AVIATION Artur Trendak

PILOT OPERATING HANDBOOK

GYROPLANE TERCEL

THIS MANUAL MUST ALWAYS BE AVAILABLE ON BOARD THE GYROCOPTER

This manual has been developed to observe the regulations in Annex No. 5 Ultralight Aircraft of the Decree of the Minister of Infrastructure dated 25 April 2005, excluding the application of some of the Laws of the Act on Air Law for some sorts of aircraft as well as defining the conditions and requirements concerning the use of this Aircraft (Official Journal 107 section 904) with subsequent amendments.

It is prohibited to make any entries or supplements in this Pilot Operating Handbook without the consent of the Civil Aviation Authority.

Organizational Information

Register of Changes

Any changes of this manual, except for the up-to-date weighing data, must be recorded in the table below as well as be approved by the Civil Aviation Authority (CAA).

A new or revised text in changed pages must be marked with a black vertical line on the margin and a change number. The number of the last change in a given page and its date must be placed in the page footer. Every time a change is entered, the pages listed in the table below must be mentioned.

Change no.	Desciption	Pages	Date	Signature

Register of Changes

Change no.	Desciption	Pages	Date	Signature

List of Up-to-Date Pages

Chapter	Page	Date		Chapter	Page	Date
1	1-4	21.08.2014				
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Chapter 1
General Information

1.1 Introduction

This manual has been written to provide pilots with information essential for the safe and effective operation of the ***TERCEL*** gyrocopter. The manual also contains basic guidelines from the manufacturer and the legal requirements concerning the performance of flights.

This manual is not a substitute for theorectical and practical training by a qualified instructor

TERCEL gyrocopter pilots must hold a qualification certificate, or a valid licence for ultralight aircraft with specialization for gyrocopters. Before any flight, pilots should be acquainted with the uniqueness of a gyrocopter. It is recommended that you study both this Pilot Operating Handbook and the Aircraft Maintenance Manual.

The gyrocopter can only be used for flight when it is technically operative and holds a valid authorization to perform flights. An authorization to perform flights is entered into the ultralight aircraft book. This document identifies the ultralight aircraft and contains details of its history of usage.

1.2 Basis for Airworhiness Acknowledgement

Details of the particular gyrocopter and its current air third-party insurance should be entered into the aircraft records kept by the relevant Civil Aviation Authority.

The ***TERCEL*** gyrocopter meets ultralight requirments. It constitutes the basis for the issue of Certificates, Permits and Approvals in accordance with the Air. The certification document is a Type Certificate No.: 943 15-1 issued by DULV.

1.3 Desciption of the Gyrocopter

The ***TERCEL*** gyrocopter is a two seat, side-by-side, ultralight gyrocopter. The main structural component is the composite fusalage. Two slender tail beams are guided from the fusalage upon which the vertical twin fin tail is housed (stabilizers and rudder), upon which in turn the horizontal stabilizer with a symmetric section is mounted, equipped with winglets. The control surfaces are a composit structure. A metal mast is affixed to the fusalage on which the control head with the lifting motor is mounted.

The metal two blade rotor is manufactured and delivered in a set (blades and hub) by Aviation Artur Trendak. The blades are made from drawn aluminium and are anodized and perfectly balanced.

The ***TERCEL*** gyrocopter is powered by a CA 912 ULT engine. This is a Rotax 912 UL engine, expertly modified by Aviation Artur Trendak with an Iveco turbocharger. It is equipped with a three-blade composite Kaspar Aero 2/3 LT propeller, with the capability to manually change pitch.

The fixed three-wheel undercarriage has a single front wheel. The main legs are made with a reinforced plastic composite. The front leg is dampened by a pneumatic tyre. The undercarriage can be converted from standard to ordinary with 350 mm diameter wheels.

The spacious cabin with a width of 136 cm is accessible through large doors on the right and left sides of the fusalage.Extensive glazing ensures optimum visability.

1.3.1 General Data

Geometric Data:

- Rotor diameter 8.60 m

- Rotor surface 58,06 m²
- Rotor blade chord 0.22 m
- Overall length (without rotor) 5.04 m
- Fusalage width 2.35 m
- Track of wheels 2.20 m
- Cockpit width 1.36 m
- Overall width 2.35 m
- Overall height 2.87 m
- Wheel diameter 0.35 m

Weight Data

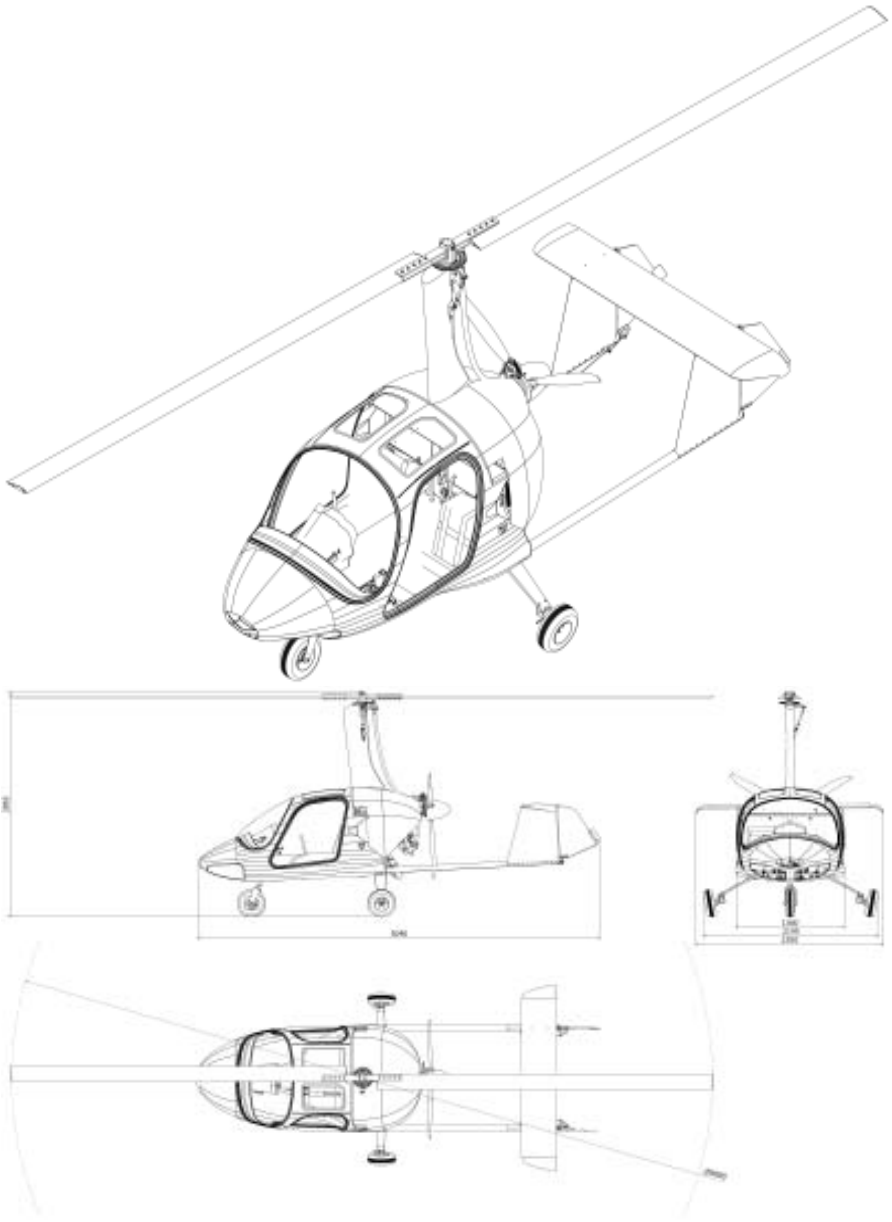
	kg	lb
• Maximun Take-off weight	560	1,235
• Empty weight*	295	649
• Load capacity	265	583

*without rotor.

ALWAYS check actual Weight and Ballance report !

