

FRAMING TIE-DOWNS TO AS1684.2 DUE TO UPLIFT (IN NON-CYCLONIC ZONES)

Introduction:

Tie-downs due to Uplift are **connection or fixings** to resist the **Uplift Forces** (Suction) caused by the wind on a roof. Tie-downs are a requirement in Australia for Residential Timber-Frame Construction, like Bracing.

In most new residential zones where the wind classification does not exceed N2, nominal fixings (minimum fixings) are adequate for majority of the framing connections from the ceiling downwards. But as the wind speed increases in higher wind areas, additional specific fixings and tie-down connections are required to resist the increased uplift forces (refer to AS1684.2-2010, Table 9.2 & Table 9.2)

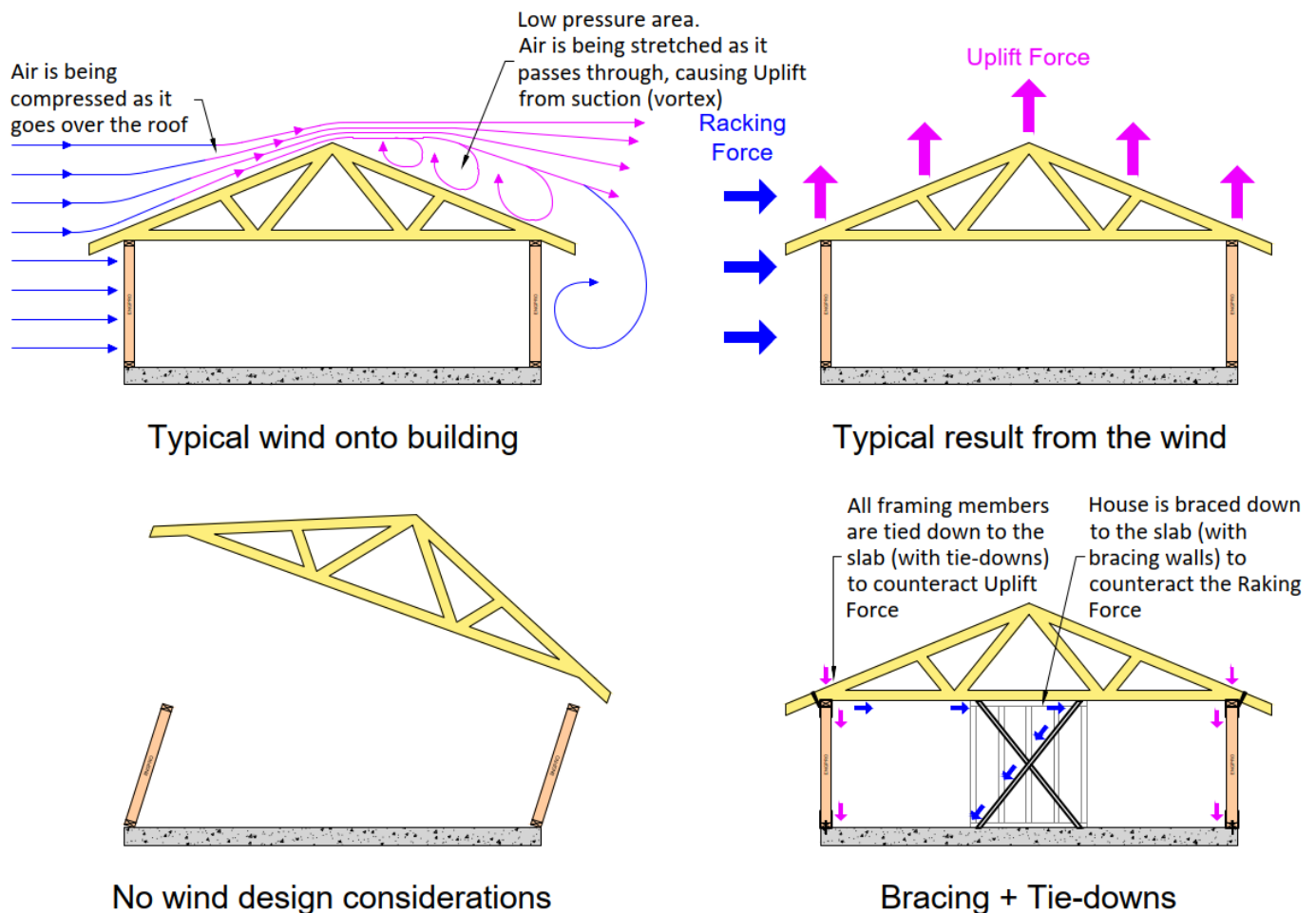


Image 1

TABLE 9.2

UPLIFT

Connection	Wind classification							
	N1		N2		N3		N4	
	Sheet roof	Tile roof	Sheet roof	Tile roof	Sheet roof	Tile roof	Sheet roof	Tile roof
Roof battens to rafters/trusses — within 1200 mm of edges — general area	S S	S S	S S	S S	S S	S S	S S	S S
Single or upper storey rafters/trusses to wall frames, floor frame or slab	S	N	S	N	S	S	S	S
Single or upper storey floor frame to supports	N	N	N	N	S	S	S	S
Lower storey wall frame to floor frame or slab	N	N	N	N	S	S	S	S
Lower storey floor frame to supports	N	N	N	N	N	N	S	S

N = nominal (minimum) connection only (refer to Clause 9.5)
S = specific connection may be required for uplift forces (refer to Clause 9.6)

AS1684.2-2010 Table 9.2

Why tie-down:

- Secure house to withstand uplift forces from wind loads.
- Prevent framing movement due to wind loads.

Absents of tie-downs in high wind areas can result in:

- Roof/timber frame ripping off, from the house.
- Cracks in the walls/ceiling due to timber frame movement
- Weak connections between timber frame members in high wind areas

TABLE 9.5

NET UPLIFT PRESSURE, kPa

Connection/tie-down position	Wind classification							
	N1		N2		N3		N4	
	Sheet	Tile	Sheet	Tile	Sheet	Tile	Sheet	Tile
Roof battens to rafters/trusses — within 1200 mm of edges — general area	1.31 0.68	0.91 0.28	1.84 0.98	1.44 0.58	2.92 1.57	2.52 1.17	4.39 2.38	3.99 1.98
