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ASRA COMPLIANT GYROGLIDER CONSTRUCTION STANDARDS

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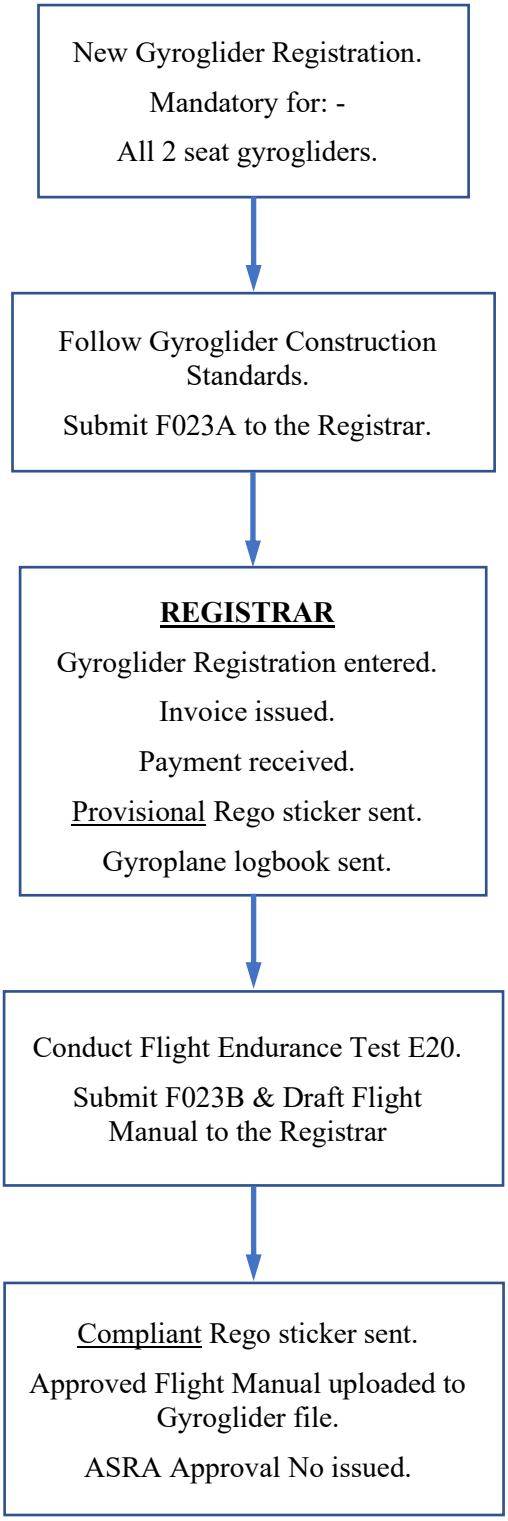
INTRODUCTION

Neither CASA nor ASRA guarantee the airworthiness of any gyroplane, and pilots fly gyroplanes at entirely their own risk.

The Construction Standards must therefore be seen as solely a pre-requisite for registration and not to be considered as any information to which any form of liability attaches.

NEW GYROGLIDER REGISTRATION PROCEDURE.

The flow chart below represents the steps to follow to obtain final Compliant registration.



ABBREVIATIONS AND DEFINITIONS

Factor of safety	Multiplier of limit load to determine design ultimate load.
Fire proof	Capable of withstanding for a period of at least 15 minutes the application of heat by the standard flame.
Fire resistant	Capable of withstanding for a period of at least 5 minutes of heat by standard flame.
Standard flame	A flame with the characteristics which are similar to those described in BS 3G 100 Part 2 Section 3013.
Limit load	Maximum expected static load on a component.
Primary structure	Those parts of the structure the failure of which would endanger the gyroglider.
Cockpit	The position from which the pilot controls the gyroglider, whether it is enclosed of not.
Ultimate load	Limit load multiplied by the factor of safety.

Acronyms

C of G	Centre of gravity
EAS	Equivalent air speed.
IAS	Indicated air speed.
PSIG	Pounds per Square Inch Gauge
RPM	Revolutions Per Minute
VD	The Maximum Design Speed, EAS.
VDF	The Maximum Demonstrated Flight Speed. EAS.
VNE	The Never Exceed Speed, IAS.
VMIN	Minimum Level Flight Speed, IAS.
g	The acceleration due to gravity is 9.80 ms^{-2}

SUBPART A- General

A5 Purpose

The Australian Sport Rotorcraft Association Inc. Gyroglider Construction Standards comprise the minimum requirements for the issue of a registration certificate for an Approved Gyroglider under the authority granted by CAO 95.14 and, when gazetted, CASR parts 103 and 149.

Gyrogliders which conform to the Construction Standards, are restricted in the use of airspace as defined in the Association's Operations Manual.

Only gyrogliders, which have been shown to comply with these requirements, will be eligible for a Type Acceptance Certificate.