Power Unit Data

- Engine type CA 912 ULT
- Horse Power 122 at 5,800 rpm
- Reducer ratio 1 : 2.43
- Propeller KASPAR Aero 2/3 LT
- Propeller diameter 1.72 m
- Fuel tank capacity 120 litres



Chapter 2
Restrictions

2.1 Introduction

Chapter 2 includes the restrictions of usage, markings of instruments and basic placards, crucial to the safe use of the gyrocopter, its engine, standard systems and standard equipment.

2.2 Flight Speed

Speed restrictions and their importance are presented in the table below:

	Speed	IAS (km/h)	IAS (kt)	Notes
VNE	Never exceed speed	200	108	Do not exceed this speedt any time
VNO	Maximum structural cross-country speed	130	70	Do not exceed this speed except in tranquil weather conditions and exercising caution
VD	Manoeuvring speed	90	49	Do not perforn full or violent movements above this speed, because under certain conditions,full movements of the control surfaces can cause an overload of the gyrocopter
VMIN	Minimum speed	60	32	The minimum speed for established horizontal flight

CAUTION
Speedometer indications fluctuate during steep climbs and descents due to the changes in the pitch attitude.

2.3 Air Speed Indicator Markings

Marking	Value or Range (km/h)	(kt)	Notes
Green arch	0-130	0-70	Range of normal use
Yellow arch	130-200	70-108	Warning range
Red line	200	108	Never exceed speed (V_{NE})
Yellow triangle	100	54	Flight best ascent speed (V_Y)

One of the speed placards shown below must be installed on the instrument panel in front of the pilot (corresponding with the units for scaling the air speed indicator):

I A S	V_{NE} = 200 km/h	V_Y = 100 km/h	V_D = 90 km/h 1 person
	V_X = 95 km/h	V_{min} = 65 km/h	V_D = 90 km/h 2 person

I A S	V_{NE} = 108 kt	V_Y = 54 kt	V_D = 49 kt 1 person
	V_X = 51 kt	V_{min} = 32 kt	V_D = 49 kt 2 person

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2.4 Driving Unit

Engine model	**CA 912 ULT** Rotax 912 UL engine, modified by AVIATION ARTUR TRENDAK by adding the Iveco Turbo Compressor

	Power	RPM	Manifold Pressure
Maximum Take-off Power	122 hp	5800	max. 45.5 in Hg
Maximum Continuous Power	100 hp	5500	max. 39.0 in Hg
75% Take-off Power	90.75 hp	-	max. 37.0 in Hg
Idle	-	1450	

Oil type	10W40		
	minimum	normal	maximum
Oil temperature	50º C	90-110º C	140º C
Oil pressure	0.8 bar (above 3,500 rpm)	2-5 bar (above 3,500 rpm)	7 bar

Fuel (type)	Lead-free car petrol with the minimum octane number of 95, or above. (98 recommended)
Min. fuel pressure	0.15 bar
Max. fuel pressure	0.4 bar
Maximum coolant exit temperature	120 °C
Maximum cylinder head temperature	135 °C
Propeller manufacturer	KASPAR AERO
Propeller model	Ka-2/3-LT
Propeller diameter	1.72 m
Propeller blade angle	12° (in measurement section, in accordance with propeller manual)

2.5 Rotor Rotational Speed

Rotor rotational speed	rpm
normal at maximum weight (MTOW)	360 - 390
normal at minimum weight (~330 kg)	330 - 340
during autorotation	310 - 340
minimum for level flight	270

Rotor rotational speed	rpm
minimum until the full opening of the throttle during take-off	180
maximum for using the rotor brake	150

WARNING

A load factor below 1g during flight causes the rotor rotational speed to fall and if maintained, it can lead to the buffeting of the rotor blades and disaster.

2.6 Rotor Tachometer Markings

Marking	Value or range [rpm]	Notes
Red line	150	After landing ma rotor rpm for using the rotor brake
Red triangle	180	During take-off min rotor rpm for full throttle
Yellow arch	180-330; 390 - 500	Warning range
Green arch	330 - 390	Normal range

2.7 Weights

Maximum take-off weight (MTOW)	560 kg	1,235 lb
Nominal proper weight *	295 kg	649 lb
Minimum crew weight	60 kg	132 lb
Maximum crew weight	170 kg	375 lb
Maximum one person weight	120 kg	264 lb
Maximum fuel weight	90 kg	199 lb
Maximum luggage weight	2 x10 kg	2 x 22 lb

* Weight without rotor. The actual proper weight for a particular model is written in the current weighing report and in subsection 6.4 of this manual.

The current take-off weight is equal to the sum of the empty gyrocopter weight and the weights of the crew, luggage and fuel. Under no circumstances, exceed the approved maximum take-off weight (MTOW) equal to 560 kg (1235 lb).

The proposed load sheet is set out below:

	Weight	Minimum	Maximum
Nominal proper weight			
Crew weight			
Fuel weight			
Total:			

WARNING
Exceeding the maximum weight published is highly dangerous and prohibited.

The baggage in the space behind the seats must not exceed 10 kg (22 lb).

During solo flights, it is recommended to place ballast on the passenger seat, fastened with seat belts to ensure the appropriate balancing of the machine. Ballast in the form of a sack of sand, or a can of water is recommended. The ballast must be protected against movement. The ballast weight is set out below:

Pilot left seat weight (kg)	Ballast right seat (kg)	Ballast right seat (lb)
50 - 60 kg	12 kg	26 lb
60 - 80 kg	10 kg	22 lb
80 - 100 kg	8 kg	18 lb

Pilot right seat weight (kg)	Ballast left seat (kg)	Ballast left seat (lb)
50 - 60 kg	15 kg	33 lb
60 - 80 kg	13 kg	29 lb
80 - 100 kg	11kg	24 lb

2.8 Position of the Centre of Gravity

The position of the centre of gravity of the gyrocopter (a sideways view) is identified through the value of the angle whose apex is located on the transverse axle for rotor head suspension on the mast, one arm is parallel to the vertical axis of the coordinate system related to the fuselage and the other arm passes through the centre of gravity of the gyrocopter. (See subsection 6.3).

The admissible range of the position of the centre of gravity of the gyrocopter in flight:

+1.5º - +8.5º

WARNING
Observing the conditions of the admissible load and the proper position of the centre of gravity of the empty gyrocopter ensures maintenance in the above range of the centre of gravity.

2.9 Approved Manoeuvers

The ***TERCEL*** gyrocopter has been classified in the ultralight aircraft category. The approved manoeuvers include:

- stalls
- lazy eights
- vertical zooms
- steep turns in which the roll angle does not exceed 60º

WARNING
All aerobatic manoeuvres and turns with a roll angle exceeding 60º are forbidden

2.10 Manoeuver Load Factor

Admissible manoeuver load factor: **0/+3**

2.11 Crew

The ***TERCEL*** is a side by side two-seater gyrocopter with an option of a single, or double flight control system. The minimum crew is one pilot. The pilot's seat on a solo flight will depend upon the configuration of the cockpit instrument panel and the position of the wheel brake lever.

2.12 Sorts of Usage

This gyrocopter can be used for leisure, sports, display purposes and training practice and other reasons, but not including air carriage. Flights can only be performed in Visual Meteorological Conditions (VMC) under by Visual Flight Rules (VFR). The specific use of the gyrocopter is described in the Certificate of Registration given by the Aviation Authority of country of registration.

