Tie *me* **up** *me* **down**

How to secure your aircraft against high winds.

EACH YEAR SEVERAL Australian general aviation aircraft are needlessly damaged by wind gusts because of inattention to weather forecasts, negligence or inadequate tiedown measures.

According to one aviation insurer, the damage bill for a storm-damaged aircraft typically exceeds $50,000.

Ahead of the autumn season, aircraft owners in the north and south of the continent should be wary of strong winds. Summer thunderstorms from heat convective build up are still present in the south, and the tail end of the wet season can bring some windy surprises in northern Australia.

Across the north, the windiest months run from October through to April. The south poses a different story – there the colder months blow more strongly.

During summer months, strong northerly winds often occur ahead of a front, while during winter they usually follow the passage of a front.

The Australian Bureau of Meteorology issues airport warnings that carry alerts for winds with a mean speed of 34kt or greater and wind gusts of 42kt or greater. The warnings are issued for most major civil aerodromes. They are made available by the bureau to the aerodrome authority for local distribution.

The best protection against storm damage is to fly the aircraft out of the impending storm area.

The next best measure is to secure the aircraft in a storm-proof hangar or other suitable shelter (see article on page 36 for tips on long-term storage). If a hangar is not available, you should make sure the aircraft is tied down securely.

If fixed tiedown points are unavailable, try to find a sheltered place to picket the aircraft, such as a natural depression in the ground, in the lee of a building, or behind a belt of trees. Seek local knowledge – sometimes what seems the most logical place may in fact be the worst because of localised wind effects.

If a relatively sheltered place cannot be found, it may be possible to park a truck or tractor in front of the aircraft. This can serve as an extra tiedown point, as well as help to break up the airflow over the aircraft.

Any aircraft parking area should be equipped for three-point tiedowns. The direction in which the aircraft are to be parked and tied down will be determined by prevailing or forecast wind direction.

Permanent anchor points: Aircraft should be headed into the wind.

The spacing of tiedowns should allow for ample wingtip clearance between aircraft. The distance is generally equal to the major axis (wingspan or fuselage length) of the largest aircraft usually operated, plus three metres.

The location of tiedowns is usually indicated by white or yellow paint, painted tyres, or crushed stone surrounding the anchor point. The tiedown anchor eye should not protrude more than 2.5cm above the ground.

Fixed tiedown anchors for single-engine aircraft should provide a minimum holding power or strength of around 1,400kg each. The type of anchor used depends on whether the parking area is concrete, bitumen or unpaved grass (see diagram).

Some aerodromes use continuous lengths of parallel wire ropes passed through U-bolt anchors and fastened at the ends of the line with wire rope clips. The distance between the wire ropes will depend on the aircraft.

Tiedown chains (or ropes) are attached to the wire rope with roundpin galvanised anchor shackles. This allows the tiedown chains to "float" along the wire rope and gives a variable distance between anchor points so a variety of aircraft can use a vertical tiedown without loss of space.

Pickets: If permanent tiedown facilities are not available, you could use your own set of pickets. Your picket set should include six (or eight) steel stakes, three (or four) crossover tubes, and three ropes of appropriate length, all stowed in a bag or other suitable container. You will also need a mallet of some sort. Be sure to include the pickets in your weight-and-balance calculations, and ensure that they are well secured in the aircraft before flight.

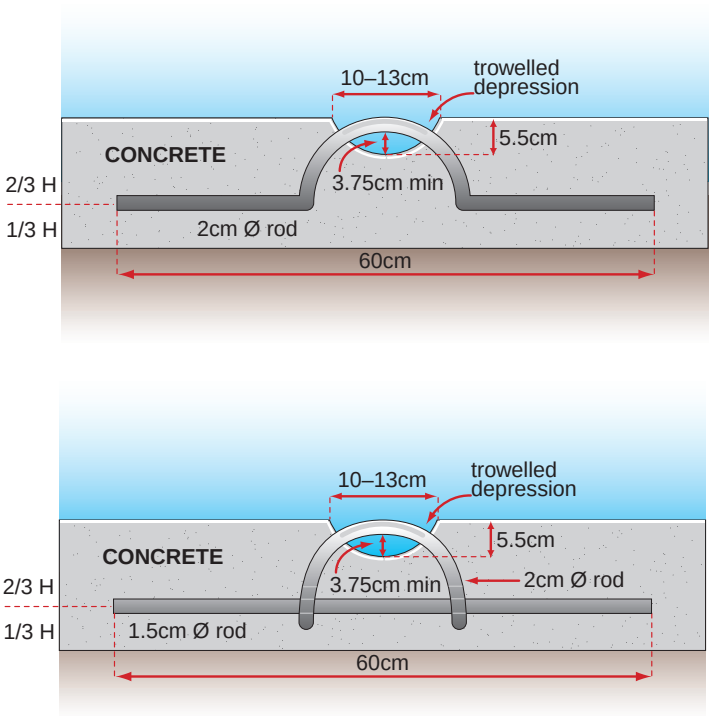
Care should be taken when selecting the area in which to picket the aircraft. Pickets can pull out under strain if the ground is soft or becomes wet. However, they are the best option when permanent tiedown anchors are not available as is the case on many smaller aerodromes. The coiled type are difficult to get into stony ground and tend to pull out in soft ground.