A10 Applicability

For the purpose of these requirements, such Gyroplanes are referred to as Gyrogliders.

(a) These requirements shall be applicable to gyrogliders having:

(i) Not more than two occupants; and

(ii) A maximum take-off weight not exceeding 350kg.

(b) A gyroglider is defined as a non-self-powered rotorcraft with rotor blades that are not engine driven in flight, and is supported in flight by the reaction of the air on one of more rotors which rotate freely on substantially vertical axes, when the aircraft is in normal level flight.

(c) These requirements apply to gyrogliders of orthodox design. Aircraft having the following basic features will be so regarded:

(i) Non-power-driven rotors of either fixed pitch or pitch control that is not adjustable in flight;

(ii) Dual seating and dual controls.

(d) Where these requirements are inappropriate to particular design and construction features it will be necessary to reconsider the validity of the requirements for each particular case, and the Association must be consulted as to the applicable requirements.

Where it can be shown that a particular feature is similar in all significant respects to one which is part of a previously accepted design, and can be considered a separate entity in terms of its operation, the Association will take this into account when assessing the acceptability of the feature, and it may then not be necessary to test or otherwise substantiate to the level set out in the appropriate requirement.

A15 Permitted Operations.

These requirements apply to gyrogliders designed for non-aerobatic operation, including any manoeuvre necessary for normal gyroglider flight training.

A20 Responsibilities

It is entirely the responsibility of the instructor to ensure the suitability and reliability of the tow car and of the qualifications of the tow car driver and observer, and the instructor is responsible for the overall conduct of the glider training operations.

SUBPART B – Flight

GENERAL

B5 Proof of Compliance

Each requirement of this subpart must be met by test upon the gyroglider, or a gyroglider of the type for which a Type Acceptance Certificate is requested, at the most adverse combination of weight and balance within the range of loading conditions within which the gyroglider will be operated.

NOTE: Flight tests may also be required to show compliance with other subparts of these requirements. At an early stage the accuracy of the airspeed indicator should be determined.

B10 Load Distribution Limits

(a) The applicant must select the range of weight and balance within which the gyroglider is to be safely operated.

(b) The selected range must be within the range of that which corresponds to the minimum placarded weight for a pilot alone (plus ballast if required) up to the maximum placarded weight. The maximum placarded weight must include pilot and passenger. The weight of pilot and passenger must be considered to be not less than 90kg per person.

(c) The horizontal centre of gravity is normally determined by a balance or hang test and the normally accepted range is between 2 and 6 degrees nose down, measured on the horizontal datum line (normally the keel).

B15 Maximum weight of compliant gyrogliders

The maximum weight must be established so that it is:

(a) Not more than the design maximum weight, which is the highest weight at which compliance with each applicable structural loading condition and each applicable flight requirement is shown.

(b) Not less than the weight which results from the empty weight of the gyroglider, plus a weight of occupant/s, plus the required minimum equipment.

B20 Empty Weight.

(a) The empty weight must be determined by weighing the gyroglider (with fixed ballast if required); and excluding weight of occupant(s).

(b) The condition of the gyroglider at the time of determining empty weight must be one that is well defined and easily repeated.

B25 Removable Ballast

Removable ballast may be used in showing compliance with the flight requirements of this subpart.

B32 Rotor Speed Limits

At the critical combinations of weight, altitude and airspeed the rotor speed must remain within the established safe range that would permit any expected manoeuvre to be performed safely. The "established safe range" must be determined by: -

(a) the rotor blade manufacturer or,

(b) acceptable "history of safe operation".

Compliance may also be shown by use of acceptable aircraft manufacturing practices and by correct use of materials of known design strength and fatigue properties.

PERFORMANCE

B35 General

The performance prescribed in this Subpart must be determined –

(a) With normal piloting skill under average conditions;

(b) For still air at sea-level in the standard atmosphere;

(c) At the most critical weight;

(d) With the most unfavourable centre of gravity for each condition.

B42 Take-off and Climb

The tow car must have sufficient performance to enable the gyroglider to take off and climb safely at a rate that would be equivalent to a climb rate of 250ff/min., without the tow car losing any speed.

B53 Glide

An angle of descent and the associated airspeed must be determined at the maximum all up weight such that the correct glide angle can be maintained in the event of tow line failure.

B55 Never Exceed Airspeed (VNE)

The maximum safe operating airspeed, considering the controllability, manoeuvrability, and requirements of B85 and B100 to B115, must be established. This airspeed must be established for the worst-case condition.

The never-exceed speed, VNE, must not exceed 0.90 times the maximum speed demonstrated in flight tests (VDF)

The established VNE must be recorded in the Flight Manual.

B60 Minimum Speed for Level Flight

The minimum air speed for level flight must be determined.

