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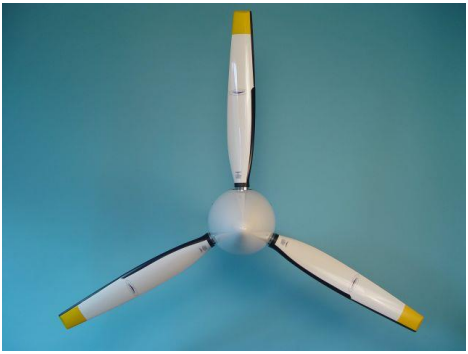
USER MANUAL
UM – 05 EN

AIRCRAFT PROPELLER

Type-Model: KW-31

Variant:

Serial No:



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2. List of Revised Pages

Changes to this manual are done by means of revisions and may only be made by the manufacturer.
The revisions shall be recorded in the table below.
New or revised text on a revised page will be marked by a vertical black line on the right side of the page. The date and number of the revision will be recorded on the bottom edge of the revised page.

Revision	Date of the revision	Revised pages	Date of insertion	Signature
1	**31.05.2018**	**4, 5, 9, 11-15, 17, 18, 22, 24, 25, 27-30, 33-39**		

3. Introduction

Read this manual carefully before putting the product into service to get basic information on operational safety.

If you do not understand the contents or if in doubt, always contact propeller manufacturer – Woodcomp Propellers s.r.o.

We wish you many pleasant flights with Aleš KŘEMEN – WOODCOMP propellers.

4. Manufacturer

Woodcomp Propellers s.r.o.
Vodolská 4, Dolínek
250 70 Odolena Voda
Czech Republic

Legal form: Limited Liability Company, registered in the Trade Register maintained by City Court in Prague, section C, file 80616
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5. Type Certificate Holder

Aleš KŘEMEN Company
Vodolská 4, Dolínek
250 70 Odolena Voda
Czech Republic

Legal form: natural person authorized to perform business according to Law on Entrepreneurship, registered in the Trade Register maintained by City Court in Prague, section A, file 58514
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6. Serial Number

Please state the correct type designation and serial number of the propeller each time you contact the manufacturer.
These data are specified on the first page of this User Manual, on Warranty Certificate and on Product plate fixed on the propeller blade No. 1

7. General Information

KW-31 propellers are reliable and field tested in long lasting operation, however problems might occur as with any product.

Although it is impossible to eliminate all the risks involved just by reading the manual, they can be minimized by applying the information presented and using the propeller properly.

Information and descriptions in the manual are valid at the time of publication. Users of Aleš Křemen propellers may be informed about changes or mandatory measures by publication in the form of service bulletins at Woodcomp Propellers website http://www.woodcomp.cz.

Illustrations in this manual are for information only and do not replace drawings in technical documentation.

Technical data are specified in SI metric system.

The manual may be translated from Czech to any other language, but the original Czech text will held decisive validity.

8. Operating Safety

This propeller is subject to approval by aviation authorities, and is always operated on users own risk!
Aerobatics and intentional spins with this propeller are prohibited!
Operation in icing conditions is not permitted!

- Only use propeller on engine and aircraft combination recorded in the Propeller Log Book.
- Do not over speed the propeller to higher than maximum permitted rpm, with the exception of emergency procedures detailed in Chapt. 14.9.
- Do not start the engine manually by the propeller.
- Pulling/pushing the aircraft using the propeller is only possible when holding the propeller blade root part closest to the hub.

- Before starting the engine, always check the condition of propeller and its mounting.
- Before starting the engine, always ensure that the propeller and its surroundings are clear.
- Record all data concerning propeller operation and repairs in the Propeller Log Book.
- Do not transport nor store the propeller standing on blade tips, even for short time!
- Do not store the propeller in extremely damp environment, and do not leave it outside in rain for extended periods.

9. Propeller Properties

Electromechanical propellers KW-31 family may be fitted with automatic rpm control (Constant Speed Propeller). This concept offers the best possible utilization of engine power while providing highly comfortable user control.

The pilot selects optimum engine rpm and controls engine power, and/or boost pressure, by throttle lever in the cabin. Automatic control maintains set rpm without any pilot intervention, keeping engine power constant regardless of changing flight speed, climbing, descent, flight in turbulence, or aircraft manouvering. If proper piloting rules are adhered to, maximum permitted engine rpm will not be exceeded.

Aircraft equipped with this propeller achieves short take-off run, fast climb to level flight altitude, the lowest possible fuel consumption and noise level for given operating range (distance travelled) or endurance, while still allowing fast change to maximum flight speed. Use of this propeller is a prerequisite for achieving high service ceiling of aircraft. Compared with other propeller concepts, aircraft thus equipped has better glider towing characteristics.

Propeller with automatic rpm control protects engine package from damage caused by improper handling during flight.

Propellers of KW-31 family offer stable control and fast reaction, thus meeting the requirements for standard aircraft categories.

10. Technical Description

10.1. Intended Use

Propellers of KW-31 family are intended for piston engine aircraft with engines up to 104kW (141HP), coupled with reducing gearbox.

KW-31 is double acting in-flight adjustable propeller, offering two modes: directly controlled blade pitch angle (so called beta–control mode), or as constant speed propeller (so called constant–speed mode).

Blade pitch angle is adjusted using servomotor controlled from the cabin; range of adjustment is from the minimum angle for take-off up to the maximum pre-set angle.

KW-31 propeller may be used as pushing or pulling propeller.

The propeller is attached to engine flange using a spacer and six screws with nuts. The spacer defines the distance between the plane of blade rotation vs. fixed parts of engine cowling. Therefore it supports adaptation to various built-in dimensions in various aircraft.

Electric motor driving the change of blade pitch angle is supplied by multisegment contact ring. The propeller is double acting, which means that movement in both directions, to increase and also to decrease the pitch, is motorized. Adjustment mechanism is self-locking, which means that if the electric motor is not energized, the blades remain at the most recent angle setting.

Electric motor power is transferred to motion screw through multiple planet gears. Motion screw thread moves a yoke, which turns propeller blades carried in two roller axial bearings and one radial sliding bearing. Movement of yoke is linked to microswitches located at low and high pitch end stops.

Propeller blades are carried by two axial needle bearings in the propeller hub flanges. Blade position is locked by a nut–cover. Cover is fixed by two locking screws after preloading the bearings.

The yoke mechanism converts axial movement to rotating movement. Bronze stone is used to transfer forces between motion screw and blade pin jutting out of the blade ferrule. To prevent direct contact between the yoke and individual blade hub bottoms, additional stones are fixed in the opposite end of each edge of yoke.

Sliding ring maintains radial position of the blade.

Propeller blades consist of core made of resonance spruce, which is wedged and glued into blade root made of hardened wood. Blade core is enclosed in glass or carbon laminate with gelcoat surface. This combination brings superb mechanical qualities, low weight, great resilience and perfect look.

Blade end is fitted into duraluminum hub and secured using steel screws with special thread. Outer part of blade leading edge is protected from damage by poured polyurethane or by stainless steel stamping. Inner part of blade leading edge (close to propeller centre) is protected by applied self-adhesive polyurethane tape.