Single- or upper-storey rafters/trusses to wall frames and wall plates to studs, floor frame or slab	0.44	—	0.74	0.14	1.33	0.93	2.14	1.74
Single- or upper-storey bottom plates to floor frame or slab	0.12	—	0.42	—	<i>1.01</i>	<i>0.61</i>	<i>1.82</i>	<i>1.42</i>
Single- or upper-storey floor frame to supports	—	—	—	—	<i>1.01</i>	<i>0.61</i>	<i>1.82</i>	<i>1.42</i>
Lower storey wall frame to floor frame or slab	—	—	—	—	<i>1.01</i>	<i>0.61</i>	<i>1.82</i>	<i>1.42</i>
Lower storey floor frame to supports	—	—	—	—	—	—	<i>1.0</i>	<i>1.0</i>

NOTE: The values in italics make allowance for overturning forces, which dictate rather than direct uplift.

AS1684.2-2010 Table 9.5

Factors affect tie-down:

- **Wind Classifications:** When the wind classification increases, the uplift pressure force also increases. (Refer to AS1684.2-2010 Table 9.5 Net uplift pressure)
- **Permanent/Dead Load of Structure:**
 - As the connection moves further down towards the slab, the uplift pressure value is lower compared to connections near the roof (Refer to AS1684.2-2010 Table 9.5 Net uplift pressure). This is due to the permanent weight of the walls, flooring, etc... increasing the overall weight of the House, and reducing the Net overall uplift pressure.
 - AS1684.2-2010 classifies the minimum requirement for residential houses based on different roofing material. E.g. For Tile Roof: the self weight is higher than Sheet Roof, making less uplift force due to the weight of the tiles reducing the Net overall uplift pressure.
- **Area of Roof:** The uplift force is higher on a house with a larger roof due to the contact area being larger.
- **Timber Grade/Species:** Different Grade/Species to timber will affect the fixings used for tie-downs.
 - E.g. Nails used in weaker grade timber will not provide higher capacity than nails used in stronger timber.
- **Type of connection method used:** Specific tie-down connection from AS1684 or from any Manufacturer's proprietary products, provide different capacities to uplift.
 - All unique connections have different recommendations on fixings/straps/anchors, sizes, number of nails/screws/bolts, minimum timber edge distance, etc. Which affects the capacity against uplift.

