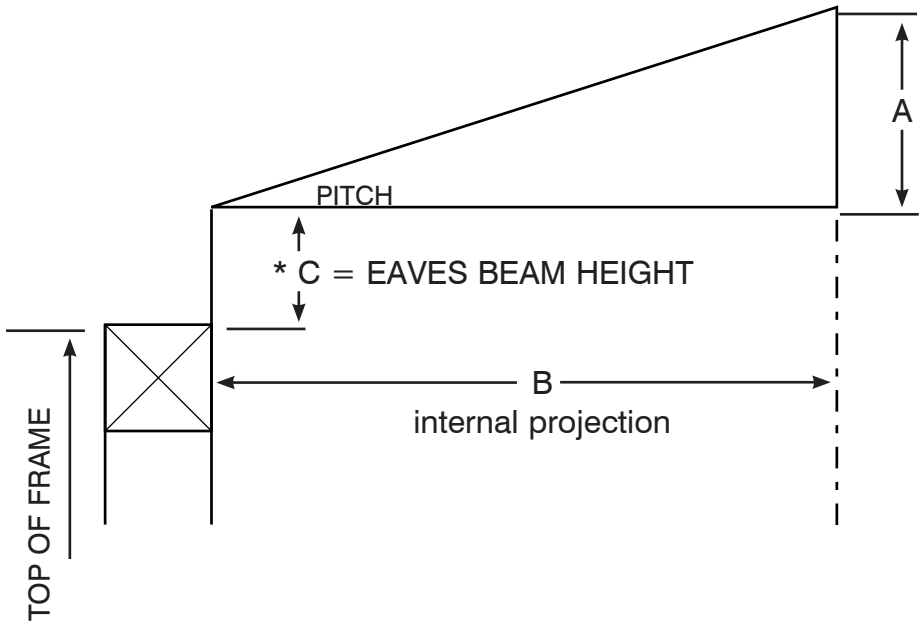
ODD FACETS: BAY PROJECTION ‘Y’ = INTERNAL WIDTH - CENTRE FACET = ÷ 2 = Z OR Y

EVEN FACETS: BAY PROJECTION ‘Y’ =

2 FACETS	INTERNAL WIDTH x 0.2887
3 FACETS	INTERNAL WIDTH x 0.2929
4 FACETS	INTERNAL WIDTH x 0.3633
5 FACETS	INTERNAL WIDTH x 0.3660
6 FACETS	INTERNAL WIDTH x 0.3987
7 FACETS	INTERNAL WIDTH x 0.4005
8 FACETS	INTERNAL WIDTH x 0.4196
9 FACETS	INTERNAL WIDTH x 0.4208
10 FACETS	INTERNAL WIDTH x 0.4281
11 FACETS	INTERNAL WIDTH x 0.4342
12 FACETS	INTERNAL WIDTH x 0.4393
13 FACETS	INTERNAL WIDTH x 0.4436
14 FACETS	INTERNAL WIDTH x 0.4474



HOW TO CALCULATE
A LEAN-TO PITCH

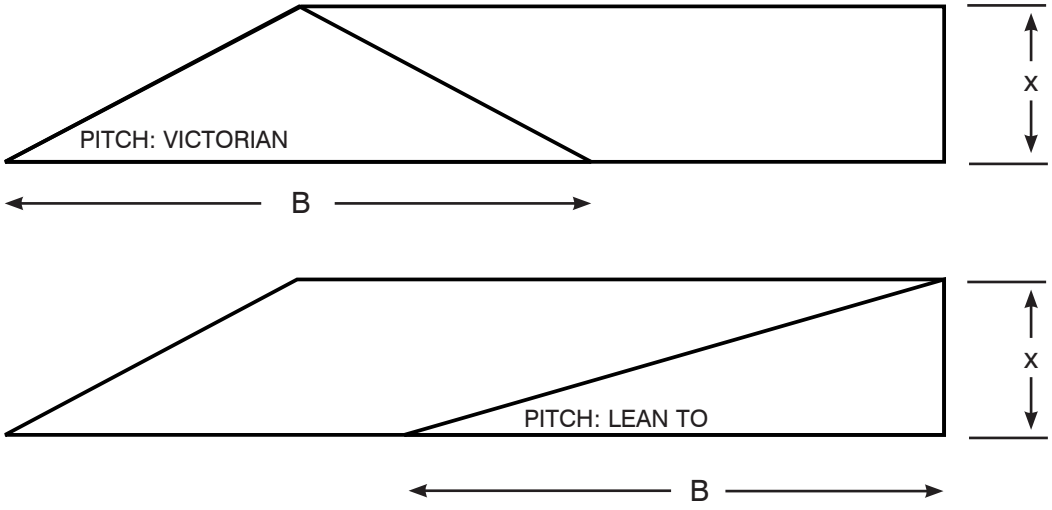


EXAMPLE: PROJECTION 3000MM - PITCH 10° (MULTI EAVES)
A = 3000 X TAN 10° = 528.9
A = 529MM

	MULTI EAVES BEAM
* C = EAVES HEIGHT	@ 5° AND 10° = 108MM
	@ 15°, 20° & 25° = 109MM
	@ 30° = 110MM

HOW TO CALCULATE

A LEAN-TO PITCH OFF A VICTORIAN PITCH
IE. ON P-SHAPE ROOF

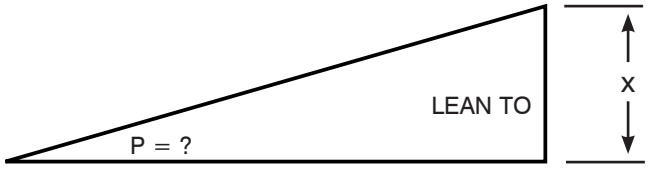


EXAMPLE: VICTORIAN WIDTH 3000MM

VICTORIAN PITCH 25°

LEAN-TO PROJECTION 2500MM

LEAN-TO PITCH ?



TO FIND THE HEIGHT OF ROOF DIMENSION X:

HALF VICTORIAN WIDTH = 1500 X TAN 25° = 699

HEIGHT 699 ÷ PROJECTION 2500 = 0.2796

PRESS: PRESS 2ND F OR SHIFT OR INV (FOR TAN^{-1}) PRESS TAN (FOR TAN^{-1}) PRESS = (15.62°) 16°

PLEASE NOTE: THIS SEQUENCE VARIES DEPENDING UPON THE CALCULATOR USED.

1 UP 4 DOWN

MAIN RIDGE BODY RULES

THERE ARE SIX STANDARD MAIN MK5 RIDGE BODIES 15° - 20° - 25° - 30° - 35° - 40° EACH RIDGE BODY WILL ACCOMMODATE A 5° VARIATION IN PITCH. FOR EXAMPLE A 25° WILL GO UP 1° TO 26° AND WILL GO DOWN 4° TO 21°. IF LOWER, A 20° RIDGE BODY WOULD GO UP TO 21° AND DOWN TO 16°.