Color of surface is made to customer order. Blade tips may be highlighted using paint, to improve visibility during rotation.

Composite propeller spinner is attached onto propeller hub in two planes, on baffles, which guarantee proper alignment and suppress negative effects of vibrations onto relative movement of the spinner vs. propeller hub; this reduces propeller imbalance during operation. Connection of spinner to rear carrier (baffle) is using 9 plated screws with self-locking nuts.

Use of quality aluminum alloys for the propeller hub guarantees high strength and rigidity with low weight. Wooden blade cores eliminate possible fatigue problems when used on piston engines. Composite shell of all blades improves resistance to mechanical damage and ingress of moisture and dirt into wooden structure.

10.2. Propeller Control Modes

Propeller may operate in manual pitch angle control mode, or constant speed mode.

10.2.1. Manual Control Mode

Manual control installation may be in two versions:

- Propeller control on instrument panel–standard
- Propeller control on stick–custom order

Propeller control on instrument panel
Propeller control on instrument panel consists of a panel incorporating both signaling of the direction of blade pitch change and also fine and coarse pitch limit indicating LEDs along with the control switch.

Propeller control on stick
Propeller control is installed on control stick, it consists of a handle which is threaded onto the stick.
In this case, signaling of the direction of blade pitch change as well as fine and coarse pitch limit indicating LEDs are located in the instrument panel without the control switch.

10.2.2. Automatic Control Mode – Constant speed

On customer's request, propeller control in the cabin can be expanded with electronic controller, allowing the setting of propeller rpm, which is then automatically maintained regardless of flight mode. In this case, the propeller acts as so called Constant speed propeller.

NOTE:
This user´s manual describes how to operate the CS 3-5 controller. The controller is typical by its properties for all other approved controllers. List of approved controllers is provided in Service Bulletin No. 03 in the current version.

Auto–Manual switch is added to the instrument panel, which allows selection of:

AUTO	- automatic control mode–Constant speed
MANUAL	- manual control mode

10.3. Propeller Blade Pitch Stops

Both end positions of blade pitch are preset by propeller manufacturer. Position of limit blocks may be changed according to the engine installed. If it is discovered that particular aircraft-engine configuration would benefit from other preset of end positions, such change may only be performed by the manufacturer or authorized service centre. The movement which changes blade pitch is limited by two systems.

10.3.1. Main System

Main limiting system consists of limit switches operated by end stops installed on links connected to the adjustment mechanism; activation of a switch stops the blade in current position. To increase reliability, redundant (double) switches are installed at both positions.

10.3.2. Backup System

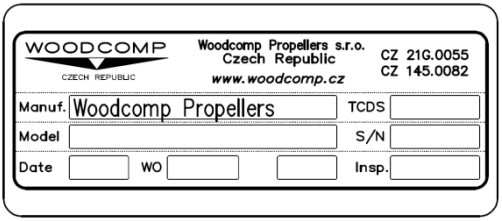
Mechanical stop–rings are threaded onto moving screw, which limit the range of adjustment mechanism movement. Mechanical stops are set approx. 2° lower/higher than electrical stops. If propeller blade pitch adjustment mechanism reaches a mechanical stop, current consumption of electric motor increases; this increase is detected by the control unit, which disconnects the electric motor.

CAUTION
If main end stop mechanism fails, the propeller must be removed and sent for repair to the manufacturer or an Authorized service centre.

10.4. Product Label

Propeller blade No. 1 bears a label, containing the following information:

- Manufacturer's name
- Propeller type designation
- Propeller serial number



Where:
TCDS - Type authorization number (EASA.P.177)
Model - Variant of the propeller (e.g. KW-31-A-E-3-0-0-F/R-173-033)
S/N - Propeller serial number
Date - Date of manufacture (MM/YY)
WO - Work Order number
- Abbreviations: NEW – New product; OH – Overhauled; REP – Repaired; INSP – Inspected/Tested; MOD – Modified

Insp. - Inspecting technician's number

Each installed propeller blade bears manufacturing label, containing the following information:

BLADE ……
Pos. S/N …….
HUB ……..

Where:
BLADE -Type of blade (Part number)
Pos. - Position within propeller hub
S/N - Propeller blade serial number
HUB - Propeller serial number

10.5. Propeller Designation System

				HUB				/	BLADES		
KW	**–**	**xx**	**–**	**( )**	**–**	**( )**	**–**	**( )**	**–**	**( )**	**–**	**( )**	**/**	**( )**	**–**	**( )**	**–**	**( )**
1		2		3		4		5		6		7		8	/	9	10	11

10.6. The Hub

1	KW	Propeller Type
2	No. of propeller model	
3	Code letter for propeller category:	A - Automatic Propeller F - Fixed Pitch Propeller G - Ground Adjustable Propeller V - Variable Pitch Propeller
4	Code letter for blade pitch change system:	H – Hydraulic E – Electric M – Mechanical
5	Number of blades installed	
6	Code letter for feathering system:	F – Feather position installed 0 – No feather position possible
7	Code letter for reverse provision:	R – Reverse position installed 0 – No reverse position possible
8	Code letter for flange type listed in Aleš KŘEMEN Service Bulletin No. 4	

10.7. Blades

9	Code letter for blade design and installation:	R - Right-hand tractor RP - Right-hand pusher L - Left-hand tractor LP - Left-hand pusher
10	Propeller diameter in v cm	
11	Blade type identification (indicates design configuration and aerodynamic	

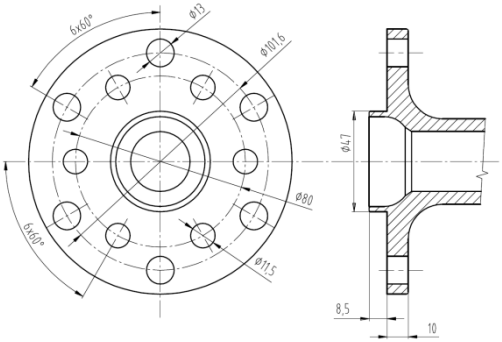
11. Basic Technical Specifications

Propeller model	**KW-31**				
Number of blades installed	**3**				
Blade type	- 031 („W“)	- 033 („C“)	- 034 („B“)	- 037 („WA“)	- 038 („WA“)
Diameter ± 4mm	1738 Left-1714	1726	1642	1944	1944
Min. angle setting	8°				
Max. angle setting	40°				
Max. engine power output-HP/kW	141 / 104				
Max. propeller RPM - n_{max}	2550			2300	
Temperature Service Rate	-25°C / +45°C				
Mass moment of inertia (kg m^2)	0.5 – 0,6			0,94	0,74
Mass of complete propeller - kg	~ 11,5 – 13,5			~13,5	~ 13,0
	ca. acc. to the type of blades, spinner and spacer				
Mass of CS 3-5 governor	0.23kg				
Time between end positions	~ 6sec				
Max. continuous current of servomotor	4A				
Lifetime	If each mandatory periodical inspection and Mandatory Airworthiness Directive is performed in the specified interval the lifetime of propeller is not limited.				

KW-31 propeller has been tested in operation of aircraft equipped with ROTAX 912 / 914 / 915 engines.