2.13 Fuel

- Capacity of the fuel tanks 120 ltr
- Admissible quantity of fuel in the tanks 120 ltr
- Including usable fuel 118 ltr
- Non-usable fuel 2 ltr

2.14 Wind speed restrictions

The admissible values of wind speed during flight and landing:

Data for beginners:

- Headwind 60 km/h
- Crosswind (90º) 30 km/h
- Tailwind 0 km/h

Data for experienced:

- Headwind 70 km/h
- Crosswind (90º) 40 km/h
- Tailwind 5 km/h

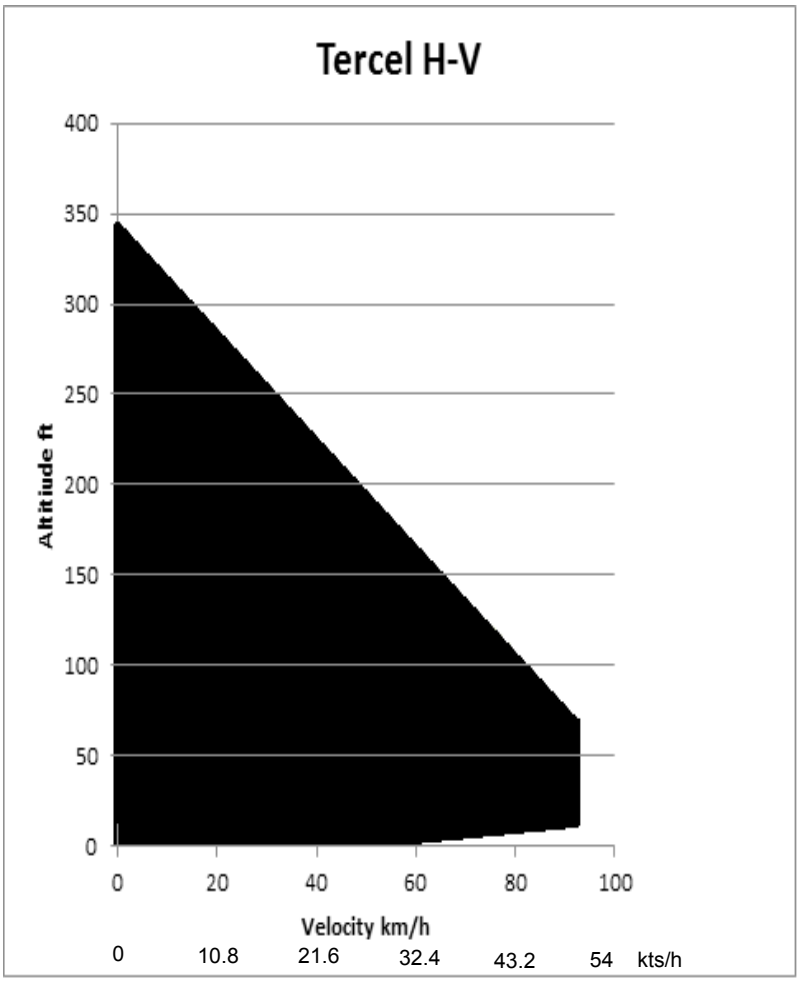
2.15 Other Restrictions

It is forbidden to perform:

- Aerobatics
- Turns in which the roll angle exceeeds 60º
- Flights in icing conditions
- Flights when the wind speed exceeds 70 km/h
- Flights in severe turbulance areas
- Flights above densely populated areas

DIAGRAM: HEIGHT - SPEED

2.16 High - Speed Diagram



Chapter 3
Emergency Procedures

3.1 Introduction

Chapter 3 contains the steps to take if an emergency occurs during ground operation, take-off or in-flight. These procedures are suggested as the best course of action for coping with the particular condition described, but are not a substitute for sound judgment and common sense. Emergencies rarely happen in modern gyrocopters, if proper pre-flight inspections and equipment maintenance are carried out. The best corrective action may not always be obvious. Pilots should familiarize themselves with the procedures given in this section and be prepared for appropriate action when an emergency arises.

Most basic emergency procedures, such as power off landings, are a part of normal pilot training. However, these emergency situations are also discussed here. This information is not intended to replace such training, but only to provide a source of reference and review, and to provide information on procedures which are not the same for all gyrocopters. It is suggested that the pilot review standard emergency procedures periodically to remain proficient in them.

CAUTION

Plan your route to allow for a potential emergency landing.

3.2 Engine Failure

3.2.1 During Take-off

- The flight level: If you are above 250 ft (80 m), you can turn back to land. If are lower, continue in the direction straight ahead.
- Reset the throttle to idle.
- Deactivate the magnetos and the electrical master switch (red key).
- Land, attempting to avoid both possible obstacles and violent manoeuvres resulting in a loss of rotor rotational speed.

3.2.2 During Flight

- If you have the sufficient height, attempt to start the engine in flight (subsection 3.3).
- If your height is too low, or attempts to restart the engine have not succeeded, perform an emergency landing (subsection 3.6).

3.3 Starting the Engine in Flight

- Adopt the gliding attitude.
- Make sure all the switches are in the appropriate position - the master switch and the magnetos are ON.
- To start the engine, set the throttle lever to the idle position.
- Activate the starter.
- After starting the engine, boost the throttle gradually.

3.4 Smoke or Fire

3.4.1 During Taxiing

- Reset the throttle lever to the idle position.
- Close fuel shut-off valve.
- Deactivate the magnetos and the master switch (red key).
- Vacate the gyrocopter as fast as possible.
- If available, use a fire extinguisher.

3.4.2 During Flight

- .Close the fuel shut-off valve.
- .Deactivate the magnetos and the master switch (red key).
- .If available, use a fire extinguisher.
- .Perform an emergency landing (subsection 3.6)

3.5 Gliding

Flight with an engine shut-off can be safely performed within the full speed range. However, approaching the ground, observe the restrictions from the height - speed diagram (page 15). In case of a vertical descent, commence accelerating the gyrocopter at a height of 250-350 ft above the ground to be able to land safely.

The highest glide ratio equals 3:1 at a speed of 100 km/h (54 kt). Then the gyrocopter will head for the area seen in the front bottom window.

3.6 Emergency Landing

- .Maintain 100 km/h (54 kt) to achieve best glide ratio.
- .Chose landing spot.
- .Land, attempting to avoid both possible obstacles and violent manoeuvers which may result in a loss of rotor rotational speed.
- .Engage rotor brake as soon as possible after touchdown.
- Stop the gyrocopter, apply full rotor brake and prepare to disembark.
- .Leave the gyrocpter as soon as the rotor stops.

3.7 Flat Tyre on Landing/Taxiing

- •. Deactivate the magnetos and the master switch.
- • .Interrupt the take-off.
- • .Attempt to maintain the direction by means of the pedals and the brake.

3.8 Jamming of the Throttle Lever during Flight

- • .Attempt to move the lever in order to release it.
- • .Choose an appropriate spot for landing.
- • .Deactivate the magnetos when you are within reach of the selected touchdown spot.
- • .Perform an emergency landing.

Chapter 4
Normal procedures

4.1 Introduction

Chapter 4 contains a list of activities and a description of procedures for performing normal operations. Normal procedures relating to the optional systems are included in Chapter 9.

4.2 Attaching the Rotor

Insert the rotor blades into the sockets secured by five bolts on each side of the hub. The five M10x75 bolts, each with washers on both sides, are fixed to the hub beam with each blade. Next, first tighten and then fully screw in all ten nuts.

Equalize the rotor blades by using stretched string, passing through the centre of the hub and along the grooves on the blade tips. The rotor must be placed on two supports with a soft surface to avoid damage, so that the strained string is about 1 cm above the central opening in the hub. When the string does not overlap the hub axle, two people are needed for help hold down the blade tips. Then push the hub into the right direction. After alignment, tighten the nuts with a torque spanner, first 18 nm, next 45 nm. If the engine is not aligned properly, unwanted vibrations in flight will occur.

The correctness of alignment must be checked on the first flight.

Installation of the Rotor on the Gyrocopter:

- Make sure the wheel brakes are activated (postion 1).
- Fix the control stick in the extreme forward position so that the rotor head disc rests on the brake.

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- Lubricate the pin for the rotor hub suspension on the head (teeter bolt) and the slip sleeves with a dedicated lubricant (WHS2002).
- With the help of another person and a ladder, raise the rotor and place it on the head.
- Insert the pin through the head and the hub (making sure the sleeves remain in their places) and press it down to the end.
- Tighten the nut, then unscrew it by 1/4 of a rotation and pass the safety cotter pin through the opening at the end of the pin.
- Check the rotor head movement range.

CAUTION
When installing the rotor you must only stand on the areas on the fusalage designated for this purpose

4.3 Daily Inspection

Most technical faults can be detected during a careful check before flight. The safety of operation depends on regular and detailed inspections and servicing. An inspection should, according to the plan below, be conducted before the first flight of the day, if possible in the presence of a qualified person (e.g. a pilot) to operate the gyrocopter correctly and avoid an accidental start.