THEREFORE: 15° RIDGE BODY - UP TO 15.9° - DOWN TO 15° **MINIMUM PITCH**

20° RIDGE BODY - UP TO 20.9° - DOWN TO 16°

25° RIDGE BODY - UP TO 25.9° - DOWN TO 21°

30° RIDGE BODY - UP TO 30.9° - DOWN TO 26°

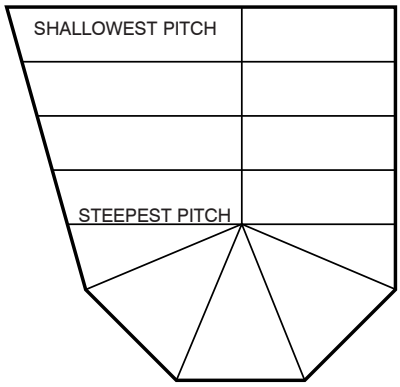
35° RIDGE BODY - UP TO 35.9° - DOWN TO 31°

40° RIDGE BODY - UP TO 40.9° - DOWN TO 36°

RIDGES 41° AND ABOVE ARE FABRICATED FROM SHEET METAL AND ARE REFERRED TO AS MK1 RIDGES. RIDGES HAVE BEEN FABRICATED UP TO 55°, ALTHOUGH WE WOULD NOT RECOMMEND RIDGES ABOVE 50°.

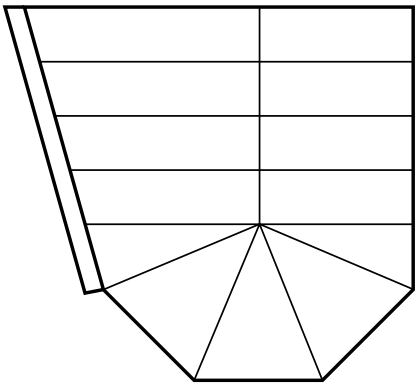
TAPERING EAVES BEAM OR BOX GUTTER

3 FACET VIC WITH TAPERING EAVES

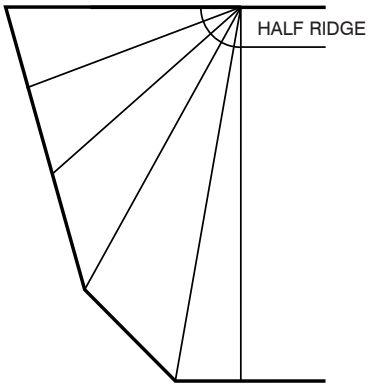


ALL GLAZING BARS ON THE LEFT SIDE OF THE ROOF ARE IN TWIST. CAN BE GLAZED IN POLYCARBONATE - NOT GLASS

3 FACET VIC WITH TAPERING BOX GUTTER

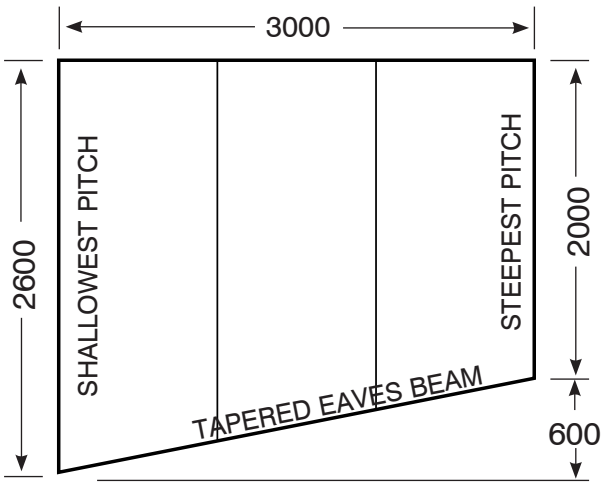


GLAZING BARS LAY FLAT ON THE RIDGE BODY - THEN TWISTED TO LAY FLAT ON THE EAVES BEAM.



A PREFORMED SHEET METAL FABRICATED END IS SHAPED TO MINIMISE THE TWIST IN THE GLAZING BARS TO EAVES BEAM LOCATION.

TAPERED LEAN-TO



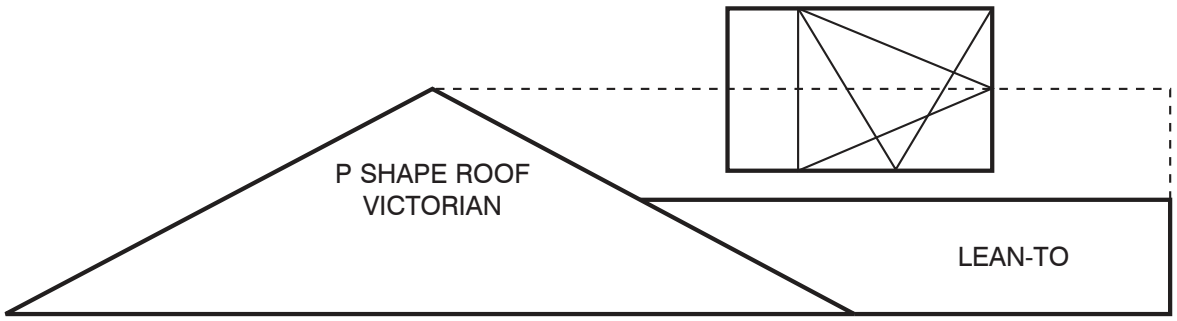
PLEASE NOTE: THE MAXIMUM TAPER IS 200MM PER 1000MM

NB. TAKE CARE NOT TO EXCEED THE 1 UP 4 DOWN RULE EG. IF USING A 25 DEGREE RIDGE BODY AND THE SHALLOWEST PITCH IS 21° BUT THE STEEPEST PITCH EXCEEDS 26° THE DESIGN MUST BE ALTERED IE. A FABRICATED RIDGE WILL BE REQUIRED.