12. Connection of KW-31 Propeller to Engine

12.1. Dimensions of Engine Flange



Dimensions correspond to ROTAX 912 engine flange – part number 837 282.
Dia. 11.5mm holes on dia. 80mm pitch circle are used to attach KW-31 propeller.

12.2. Connecting Flange - Spacer

A spacer is used for installation of the propeller and it is placed (see 10.1) between the propeller and the propeller flange of the engine, to which it is secured by propeller attachment bolts.

The thickness of the spacer and arrangement of attachment bolts depend on the type of engine, to which the propeller is fitted.
Different spacer thicknesses are needed for different engine installations, since the propellers flange may project from the front of the cowling by different amounts.
The spacer thickness shall allow positive clearance between the rear edge of the spinner and stationary parts of the aeroplane (see CS-23.925(d)).
When ordering the propeller, customer should specify the distance of engine flange from engine cowlings according to our drawing, the diameter of pitch circle through of installation bolts and the centering diameter of central surface.

13. Propeller Unit Adjustment

Propeller unit consists of a propeller and a controller. Connection between the controller and pilot is a part of airframe and can differ in each particular case, and as such, is not detailed in this text.

Adjustment of propeller unit by persons not authorized by the manufacturer is strictly prohibited.

Although the adjustment of propeller unit on aircraft is simple, improper modification of settings may be dangerous to propulsion unit and operating safety.

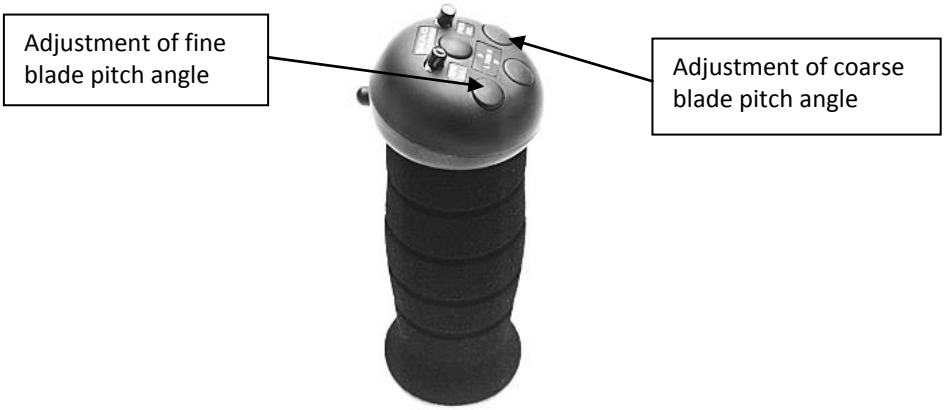
13.1. Control Mode

13.1.1. Manual Control Mode

The manual control can be situated either on the control stick or on the instrument panel.

Control on the control stick

On the top of control stick there is a grip with a rocker switch to control the servomotor mechanism for blade adjustment.
On the instrument panel there is an indicator of blade position
For the sense of controllers and their functions – see the pictures below.



Control on the instruments panel

A rectangular signal device of blade position is situated on the instrument panel. Sense of controller and functions are seen in the following picture:

Yellow lamp for adjustment of fine pitch. Blinks when adjusting to fine pitch. Is lit when the end position (stop) of minimum pitch is reached.

Blue lamp for adjusting the coarse angle. Blinks when adjusting to coarse angle. It is lit when the end position (stop) of maximum pitch is reached.

Knobs for blade pitch adjustment

INC.RPM Decreases the blade pitch angle (increases rpm)	**DEC.RPM** Increases the blade pitch angle (decreases rpm)

13.2. Control Unit for Automatic Control

13.2.1. Instruction Manual

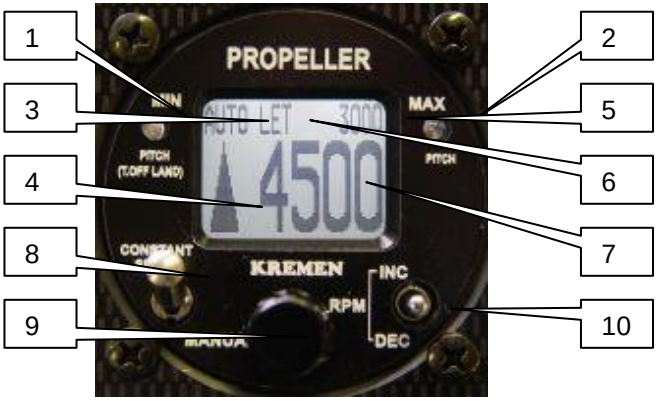
CS 3-5 governor is used to control KW-31 propellers. It operates in two modes:
AUTOMATIC – the instrument evaluates actual engine speed, compares the value with preset value, and keeps the actual engine speed within pre-set tolerance.
The propeller is operated in constant speed mode.
MANUAL – the pilot controls propeller blade pitch according to specific flight conditions

Agreement on CS 3-5 operation

1. Before installing CS 3-5 into an aircraft, study the manual.
2. The pilot must understand the principles of the instrument control and the principlesof work of the in-flight variable propeller. Without such knowledge, he/she must NOT use them!
3. Keep the manual in the cabin of the aircraft.
4. After installation of CS 3-5, perform ground engine test, and only afterwards perform a test flight, first of all, switching on current consumers one after another, to discover possible interference to CS 3-5 from any of current consumers already installed on the aircraft.
5. CS 3-5 connects directly to propeller pitch adjustment mechanism.

If the conditions listed above are not complied with or in case of fault, inadvertment adjustment of the the propeller pitch may occur!

If you do not accept these conditions, do not install CS 3-5 into the aircraft!



Functions of controllers and used symbols:

1 - in manual and automatic mode signals at the minimum angle of the propeller blade
2 - in manual and automatic mode signals at the maximum angle of the blades
3 - AUTO inscription indicates active automatic mode
4 - arrow symbol shows the command to change the propeller
Δ propeller moves to the smaller angle, engine speed will increase
∇ propeller moves to the higher angle, engine speed will be reduced
5 - actual engine speed
6 - CRUISE description or TAKE-OFF - signalling fast selection of flight (if this feature is enabled)
7 – the pre-set (desired) engine speed; the propeller will change the blade pitch angle so as to reach the desired engine speeds
8 – a switch of automatic and manual mode with a lock
9 – a knob useful fordesired values setting
10 - Propeller Control switch:
In manual mode: position INC - speed will increase, population DEC - speed will decrease.
In automatic mode, fast selections between CRUISE (corresponds to DEC) and TAKE-OFF (corresponds to INC) regimes.

13.2.2. Control mode –AUTOMATIC

CS 3-5 is activated after switching on the on-board network.
To set the device before the flight, it is necessary to move the switch (8) with lock to the MANUAL position; the display now indicates MANUAL mode.