General

- Check the magneto switches and set to the deactivated position (OFF).
- Remove any frost, snow, ice, or mud.
- Check the gyrocopter documents and ensure that all necessary maintenance has been carried out.

- Loose equipment is properly secured.
- If the gyrocopter has not been flown recently and before the next flight, make sure any reported faults that would affect the flight have been addressed.

Glazing

- Check the overall condition and clean if necessary.

Fuselage

- Check the outside surfaces, tail beam pipes and their mounting in the fuselage, the rotor mast and its mounting in the fuselage and the available inside structure of the fuselage for damage, corrosion and cracks and ensure all components are protected and secured.
- Check the drainage and ventilation holes are not clogged.
- Check the radio antennas are not damaged and are secured.

Tail

- Check the fixing of the vertical stabilizers to the tail beams and the horizontal stabilizer to the vertical stabilizers.
- Check the condition of the composite surfaces of the stabilizers and rudders for delamination, or other damage.
- Check the condition of the Bowden cables and their connection to the control surfaces.
- Check the rudder hinges.·
- Check the tail wheels.

Undercarriage

- Check the static deflectors on the undercarriage are intact.

- Check the condition of the undercarriage for damage, corrosion and cracks.
- Check the connection of the undercarriage legs attached to the fuselage structure for cracks and excessive play.
- Check the tyres are properly inflated (2.5-4 bars) are not damaged.·
- Check that the braking system is not damaged and has no signs of leaks.
- Check the brake fluid level.
- Check the bolts fixing the brake discs (2x4 pieces) are tightened.·
- Check the front leg rotates freely and the pushers are fixed correctly.

Flight control systems

- Check the pedals. In order to check the free movement of the rudder, raise the front wheel, by pressing down on the horizontal stabilizer (where is joined to the vertical stabilizer).
- Check the condition of rudder pedals, ensuring they are securely attached and there are no cracks in the welds and no jamming of the controls
- Check the control stick moves freely in the full movement range (between the stops) and the stick and rotor are in alignment.
- Check the mechanical connections of the control stick and the rotor head, ensuring there are no loose bearings or components. Ensure the pushers are not bent and move freely.
- Check the condition and operation of the electric trimmer.

Driving system

- Replenish the oil tank and the cooling fluid tank with appropriate fluids.
- Check the cooling lines (water and oil) are not cracked.

- Check the fixing of the exhaust system and turbocharger and all safety wires are secure.
- Check overall condition of exhaust system and turbocharger.
- Check the air filters are clean and securely fixed.
- Check the engine suspension for secure attachment and rubber components for cracks and excessive wear.·
- Check the spark plugs and their caps are securely fixed.
- Check the condition of the water and oil coolers, their fixing and make sure there are no leaks.
- Check the full and free movement of the engine control system for proper control and connection in the right direction.
- Check that all the wiring around the engine runs freely and is properly attached and connected.
- Make sure both covers of the inspection panels are secure and locked.

Propeller

- Check that the propeller blades are securel attached to the hub and the hub to the engine and that the nuts and bolts are secured with safety wire.
- Before checking the rotation of propeller and engine ensuring no unusual noises during rotation, the ignition must be deactivated and the throttle set at minimum.
- Check rotation of propeller and engine ensuring no unusual noises

CAUTION
In order to prevent the engine from starting, ensure that the ignition is off, the magnetos are off, the throttle is set to idle, the brakes are on and the chocks are in place.

Fuel system

- Check both fuel tanks for their condition ensuring their attachments are secure, there are no leaks, the filler caps secure and the fuel level in the tanks corresponds to the fuel level on the gauge. Ensure operation of the fuel shut-off valve and check there is no water in the fuel settling tank.
- Check the fuel system conduits for overall condition and that they are not slit, rotten or bent.
- Check that the fuel filters are not polluted with water.

Rotor

- Check the rotor head, its condition and freedom of movement.·
- Check the security of bolts and nuts securing the rotor blades to the hub.·
- Check visually blades for scratches, nicks, signs of cracks, or other damage The blades must be clean.
- Check that the rotor swings freely against the head and in the full range between the stops.

Prerotation mechanism

- Check the V-belts for damage or delamination.
- Check the pre-rotation sheave for damage or cracks.
- Check the rotor drive transmission rotates freely and is lubricated.
- Check the overall condition of the pre-rotation mechanism for cracks or other damage.
- Check that the pre-rotation brake operates correctly - it should block movement when pulling down the V-belts on the left side. The clutch cable should have several millimetres of clearance with no tension.

Cabin

- Check the opening and closing of the doors to ensure that the hinges and locks operate correctly.

- Check the seat belts overall condition.
- Check the seats for proper attachment to the cabin floor.
- Check that the readings of the instruments correspond with the prevailing atmospheric conditions.
- Check the wiring harness for traces of overheating, or other damage.·
- Check the operation of the electrical circuits.
- Check that the battery is charged and that the radio and other electrical instruments are working.
- Check the stickers and placards are legible.

4.4 Pre-flight Inspection

Before every flight, the pilot must perform an overall visual check of the whole gyrocopter. A thorough check of the gyrocopter, any faults, or mechanical issues should be rectified before flight. Particularly, it is essential to:

- Check that the weight and balance for the flight is within the recommended limits.
- Check the fuel level and replenish if necessary.
- Adjust the seats and check the security of luggage. There should be no loose objects in the cockpit.
- In the case of a solo flight, close the doors and fasten the passenger seat belt on the empty seat.
- Check the freedom of movement of the flight controls. When checking the rudder pedals, lift the front wheel by pressing the horizontal stabilizer.

4.5 Before Starting the Engine

If the engine is cold, all the oil will have drained to the bottom of the engine. The oil must be sucked around again into the engine. The following procedure should be performed:

- Deactivate the magnitos.
- Set the throttle on idle;
- Set the wheel brakes (position 1).
- Rotate the propeller manually anti-clockwise until you hear the first bubbling from the oil tank.
- Perform 10 more rotations to fully remove the air from the circulating oil.
- From the cockpit, check the propeller area is clear and the magnetos off. Activate the starter for a maximum of 10 seconds, checking that the value of oil pressure is reading a minimum 1 bar.
- If the pressure is too low, repeat the previous operations.

4.6 Starting the Engine

CAUTION
Only qualified personnel can start the engine

- Block the control stick with the strap in the extreme front position.
- Activate the master switch.
- Activate the electric fuel pump.
- Set the throttle (the black lever) to the idle position (entirely backwards).

- Activate both magnetos (upwards).
- Make sure all the other electronic switches and instruments are deactivated.
- Make sure the space around the propeller and rotor is clear.
- Make sure the wheel brakes are activated (position 1).
- Pull the choke lever (blue) if necessary, depending on air temperature. To start the cold engine, use full choke and the throttle in the minimum position, otherwise choke does not operate properly. When the engine is warm do not use choke.
- Call “Clear Propeller”
- Press the starter button for a maximum of 10 seconds.

  After starting the engine all the necessary devices can be activated.
- Deactivate the choke.
- Initionally warm up the engine at about 2000 rpm, gradually increasing to 2500 rpm until the oil temperature in the engine reaches 50˚C.

4.7 Checks after Starting the Engine

- If any of the parameters are outside the normal range, turn off the engine and check the cause.
- Check the oil pressure. If it does not raise smoothely to the normal value (2-5 bars), shut down the engine and find the cause.
- Magnetos check: at about 3000 RPM, turn off one of the magnetos. The maximum expected drop should be 200 RPM. Turn magneto on. Repeat the same procedure for the second magneto.

4.8 Taxiing

- For safety reasons, it is recommended to stop the rotor during taxiing.
- During taxi do not exceed a fast walking speed (15 km/h) with the rotor immobilized by the brake. It is recommended that the rotor blades are aligned with the axis of the gyrocopter.
- Make sure the pedals operate correctly. Left pedal turn left, right pedal turn right.
- Check the brakes. Avoid using brakes during turns, it leads to an unnecessary overload on the front wheel and the pedals.

4.9 Checks before Take-off

Make sure:

- Quantity of fuel is sufficient. A visual inspection of fuel in tank is recommended.
- Doors are closed.
- Seats are set up appropriately and the seat belts fastened.
- Choke disengaged.
- Trimmer is loose.
- The gyrocopter is facing against the wind.
- The condition of the runway and its length are appropriate.
- Radio is operative.