The underwing ropes should be led to points outboard and forward of the underwing attachment point.

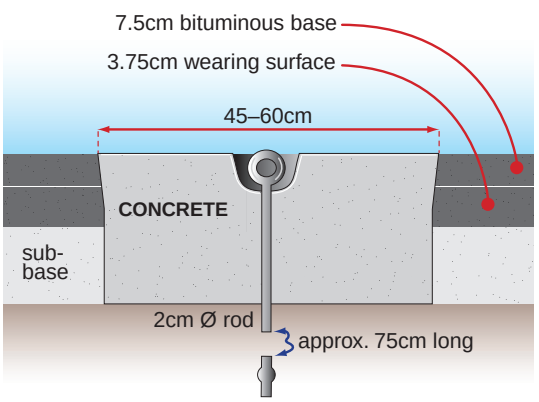
Ropes: Tiedown ropes need to resist a pull of around 1,400kg (3,000 pounds). Nylon or dacron rope is preferable to manila rope, which shrinks when wet, is subject to mildew and rot, and has less tensile strength.

Manufactured tiedowns (webbing with end fittings and a ratchet tightener) can also be used. These are made to a variety of load figures. Be wary of the single S-clip fitting usually supplied at the ends – these can unhook from the aircraft tiedown ring with significant wing rocking. Make sure you have a closed fitting that cannot come off – this might mean you will need to have the tiedowns custom-made. You should not try to re-fit the ends yourself, as the stitching can be the weakest link. Don't use chains, as there

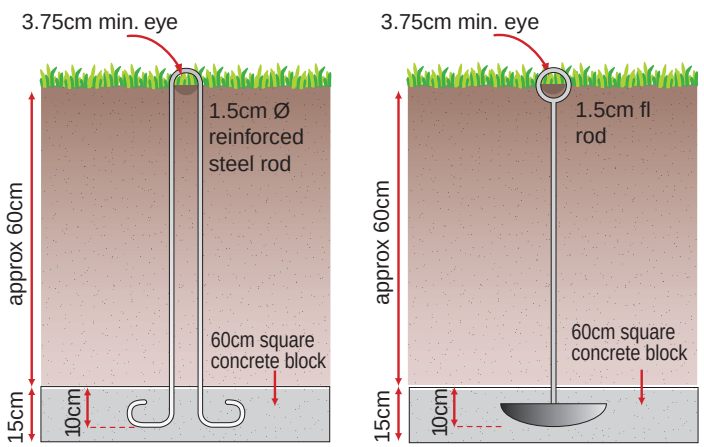
CONSTRUCTION OF TIE-DOWN ANCHORS



Tiedown anchors for concrete paved areas.



Tiedown anchors for bituminous paved areas.



Tiedown anchors for turfed areas.

is no elasticity in them to avoid sudden shock being applied to the aircraft structure in gusty conditions.

A combination of chain and rope can be used, but the rope must always be the part attached to the aircraft. Chains are often used with the parallel wire cable system – in this case the vertical anchor and the flex in the wire rope significantly reduce impact loads. Chains should be secured without slack and all fittings must be equally as strong . Dog-chain type clips are not strong enough so round-pin galvanised anchor shackles should be used.

To secure your aircraft, use three-point tiedowns, allowing adequate wingtip clearance from other parked aircraft. Make sure adjacent aircraft are also securely tied down – your efforts will be wasted if the neighbouring aircraft blows into yours.

Your aircraft should be parked and tied down into wind, or as nearly into wind as possible.

Tailwheelers: There are differing opinions as to whether a tailwheel aircraft should be tied down tail into wind. Remember, aircraft are designed to meet airflow head-on, and flying control surfaces can be easily damaged if control locks are not in place when aircraft are parked tail into wind.

Tailwheel aircraft also have a tendency to turn into wind. Therefore, if your aircraft is parked tail into wind (and not properly secured), it could be blown over as it is rotated into wind by a sudden gust. If you park your aircraft tail into wind, make sure the park brakes are on, control locks are in place and the tail is securely tied down.

Always check the area for items that could become flying debris.

Flight controls should be locked or tied to prevent them banging against the stops and damaging hinges, cable, pulleys and so on.

Secure the ailerons, rudder and elevator in their neutral position. If integral gust-locks aren't fitted, use external control surface locks or secure the control column. The problem with using a seatbelt to do this is that the control column is pulled back with full aileron deflection one way. It's better to use bungee cords.

When using external surface locks, make sure they have a means of reminding the pilot to remove them before flight.