Press the knob (9) for 2 sec, amessage Done is displayed. Set the switch (8) to the CONSTANT SPEED lock position - Done, wait 2 seconds and turn the knob (9) to the right and then left to browse through the device settings menu and to set the following values:

- Take-off rpm: Preset the speed for fast selection of TAKE-OFF regime. (Upper limit pre-set by the manufacturer is 5700rpm.) User may reduce the value by pressing the knob (9), which highlights the pre-set rpm value; turning the knob (9) allows setting of required value. Then press the knob (9) to confirm your selection and store it to the memory. Continue turning the knob (9) to highlight another menu item:
- Flight rpm: Preset the speed for fast selection of CRUISE regime. (Upper limit pre-set by the manufacturer is 5700rpm; lower limit pre-set by the manufacturer is 4000rpm.) User may reduce the value by pressing the knob (9), which highlights the pre-set rpm value; turning the knob (9) allows setting of required value. Then press the knob (9) to confirm your selection and store it to the memory. Continue turning the knob (9) to highlight another menu item:
- Display: User may select normal or inverted display; press the knob (9) to highlight current setting, turn the knob (9) to the left or to the right to switch between normal or inverted display; press the knob (9) to confirm. Continue turning the knob (9) to highlight another menu item.
- Disp.con: Setting of display contrast; press the knob (9) to highlight current setting, turn the knob (9) to the left or to the right to change the value. Continue turning the knob (9) to highlight another menu item:
- Disp.bri: Setting of display brightness; press the knob (9) to highlight current setting, turn the knob (9) to the left or to the right to change the value. Continue turning the knob (9) to highlight another menu item:

- LED bri.: User may select brightness of LEDs 1 and 2; press the knob (9) to highlight current setting, turn the knob (9) to the left or to the right to change the value. Continue turning the knob (9) to highlight another menu item:
- Language: User may select display language; press the knob (9) to highlight current setting, turn the knob (9) to the left or to the right to change to desired language – CZE (Czech), ENG (English), and press the knob (9) to confirm.

Other menu items are pre-set by the manufacturer, i.e. user cannot change them!

- Password: Used to protect manufacturer's settings.
- RPMdisp.: Current engine rpm (5) rounded to nearest 50rpm– pre-set by manufacturer
- RPMstep: Setting of engine rpm (7) with 100rpm step–pre-set by manufacturer
- RPM: Pre-set value of minimum rpm for all regimes (CONSTANT SPEED, TAKE-OFF and CRUISE)
- RPMmax: Pre-set value of maximum rpm for all regimes (CONSTANT SPEED, TAKE-OFF and CRUISE)
- RPMratio: Multiplier for prop speed measurement
- Insens.: Defines the insensivity band–HYSTERESIS (in case of engine speed change smaller than this value, the governor and propeller do not react)
- Ext.Pot: Control by external potentiometer
- Rv.ramp: Propeller electric motor ramp speed
- Mot.prot: Current limiting of propeller electric motor
- Control: TAKE-OFF and CRUISE
- Eng.hrs: The instrument adds up actual engine hours

When finished making settings in the menu, turn the knob (9) to the left to Done, press knob (9) and you will be in CONSTANT SPEED mode.
Before taking-off, set TAKE-OFF rpm using knob (9).
(If Fast selection TAKE-OFF and CRUISE is enabled in the menu, switch (10) may be pushed to RPM INC position to activate TAKE-OFF rpm (this is indicated on the display as well, along with display of pre-set rpm value).
During take-off, propeller is controlled automatically to prevent engine overspeed.
After take-off, user may turn knob (9) to set the desired cruise rpm (coordinate this control with control of fuel supply to the engine – MANIFOLD PRESSURE!)
(If Fast selection of TAKE-OFF and CRUISE is enabled in manufacturer's menu, the switch (10) may be pushed to RPM DEC position to set cruise rpm (this is indicated on the display as well, along with display of pre-set rpm value).
Any change of the set engine speed by turning the knob (9) changes the before pre-set value, the indication CRUISE disappears, and newly set value becomes valid.
If current engine speed (5) differs from set value (7) by more than 100rpm, the instrument controls the propeller; example: if the pre-set value is 5000rpm and the current value is 5150rpm, the instrument commands increase of propeller pitch and

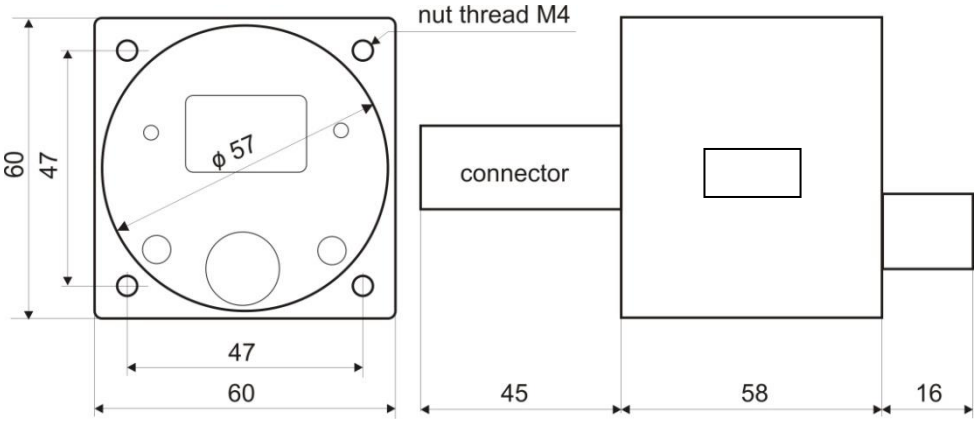
subsequent drop in engine rpm will establish a new equilibrium; the insensitive band is 100rpm, and therefore engine rpm will drop below 5100rpm, but never below 4900rpm.
During active change of blade pitch, an arrow is displayed; its orientation indicates the direction of blade pitch change; up arrow means decreasing pitch (and increasing engine speed), while down arrow means increasing pitch (and decreasing engine speed).
On reaching the end position, LED1 (minimum pitch) or LED2 (maximum pitch) is lit. At the same time, the simple arrow (6) on the display changes to the arrow with stop line.

13.2.3. Control–MANUAL mode

Switching from CONSTANT SPEED mode (NOT from the menu) is possible by pulling and then moving the switch (8) to the MANUAL position.
Switch (10) allows manual control of engine speed: RPM INC–decreases propeller pitch, thus increasing the rpm–LED 1 blinks during the change; on reaching the end position, it is lit permanently. RPM DEC position–increases propeller pitch, thus decreasing the rpm–LED 2 blinks during the change; on reaching the end position, it is lit permanently.

When switch (8) is in the Constant speed position, turning knob (9) allows setting of TAKE-OFF speed.
Pre-set TAKE-OFF speed may also be activated quickly by pushing switch (10) to up position (RPM INC). (Keep pushed for 2sec.)

13.2.4. Dimensions of CS 3-5 governor



1. **Always set TAKE-OFF regime before landing – the propeller must be able to achieve maimal permitted speed!**
2. **In case of fault in AUTOMATIC mode, switch to MANUAL mode and utilize manual control**.