4.10 Pre-rotation and Take-off

- If pre-rotation belts have been replaced, it is recommended to powder them with talc.

- Set brakes on.
- Unlock control stick.
- Check control stick movement range.
- Set control stick in neutral position.
- Set throttle to idle.
- Pull back the pre-rotation lever (red) until you hear the Bendix turn on with its characteristic sound.
- After the Bendix turns on, hold the pre-rotation lever on in the same position until the rotor accelerates to 100 rpm.
- Then firmly continue pulling the pre-rotation lever until the rotor revolutions stop increasing (this means the prerotation system has been fully synchronized).
- Set pre-rotation to fully engaged.
- Set the throttle lever so that the rotor revolutions reach 150 rpm and then pull the control stick back 10 cm [4"] and hold on until the rotor revolutions reach 180-200 rpm.
- Set pre-rotation to fully disengaged.
- make sure that the prerotation mechanism is deactivated.
- Release the wheel brake.
- Pull the control stick backwards and gradually accelerate.
- At a speed of 40 km/h (22 kt) gently lift the front wheel, observing the attitude of the gyrocopter.

The pre-rotation lever is the red lever in central console. The Bendix mounted on gyrocopter is a mechanical type.

CAUTION

After setting the pre-rotation lever to the pre-rotation position, the pre-rotation clutch is engaged, the Bendix is turned on and rotor is accelerating.

It is forbidden to apply prerotation during flight

CAUTION

The gyrocopter tends to lift off the ground prematurely. Attempt to keep the front wheel about 10 cm [4"] above the ground. If the front wheel is lifted too high, it can lead to a dangerous, unintended take-off with insufficient speed

- Use the left rudder pedal to compensate for the left yawing tendency that occurs when increasing the throttle.
- The lift-off speed is about 85 - 90 km/h (46 - 49 kt). After lift-off, accelerate the gyrocopter just above the ground to the speed of 105 - 110 km/h (57 - 60 kt).
- Start the ascent by controlling the position of the gyrocopter and the engine parameters.

CAUTION

Since the pilot sits to the side of the gyrocopter's axis, remember not move the control stick diagonally if you want to make a move straight forward. It is recommended to practise this reflex reaction on the ground with an instructor.

4.11 Climb, Cross-Country Flight, Descent

- Controlling the climb and descent is performed by moving the throttle lever coordinated with the movement of the control stick. An optimal climb speed is 105 km/h.
- Climb: increase the engine rotational speed, by moving the throttle lever forwards.
- Descending: decrease the engine rotational speed, by moving the throttle lever backwards.
- The cross-country speed depends on the take-off weight, the engine rotational speed and atmospheric conditions.
- Trim the gyrocopter till it flies straight and level.

- The ***TERCEL*** is designed to react to the pilot's instructions in an intuitive and normal manner. Increasing the throttle causes climb, reducing the throttle causes descent.

4.12 Approach and Landing

- Choose an appropriate area for landing, check the movement of other aircraft around, by using your radio and noting the direction and speed of wind.
- Check the descent speed by using the throttle lever and control stick.
- Maintain the appropriate approach speed (about 95 km/h (51 kt)).
- Avoid sudden sideways movements.
- Make sure the front wheel is straight.
- At an appropriate level, initiate round out so as to align just above the ground and touch down gently.
- Remember landing **does not finish** when all the wheels touch the ground.
- Perform the landing run along a straight line until you stop. Do not turn during the landing run.
- Check the rotor until it stops completely.
- Use the rotor brake below the speed of 150 rpm until it stops.

CAUTION

In case of strong sideway winds, plan the landing for the shortest possible landing run and during the landing run tilt the control stick in the direction into the wind (the wind from the left - the stick to the left).

4.13 Turning off the Engine

CAUTION
Every engine with a turbo-compressor must be cooled after flight.

- Allow the engine to run at a low rpm (1,650 rpm) for about 5 minutes. All the parameters must stabilize.
- Deactivate the magnetos and the master switch.

4.14 Post-flight Inspection

After flying, the pilot should perform an overall visual check of the whole gyrocopter. Any unusual observations should be passed onto competent personnel. Similarly, if any abnormal situations occur during flight, it is important to inform competent personnel.

4.15 Detaching the Rotor

The rotor must be detached from the gyrocopter for transportation and in case of longer hangar storage.

NOTE: When detaching the rotor, you must only stand on those areas on the fuselage assigned for this purpose!

- Make sure the wheel brakes are activated (position 1).
- Immobilize the control stick by fully tightening the strap anchored to the floor around the control stick, so that the rotor head disc rests on the brake.
- Remove the safety cotter pin and unscrew the nut from the pin for rotor hub suspension in the hub (teeter bolt).
- With the help of another person holding down the rotor, remove the pin (making sure the sleeves remain in their

places) and remove the rotor from the head.

- Unscrew the nuts, withdraw the M10x75 bolts (10 pieces) and remove the blades from the sockets in the hub.
- Piece together and assemble back the hub, sockets, M10×75 bolts, washers and nuts.
- Place the pin (teeter bolt) in the hub with washers, screw on a nut and pass through the cotter pin (safety pin).

The removed blades, for storage or transportation, must be appropriately fastened and protected against damage.

Chapter 5
Performance

5.1 Introduction

Chapter 5 includes information regarding flight speed and performance during take-off, climb, cross-country flight and landing, and also data about noise.
Unless stated otherwise, the values refer to a take-off weight equal to 560 kg and standard atmospheric conditions.

5.2 Characteristic Speeds (IAS)

		(km/h)	(kt)
Never-Exceed Speed	V_{NE}	200	108
Maximun structural cross-country speed	V_{NO}	130	70
Normal structural cross-country speed	V_{C}	120	65
Best rate of climb	V_{Y}	100	54
Approach speed	V_{APP}	90	49
Manoeuver speed (two people)	V_{D}	90	49
Manoeuver speed (one person)	V_{D1}	90	49
Minimum speed	V_{min}	60	32

NOTE:

The actual speed will differ from the indicated air speed during a steep climb, descent and in autorotation due to a change of the angle of attack.

5.3 Take-off

Lift-off speed is about 85 - 90 km/h (46 - 49 kt).

Standard take-off run is about 80 - 110 m (262 - 360 ft).

Take off to clear a 15 m (50 ft) obstacle, after accelerating to V_Y (100 km/h) (54 kt) is about 299 m (981 ft)

5.4 Climb

The maximum rate of climb at ground level with a speed of V_Y = 100 km/h (54 kt) is about 1,180 ft/min (6 m/s) and with a one-person crew it can reach 1,380 ft/min (7 m/s).

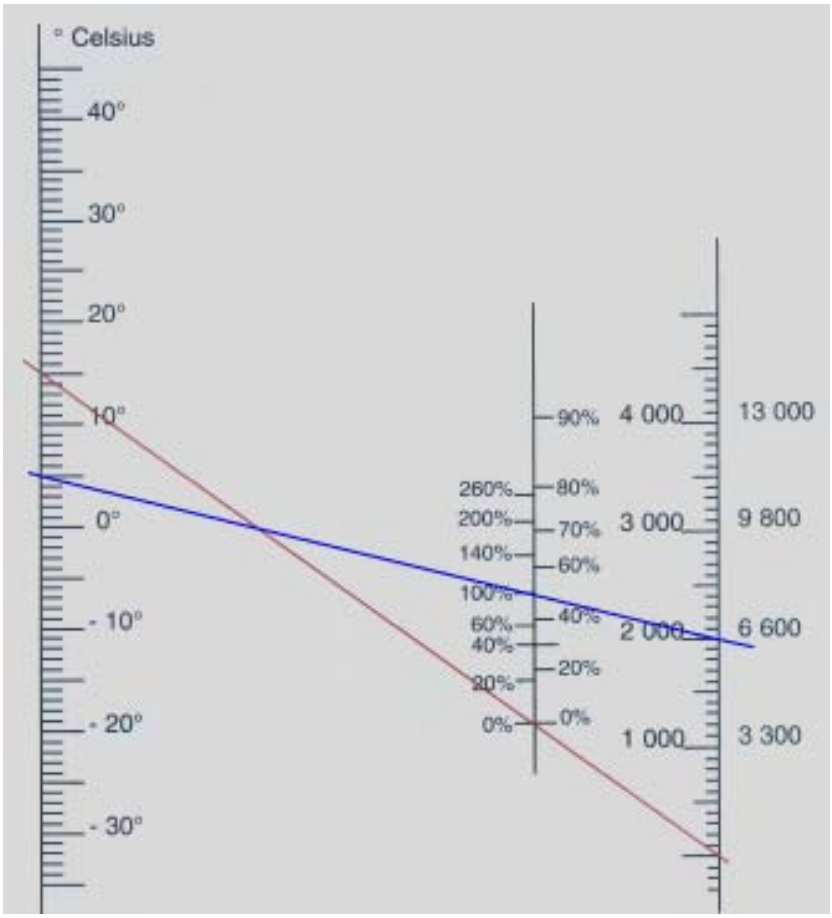
The practical ceiling is 10,000 ft Above Sea Level (3,000 m).