Tailwheel aircraft should have the elevators locked in the up position when facing into wind – unless the tail has been raised to the flying position, when they should be secured in the neutral position as for tricycle type aircraft. If a tailwheel aircraft is parked tail into wind, then the elevator should be secured in the down position.

After the aircraft is properly located, lock the nosewheel or the tailwheel in the fore-and-aft position, apply the park brake, and chock the main wheels fore and aft.

All doors, windows and hatches should be closed properly. To prevent entry of foreign matter you should cover engine openings (intake and exhaust) and pilot-static tubes.

Fuel tanks can be topped up to provide mass and added stability in gusts.

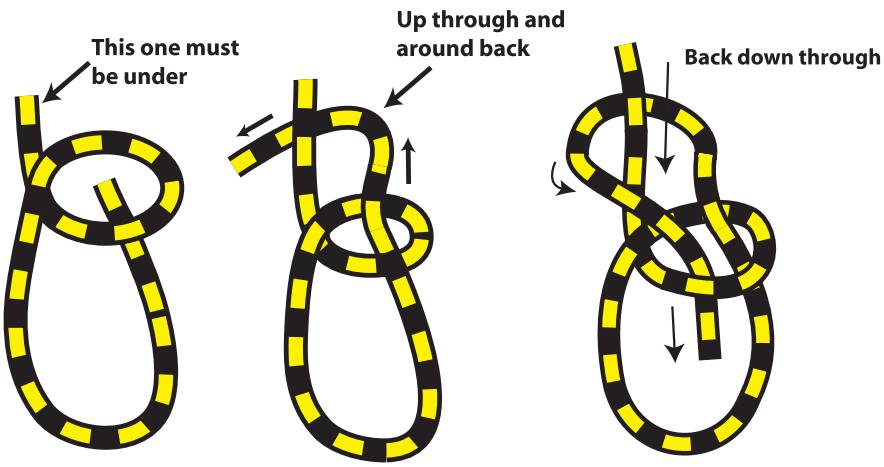
You should double-check the security and sealing of fuel tank filler caps to stop water from heavy rain getting in. If the filler cap sealing is in doubt, then ducting tape should be placed over the cap area.

Tyres can be deflated as an extreme measure for reducing bounce.

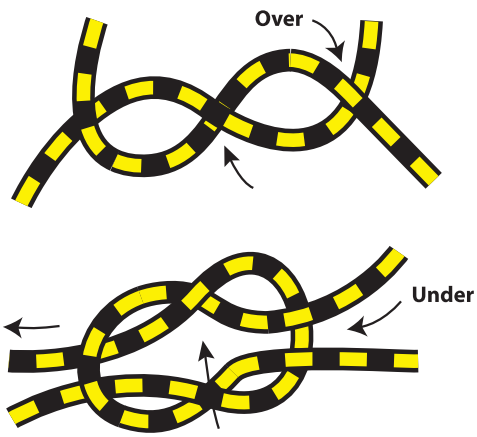
Ropes should be tied only to the tiedown rings provided. Never tie to a strut as the rope may slip to a point where even slight pressure can bend the strut.

Ideally, you should position the aircraft so that underwing ropes can be led to points 1m outboard and 2m forward of the

TYING A BOWLINE



TYING A SQUARE KNOT



underwing attachment point.

On tricycle undercarriage aircraft, secure the middle of a length of rope to the tiedown ring under the tail section, then pull each end of the rope away at an angle of 45 degrees and secure to ground anchors. If extreme weather is expected, tie down the nosewheel as well.

When you tie ropes, draw them tight (not stretched) and then back them off a few centimetres. Too much slack allows the aircraft to jerk against the ropes. If the rope is too tight, it can put too much stress on the aircraft.

Tie down rope is only as good as the knot you use. Use an anti-slip knot like the bowline "figure eight" or "round turn and two half hitches". Don't use reef knots because they are unreliable, particularly for synthetic rope.

Wing lift from the wind can be reduced by using spoiler boards placed span-wise along the top of the wing. If the winds exceed the lift-off speed, the spoilers should run the entire length of the wings.

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Multi-engine aircraft: Multi-engine aircraft require stronger tiedowns because of their weight. The anchors should be capable of a holding power of 1,814kg (4,000 pounds) each for the lighter executive twin-engine aircraft.

Multi-engine aircraft should be tied down and chocked when left unattended for any length of time. You should use gust locks to protect control surfaces – these should be well marked to stop any attempt at take-off with them still in place.

If the landing gear uses down lock safety pins, these should be inserted when the aircraft is being secured.

After the aircraft has been standing out in a storm, you should carry out a careful pre-flight inspection. Look for any structural damage around control hinges, or wing skins at points where high loads collect. Check all hinges and controls for unusual slackness.

Pay particular attention to fuel drains. Drain all sumps and check each sample; shake the wingtips and repeat the draining process. Don't forget to remove all opening covers and external gust-locks before flying.

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