WARNING :

THIS AIRCRAFT ENGINE DOES NOT COMPLY WITH FEDERAL SAFETY REGULATIONS FOR STANDARD AIRCRAFT. THIS IS FOR USE IN EXPERIMENTAL AND MICROLIGHT UNCERTIFIED AIRCRAFT ONLY IN CIRCUMSTANCES IN WHICH ENGINE FAILURE WILL NOT COMPROMISE SAFETY. READ OPERATOR'S MANUAL BEFORE OPERATING THE ENGINE.

1. Basic Technical Specifications

The following notes are the installation, operating and maintenance instructions for the VERNER 133MK engine. It is highly recommended that users of the engine familiarize themselves with the contents of these pages before installing the engine and adhere to the given instructions fully and in every respect throughout the operational life of the engine.

Technical specifications:

Displacement	1345 cc /86.15 cubic inch
Bore	97 mm /3.81 inch
Stroke	90 mm /3.54 in
Compression ratio	1 : 9.5
Maximum power	84 BHP (62 kW) @ 5500 RPM (5 minutes max.)
Max. continuous power	70 BHP (52 kW) @ 4000 RPM
Torque	129 Nm (95 ft/lb) @ 3500 RPM
Fuel spec. Consumption	175 g/HP/hour (230g/kWh) at recommended cruise RPM (0.38 lb/hph)
Propeller rotation	CW, viewed from the front, tractor propeller (tractor propeller) - like Rotax 912
Weight dry weight:	61 kg, oil cooler: 1 kg, exhaust pipe: ~4 kg
Ignition timing	5° BTDC up to 2500 rpm, after, electronically variable
Spark plugs	NGK DCPR9E R Thread M 12x1.25
Spark plug gap	0.5 mm (0.02 in)
Electric starter	12 V/1000 W
Generator (Alternator)	12 V/160 W (13 Amp)
Lubrication	semi-synthetic motorcycle oil SAE 15W-50, JASO MA (oil capacity 2.5 - 3 liters)
Fuel	aviation petrol 100 LL AvGas or motor petrol, octane number 95 or more
Fuel pump	Pierburg 7.20971.63
Carburetors	2 x BING - Verner setting
Reduction drive	1 : 2 gear box, lubrificated with motor oil
Propeller hub	75 mm B.C. × 6 × M8 mm tapped holes and Rotax standard on request
Recommended TBO	1000 hours

2. Operation

The engine is run-in at the factory for 8 hours and requires no further ”breaking in” after installation. All relevant items were adjusted for optimum performance and the carburetor is set to operate satisfactorily between the sea level and 2000 meters MSL (6,514 ft MSL) without requiring different jetting or further adjustment. (See note below) Nevertheless, all gauges should be monitored with extra attention during the first few hours of service, with particular attention to the temperature and pressure limitations shown below:

Engine speed:
Maximal speed: 5500 RPM, for 3 minutes maximum
Operating speed: 3000 ÷ 4500 RPM
It is recommended to use operating speed within the range of 3400 ÷ 4000 RPM, when power, fuel consumption and engine wear are in ideal configuration.

Cylinder head temperature:
Maximal temp.: 230°C (446 deg.F) - FOR 5 MINUTES MAXIMUM!
Operating temp.: 125 ÷ 200°C (257 ÷ 392 deg.F)
Minimal temp. : 70°C (158 deg.F)
The normal operating temperature should not exceed 200°C during engine operation. The maximal temperature 230°C can be used only in the state of emergency and for 5 minutes maximum! If this occurs consult your Verner dealer. Head deflection and other accompanying defects can occur when exceeding operating temperature.
The minimal operating temperature 125°C is measured during current horizontal flight and engine operation under lower temperature is forbidden.
The minimal listed temperature 70°C can be reached by long term descent but the temperature can drop below this limit. If this happens, it is absolutely necessary to interrupt descent and warm the engine at least on the operating temperature 125°C. This is not valid for the state of landing.