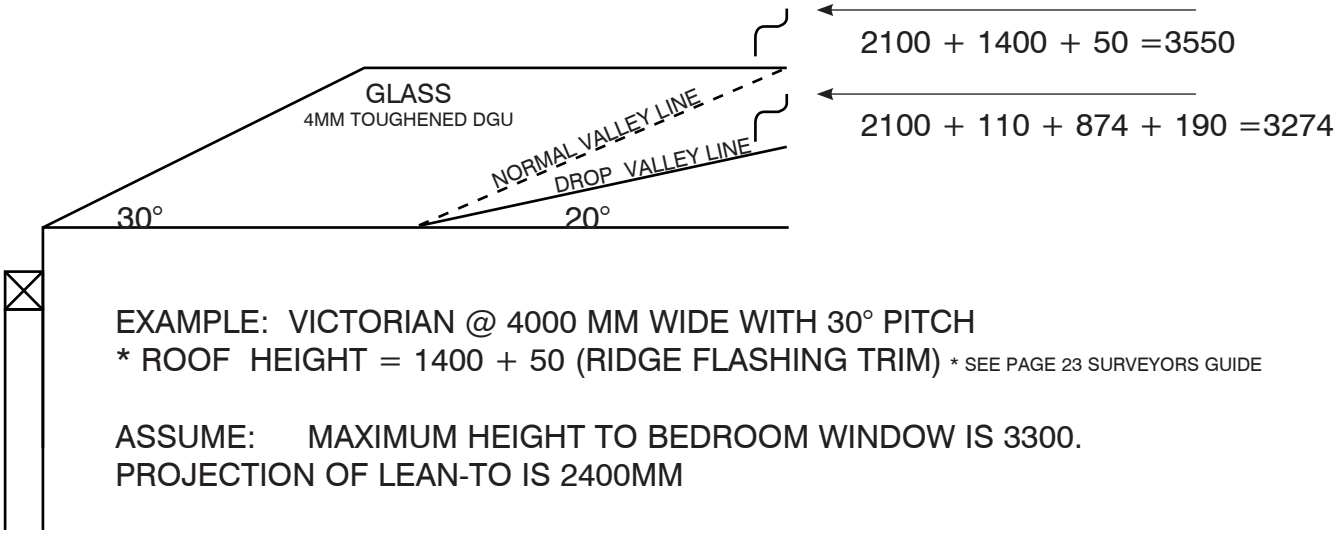
HOW TO CALCULATE

A DROP VALLEY PITCH

ALSO KNOWN AS A LOWERED VALLEY



USUAL REASON FOR A LOWERED VALLEY IS A HEIGHT RESTRICTION AS ILLUSTRATED ABOVE



EXAMPLE: VICTORIAN @ 4000 MM WIDE WITH 30° PITCH
* ROOF HEIGHT = 1400 + 50 (RIDGE FLASHING TRIM) * SEE PAGE 23 SURVEYORS GUIDE

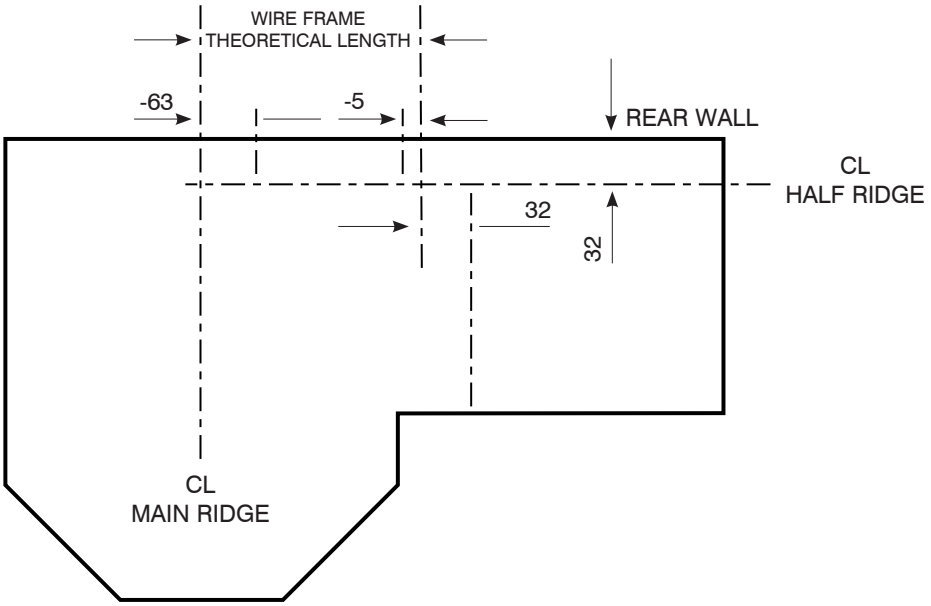
ASSUME: MAXIMUM HEIGHT TO BEDROOM WINDOW IS 3300.
PROJECTION OF LEAN-TO IS 2400MM

FRAME HEIGHT = 2100
EAVES HEIGHT = 110 (MULTI EAVES BEAM)
2400 X TAN 20Þ HEIGHT = 874
**SERIES 7 BAR HEIGHT = 190 (TOP OF HALF RIDGE UPSTAND)
OVERALL HEIGHT = 3274

PLEASE NOTE: INSTALLATION LOCATION IS IMPORTANT: PLEASE REFER TO THE STRUCTURAL DESIGN GUIDE

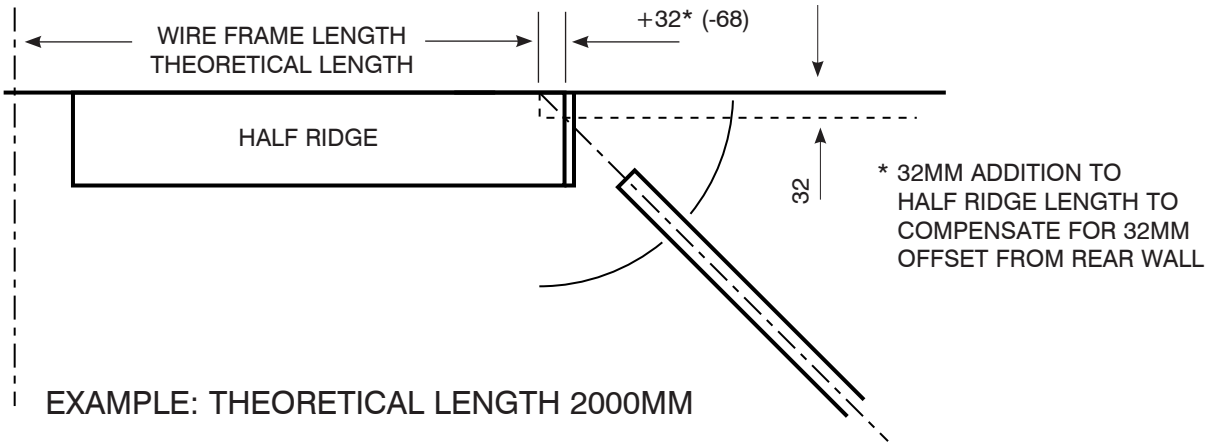
HOW TO CALCULATE

P SHAPE HALF RIDGE LENGTH WITH HIPPED END



-63 CENTRE LINE OF MAIN RIDGE TO START OF HALF RIDGE (MK5)

-5 HALF RIDGE REDUCTION TO ACCOMMODATE 5MM ADAPTOR PLATE

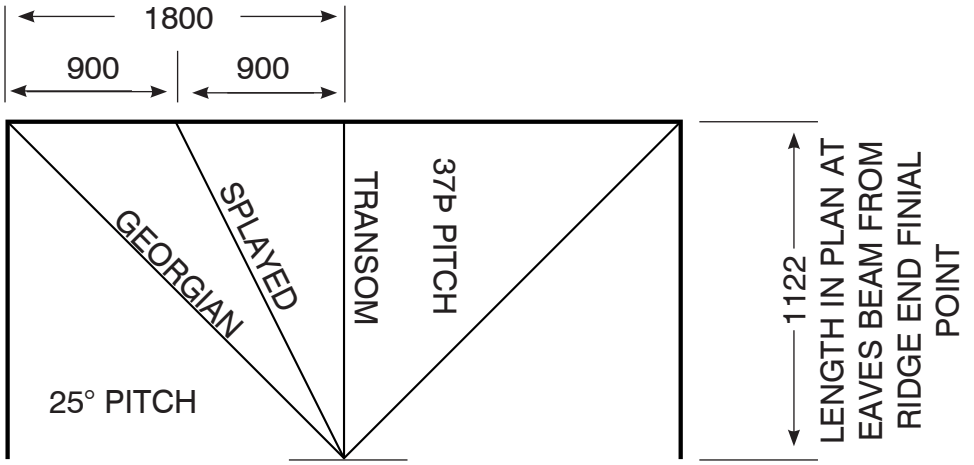


EXAMPLE: THEORETICAL LENGTH 2000MM

2000 + 32 - 68 = CUT LENGTH 1964

HOW TO CALCULATE
WIRE FRAME GLAZING BAR LENGTHS

* ACTUAL GLAZING BAR LENGTH WILL BE DETERMINED BY:
A. REDUCTION FROM FINIAL POINT TO START OF BAR
B. OVERHANG FROM INTERNAL FRAME