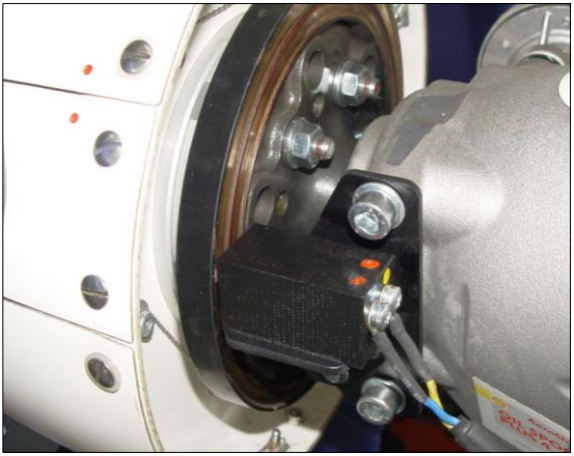
Due to system lag, use throttle level gradually.

NOTE

Propeller manufacturer recommends installation of boost meter, allowing the pilot to set proper engine operation mode.
Without this instrument, fuel efficiency may drop and engine may be damaged by overloading during operation (e.g. due to low engine rpm with improper position of throttle lever.)

13.3. Installation and assembly of cabling and instruments

Use drilling template (included with propeller) to make holes for installation of instruments in the instrument panel. Instruments must be located in a way that makes them visible and accessible from both piloting seats.
Installation of instruments and cabling continues by threading the cables (bundle inside ACHR–flame retardant tube) from the cabin using the shortest possible route to the propeller. Pay extra attention when passing the bundle through baffles (sharp edges must be avoided at all costs), and also around movable parts (keep safe distance from movable parts and when the bundle is at/near a movable part e.g. when installing onto the control stick – always maintain the biggest possible bending radius).
When installing the cables, avoid hot areas and contact with engine parts which heat up during operation.
Fitting the flange (which carries the brushes) onto ROTAX engines is shown in the figure below. The flange attaches by two screws to existing holes on ROTAX engine. It is therefore not necessary to drill holes into the engine.



Note:
Installation onto other engine type then Rotax 912/914/915 must always be consulted with the propeller manufacturer.

13.4. Propeller Installation

Into six mounting holes in the engine flange is inserted 6 pieces centering bushings of 11,5mm diameter. The centering bushings are inserted from the engine side.

The propeller is mounted on the engine flange using six M8 bolts, which protrude from the rear of the propeller. The bolts must be threaded to the bushings. Be careful when fitting the propeller do not damage the carbon brushes, which supply the propeller with electric power. Carbon brush housing flange must move freely and must be shifted into rear position. The propeller is then gently pushed onto the propeller flange by hand and open end spanner is used to tighten M8 self-locking nuts from behind the propeller progressively. During screwing nuts, check touchdown of mounted faceplates of inserted bushings on the engine flange. Bushings must face planted area of land on the motor flange - transmits torque from the engine shaft to the propeller hub. If all bushings are leaned by its shoulders holster on the motor flange, perform successively tighten the nuts.
Final tightening is done with a torque spanner set to 22Nm. After checking this final tightening, adjust carbon brush housing according to the given scheme. While turning the propeller by hand, check that the carbon brushes seat properly in the centres of the brass slipways, and make contact with their entire surfaces.

13.5. Checking the Installation

Switch on the electric power source and check propeller functions:

1. Switch on the electrical master switch.
2. Check function of the cradle switch on control stick, or the switch on the CS 3-5 instrument panel.
3. Check movement between propeller pitch end positions and related signalling
   - when adjusting towards fine pitch: yellow LED should blink;
   - when reaching end position (minimum–fine–blade angle): yellow LED must be lit;
   - when adjusting towards coarse pitch: blue LED should blink;
   - when reaching end position (maximum–coarse–blade angle): blue LED must be lit.
4. During pre-flight inspection, checks main end stop system. With the engine off, cycle the propeller from one end position to the other. The main system is functioning normally if the propeller reaches its end positions and adjustment is stopped there.

WARNING!
In case of failure of the main stop system, the propeller must be removed and sent for repair to the producer or to the authorised service centre.

5. Adjust the propeller approximately for the middle blade pitch angle and carry out the engine test on the ground. During the engine ground test, excessive vibration or unusual noise must not occur.

WARNING!

At maximum engine power output with fine angle of blades (at end stop), engine overspeeding can occur. RPM display must be carefully monitored.
When making the engine ground test with the aircraft stationary, never adjust the maximum coarse angle on the propeller when the engine runs at maximum power (full throttle). This may produce stall flutter on the propeller with subsequent damage.

14. Operation Instructions

14.1. Starting the Engine/Engine Test

Starting the engine and engine test must be performed according to the following procedure:

1. Inspect the power unit according to its manufacturer's instructions.

2. Check that the propeller is undamaged.

3. MANUAL mode: move the blades to the fine pitch stop. The fine pitch stop shall be adjusted so as to allow maximum take off speed and power of the engine at the flight velocity close to the velocity of best climbing of the aircraft. For the propeller unit equiped by the automatical control system with the governor set the AUTOMATIC mode and take-off regime, i.e. minimum blade pitch. This position allows reaching of maximum engine speed.

4. Start the engine.

On starting the engine, the propeller reaches engine idle speed. Observe the instruction for warming up the engine and gradually increase engine rpm. During this operation, blades rest on the fine pitch end stop; propeller governor usually does not intervene, with the exception of atmospheric conditions far from standard ones, and even in this case, it may only start to interfere near engine take-off power. ROTAX 912 engine will reach up to 5400 or 5500rpm under standard conditions, while the governor limits the speed only on reaching 5730–5750rpm.

14.2. Taxiing

The manually controled propeller has the blades on the fine pitch stop. Do not change the setting. For the propeller with the governor keep propeller control in Take-off position, i.e. minimum pitch and maximum speed, throughout taxiing. Use throttle lever to control engine speed; when necessary, use brakes to slow down the aircraft. Throttle lever normally controls engine speed, and propeller governor usually does not intervene.

When taxiing, propeller thus equipped usually allows finer control of aircraft speed than fixed or manually adjustable propeller. Due to lower propeller blade pitch, expect the need to use higher propeller speed for the same taxiing speed, but keep in mind that required engine power is actually lower.

14.3. Take-off

For the manually controlled propeller leave the blades on the fine pitch stop, see chapter 14.1. Set full throttle, for the propeller with the governor keep propeller control in the take-off mode. With aircraft forward velocity increasing, during take-off run and initial climb, engine speed increases on its own up to the maximum value pre-set on the governor, which then begins to intervene, and maintains constant speed.

After initial climb, it is advisable to switch from take-off power (only permitted for 5 minutes with ROTAX 912 engine) to maximum continuous power (full throttle and 5500rpm for ROTAX 912). The safest and most appropriate procedure to change to maximum continuous power is to keep throttle lever at max. setting, and reduce engine speed by governor control. On reaching desired attitude, reduce throttle opening according to desired cruise speed. . For the manually controlled propeller it is necessary to adjust the blade pitch angle according to the desired flight velocity, engine boost pressure and rotational speed.

An attempt to reduce engine speed during flight by reduction of throttle opening is serious error, resulting from misunderstanding of automatic propeller governor function. With constant speed propeller, throttle lever does not control engine speed, but whole propulsion package pull/thrust. If the pilot reduces throttle opening, the governor reduces blade pitch, until the engine reaches very low power output, where engine and prop speed drops rapidly, and especially inexperienced pilots risk dangerous change into 2nd flight mode with all its consequences.