Exhaust gas temperature:
Operating temp.: 620 ÷ 750°C (1150 ÷ 1382 deg.F)
Note:
For reference only. Exhaust gas temperature gauge is not a mandatory requirement for this engine.

Oil temperature and pressure:
Oil pressure: 1.0 ÷ 5.0 kg/cm$_2$ (15 ÷ 70 psi)
Oil temperature: 50 ÷ 100°C, (122 ÷ 212 deg.F)
Note:
The oil temperature must reach the minimum temperature shown above before the carburetor throttle is wide open and it is the lowest temperature suitable for engine operation. The highest possible oil temperature during engine operation is 100°C and only in the state of emergency can be exceeded up to 120°C in the short run. The oil temperature is measured on in the bottom back side of the crankcase (oil sump).

3. Starting and Warming Up the Engine

Under temperature conditions above -20°C, there should be no need to ”pre-heat” the engine and/or the oil in the tank before starting.

Note:
It is forbidden to start the engine without propeller !!!
1. Turn the fuel ON.
2. Pull the choke ON.
3. Set Master Switch ON
4. Set ignition switches ON.
5. ”Crack” the throttle on minimum.
6. Make sure that the propeller is clear and start the engine.

After the engine has started check that the oil pressure gauge indicates positive pressure within 10 seconds.
If the oil warning lamp is installed, it has to turn off within 10 seconds. Adjust the throttle for 1800 RPM and return the choke slowly to its fully closed position. Warm a the engine at 2000 RPM for one minute and at 2500 RPM until the oil warms up to 50 °C (122 deg.F) before going to higher revolutions. Check both ignition systems at 3500 RPM (the permitted drop in revolutions should not exceed 300 RPM). This is the end of ignition check-out.
Move the throttle to maximum and check the maximal speed available for the engine when the plane is on the ground (all engine starts can be performed only with attached propeller and properly adjusted flight angle).
Note:
For the first 25 hours of the maximum power check, it is forbidden to exceed 4800 RPM due to limited cooling available for the still ”tight” engine in a plane on the ground.

!! IT IS FORBIDDEN TO START THE ENGINE WITH OPEN THROTTLE BUTTERFLY !!
THE THROTTLE MUST BE ON IDLE POSITION

Otherway can occour the risk of engine kick back and could break the free-wheel bearing of the starter gearing . This kind of damage is not warranted .

4. Shutting Down the Engine

Because of its air-cooled design, it is imperative that the engine is allowed to cool down only gradually to prevent warping or cracking of the cylinder heads. NEVER (only in the state of emergency) shut the engine down without sufficient cooling period (2 - 3 minutes at minimal speed).

1. Reduce the throttle to 1800 RPM and run the engine at this setting until both cylinder head temperature gauges register no more than 160 °C (304 deg.F)
2. Switch off all radios and electronics.
3. Carry out the hold off 2 - 3 minutes at 1400 RPM.
4. Switch off the 1st ignition circuit.
5. Move the throttle to minimal position.
6. Switch off the 2nd ignition circuit.
7. Switch off the Master Switch.
8. Close the fuel feed.

!! IT IS FORBIDDEN TO TURN OFF THE ENGINE WITH OPEN THROTTLE BUTTERFLY !!

Note:
Prolonged run at idle speed tends to ”load up” the spark plugs due to the rich fuel mixture delivered by the carburetors at idle setting. It also takes longer for the engine to cool down with the throttle butterfly fully closed since very little fresh air enters the cylinders to help the cooling down process. For these reasons, do not cool the engine down with a completely closed throttle.

5. Periodic Maintenance

After the first flight with the engine the cowling should be removed, followed by a thorough inspection of the engine compartment. Check the engine for signs of any oil leak at the joining faces of the crankcase, cylinder bases, valve covers and shaft seals. All hoses and wiring to and from the engine should be inspected for looseness, chaffing or any discoloration.
This might indicate that these are routed where excessive heat from the engine could cause premature failure. Check that all components mounted onto the engine mount and firewall have remained securely fastened. Should anything be found damaged, loose, or otherwise indicating any abnormality, the reason for it must be found and the condition must be rectified before the next flight.