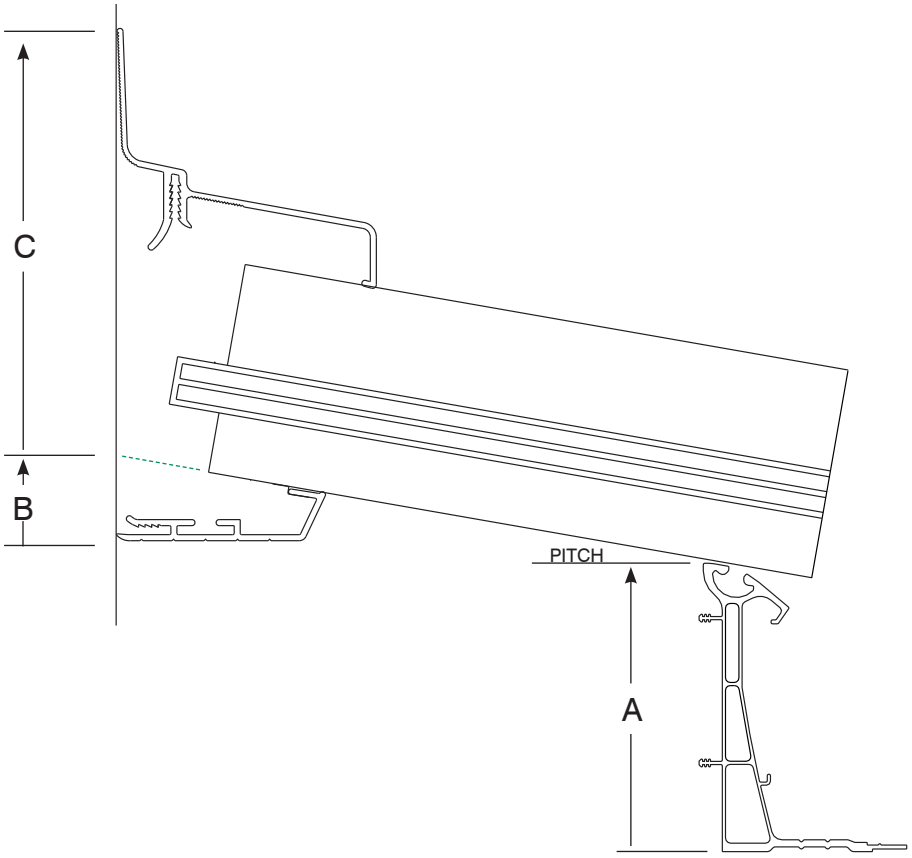
VICTORIAN HIP OR SPLAYED
1122 ÷ COS 37° = 1404.89
PRESS X² PRESS = (1973733.357) + 900
(FROM CENTRE LINE TO SPLIT)
PRESS X² (SQUARED)
PRESS = (2783733.357)
PRESS ÷ (SQUARE ROOT)
PRESS = 1668.45

GEORGIAN HIP
1122 ÷ COS 37° = 1404.89
PRESS X² PRESS = (1973733.357) + 1800
(HALF INTERNAL WIDTH)
PRESS X² (SQUARED)
PRESS = (5213733.357)
PRESS ÷ (SQUARE ROOT)
PRESS = 2283.36

TRANSOM BAR
1122 ÷ COS 37° = 1404.89

HOW TO CALCULATE
VENTILATED WALL PLATE HEIGHTS

MINIMUM PITCH 5° TO MAXIMUM PITCH 30°



DIM A
5° - 109MM
10° - 109MM
15° - 109MM
20° - 109MM
25° - 110MM
30° - 111MM

DIM B
5° - 25MM
10° - 32MM
15° - 35MM
20° - 41MM
25° - 47MM
30° - 54MM

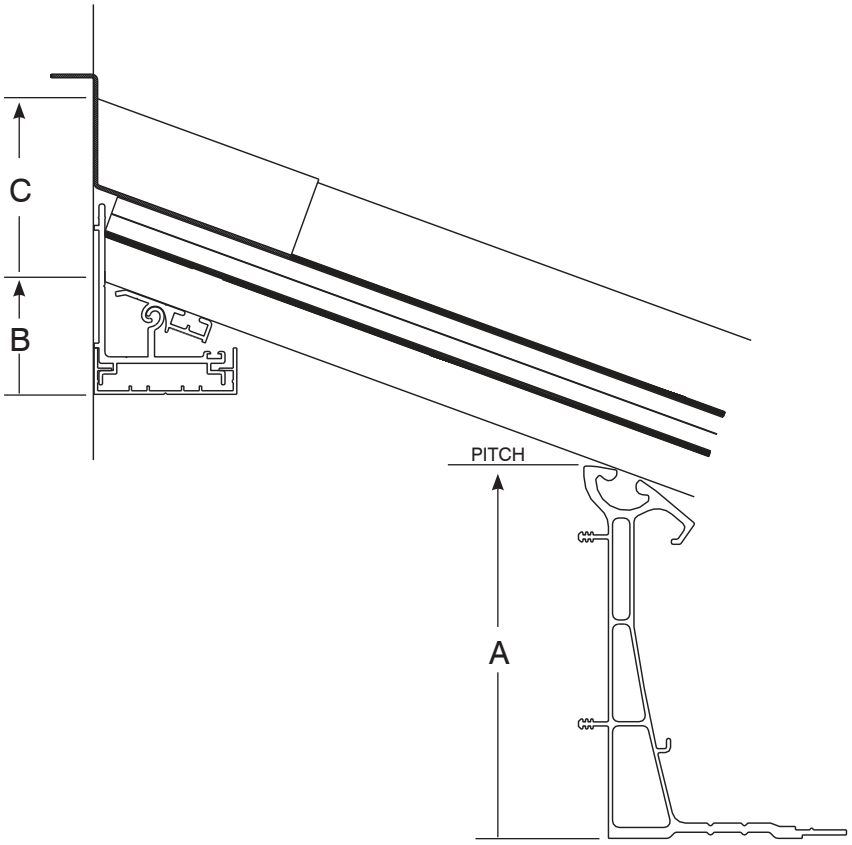
DIM C

BAR TYPE	CHAMBERED SERIES 7
5°	168MM
10°	161MM
15°	156MM
20°	153MM
25°	150MM
30°	145MM

EXAMPLE: PROJECTION 3000MM - PITCH 20° - POLY - FRONT FRAME 2100MM
3000 x TAN 20° = 1091.91 (7 SERIES BAR)
FULL HEIGHT = 2100 + 109 + 1092 + 148 = 3449
HEIGHT TO UNDERCLADDING = 2100 + 109 + 1092 - 41 = 3260