Typical tie-down of double-storey member path to slab:

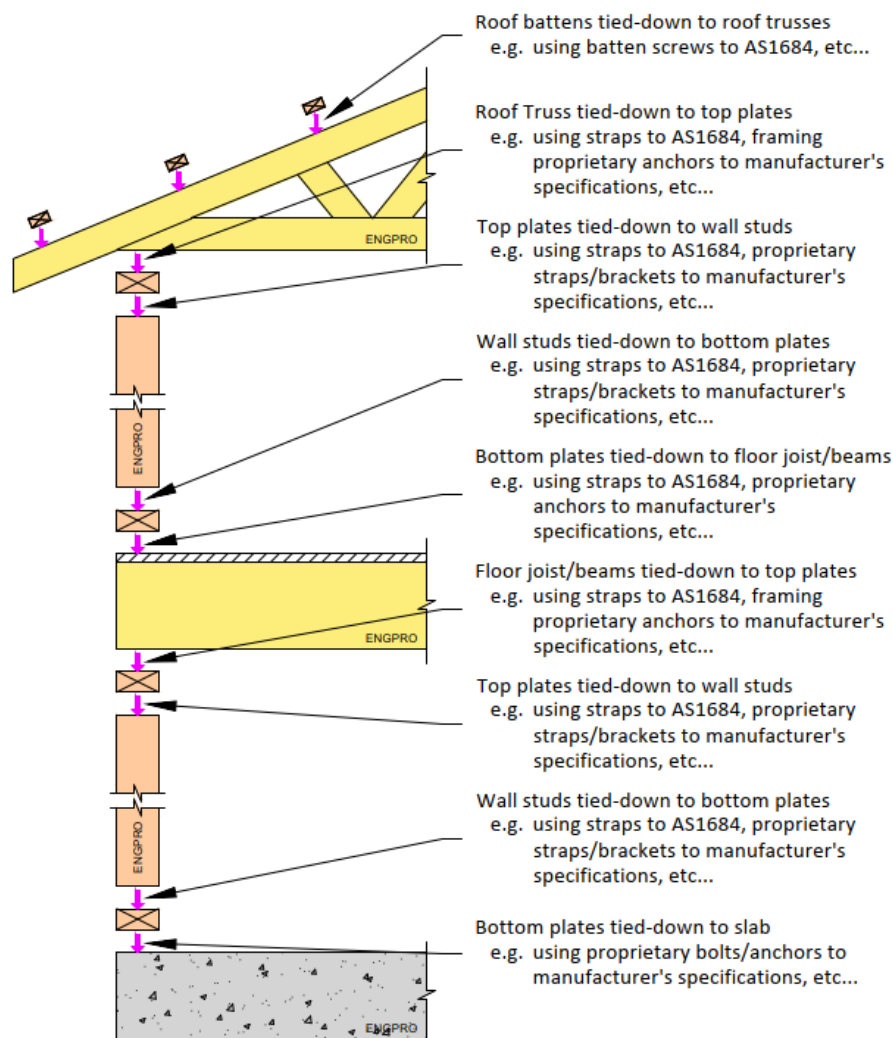


Image 4

References

- AS1684 - Residential timber-framed construction
- Refer to Table 9.2 of AS1684.2 for Specific fixing requirement for Uplift
- Refer to Table 9.5 of AS1684.2 for Net Uplift Pressure