14.4. Horizontal Flight

For the manually controlled propeller it is necessary to adjust the blade pitch angle according to the desired flight velocity, engine boost pressure and rotational speed.

Automatically controlled propeller allows the best possible operating economy–the lowest possible fuel consumption for maximum range or endurance. It is also possible to reach high cruising speed without undue overload of the engine, and/or select propulsion package mode with the best possible (noise) comfort.

The best possible operating economy may be calculated by complicated method from aircraft, engine, and propeller characteristics; almost the same result may be obtained by performing the following test.

Recommended procedure to reach the best possible adjustment:

1. When at desired flight level, set desired flight velocity by appropriate setting of throttle lever and propeller speed control, e.g. set to 4800–5500rpm, and stabilize the flight regime.

2. Do not touch the throttle lever, and use governor control to achieve engine rpm recommended by the manufacturer, e.g. 4300rpm.

3. Keep the newly found position of propeller governor control and use the throttle lever to restore original (desired) flight velocity.

If the propeller and/or engine are overloaded (check oil pressure and temperature, engine temperature), allow higher engine/propeller speed by using governor control (e.g. to 4800, 5200rpm, etc.), and use throttle lever to adjust flight speed. Recommended settings included in aircraft flight manual have priority over this instruction. For most regimes, you usually obtain lower fuel consumption and higher propulsion effectiveness of propeller.

14.5. Aircraft Manoeuvering and Turbulence

Propulsion package with the governor maintains set rpm without pilot intervention, with high precision. Manually controlled propeller behaves similar to the fixed-pitch propeller.

14.6. Maximum Flight Speed

Some aircraft reach maximum horizontal flight speed not at maximum propulsion package rpm, but at full throttle with slightly lower rpm. Suitable setting must be reached by trial and error, using the procedure recommended in Chapter 14.4.

The governor protects the engine from overspeed within the whole flight envelope, up to the velocity slightly higher than the never exceed velocity (v_{NE}).

14.7. Landing

When landing, set governor control to the Take-off regime not later than after the 3rd turn, for the manually controlled propeller leave the blades at the fine pitch stop. If necessary (incorrect approach, obstacle on runway…), this setting will support faster increase of flight velocity and altitude. When commanding full throttle, use gentle and gradual movement, so that the governor manages to control the propulsion unit, protecting the engine from overspeed. The change from idle to maximum power takes approx. 5 sec.

14.8. Switching the Engine Off

Before switching the engine off, set the governor control to the Take-off regime; leave it in this position when aircraft is parked. For the manually controlled propeller leave the blades at the fine pitch stop.

14.9. Emergency Procedures

KW-31, series propellers are very reliable, but there is always a theoretical risk of failure; therefore the pilot must be familiar with procedures allowing safe completion of flight.

Failure of propeller governor usually manifests itself by blocking of pitch setting to a particular value between the end stops, or at an end stop. Propulsion unit may then be used in the same way as with fixed pitch propeller. In this case, it is possible to use throttle lever to control the speed. Sometimes, governor may become unstable, e.g. because of improper function of automatic control unit.

Depending on the position in which blade pitch locks, and also on current flight mode, proceed according to instructions below:

A) Propeller blades locked at fine pitch setting

When the adjustment of fine and coarse pitch stops of the propeller is done according to the manufacturer´s recommendations the failure manifests itself by increased rotational speed above the maximum take-off engine speed when the flight velocity of best climbing is exceeded.

Should the fault occur during take-off and/or initial climb, it will not manifest itself in any way; take-off will be completely normal. The pilot will only discover the fault when aircraft speeds up, and the engine begins to overspeed.

Proper reaction: reduce the flight velocity to the optimum climbing speed.

Should the fault occur during high flight velocity, engine speed will increase. Pilot must react quickly, by reducing the throttle, if possible completely, to the idle speed, and wait until flight velocity drops to the optimum climbing speed; afterwards, gradually open the throttle and continue flying at lower velocity.

In both cases mentioned above, slight overspeed of engine is always possible, even for longer time period.

Continue flying only to the nearest area suitable for landing.

B) Propeller blades locked at coarse pitch setting

This fault manifests itself by reduced propeller speed, which can only be increased by opening the throttle. The pilot must increase engine power and if flight altitude permits, increase flight speed by slight diving. The goal is to reach and maintain sufficient flight speed. Propulsion unit is still able to maintain level flight, and in certain flight speed range, also allows slight climbing. Landing approach must be carefully calculated, because in landing configuration (wing devices, landing gear), a re-landing may not be possible.

Continue flying only to the nearest area suitable for landing.

C) Loss of Governor Stability

This fault manifests itself by unstable propulsion unit speed. It is necessary to switch the governor to the MANUAL mode. If control unit operates normally in Manual mode, it is possible to continue flying.

15. Transport, Handling, Storage

15.1. Propeller Delivery

Propeller is delivered complete, with cabling, controls, signaling, electric power brushes, propeller attachment hardware, and necessary documentation.

15.2. Handling

Propeller must be handled very carefully, to prevent damage, including e.g. damage by impact.

When transporting disassembled propeller, blades must be protected by cloth pockets. For safer transport, we recommend to place propeller into solid box (cardboard, plywood). Compete propeller must be transported in horizontal position with the hub supported.

15.3. Storage

During storage, blades must be protected by cloth pockets. Before long-term storage, we recommend to clean propeller body and blades with lukewarm water and detergent.

Compete propeller must be stored in horizontal position with the hub supported, or hanged by attachment holes.

Storage condition: temperature 5° to 25°C, relative humidity up to 80%.

It is prohibited to store and/or transport the propeller standing on blade tips – even for short time!

15.4. Transport

Propeller is always delivered in special carton package, which may be used to return the propeller to manufacturer or authorized service centre for service inspections.

Note:

When sending the propeller for overhaul, it may only be sent disassembled provided that the disassembly was performed by an authorized service centre.

15.5. Responsibility for Transport

When standard packing recommended by the manufacturer is used to transport the propeller, the manufacturer bears responsibility for proper packing at manufacturing plant, up to acceptance of the package by the transport company, which takes over the responsibility afterwards.

Customer must always check that the propeller packing is undamaged on receipt of the package from the transport company.

If the packing is damaged on receipt, unpack the product in presence of the transport company representative, observe, record, and/or claim the damage.

16. Inspections

Mandatory inspections must be performed by the manufacturer or a service centre authorized to perform aircraft maintenance according to the internationally valid regulations (EASA, FAA, etc.) – "**Authorized service centre**" in the following text, in the intervals specified below:

Chap.	Type of inspection	Operating hours	Performed by
16.1	Pre-flight inspection	Before each flight	Pilot or designated mechanic/technician
16.2	Check tightening the fastening nuts	After 25 operating hours from each new installation to the engine	Aircraft engineer (AML ICAO, AML Part 66, etc.)
16.3	On-aircraft periodical inspection	Each 100 op. hrs / 1 year[1)]	Maintenance organization of the aircraft with the propeller is certified
16.4	Medium repair	See Chap. 16.4	Propeller manufacturer or Authorized service centre
16.5	Overhaul	Service Bulletin No. 01	Propeller manufacturer or Authorized service centre
18	Exceptional	Special inspections	Propeller manufacturer

[1)] Whichever occurs first

CAUTION
Each inspection must be recorded in Propeller Log Book.