HOW TO CALCULATE
PWLA WALLPLATE HEIGHTS

MINIMUM PITCH 5° TO MAXIMUM PITCH 35°



DIM A
5° - 109MM
10° - 109MM
15° - 109MM
20° - 109MM
25° - 110MM
30° - 111MM
35° - 112MM

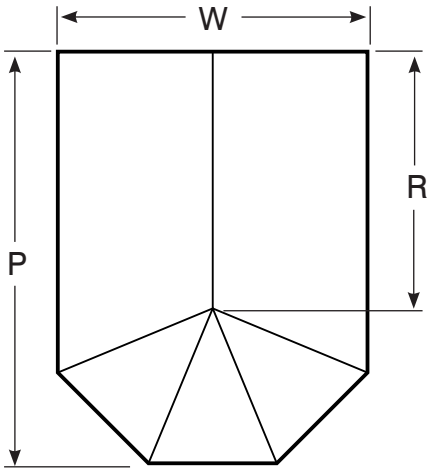
DIM B
5° - 26MM
10° - 30MM
15° - 46MM
20° - 48MM
25° - 51MM
30° - 54MM
35° - 58MM

DIM C

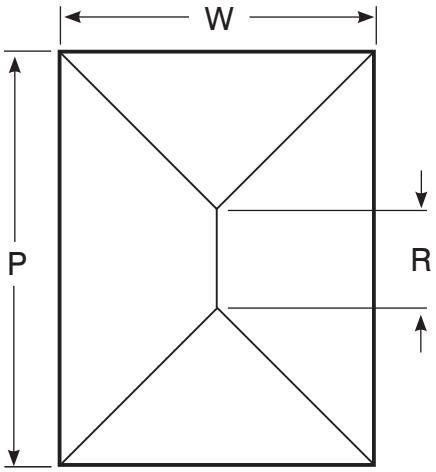
BAR TYPE	CHAMBERED SERIES 7
5°	84
10°	84
15°	86
20°	88
25°	91
30°	96
35°	100

EXAMPLE: PROJECTION 3000MM - PITCH 20° - POLY - FRONT FRAME 2100MM
3000 x TAN 20° = 1091.917+ SERIES BAR
FULL HEIGHT = 2100 + 109 + 1092 + 83 = 3384
HEIGHT TO UNDERCLADDING = 2100 + 109 + 1092 - 48 = 3253

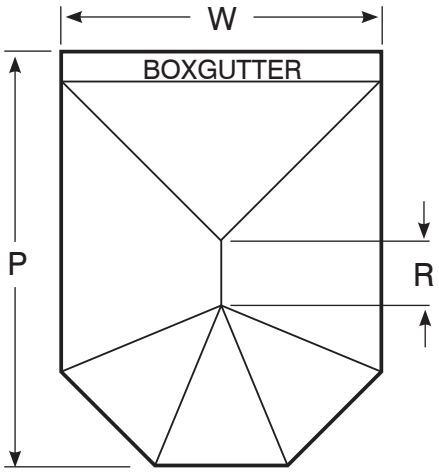
HOW TO CALCULATE
RIDGE LENGTHS



SINGLE ENDED RIDGE
R = P - 1/2 WIDTH
EXAMPLE: P = 4000
W = 4000
THEREFORE R = 4000 - 2000
RIDGE LENGTH = 2000MM



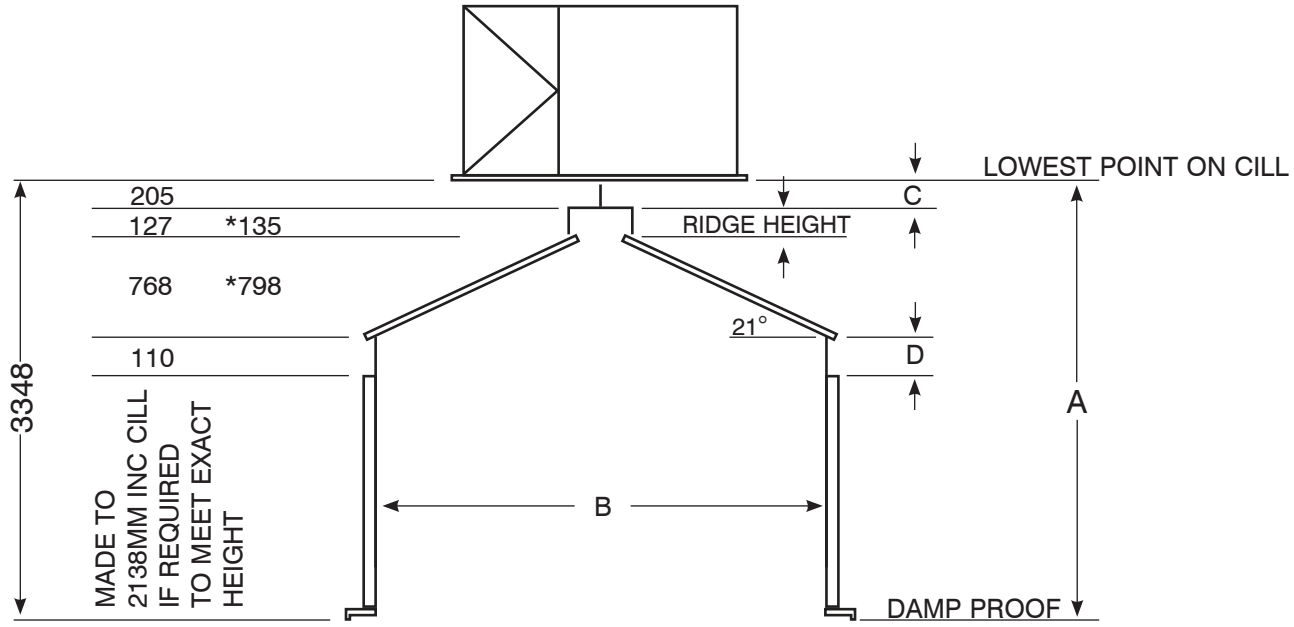
DOUBLE ENDED RIDGE
R = P - W (IF P IS GREATER THAN W) NOTE: IF W IS GREATER THAN P, THE RIDGE WOULD RUN PARALLEL TO W
EXAMPLE: P = 5000
W = 4000
THEREFORE R = 5000 - 4000
RIDGE LENGTH = 1000MM



DOUBLE ENDED RIDGE WITH BOXGUTTER
R = P - BOXGUTTER WIDTH - WIDTH
EXAMPLE: P = 5165, W = 4000.
THEREFORE P - BOXGUTTER WIDTH = 5165 - 165 = 5000
RIDGE = 5000 - 4000
RIDGE LENGTH = 1000MM