B70 Landing Distance

The distance required to land and come to rest from the normal training speed, with zero wind and normal towcar operation, must be determined

B80 Height-Speed Envelope

The combinations of height and forward speed, from which a safe landing cannot be made following towline breakage, must be established as a limiting height-speed envelope (graph).

CONTROLLABILITY AND MANOEUVRABILITY

B85 General

(a) The gyroglider must be able to maintain any required flight condition and make a smooth transition from one flight condition to another (including turns) without exceptional piloting skill, alertness or strength, and without danger of exceeding the limit manoeuvring load factor, under any operating condition probable for the type including the effect of power changes (and sudden tow line failure). Normal variations in pilot techniques must not cause unsafe flight conditions.

(b) Any unusual flying characteristics observed during the flight tests required to determine compliancewith the flight requirements must be investigated.

(i) The controls must not exhibit excessive breakout force, friction or free play.

(ii) There must be no overbalance of the pitching and rolling controls.

(c) A technique must be established, and demonstrated, for landing the gyroglider at maximum all upweight, with no assistance from the tow car, without hazard to the occupants.

(d) The gyroglider shall not exhibit any tendency to enter a pitch oscillation at any airspeed, at the critical weight and centre of gravity, during any manoeuvre appropriate for the type.

WARNING

NOTE: ***The gyroglider tow rope, especially if short, can cause the glider to enter a pitch oscillation if the height flown is too high. The tow rope can induce a larger nose down force component than when flying at an appropriate height. Operations at or above a height that induces oscillations shall be avoided at all times. The area concerned shall be marked on the Height Speed Envelope graph.***

B90 Longitudinal Lateral and Directional Control

In no case may the control forces exceed those prescribed in the following table.

A maximum wind speed, maximum cross wind and maximum tail-wind must be established in which the gyroglider can be operated without loss of control near the ground in any manoeuvre appropriate to the type(such as cross wind take-offs and landings), with:

(a) Critical weight; and

(b) Critical centre of gravity.

These wind velocities must be specified in the Gyroglider Flight Manual.

B95 Pitch Control Force in Manoeuvres

The pitch control forces during turns or when recovering from manoeuvres must be such that at constant speed an increase in load factor is associated with an increase in control force.

	Pitch	**Roll**	**Yaw**
Temporary application	150N (34 lbs. force)	90N (20 lbs. force)	670N (150 lbs. force)
Prolonged application	45N (10 lbs. force)	45N (10 lbs. force)	220N (50 lbs. force)

STABILITY

B100 General

(a) The gyroglider must be able to be flown without undue piloting skill, alertness or strength in any normal manoeuvre for a period of time as long as that expected in normal operation.

(b) There must be no tendency for the gyroglider to rapidly increase the turn rate, stick fixed, during a turn with normal accelerations of up to 1.5g at any allowable air speed.

B106 Longitudinal, Lateral and Directional Stability

The longitudinal, directional and lateral stability should be sufficient to prevent dangerous flight conditions following abrupt control displacements, at any attitude or airspeed likely to be encountered during training operations.

B115 Dynamic Stability

Any short-period oscillations occurring under any permissible flight condition must be heavily damped with the primary controls fixed or free.

GROUND HANDLING CHARACTERISTICS

B120 Directional Stability and Control

The gyroglider must have satisfactory ground handling characteristics, including freedom from uncontrolled tendencies in any condition expected in operation, particularly in all take-off conditions. It is recommended that nose wheel steering be linked to both sets of rudder pedals and should operate in the "correct sense" (i.e. push right to go right)

B125 Taxiing Condition

(a) The gyroglider must be safely controllable and manoeuvrable when it is towed over the roughest ground that may reasonably be expected in normal operation.

(b) The ground speeds up to which it is safe to taxi, take-off and touch down must be determined.

SUBPART C – Structure

General

C5 Loads

(a) Strength requirements are stated as limit loads (the maximum load to be expected in service) and ultimate loads (limit loads multiplied by factors of safety). Unless told otherwise, loads stated are limit loads.

(b) Unless stated otherwise, the inertia loads resulting from each major item of mass in the gyroglider must balance with the flight and ground loads. (i.e. ground or flight disturbances should not cause unsafe conditions due to out of balance inertia loads).

C10 Factor of Safety

Unless otherwise provided, a factor of safety of 1.5 must be used.

C15 Strength and Deformation

(a) The structure and control systems must be able to support limit loads without permanent deformation. At any load up to limit loads, the deformation must not interfere with safe operation.

(b) The structure must be able to support ultimate loads without failure for at least three seconds. When proof of strength is shown by dynamic tests simulating actual load conditions, the three-second limit does not apply.

C30 Limit Manoeuvring Load Factors

The gyrogliders rotor must be designed for positive limit manoeuvring load factor of 3.5, at all forward speeds from zero to the Maximum Design Speed VD. A "history of safe operations" would be an acceptable method to show compliance with this subpart.