16.1. Pre-flight Inspection

Perform visual check before each flight:

- Tightening and securing of all screws;
- Attachment and securing of propeller to engine flange;
- Condition of blades, leading and trailing edtges. Condition of blade roots at connection to the propeller hub;
- Condition of propeller spinner, attachment to propeller.

Defects, if discovered, must not exceed the scope detailed in Chapter 19.

On discovering unacceptable defects, stop using the propeller immediately and send the propeller for repair to manufacturer or an Authorized service centre!

16.2. After first 25 operation hours or after each new installation

Check tightening torque of flange nuts (22Nm). Use torque wrench with valid calibration.

16.3. After 100 operating hours

Perform actions described by TN-31 technological process.

The 100 hours inspection is performed after each 100 hours of operation or as a part of each annual aircraft inspection - whichever occurs first.

The 100 hours inspection may be performed by the Authorized maintenance organization of the aircraft with the propeller installed.

16.4. Medium Repair

Medium Repair is performed when half of the established operational hours or calendar interval of Overhaul (TBO) is met – whichever occurs first.

Medium Repair may only be performed by the manufacturer or an Authorized service centre.

16.5. Overhaul

The time between owerhauls (TBO) is established by Service Bulletin No. 01 in the current wording (see www.woodcomp.cz).

Overhaul may only be performed by manufacturer or an Authorized service centre.

CAUTION
Without mandatory inspections being regularly performed,
the propeller is not airworthy and must not be used.

17. Airworthiness Limitations Sections

No Airworhtiness Limitations!

This Airworthiness Limitations Section (ALS) is EASA approved in accordance with Part 21A.31(a)(3) and CS-P40(b). Any change to mandatory replacement times, inspection intervals and related procedures contained in this ALS must also be approved.

18. Special Inspections

Special inspections are necessary when:

- When major damage to blade by impact of foreign object (stone, bird, hail, etc.) is detected
- In case of careless or prohibited handling;
- In case of propeller overspeeds specified for particular configuration, by more than 150rpm not exceeding max. 30sec;
- In case of lighting strike;
- In all cases of operating the propeller outside the conditions/ranges stated in this manual.

Special inspections may also be required when installing propeller on other engines than ROTAX 912/914/915.

Special Inspections can be performed only by the propeller manufacturer.

WARNING!

Damage to the propeller is more dangerous than damage to the engine!

19. Repairs

This chapter describes repairs of small damages which may be performed by the user. Description of damage and method of repair must be recorded in the Propeller Log Book.

WARNING!
More serious damage can only be repaired by the manufacturer.

19.1. Blade Repairs

Only small dents and cuts on the blade surface or leading edge may be repaired. In case of any doubt about blade condition contact the manufacturer or authorized service centre.

Blade surface:

Maximum permitted depth of damage to suction or pressure side of blade is 0.7mm. Surface area of single repaired spot must not exceed 0,5cm^2

Maximum permitted depth of damage to trailing edge is 2mm, repaired locations must be farther than 80mm away from each other, and must not be longer than 15mm.

Pay special attention on leading edge or trailing edge damage. Such damage may cause penetrating of moisture to wooden core and must be repaired as soon as possible.

Repair procedure:

1. Clean and dry the location.
2. Use fine file or sandpaper to prepare the location.
3. Fill the location with epoxide filler.
4. Let cure and grind to blend with the surroundings.
5. Apply polyurethane paint to repaired location.

Hairline cracks of the top surface are permitted when located in the gelcoat layer. In the case of fast development (growing) into the composite skin stop the propeller operation immediately and conatct the manufacturer or an authorized service centre.

Polyurethane leading edge sheath

Maximum permissible depth of damage is 2 mm providing that the repaired locations are minimum 80 mm far away each from each other and do not exceed 15 mm of length each. No cracks in the sheath are permitted. The sheath must always be well glued along its whole length.

The sheath repair shall be done only by means of grinding or using a fine file to make smooth transition between the damaged location and surrounding area. No filling of damaged location using any material is permitted.

Stainless steel leading edge sheath

Maximum permissible depth of damage of the stainless steel sheath is 1 mm providing that repaired locations are minimum 80 mm far away each from each other and do not exceed 5 mm of length each. The sheath must not be pierced and no cracks in the sheath are permitted. The sheath must always be well glued along its whole length.

Repairs of the stainless leading edge sheath are prohibited.

19.2. Repairs of Propeller Hub and Metal Parts

Repairs of propeller hub and metal parts are strictly prohibited!

19.3. Repairs of Propeller Spinner

Only small surface cuts on outside surface not deeper than 0.5mm may be repaired.

Repair procedure:

1. Clean and dry the location.
2. Use fine file or sandpaper to prepare the location.
3. Apply polyurethane paint to the dent/cut.

19.4. Replacement of Polyurethane Protective Tape

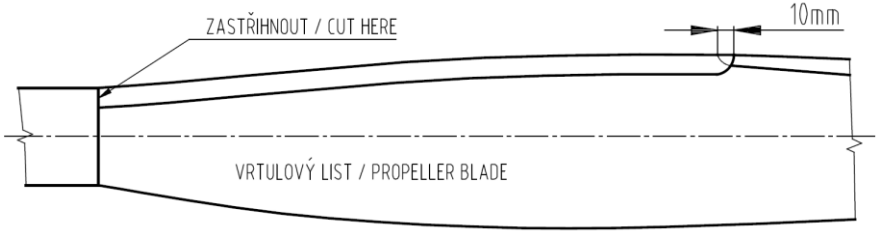
Use only the tape provided or specified by the propeller manufacturer, see the Illustrated Parts Catalogue – IPC KW-31.

Replacement procedure:

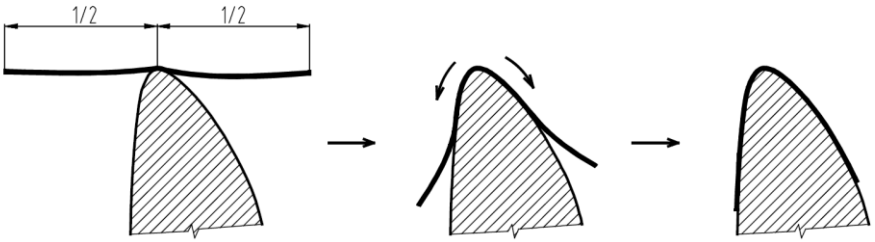
1. Carefully remove old tape (slightly heat the tape using hairdryer).
2. Clean the surface from dust and oil. The rest of glue carefuly remove using acetone or MEK (Methyl Ethyl Ketone).
3. Measure the distance from the root section to the leading edge sheath (polyurathane or stainless steel).

4. Prepare a piece of the self bonding protective tape approximately 50 mm longer than the measured length. Finish one end of the tape by radius.

5. Carefully remove backing tape from the new tape, taking care not to touch/soil the glue surface. The end with the radius shape shall be oriented in the blade tip direction and glued approximatelly 10 mm over the sheath (polyurethane or stainless steel). Cut the opposite end of tape in line with the rim of the blade ferrule.