HOW TO CALCULATE

PITCH AND HEIGHT OF A CONSERVATORY WHEN GIVEN AN EXACT HEIGHT RESTRICTION



DIMENSION A: GIVEN
DIMENSION 3348 FROM BEDROOM CILL TO DPC
DIMENSION B: GIVEN
DIMENSION 4000MM INTERNAL WIDTH
GLAZING MATERIAL: POLYCARBONATE
GLAZING BAR: SERIES 7
DIMENSION C: CRESTING SELECTED: CLASSIC = 205MM
DIMENSION D: MULTI EAVES BEAM HEIGHT = 110MM

3348 HEIGHT RESTRICTION
2100 INDUSTRY STANDARD FRAME HEIGHT
110 EAVES BEAM HEIGHT
205 CLASSIC CRESTING HEIGHT
154* MAX HEIGHT OF RIDGE FOR 7 SERIES BAR

∴ 3348 - 2100 - 110 - 205 - 154 = 779 ÷ 2000 (HALF INT. WIDTH) = 0.389
PRESS SHIFT OR INV - PRESS TAN (FOR TAN^{-1}) = 21.28°

NOTE: DIMENSIONS BASED ON SERIES 7 BAR WITH CHAMBERED CAPPINGS

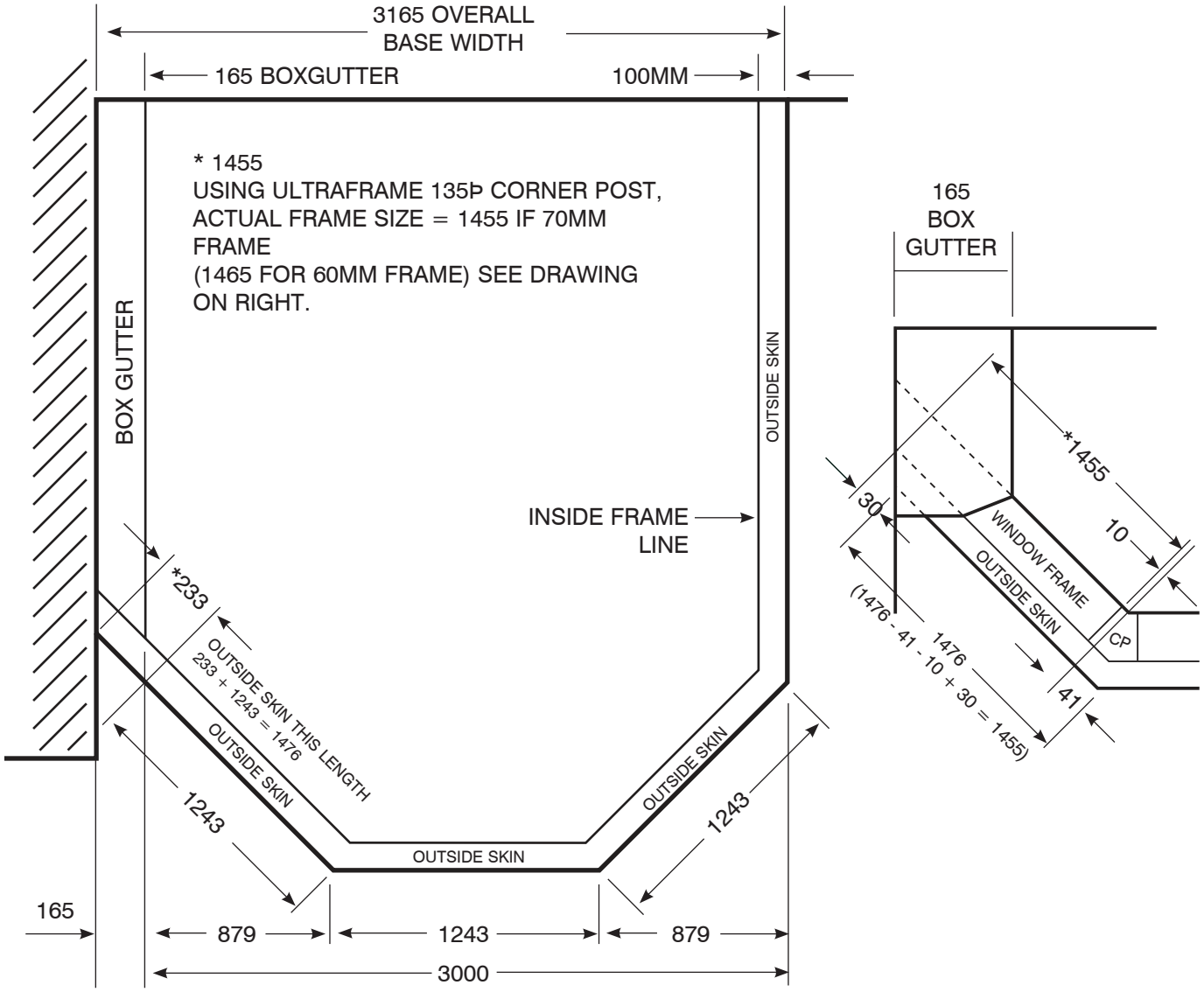
PRESS 2ND F OR SHIFT OR INV

*ASSUMED MAX DIMENSION 154MM
SERIES 7 BAR @ 15°
ACTUAL DIMENSION @ PITCH OF 21.28° WOULD BE 146MM
THEREFORE 779 WOULD REDUCE TO 771MM

∴ 771 ÷ 2000 = 0.385 PRESS 2ND F OR SHIFT THEN TAN = 21.08°
EXACT PITCH = 21.08°
PRACTICAL PITCH = 21°
(2000 X TAN 21° = 768MM)
SEE DIAGRAM FOR EXACT HEIGHTS