The rest of the gyroglider must be designed for positive and negative limit manoeuvring load factors of +3.5 and -0.5 respectively, at all forward speeds from zero to the Maximum Design Speed VD.

Compliance may be shown by use of acceptable aircraft manufacturing practices and by correct use of materials of known design strength and fatigue properties.

CONTROL SURFACES AND SYSTEM LOADS

C55 Primary Control System

(a) The part of each control system from the pilot's controls to the control stops must be designed to withstand pilot forces of not less than the forces specified in C60.

(b) The part of each control system from the control stops to the attachment to the rotor hub (or control areas) must be designed to, at least:

(i) Withstand the maximum pilot forces obtainable in normal operation; and

(ii) If operational loads may be exceeded through jamming, ground gusts, control inertia, or friction,support without yielding, 1.6 times the limit pilot forces specified in C60.

C56 Control System Design

The primary control system and their attachment points must be designed to be withstand the loads set out below at C60 and also be capable of visual inspection during normal pre-flight checks and regular maintenance.

Pitch and roll control inputs will normally be transmitted to the rotor head by push-pull control rods although ASRA recognizes that some builders will opt to use push-pull control cables. A significant shortcoming with the use of push-pull cables is that the condition of the internal cable cannot be inspected, as is their reported less-precise "feel".

If a builder-to-order or a home-builder elects to use push-pull cables for pitch and roll in their project, the only approved push-pull cables are **Teleflex 60 Series** with 5/16" UNF thread ends or **Teleflex 80 Series** with 3/8" UNF thread ends. Such cables must be fitted strictly in accordance with the manufacturer's directions with particular care taken in relation to bend radii.

Push-Pull cable installations used for rudder control must be **Teleflex 40 Series** push-pull cables with 1/4" UNF thread ends.

Such Teleflex cable installations in build-to-order and home-builds have an operational life of **1000 hours**.

Because of the sealed or sheathed nature of push-pull cables, the visual inspection requirement is waived for: -

(a) sheaths (if fitted) for rudder cable systems; and

(b) push-pull cables running within sheaths fitted as original equipment by a recognized manufacturer; or

(c) Teleflex push-pull cables running within sheaths in builds-to-order or home-builds as specified above.

C60 Limit Pilot Forces

For primary flight controls. The limit pilot forces are as follows:

(a) For foot controls, 580N (130 pounds force); and

(b) For stick controls, 445N (100 pounds force) fore and aft, and 300N (67 pounds force) laterally.

Dual control systems must be designed to withstand the loads that result when each pilot applies 0.75 times the load specified in C60, with:

(a) The pilots acting together in the same direction; and

(b) The pilots are acting in opposition.

C70 Secondary Control Systems

Secondary control systems such as those for brakes, trim controls etc., must be designed for supporting the maximum forces that a pilot is likely to apply to those controls.

STABILISING AND CONTROL SURFACES

C75 Control Surface Loads

Each stabilizing and control surface, (e.g. Rudder, fin and horizontal stabiliser) and its supporting structure, must be designed so that limit loads are not less than 720N (160 lbs. force) per square metre (evenly distributed over the control surface).

GROUND LOADS

C85 Landing Gear - Shock Absorption

It shall be determined that the landing gear is capable of absorbing the energy which would result from the gyroglider being dropped at its maximum permitted take-off weight from a height of 220mm (8 inches). This should simulate a drop contact velocity equal to the greatest probable sinking speed likely to occur at ground contact in less than perfect landings.

MAIN COMPONENT REQUIREMENTS

C90 Rotor Structure

(a) The rotor structure must be designed to withstand the critical flight loads prescribed in C30.

(b) The rotor structure must be designed to withstand loads simulating, for the rotor blades and hub bar, the impact force of each blade against its teetering stops during ground operation.

(c) The rotors and rotor head structure must be designed to withstand the maximum limit torque likely to be transmitted by any rotor spin-up device or rotor brake at all speeds from zero to maximum at which the device is designed to be engaged. This limit torque must be distributed to the rotor blades in a rational manner.

C95 Fuselage, Landing Gear and Rotor Pylon Structures

(a) Each fuselage, landing gear and mast structure must be designed as prescribed in this section. Resultant rotor forces may be represented as a single force applied at the rotor hub bar attachment point (teeter bolt).

(b) Each structure must be designed to withstand:

(i) The critical loads prescribed in C100.

(ii) The applicable ground loads prescribed in C85.

(iii) The loads prescribed in C90.

EMERGENCY LANDING CONDITIONS

C100 General

The structure must be designed to give each occupant every reasonable chance of escaping serious injury in a crash landing, when proper use is made of belts and harnesses provided for in the design, in the following conditions:

Each occupant experiences ultimate inertial forces corresponding to the following load factors:

Direction	Load Factor
Upward	4.5
Forward	9.0
Sideward	3.0
Downward	4.5

These forces are independent of each other and are relative to the surrounding structure.