5.5 Diagram for calculating Take-off distance and Rate of Climb depending on Air Temperature and Pressure

The diagram depicts the values applicable for light aircraft

.

The diagram is provided only for general information and shall not be applied without ensuring the appropriate safety margin.



Example:

Conditions at the take-off airfield: temperature 15 ºC, pressure matching an altitude of 2,000 m.

Connect with a line the points matching the above values on appropriate scales.

At the point where this line intersects with the middle scale, read the results.

In the stated example, the take-off run distance will increase by 100% and the rate of climb will decrease by 50% in comparison with the values in standard atmospheric conditions.

CAUTION
Some runway conditions such as high grass, sand, mud and snow, etc. can make take-off impossible. Always make sure that the runway is in suitable condition.

5.6 Landing

Approach speed: V_{APP} (90 km/h) (49 kt),.

Landing above the obstacle 50 ft (15 m): 150 - 180 ft (45 - 55 m).

Standard landing run: 0 - 33 ft (0 - 10 m).

5.7 Range and Flight Endurance

Average fuel consumption at a cruising speed of V_C = 130 km/h (70 kt) is about 20 l/h (5.3 US Gal/h). Hence, at take-off with the full fuel tanks (118 l of usable fuel):

- Approximate range: 758 km.
- Approximate flight endurance: 5h 50min.

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Chapter 6
Weights and the position of the centre of gravity

6.1 Introduction

Chapter 6 includes information regarding the gyrocopter's empty weight, the usable weight, and the admissible load variants assuring the position of the centre of gravity of the gyrocopter is in the admissible range.

The way of weighing and specifying the position of the centre of gravity of the gyrocopter is stated in the Aircraft Maintenance Manual (document no. TERCEL-SM-001-EN) in Chapter 6.

6.2 Weights

The maximum take-off weight (MTOW) is 560 kg (1235 lb).

The empty weight is 295 kg (649 lb. The actual empty weight for a specific model is included in the up-to-date weighing report and is set out in subsection 6.4 of this manual.

The usable weight is the difference between the maximum weight and the empty weight. You can calculate this value on your own (for the empty weight it is equal to 295 kg (649 lb). The cargo weight which includes the weights of the crew, luggage and fuel, cannot be greater than the usable weight. Restrictions concerning load weights:

Minimum crew weight	60 kg	132 lb
Maximum crew weight	170 kg	375 lb
Maximum one person weight	120 kg	264 lb
Maximum fuel weight (xx lt)	93 kg	205 lb

The luggage compartment is located behind the seats and holds 2 x 10 kg (2 x 22 lb). In addition, a maximum of 8 kg (18 lb) may be placed under the seats. The luggage weight should be included in the crew weight. All luggage should be secured to avoid movement in flight.

During solo flights, it is recommended to place ballast on the unoccupied seat, fastened with seat belts to ensure the appropriate balancing of the machine. Ballast in the form of a sack of sand, or a can of water is recommended. The ballast must be protected against movement.

The ballast weight is set out below:

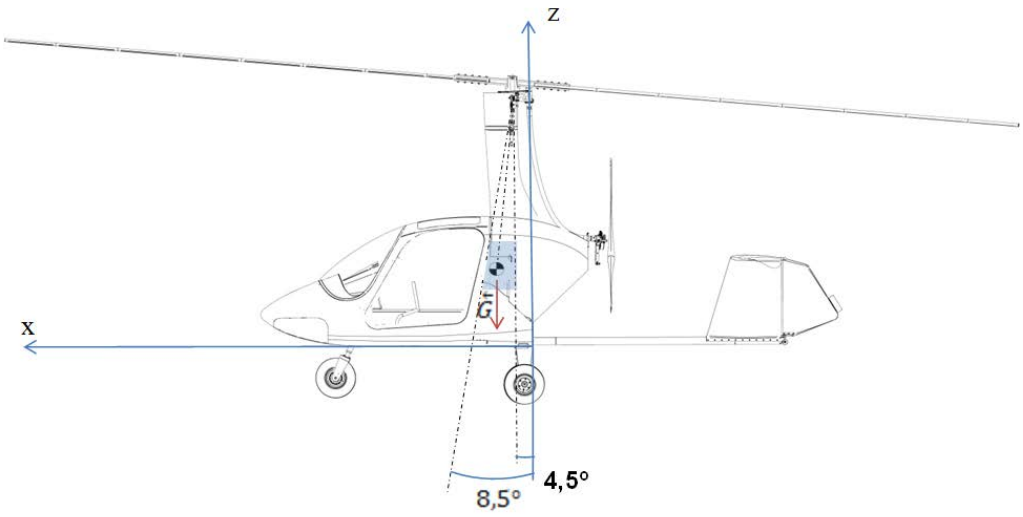
Pilot left seat Weight (kg)	Ballast right seat (kg)	Ballast right seat (lb)
50 - 60 kg	12 kg	26 lb
60 - 80 kg	10 kg	22 lb
80 - 100 kg	8 kg	18 lb

Pilot right seat Weight (kg)	Ballast left seat (kg)	Ballast left seat (lb)
50 - 60 kg	12 kg	26 lb
60 - 80 kg	10 kg	22 lb
80 - 100 kg	8 kg	18 lb

CAUTION
Under no circumstances exceed the approved maximum take-off weight (MTOW) equal to 560 kg (1235 lb).

6.3 Position of the Centre of Gravity

The position of the centre of gravity of the gyrocopter (a sideways view) is specified through the value of the angle whose apex is located on the transverse axis for rotor head suspension on the mast, one arm is parallel to the vertical axis of the coordinate system related to the fuselage and the other arm passes through the centre of gravity of the gyrocopter.



The admissible range of the position of the centre of gravity of the **empty gyrocopter** is:

- 0.6º - +0.6º

The actual position of the centre of gravity of the empty gyrocopter for a specific model is included in the up-to-date weighing report and is set out in subsection 6.4 of this manual.

The admissible range of the position of the centre of gravity of the **gyrocopter in flight** is:

+4.5º - +8.5º

NOTE:

Observing the conditions of the admissible load and the proper position of the centre of gravity of the empty gyrocopterensures maintenance in the above range of the positions of the centre of gravity.

6.4 Entering the Weight and Position of the centre of Gravity of the Empty Gyrocopter

The table below serves to enter periodic weighing checks of the gyrocopter or weighing checks after making changes in the equipment, repairs or lacquering.

Date	Gyrocopter empty weight	Position of centre of gravity	Approved by:
	(kg)	(degrees)	Signature

Chapter 7
Description of the Gyrocopter and its Equipment

7.1 Introduction

Chapter 7 includes the description and manner of operating the gyrocopter, its systems and equipment. The details about the optional systems and equipment are included in Chapter 9.

7.2 Airframe

The main structural component of the gyrocopter is the composite fuselage. It is made of glass fibre saturated with vinylester resin with a core mat applied as the core of separator structures. The horizontal stabilizer (with its symmetrical air-foil section) is mounted on the vertical tail (consisting of a stabilizer and rudder). The empennage is attached to two pipes, made of an aluminium alloy, guided from the fuselage. A metal mast is affixed to the fuselage structure, on which the control head with the lifting rotor is mounted.