6. Items Requiring Periodic Adjustment

OHC chain drive
It is an inherent characteristic of any roller-chain driven machinery that the efficiency of their drive and the longevity of the moving components greatly depends on the proper entering and exiting of the rollers into and from the teeth of the sprockets. A certain amount of ”slack” in the unloaded leg of the chain must necessarily be present to prevent binding and this slack should be checked (and adjusted, if needed) at regular intervals.
The instructions for checking and adjusting the ”chain tension” can be found in the Appendix (see appendix). Please note that the method requires that the engine is turned in the direction of its normal rotation to place the upper leg of the chain in tension. The slack of the chain in the opposite leg should only be checked (and adjusted, if necessary) in this position of the chain drive.

Valve clearance
The valve stem clearances should be checked and if needed, adjusted at 25 hour intervals. The clearances should be checked when the engine is cold and the feeler gauge should slide freely between the valve stem and the adjusting screw, without any tendency to buckle when pushed.
Intake valves: 0.10 mm
Exhaust valves: 0.10 mm
(Re-check the gaps after the locknuts are fully torqued 12 Nm up.).

CDI ignition pick-ups
Although it is seldom necessary to disturb the factory setting of the gap for the CDI pick-ups, the correct procedure to change the gap is described in the Appendix (see appendix). While in normal conditions it is sufficient to assure that the gap is between the specified limits, engine starting in cold weather could be noticeably improved by assuring that the gap is set at the minimum specified limit.

Ignition timing
The checking and adjustment of the ignition timing is illustrated in the Appendix. The adjustment is performed with stroboscope lamp in the way that we mark TDC on the ignition fly wheel (or rotor) against fixed point on the engine case visible during engine run. Set the speed on 2000 RPM after engine start and read the ignition advance value on stroboscope lamp. This value should be within the range of 4 - 5° degrees.

Torque specification
All 8 mm dia. Bolts: 24 Nm (18ft/lb) (cylinder head bolts – 25 Nm)
All 6 mm dia. Bolts: 12 Nm
Spark plugs: 9.5 Nm (7ft/lb)

Note:
The use of ”Loctite 243” is recommended for all bolts that are installed into any of the rotating components. Use only the low to medium break-out torque varieties, since some of the ”Loctite” compounds can cement in place small diameter ”all threaded” fasteners tight enough to make their removal very difficult, if not impossible, without the application of heat.

Oil specification

Use only oils of registered brands for 4-stroke motorcycle engines with JASO MA or JASO MB classification.
Non-compliance with this recommendation could results in engine damage.

PERIODIC MAINTENANCE SCHEDULE VERNER 133S ENGINE

Daily

Check –	**Carburettor air filter**	
	Oil	
	Oil hoses	**(replace after 3 years)**
	Fuel Hoses	**(replace after 3 years)**
	Rubber manifold - carburettor	

Daily (until 10 hours)

Check/Adjust -	**Cylinder base studs**	**(M8 studs - 24Nm, M6 studs - 12Nm)**
	Cylinder head bolts	**(M8 bolts – 25Nm)**
	Crank case bolts	
	OHC drive chain	
	Carburettor slide valve synchronization	
	Valve stem gap	**(Clearance 0.1 mm)**

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5 hours

Replace -	**Oil**	
	Oil filter	**(replace with each oil change)**

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25 hours

Check/Adjust -	**Cylinder base studs**	**(M8 studs - 24Nm, M6 studs - 12Nm)**
	Cylinder head bolts	**(M8 bolts – 25Nm)**
	Crank case bolts	
	OHC drive chain	
	Carburettor slide valve synchronization	
	Valve stem gap	**(Clearance 0.1 mm)**
Replace -	**Oil**	
	Oil filter	**(replace with each oil change)**
Clean -	**Spark Plugs**	**(Spark plug gap 0.5 mm)**
	Carburettor air filter	