The supporting structure must be designed to restrain each item of mass (including ballast if used) that could injure an occupant if it came loose in a minor crash landing.

OTHER- LOADS

C105 Loads from Single Masses

The attachment means that all single masses, which are part of the equipment of the gyroglider, including ballast, must be designed to withstand loads corresponding to the maximum design load factors to be expected from the established flight and ground loads, including the emergency landing conditions of C100.

SUBPART D - Design and Construction

D5 General

The strength of any part having an important bearing on safety and which is not easily analysed must be established by test.

D10 Materials

Where bolting is used, 'Aircraft' bolts must be used in the main frame and control components.

(i.e. cheek and cluster plates and from the 'hands to the rotors'). Aircraft bolts must also be used on any part which has an important bearing on safety.

Materials shall be durable and suitable for the intended use, and design values (strength) must be chosen so that structural deficiency because of material variations is extremely remote as shown by test, analysis, service history, or manufacturer certification.

D15 Fabrication Methods

(a) Workmanship of manufactured parts, assemblies, and aircraft shall be of high standard,

(b) Methods of fabrication used must produce consistently sound structures,

(c) Structures must be reliable with respect to maintaining the original strength under reasonable service conditions

(d) Process specifications shall be followed where required.

(e) Unconventional methods of fabrication must be substantiated by adequate tests or "history of safe operation"

D20 Locking of Connections

An acceptable means of locking must be provided on all connecting elements in the primary structure and in control and other mechanical systems which are essential to safe operation of the gyroglider. In particular self-locking nuts must not be used on any bolt subject to rotation in operation, unless a non-friction locking device is used in addition to the self-locking device.

D25 Protection of Structure

Protection of the structure against weathering, corrosion, and abrasion, as well as suitable ventilation and drainage, shall be provided.

D30 Inspection

Means must be provided to allow inspection (including inspection of principal static and rotating structural elements and control systems), close examination, repair and replacement of each part requiring periodic inspection, maintenance, adjustments for proper alignment and function, lubrication or servicing.

D35 Provisions for Rigging and De-rigging

The design must be such that where any rigging and de-rigging may be expected to be carried out on a routine basis, the probability of damage or incorrect assembly is minimized. It must be possible to inspect the gyroglider easily for correct assembly.

When using only two hinges at each control surface, the safety factor for these hinges and the attached parts of the primary structure must be multiplied by a factor of 1.5.

D45 Fatigue Strength

The detail design of the blade and hub bar of the gyroglider should be such that as far as reasonably practicable features that cause high stresses are avoided, especially if it cannot be shown that features of a similar design have accumulated considerable satisfactory service experience in a similar application.

With the exception of the rotor head, bolts or threaded parts shall not be used in the construction of the rotor hub or blades in any application where they are subject to an alternating tensile stress, (unless it can be shown that parts of a similar design specification and use have a "history of safe operation").

The rotor head shall have an ultimate reserve factor in excess of 10.

Materials known to have poor crack propagation properties shall not be used in any part of the primary structure. All parts of the primary structure shall be easily accessible for inspection.

Paints or coatings shall not be used on the external surfaces of the critical parts of the primary structure if they are flexible enough to inhibit crack inspection.

D70 Cable Factor

An ultimate factor of safety of 2.0 on nominal cable strength must be applied to cables used for structural applications and for all primary control systems.

D75 Flutter Prevention and Structural Stiffness

Each major part of the gyroglider must be free from flutter and resonance under any appropriate speed, and this must be demonstrated by flight tests at speeds up to VDF.

CONTROL SURFACES AND ROTORS

D80 Drainage

For each rotor blade:

(a) There must be a means for venting the internal pressure of the blade,

(i) Drainage holes must be provided for the blade, and

(ii) The blade must be designed to prevent water from becoming trapped in it.

(b) Sub-paragraphs (a), (i) and (ii) of this paragraph do not apply to sealed blades capable of withstandingthe maximum pressure differentials expected in service.

D85 Control Surface Installations (other than rotor blades)

Movable control surfaces must be installed so that there is no interference between any surfaces or their bracing's when one surface is held in any position and the others are operated through their full angular movement.

D95 Mass Balance

(a) The span wise balance of the rotor blades must be such that excessive out-of-balance vibration is prevented.

(b) The chord wise balance of the blades must be such that the blades cannot be induced to flutter or weave in all flying conditions. The chord wise balance of each blade in a pair must be the same. The aerodynamic centre should be at or very close to the 25% chord, or as specified by the rotor blade manufacturer.

(c) The supporting structure and the attachment of rotor blade mass balance weights must have an ultimate reserve factor in excess of 10 when subjected to the combined loads resulting from:

(i) Accelerations of plus or minus 20 g in the flap plane of the rotor;

(ii) Accelerations of plus or minus 20 g in the lag plane of the rotor; and

(iii) The centrifugal force at the maximum rotor speed.