HOW TO CALCULATE

EXTERNAL BASE & INTERNAL FRAME SIZES - WHEN COMING OFF A WALL

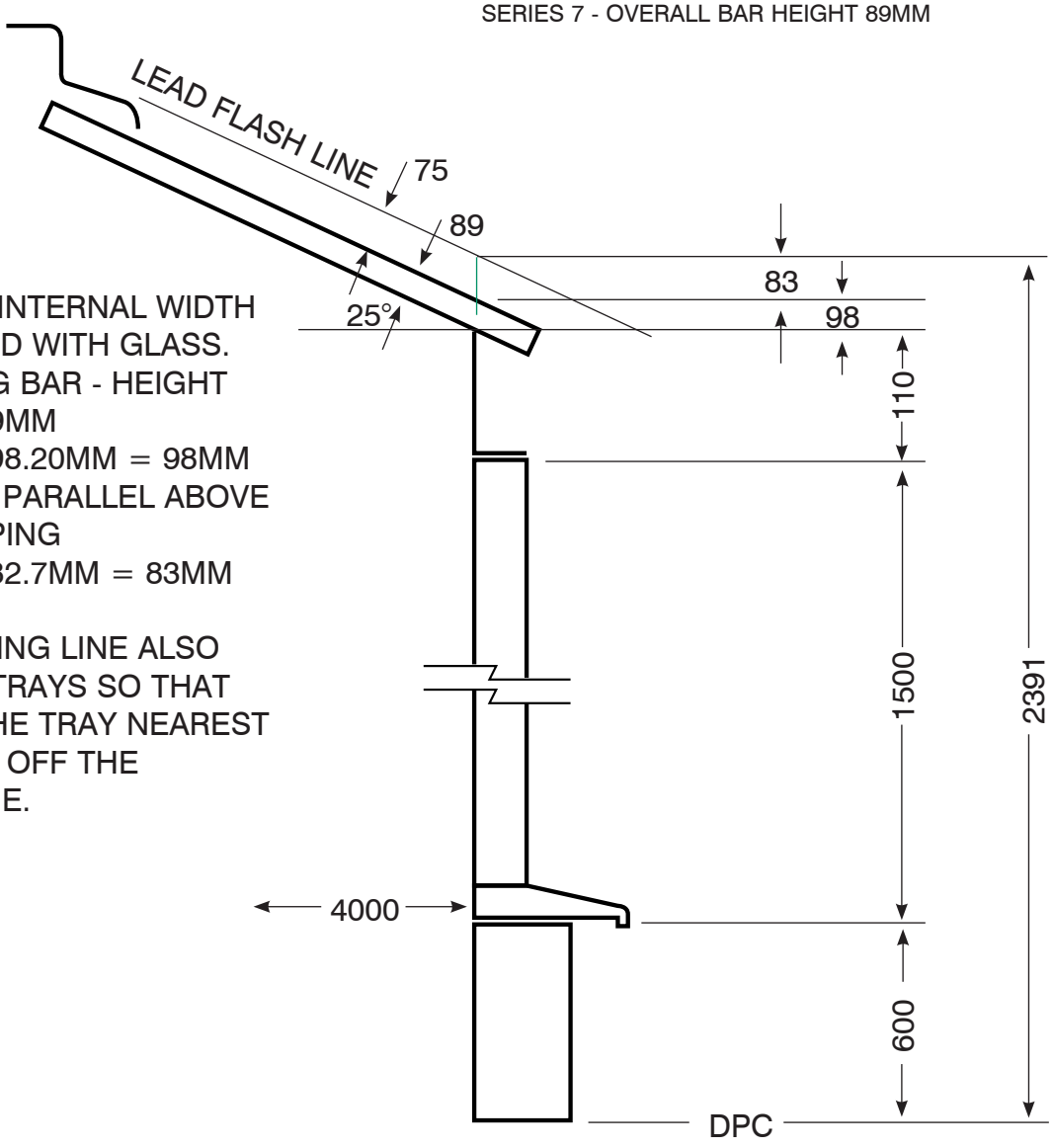


* 233 CALCULATED FROM 165 ÷ COS 45 = 233

HOW TO CALCULATE

TOTAL HEIGHT OF ROOF ABOVE EAVES FOR LEAD FLASHING RUN

SERIES 7 - OVERALL BAR HEIGHT 89MM



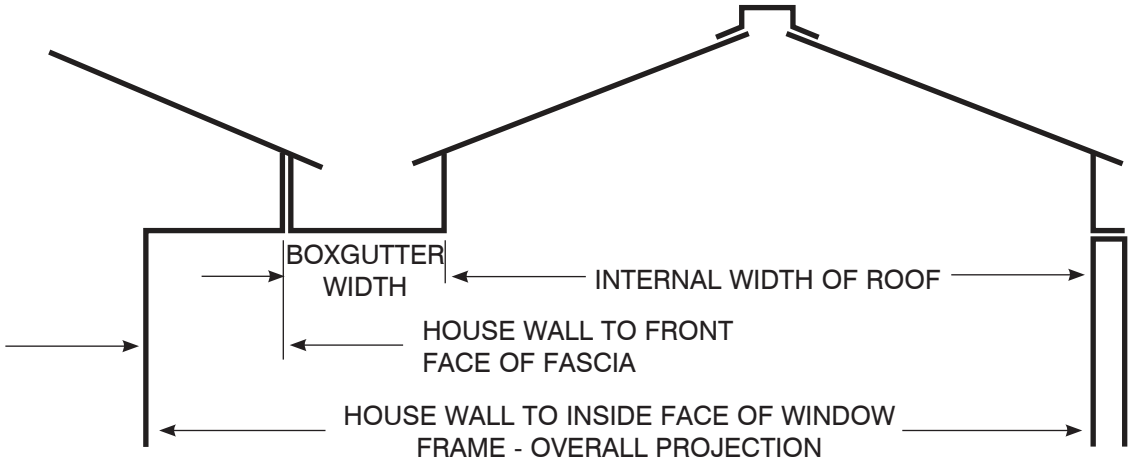
EXAMPLE: 4000MM INTERNAL WIDTH
@ 25° PITCH GLAZED WITH GLASS.
* SERIES 7 GLAZING BAR - HEIGHT INC CAPPINGS = 89MM
∴ 89 ÷ COS 25° = 98.20MM = 98MM
LEAD LINE = 75MM PARALLEL ABOVE STARTER BAR CAPPING
∴ 75 ÷ COS 25° = 82.7MM = 83MM

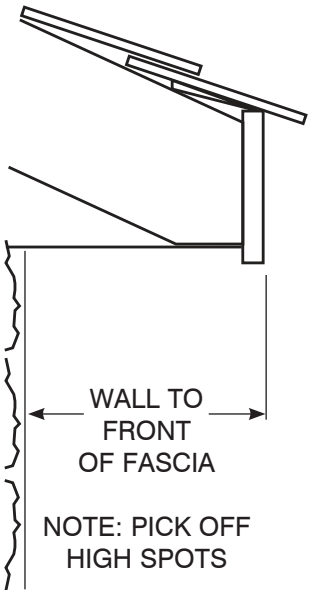
NOTE: LEAD FLASHING LINE ALSO USED FOR CAVITY TRAYS SO THAT THE CORNER OF THE TRAY NEAREST THE ROOF IS 75MM OFF THE FINISHED ROOF LINE.