The two-blade rotor with metal structure is manufactured and delivered in a set (blades + a hub) by AVIATION ARTUR TRENDAK Company. The blades with a 8H12 air-foil section are made from drawn aluminium and are entirely anodized and perfectly balanced.

7.3 Flight controls

Controlling flight is performed by using the control stick and pedals. Each crew member has his own flight control set. The movements of the control stick are transmitted by the flexible Bowden cables kinematic system to the rotor head. The movements of the pedals are transmitted to the rudders by the flexible Bowden cables.

When the pilot moves the stick forwards, the rotor head tilt forwards and the gyrocopter pitches down.

When the pilot moves the stick backwards, the head tilt backwards and causes the nose to pitch up.

When the pilot moves stick completely forwards (in practice it is impossible in flight - full range only on the ground), the rotor head disc rests on the fixed frictional component (bent from stainless steel) and brakes the rotor.

When the pilot moves the stick to the left, the head tilts to the left and banks the gyrocopter left.

When the pilot moves the stick to the right, the head tilts to the right and banks the gyrocopter right.

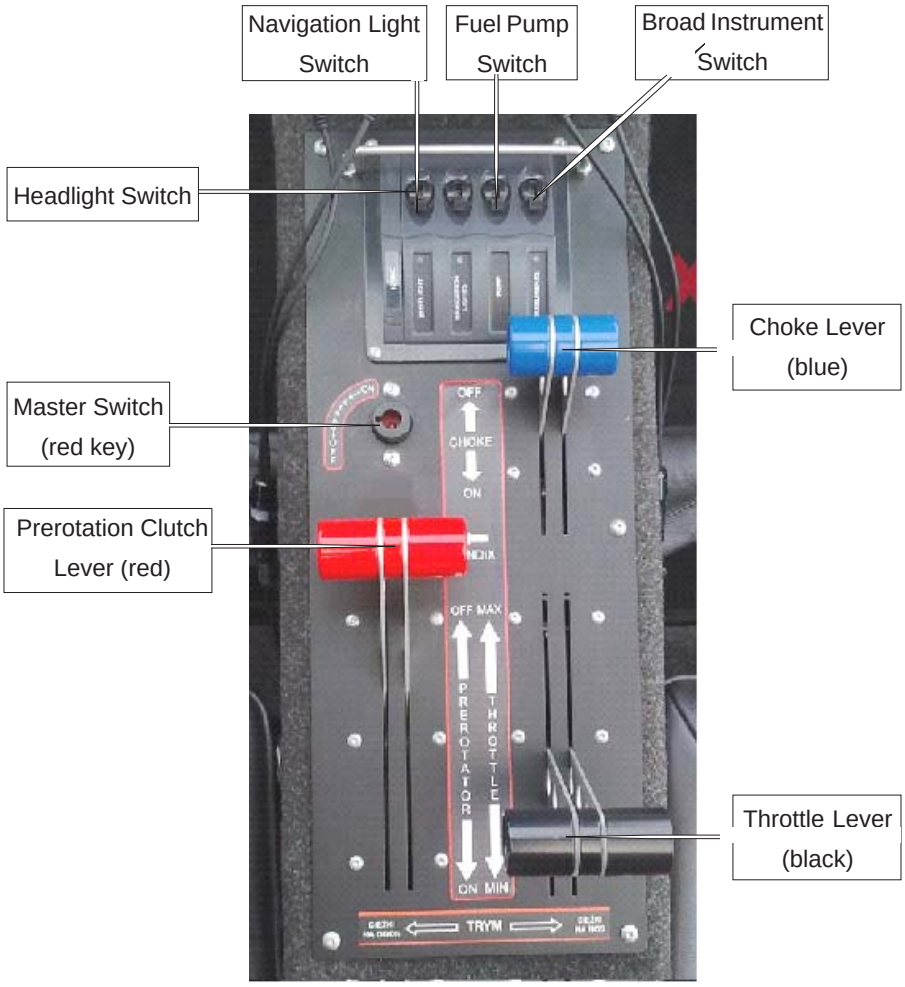
When the pilot pushes the left pedal, both rudders deflects left. Pushing the right pedal causes rudders to deflect right. Deflecting the rudder right pushes the tail left and causes the nose to yaw to the right.

The gyrocopter is equipped with an electrical trim system. This device reduces the effort required to adjust, or maintain a desired flight attitude. Electrical trimming is implemented by means of electrical actuators installed in the control system. By clicking the appropriate trimmer, the corresponding actuator will move and change the neutral position of control stick.

The trimmer release button changes the position of the actuators towards the neutral position. This will reduce all forces generated by the trimmers on the control stick to 0. In order to release the trimmers, the pilot must push the trim release button and hold it for longer than one second. This changes position of actuators towards neutral position. This will reduce all forces generated by the trimmers on control stick. The figure below shows control stick grip.

On the rudder there is a relieving flap, which aims at facilitating flight straight ahead without the necessity for the pilot to use the pedals. It is installed by the manufacturer after the phase of test flights. If needed, flap position can be corrected, by gently bending it in or out (see Aircraft Maintenance Manual).

7.4 Central Console



7.5 Instrument Panel

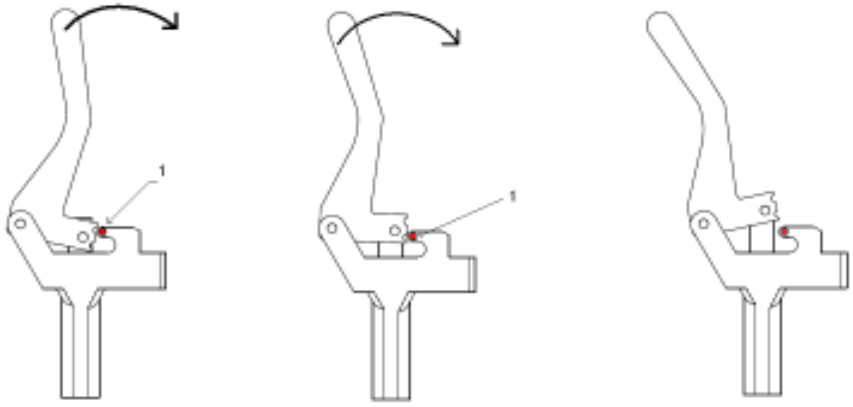
A sample instrument panel is shown below. Different panel configurations and sets of flight and navigation instruments are possible. The details concerning other variants are set out in Chapter 9 Supplements.

7.6 Main gear, Wheel Brakes

The gyrocopter is equipped with fixed tricycle landing gear. The main landing gear leg is reinforced elastic, made of a composite. The forward leg, dampened with the pneumatic wheel unit, is controlled by using the rudder pedals.

Normal operating range of the tyre pressure is 2,5 - 4 bar.

The main landing gear wheels are equipped with hydraulic disc brakes. The brakes are activated with the lever on the control stick and act simultaneously on both wheels.



To lock the brake lever in Position 1, or Position 2 pull it to the required position and press the red button (marked no 1). In order to release the brake, pull the lever harder to enable the automatic release of the lock.

CAUTION
Do not use the brake during a long-lasting stopover.
It can cause damage to the braking system

When taxiing or performing the landing run, brake without locking the lever. Information on the sort of brake fluid and its replacement, or replenishment are included in the Aircraft Maintenance Manual.

7.7 Seats and the Safety Belts

Two ergonomic bucket seats, made of a composite, can be moved in a front-aft direction in limited range. Adjusting the position can be performed during flight and consists of releasing seat lock by pushing the lever beneath the seat.

Each seat is equipped with adjustable four-point belts.

7.8 Luggage Compartment

The luggage is located behind the seats and holds 2 x 10 kg (2 x 22lb). In addition, a maximum of 8 kg (18lb) may be placed under the seats. All luggage should be secured to avoid movement in flight.

7.15 Glazing, Doors

The glazing is made of Plexiglas with a thickness of 3 mm and comprises a panoramic front pane, two roof panes and two panes in the bow of the floor. The The glazed left and right side doors have air vents.