Compliance may be shown by "history of safe operations" (e.g. weights made to Benson plans and used on blades made to Benson plans).

D100 Rotor Hub Tilt and Teeter Ranges

(a) Nomenclature

The rotor hub assembly of a gyroglider is an assembly that:

(i) incorporates the rotor spindle axis, either as a fixed tube or fixed bolt (or both) or as a rotating spindle;

(ii) is capable of being tilted from side to side and from vertical to the rear (as specified below);

(iii) incorporates the component customarily called the torque tube or torque bar or variations thereof;

(iv) may incorporate fixed components of a pre-rotation mechanism (if fitted); and

(v) may incorporate a rotating bearing block to which side-towers with provision for rotor-teeter are laterally bolted.

The rotor assembly of a gyroglider comprises:

(i) the rotor blades and blade straps; and

(ii) a hub bar and elevated teeter block (if a solid hub-bar is used) OR (alternatively) Magni-style side-plates.

The following terminology must always to be used:

(i) **TILTING** is confined to describing the side-to-side and vertical-to-aft movement of a rotor hub and spindle assembly; and

(ii) **TEETERING** is confined to describing the see-sawing movement of a rotor assembly within a rotor hub assembly.

(b) Hub Tilt Range

ASRA requires that:

(i) the minimum rotor hub fore-and-aft hub tilt range for gyrogliders shall be **16 degrees**, with the forward limit (normally) being **vertical** and the rear limit (normally) being 16 degrees rear of vertical. Additional tilt range forward of vertical up to 4 degrees can be installed at the discretion of the designer to accommodate a stick forward rotor brake (if fitted). While no maximum rotor-hub fore-and-aft tilt limit is specified ASRA requires that the static clearances to other parts of the gyroglider specified elsewhere in these Standards be maintained.

(ii) The minimum rotor hub side-to-side tilt range for gyroglider shall be **16 degrees** (i.e. 8 degrees left tilt + 8 degrees right tilt. If the designer rigs a bias allowing one side to tilt slightly more than the other, the minimum tilt either side should still be 8 degrees).

(iii) That the ranges stated above at (i) and (ii) are mandatory for gyrogliders constructed within Australia, either as builds-to-order, home-builds, hybrid conversions, or for the restoring or rebuilding of gyrogliders previously manufactured by companies that are no longer in business.

(iv) In the case of gyrogliders manufactured as an identifiable and identical type by a company or companies that are still operating, where it is found that the tilt ranges of an inspected gyroglider are at variance in some respect from those specified above at (i) and (ii), the matter is to be referred to the Operations Manager. Unless otherwise approved by the Operations Manager, where there are existing minor non-compliance issues, the gyroglider must be able to demonstrate a history of safe operation and the non-compliant standards shall be clearly placarded in the cockpit to provide notice to the occupants.

NOTE: The ASRA Board at all times reserves the right to **deny** registration where the Board deems that there is a risk that the non-compliant feature may possibly give rise to a serious and imminent risk to flight safety.

(c) Rotor Teeter Range

(i) ASRA notes that UK scientific research has established that a rotor assembly in flight can easily teeter up to plus-or-minus **8 degrees** within the hub if control inputs are abrupt. Therefore, ASRA ***strongly recommends*** that measured static rotor teeter ranges be not less than plus or minus 8 degrees (ie, total range **16 degrees**).

WARNING

Extreme care must be exercised by operators who swap out rotor assemblies made by different manufacturers into their gyrogliders. If such swapping occurs it is essential that the existence of adequate static teeter range be checked and measured before flight is resumed.

NOTE: A constrained teeter range is implicated in one Australian fatality.

(ii) That the range stated above at (i) is mandatory for gyrogliders constructed within Australia, either as builds-to-order, home-builds, hybrid conversions, or for the restoring or rebuilding of gyrogliders previously manufactured by companies that are no longer in business.

(iii) In the case of gyrogliders manufactured as an identifiable and identical type by a company or companies that are still operating, where it is found that the teeter ranges of an inspected gyroglider are at variance in some respect from that specified above at (i), the matter is to be referred to the Operations Manager. Unless otherwise approved by the Operations Manager, where there are existing minor non-compliance issues, the gyroglider must be able to demonstrate a history of safe operation and the non-compliant standards shall be clearly placarded in the cockpit to provide notice to the occupants.

NOTE: The ASRA Board at all times reserves the right to **deny** registration where the Board deems that there is a risk that the non-compliant feature may possibly give rise to a serious and imminent risk to flight safety.

D102 Rotor Clearances

There must be enough clearance between the rotor blades and other parts of the structure to prevent the blades from striking any part of the structure or passing through any area likely to cause injury to occupants during any operating conditions (including blade flap).