6. Apply tape to prepared blade surface. Use plastic spatula to force out air bubbles, or puncture the tape by a pin, and press out air using a roller or finger pressure. Do not use a blade or razor to cut the tape!!



7. Place the propeller into operation no sooner than after 24 hours from applying the tape, when the glue fully cures.

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20. Troubleshooting

If you cannot solve a problem according to the following instructions, contact the manufacturer or Authorized service centre.

Problem	Possible cause	Elimination
Vibration in flight or on the ground	Mass imbalance of the propeller	Check on the ground that the balance weights inside the spinner are not missing and that there are no missing or broken parts of the blades, which could cause the imbalance.
	Aerodynamic imbalance of the propeller	Check on the ground, with engine out of operation, if all three blades are adjusting simultaneously and smoothly. These defects can only be repaired by the manufacturer or an Authorized service centre.
Propeller blades do not change pitch, while the LED blinks.	Broken, worn or wrong contact of carbon brushes.	Replace or adjust the brushes. Check according to the diagram whether there is proper electrical connection of propeller and all electrical connections. All other faults can only be repaired by the manufacturer or an Authorized service centre.
Lubricant leak	Within the first 25 hours of operation there may be slight leak of lubricant from the propeller, which has been used for its conservation.	Clean the propeller using a cloth dipped in lukewarm water with added detergent.
	Any other leak signals damage to the rubber sealing rings.	Replacement can only be performed by the manufacturer or an Authorized service centre.

21. Warranty Conditions

21.1. Warranty Period

The manufacturer accepts responsibility for faults of new and unused product for the period of 24 consecutive months from sale to original purchaser recorded in the Warranty Certificate, or for 100 operating hours, whichever occurs sooner.

After 25 operating hours, the propeller must be inspected by an aircraft mechanic (AML ICAO, AML Part 66, etc.) approved to perform works on the propeller, who will record the the action into the Propeller Log Book, otherwise the warranty becomes void.

Actual operating hours must be recorded to Propeller Log Book and Aircraft Log Book.

No unauthorized or modifications in conflict with the approved airworthiness state of the propeller may be performed, otherwise the warranty becomes void.

The propeller must be operated according to manufacturer's instructions and provision of this User Manual.

21.2. Warranty Conditions

The user must present the manufacturer with completed Propeller Log Book and stamped/signed Warranty Certificate, along with proper records of propeller installation and operation.

21.3. Responsibility

The warranty does not cover possible secondary damages.

All legal relationships resulting from purchase of the propeller by the user, from services provided by the manufacturer during maintenance, and also all legal relationships resulting from propeller operation, especially those resulting from responsibility for propeller faults, responsibility for damages, and remuneration of property and other damages related to propeller operation, propeller accident, and related events, will be assessed according to Czech law, and will be decided according to it by applicable court in the Czech Republic.

21.4. Honoring the Claim

Faulty product will be assessed by the manufacturer within the warranty period, and if claim is accepted, faulty parts will be replaced with new ones, with parts and work free of charge. Original replaced parts become property of the manufacturer.

WARRANTY CERTIFICATE

Manufacturer:

Woodcomp Propellers s.r.o.
Vodolská 4
250 70 Odolena Voda
Czech Republic

Propeller Type-Model: **KW-31**

Variant:

Type Certificate: **EASA.P.177**

Serial Number:

Date of Sale:

Supplier's Stamp and Signature:

Product warranty is subject to warranty conditions listed in Chapter 21 of this User Manual.

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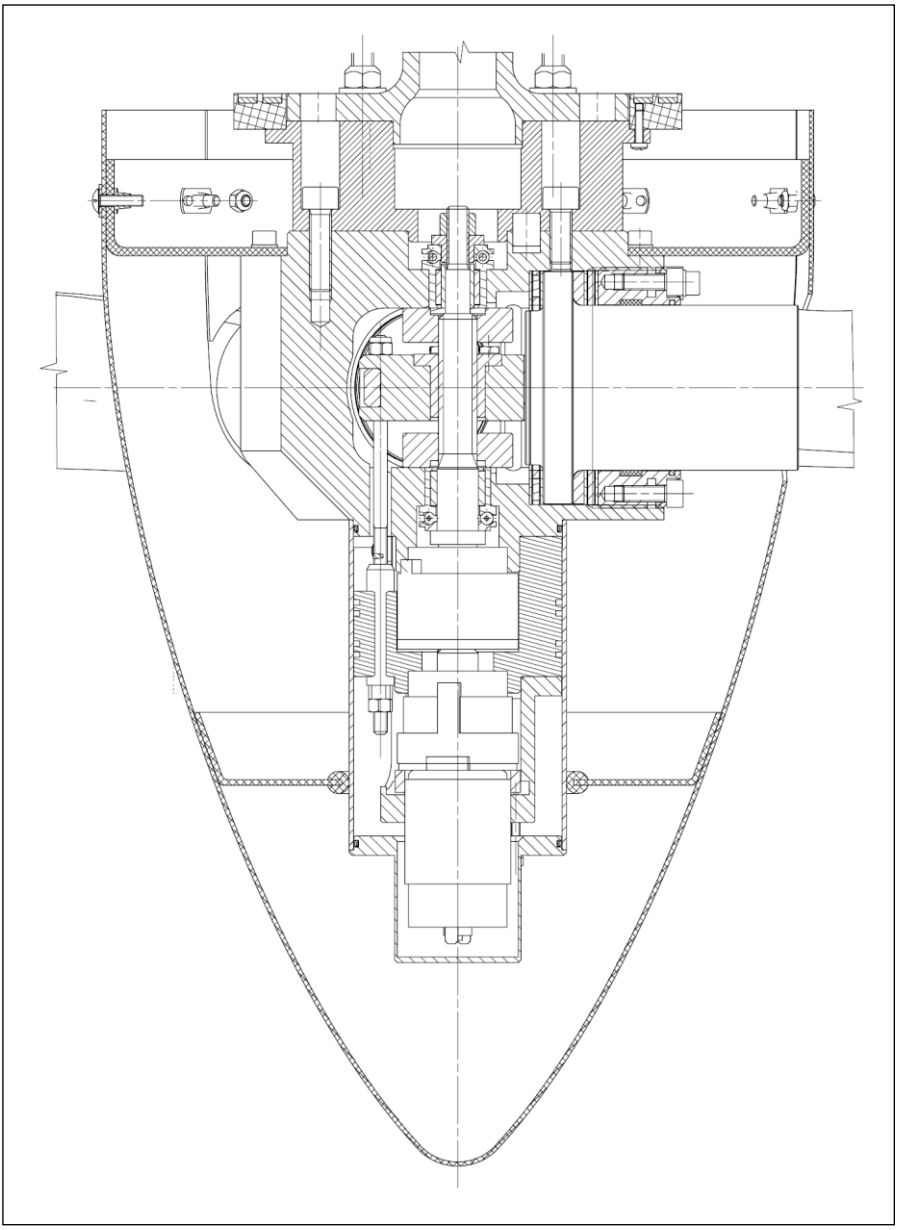
KW-31 PROPELLER



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