The doors open in a forward direction. In the closed position, they are secured with a lock accessible both from the outside and inside.

7.10 Power plant

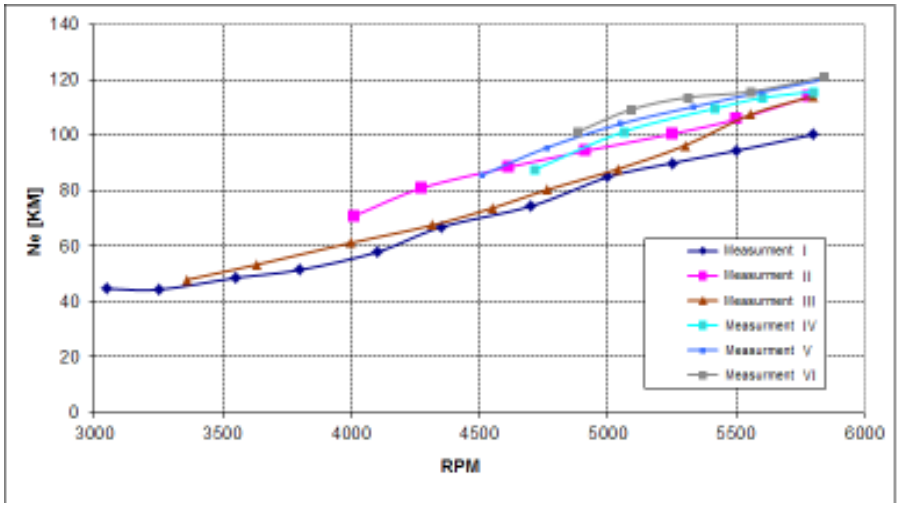
7.10.1 Engine

The ***TERCEL*** is powered by a CA 912 ULT engine. It is the Rotax 912 UL

engine, modified by AVIATION ARTUR TRENDAK by adding an Iveco turbo-compressor.

The details concerning the parameters of the engine and its usage are included in the instruction manual of the CA 912 ULT engine.

CA 912 ULT engine characteristics



7.10.2 Propeller

The KASPAR Aero 2/3 LT three blade, left rotational propeller with a diameter of 1.72 m is fitted in the pushing position, having the capability to manually change pitch. The hub and blades are made of a composite reinforced carbon fibre. The angle of the blade setting measures 714 mm from the axis of rotation is 12º

7.11 Engine Oil

Traditional oils for aviation piston engines are not appropriate for Rotax engines. Due to the heavy load on the transmission, motor-cycle oils with additions for gearboxes are recommended. Oil for heavy motor-cycle 4-stroke engines meet all the requirements.

It is essential only to use oil with the API classification “SJ” “SG” or ”SL”

Recommended oils are contained in the Rotax engine manual Recommended oil: Aeroshell oil sport plus .

Do not use oils from diesel engines!

A diagram of the oil system and information on oil replacement and replenishment are included in the Aircraft Maintenance Manual.

The oil temperature optimal range for engine work is: 90 ºC - 110 ºC.

If the oil temperature is not correct, it is possible to change the position of the oil cooler (see the Aircraft Maintenance Manual).

NOTE:
Do not use re-refined oil.

7.12 Fuel System

A diagram of the fuel system is included in the Aircraft Maintenance Manual.

Two connected composite fuel tanks are located close to the centre of gravity of the empty gyrocopter, so the quantity of fuel in the tanks does not significantly affect the behaviour of the machine in flight.

The capacity of the tanks is 120 lt. Unusable fuel 2 lt.The tanks are located behind the seats. The fuel level is easily seen from the scale attached to the translucent fuel tank walls. An additional fuel level gauge is located on the instrument board.
It is essential to use **lead-free** car petrol with an octane minimum of 95 [RON 95] AKI 91, An octane level of 98 [RON 98] is recommended if available. For fuels according to ASTM D4814 specifications following AKI (Anti Knock Index) value has to be observed: min. AKI 91

NOTE:
AVGAS should not be used on a regular basis.

Average fuel consumption at a cruising speed of V_C = 130 km/h (70kt) is about 20 l/h. (5.3 US Gal/h)

7.13 Electrical System

The diagram of the electrical system of the gyrocopter is shown in Chapter 2 of the Aircraft Maintenance Manual.

The main source of the aircraft's electrical energy is a direct current generator mounted on the engine. The master switch is located on the central panel and is activated with the removable red key.

The electrical system provides power to all the electrical appliances in the gyrocopter including the ignition system, magnetos, cockpit, navigation lights, pumps, sensors and any additional appliances. On the side of the instrument console, there is a 12V socket (a typical car socket for a lighter) giving the possibility of connecting additional devices.

Individual circuits are activated with the appropriately described switches and protected with safety fuses. When the generator is not working (e.g. if the engine is off, at low rotations, or there is a failure), an orange charging indicator light is illuminated on the instrument panel and then the electrical units will be powered by the battery.

7.14 Static and Total Pressure System

The total pressure feeder, in the form of a pitot tube, is located in the nose of the gyrocopter's fuselage. It is connected with a plastic hose directly to the speedometer. Static pressure to the speedometer, altimeter and vertical speed indicator is taken from sensor placed in the cabin, directly through the instrument connectors.

Chapter 8
Manoeuvring, Temporary Operation and Maintenance

8.1 Introduction

Chapter 8 contains the procedures for manoeuvring on the ground and the operation of the gyrocopter as recommended by the manufacturer. It also sets out certain requirements concerning maintenance and operation which must be met, if the gyrocopter is to maintain its performance and reliability. It is prudent to observe the planned schedule of lubrication and preventive maintenance.

8.2 Periodic Inspection of the Gyrocopter

The periodic inspections and their frequency are set out in the Aircraft Maintenance Manual of the gyrocopter. Regardless of these periodic inspections, the gyrocopter will also be subject to the inspections required by the appropriate Aviation Authority.

The owner/user is responsible for the operation of the gyrocopter and must ensure that all the necessary operations are performed by authorized personnel.

8.3 Repairs and Modifications

Any repairs and modifications to the structure can only be made by authorized personnel and in agreement with the gyrocopter manufacturer.

NOTE:

Before making any modification to the gyrocopter, contact the appropriate aviation authority to make sure the planned modification does not affect its airworthiness.

After making any reparations or modifications, weigh the empty gyrocopter, record the position of the centre of gravity and enter the details in the table in subsection 6.4 of the pilot operating handbook.

8.4 Manoeuvring on the Ground, Road Transport

When transporting or moving the gyrocopter, the control stick should always be immobilized with a strap. For road transport on a trailer, or in a container, detach the rotor (see subsection 3.1.2) and fix the gyrocopter to the base by the landing gear legs.

Moving the gyrocopter on the ground should be performed with great caution by using a forked drawbar grappled by the front wheel axle, or a rope grappled by the front leg.

When parking with the rotor installed, tie the rotor to the fuselage by means of turnbuckles with pockets fitted on the blade tips, or by using two straps.

8.5 Cleaning and Conservation

The outside surfaces of the fuselage, rotor and propeller should be washed with water with the addition of a mild soap. Hard-to-wash stains of lubricant, or oil can be removed with a lint free cloth wetted with heavy aliphatic petrol.
For painted surfaces, you can use any high-grade waxes or an abrasive compound of the automotive type. Soft fabrics or suede must be used for polishing.

The glazing should be rinsed with clean water or a water solution with the addition of a mild soap and then wiped with a clean soft fabric, sponge or suede. Exercise caution to avoid scratches.

The cockpit interior, chairs, rugs and upholstery should be cleaned with a vacuum cleaner. It is recommended to apply commercially available cleaning agents for car upholstery.

Clean the engine in accordance with the Engine Manual.

Chapter 9
Supplements

9.1 Introduction

Chapter 9 includes appropriate supplements essential for the safe and efficient operation of the gyrocopter when it is equipped with various systems and equipment not durin the standard model.

9.2 List of Introduced Supplements

Document no.	Title of an Attached Supplement	Notes

In the “Notes” column, confirm by hand whether there is additional equipment or systems in the gyrocopter model for which this manual is intended.