D103 Examination of First of Type Gyrogliders

The ASRA Operations Manager or authorised delegate will be the only person permitted to sign-off first of type gyrogliders. The manufacturer will pay for ASRA expenses incurred in the inspection and subsequent signing off of the aircraft.

D105 Rotor Head Bearings

All rotor head bearings: -

(a) Must have specifications that ensure that they have the strength and other properties assumed by the gyroglider designer, and

(b) Must have their suitability established by experience or tests.

CONTROL SYSTEMS

D110 General

Each control must operate easily, smoothly and positively enough to allow proper performance of its functions.The joystick should have a minimum of 300mm fore and aft and 250mm side to side movement.

D115 Stops

(a) Each control system must have stops that positively limit the range of motion of the pilot's controls.

(b) Each stop must be located so that wear, slackness, or take-up adjustments will not adversely affect the control characteristics of the gyroglider because of a change in the range of travel of the control.

(c) Each stop must be able to withstand any loads corresponding to the design conditions for that control.

(d) Joystick stops must be in the rotor head to avoid excessive control rod and joystick loads.

D125 Trim System

If a trim system is fitted which is operable in flight, proper precautions must be taken to prevent inadvertent, improper, or abrupt trim operation. There must be means near the trim control to indicate to the pilot the direction of trim control movement relative to the gyroglider motion. In addition, there must be means to clearly indicate to the pilot the position of the trim device with respect to the range of adjustment.

In addition, trimmed range must be limited so that stick force cannot exceed 2.27 kg (5 lbs.) on take-off or during level flight.

D135 Control System Details

(a) Each detail of each control system must be designed and installed to prevent jamming, chafing and interference from passengers or loose objects.

(b) There must be means to prevent the slapping of cables, tubes, or rods against other parts.

(c) Each element of the flight control system must have design features, or must be distinctively and permanently marked, to minimize the possibility of incorrect assembly that could result in malfunctioning of the control system.

D140 Spring Devices

Experience or tests simulating service conditions must establish the reliability of any spring device used in the control system, unless failure of the spring will not cause unsafe flight characteristics.

D180 Seats

(a) Each seat and its supporting structure must be designed for an occupant weight in accordance with B10 and for the maximum load factors corresponding to the specified flight and ground conditions including the emergency landing conditions prescribed in C100.

(b) Seats including cushions must not deform under flight loads to such an extent that the pilot is unable to reach the controls safely, or that the wrong controls are operated.

D185 Safety Harnesses

(a) The strength of the safety harness must not be less than that following from the ultimate loads for the flight and ground load conditions and for the emergency landing conditions prescribed in C100, taking into account the geometry of the harness and seat arrangement.

(b) Each safety harness must be attached so that the wearer is safely restrained in the initial sitting position under flight and emergency landing accelerations.

D190 Protection from Injury

Rigid structural members or rigidly mounted items of equipment must be padded where necessary to protect the occupant/s from injury during minor crash conditions.

SUBPART E

E15 Rotor Spin-up and Brake Systems

(a) If a rotor spin-up or brake system is installed, it must be designed to prevent:

(i) It remaining engaged on take-off, and

(ii) It becoming engaged in flight.

(b) Limitations on the use of any rotor spin-up or brake systems must be specified.

E20 Flight Endurance Test

(a) The applicant shall conduct a comprehensive flight test on a gyroglider of the type for which an Acceptance Certificate is sought. The gyroglider must not experience any significant problems or failures during the test. This test must be to a flight schedule which is representative of operational use. If any problems or failures occur, extra flying may be necessary to ensure that the proposed solution had been tested without recurrence of the problem.

(b) For new designs of rotor system, the applicant shall conduct an endurance test on a suitable test vehicle,to a rigid test schedule representative of operational use.

(c) It shall be confirmed by flight tests that the proposed tow car and rotor system operating limitations are compatible with the satisfactory functioning of the gyroglider over the proposed range of operating conditions and flight envelope. The applicant must ensure that the tow car is compatible with the gyroglider, functions in a satisfactory manner and can be operated safely.

(d) The towrope must have a minimum safety factor of 3 with respect to the maximum drag likely to be encountered during gliding operations at maximum all up weight. The towrope must not be made from materials with "elastic" properties.

(e) In any flight test carried out, a minimum of 2 hours and 30 landings must be performed.

NOTE: Evidence of safe and satisfactory operation of the tow car and gyroglider combination without significant problems is an acceptable means of demonstrating compliance. Note that if any significant changes are made, additional flying may be necessary to ensure that evidence exists of safe operation.

SUBPART F - Equipment

F20 Miscellaneous Equipment

(a) There must be an effective means of communication between the instructor and the tow car driver.

(b) A tow line release mechanism must be fitted to the gyroglider that can be readily operated by the instructor when buckled in the seat.

F10 Flight and Navigation Instruments

Recommended flight instruments:

(a) An air speed indicator.