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50 hours

Check/Adjust -	**Cylinder base studs**	**(M8 studs - 24Nm, M6 studs - 12Nm)**
	Cylinder head bolts	**(M8 bolts – 25Nm)**
	Crank case bolts	
	OHC drive chain	
	Carburettor slide valve synchronization	
	Valve stem gap	**(Clearance 0.1 mm)**
Replace -	**Oil**	
	Oil filter	**(replace with each oil change)**
	Spark plugs	
Clean -	**Carburettor air filter**	

75 hours

Check/Adjust -	**Cylinder base studs**	**(M8 studs - 24Nm, M6 studs - 12Nm)**
	Cylinder head bolts	**(M8 bolts – 25Nm)**
	Crank case bolts	
	OHC drive chain	
	Carburettor slide valve synchronization	
	Valve stem gap	**(Clearance 0.1 mm)**
Clean -	**Carburettor air filter**	

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100 hours

Check/Adjust -	**Cylinder base studs**	**(M8 studs - 24Nm, M6 studs - 12Nm)**
	Cylinder head bolts	**(M8 bolts – 25Nm)**
	Crank case bolts	
	OHC drive chain	
	Carburettor slide valve synchronization	
	Valve stem gap	**(Clearance 0.1 mm)**
Replace -	**Oil**	
	Oil filter	**(replace with each oil change)**
	Spark plugs	
Clean -	**Carburettor air filter**	

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125 hours

Check/Adjust -	**Cylinder base studs**	**(M8 studs - 24Nm, M6 studs - 12Nm)**
	Cylinder head bolts	**(M8 bolts – 25Nm)**
	Crank case bolts	
	OHC drive chain	
	Carburettor slide valve synchronization	
	Valve stem gap	**(Clearance 0.1 mm)**
Clean -	**Carburettor air filter**	

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150 hours

Check/Adjust -	**Cylinder base studs**	**(M8 studs - 24Nm, M6 studs - 12Nm)**
	Cylinder head bolts	**(M8 bolts – 25Nm)**
	Crank case bolts	
	OHC drive chain	
	Carburettor slide valve synchronization	
	Valve stem gap	**(Clearance 0.1 mm)**
Replace -	**Oil**	
	Oil filter	**(replace with each oil change)**
	Spark plugs	
Clean -	**Carburettor air filter**	

175 hours

Check/Adjust -	**Cylinder base studs**	**(M8 studs - 24Nm, M6 studs - 12Nm)**
	Cylinder head bolts	**(M8 bolts – 25Nm)**
	Crank case bolts	
	OHC drive chain	
	Carburettor slide valve synchronization	
	Valve stem gap	**(Clearance 0.1 mm)**
Clean -	**Carburettor air filter**	

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200 hours

Check/Adjust -	**Cylinder base studs**	**(M8 studs - 24Nm, M6 studs - 12Nm)**
	Cylinder head bolts	**(M8 bolts – 25Nm)**
	Crank case bolts	
	OHC drive chain	
	Carburettor slide valve synchronization	
	Valve stem gap	**(Clearance 0.1 mm)**
Replace -	**Oil**	
	Oil filter	**(replace with each oil change)**
	Spark plugs	
Clean -	**Carburettor air filter**	

air filter

Note: Should anything be found damaged, loose, or otherwise indicating any abnormality, the reason for it must be found and the condition must be rectified before the next flight.

WARNING:

This is not a certificated aircraft engine. It has not received any safety or durability testing, and conforms to no aircraft standards. It is for use in experimental, uncertificated aircraft and vehicles only in which an engine failure will not compromise safety. User assumes all risk of use, and acknowledges by his use that he knows this engine is subject to sudden stoppage .