NOTE: DIMENSIONS BASED ON SERIES 7 BAR WITH STD CHAMBERED CAPPINGS

HOW TO CALCULATE

THE ROOF SIZE (PROJECTION) IF FITTING A BOXGUTTER TO A BUNGALOW FASCIA



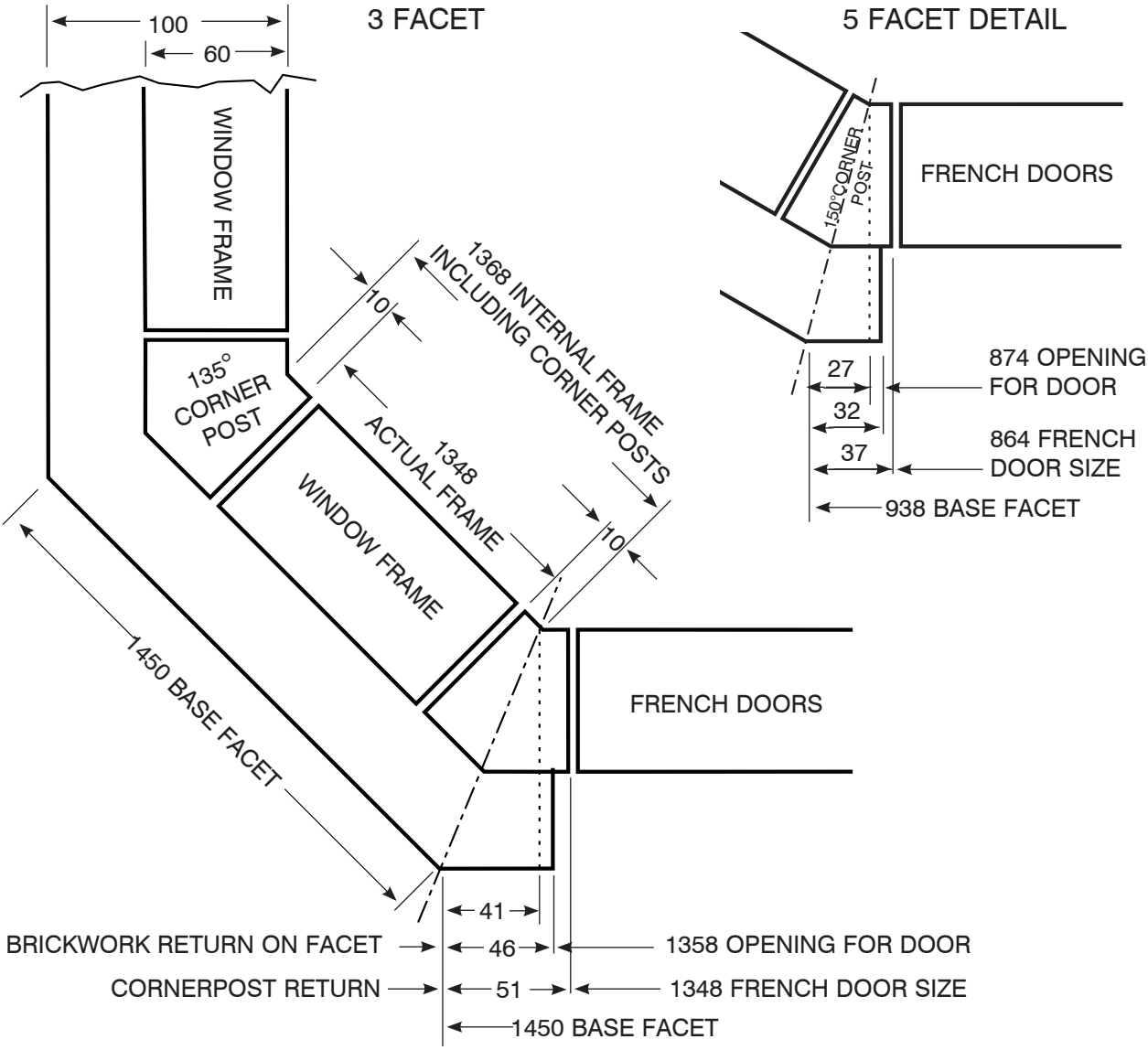


EXAMPLE: OVERALL PROJECTION 4000MM
WALL TO FRONT OF FASCIA 235MM
BOXGUTTER WIDTH 265MM
ACTUAL INTERNAL ROOF DIMENSION =
4000 - (235 + 265) = 3500MM

ROOF SIZE = 3500MM

HOW TO CALCULATE

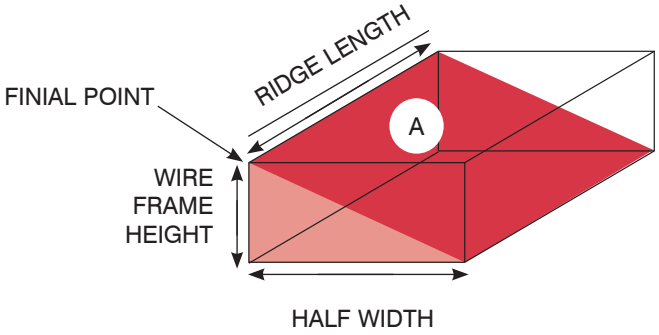
A DOOR OPENING ON A BRICKWORK 3 AND 5 FACET USING THE ULTRAFRAME CORNERPOST SYSTEM



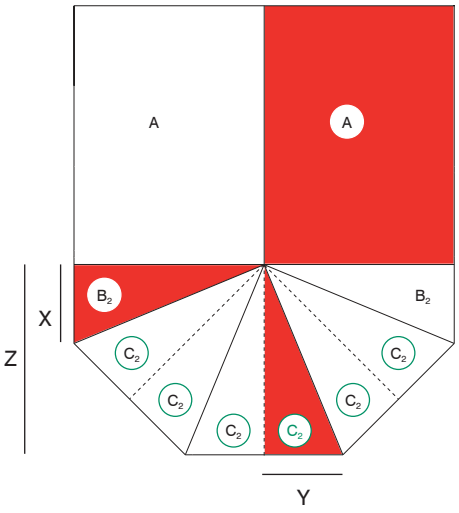
HOW TO CALCULATE

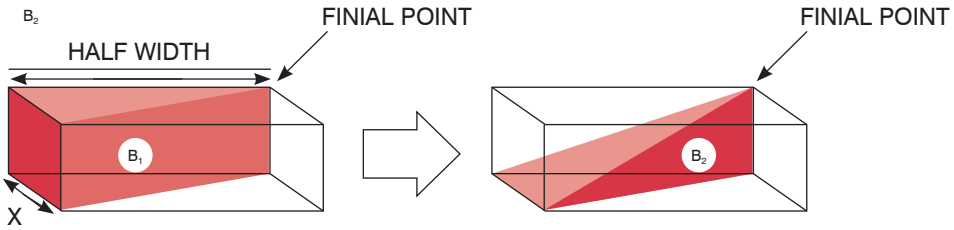
THE TOTAL VOLUME OF A VICTORIAN ROOF

THE TOTAL ROOF VOLUME = (2 X A) + (2 X B_2) + (6 X C_2)



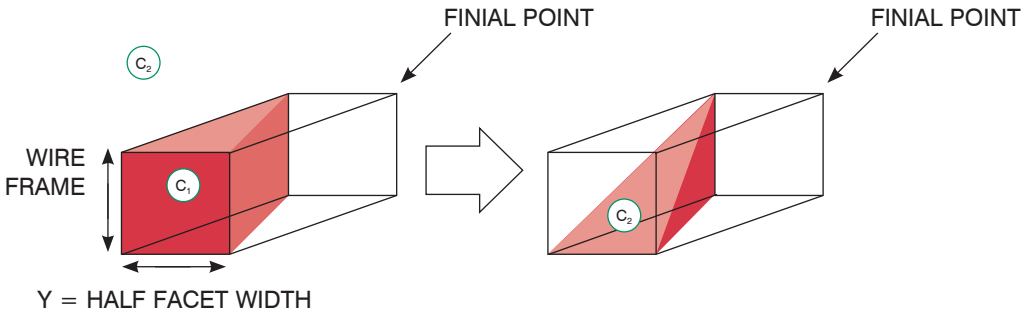
Volume A = $\frac{\text{ridge length x wire frame height x half the width}}{2}$





Volume B_1 = $\frac{\text{half the width x wire frame height x 'X'}}{2}$

Volume B_2 = $\frac{\text{Volume } B_1}{2}$



Volume C_1 = $\frac{\text{'Y' x wire frame height x 'Z'}}{2}$

Volume C_2 = $\frac{\text{Volume } C_1}{2}$

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