(b) A yaw indicator.

F25 Arrangement and Visibility

Flight instruments if fitted must be plainly visible to both occupants when buckled in.

SUBPART G - Operating Limitations and Information

G5 GENERAL

The operating limitations and other information necessary for safe operation must be made available to the pilotas prescribed in G35.

G10 Air-speed Limitations

(a) All flight speed must be stated in terms of indicated airspeed (IAS).

(b) The never-exceed speed, VNE, must not exceed 0.90 times the maximum speed demonstrated in flight tests (VDF).

G25 Flight Manual or Pilot Operating Handbook

A Flight manual containing all the information required for proper operation, maintenance, service andadjustments must be provided.

MARKINGS AND PLACARDS

G35 Operating Limitations, Placards and Instrument Markings

Limitations essential to the safe operation of the gyroglider must be plainly visible to the pilot. Where this cannot be achieved by instrument markings a placard must be provided. Where these limitations are shown by instrument markings each maximum and minimum safe operating limit must be marked by a red line.

G50 Control Markings

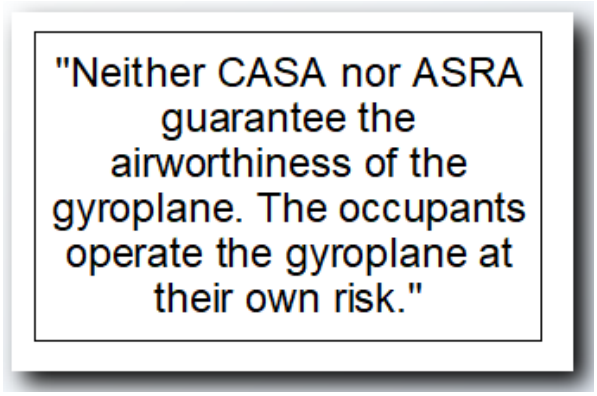
(a) Each control, other than primary flight controls, must be clearly marked as to its function and method of operation.

(b) Towline release control must be coloured red and placarded as to method of operation.

G55 Miscellaneous Markings and Placards

(a) Loading: If removable ballast is used, the place for carrying ballast must have a placard stating instructions for the proper placement and securing of the removable ballast under each loading condition for which each removable ballast is necessary. The following must be placarded in each gyroglider so that they are plainly visible to the pilot: - Maximum cockpit load and cockpit load conditions for the gyroglider flown solo.

(b) Occupant warning: For a two place gyroglider a placard showing an occupant warning must be plainly visible to both occupants when occupying the control seats, as follows:



INSTALLATION OF SHOULDER HARNESS

Figures 1, 2 and 3 below show the required installation geometry for this type of restraint.

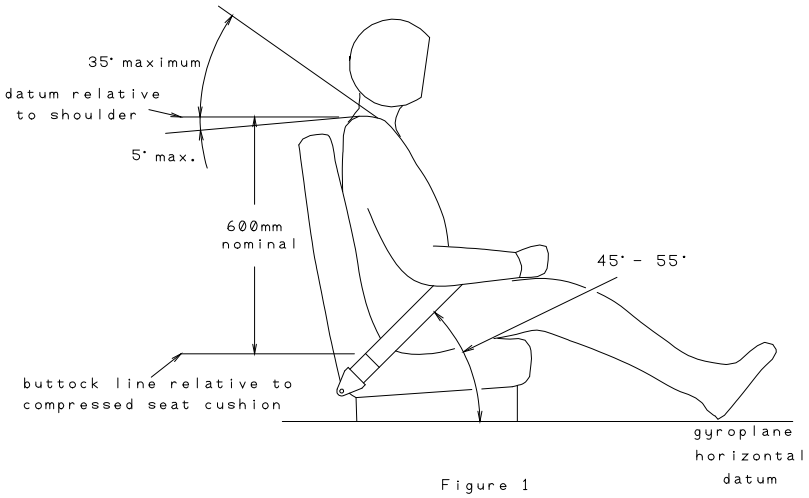


Figure 1

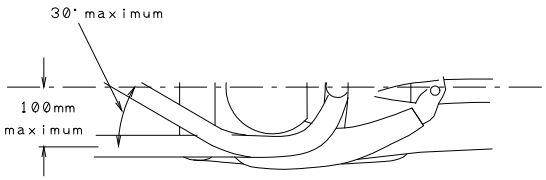


Figure 2

Range of Angles of Sholder Straps

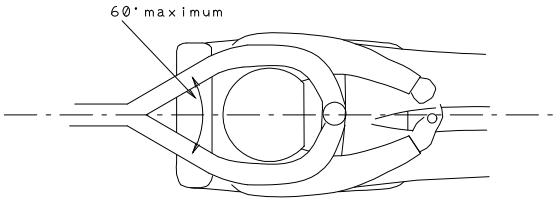


Figure 3