



# INSTALLATION, OPERATING & MAINTENANCE NOTES “VERNER - 133M” ENGINE

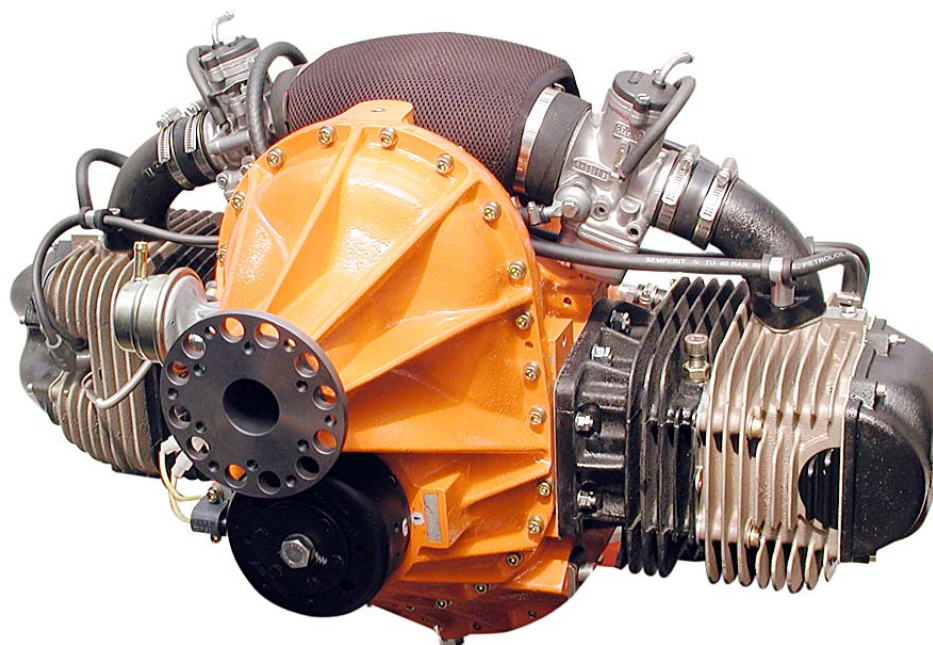
**VERNER - MOTOR®**

Czech Republic

phone/fax: +420 / 583 211 576

[www.verneraircraftengines.com](http://www.verneraircraftengines.com)

e-mail: [verner\\_motor@pvtnet.cz](mailto:verner_motor@pvtnet.cz)





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## 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 133 M 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	1330 cc /85.19 cubic inch
Bore	97 mm /3.81 inch
Stroke	90 mm /3.54 in
Compression ratio	1 : 9.5
Maximum power	80 BHP (59 kW) @ 5000 RPM (5 minutes max.)
Max. continuous power	70 BHP (52 kW) @ 4000 RPM
Torque	129 Nm (95 ft/lb) @ 3500 RPM
Fuel consumption	8.6 lit/hr (2.2 Imp. gal/hr.) @ 3550 RPM (70% power)
Propeller rotation	W, viewed from the front, tractor propeller (tractor propeller) - like Rotax 912
Weight	68 kg (150 lbs), including exhaust pipe (without oil)
Ignition timing	5° BTDC up to 2500 rpm, after, electronically variable
Spark plugs	NGK DCPR9E R diam.12 mm or NGK CR9EK R diam.10 mm
Spark plug gap	0.4 mm (0.016 in)
Electric starter	12 V/1000 W
Generator (Alternator)	12 V/160 W (13 Amp)
Lubrication	semi-synthetic motorcycle oil SAE 15W-50, API SH-CF (we use DENICOL Pro 2000 racing motorcycle oil)
Fuel	aviation petrol 100 LL AvGas or motor petrol, octane number 95 or more
Fuel pump	Pierburg 7.20971.63
Carburetors	2 x Dellorto PHBE 36 or 34 - Verner setting
Reduction drive	1 : 2 gear box, lubricated with motor oil
Propeller hub	75 mm B.C. x 6 x 8 mm tapped holes and Rotax standard on request



## 22. Marking of engine

Every engine VERNER 133M is marked with name plate.

<b>VERNER MOTOR CZ</b>		
Model: 133M	Serial No.: <input type="text"/>	Empty weight: 64kg
Production date: <input type="text"/>		Max. power: 80HP
Maximal RPM: 5000	Operational RPM: 3000 - 4000	Max. continuous power: 70HP

## 3. Operation

The engine is run-in at the factory for 2.5 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: 5000 RPM, for 3 minutes maximum

Operating speed: 3000 - 4000 RPM

It is recommended to use operating speed within the range of 3400 - 3850 RPM, when power, fuel consumption and engine wear are in ideal configuration.

### **Cylinder head temperature:**

Maximal temp. : 220 °C (428 deg.F) - For 5 minutes maximum!

Operating temp.: 125 - 185 deg.C (284 - 365 deg.F)

Minimal temp. : 70 deg.C (158 deg.F)

It is forbidden to exceed operating temperature 185°C during engine operation. The maximal temperature 220°C can be used only in the state of emergency and for 5 minutes maximum! 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 - 820 deg.C (1150 - 1300 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<sup>2</sup> (15 - 70 psi)

Oil temperature: 50 - 95 deg.C, (122 - 248 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 95°C and only in the state of emergency can be exceeded up to 120°C in the short run.

**Fuel pressure:**

Fuel pressure: 0.15 - 0.7 kg/cm<sup>2</sup> (2.2 - 10.1 psi)

Should any of the indications approach or reach the upper limits shown, the engine must be throttled back in flight to the minimum practical revolutions possible and a landing carried out at the nearest opportunity. The cause of the abnormality must be identified and rectified before further operation of the engine.

**Note:**

Although the carburetors are adjusted for optimum performance, the idle speed could be affected by a number of variables (especially by the prevailing climatic conditions and the slight variations in the composition of the fuel sold in various countries). If necessary, adjust the idle speed of the carburetors for 1400 RPM engine revolutions. Under no circumstances should the jetting of the carburetors be changed without prior consultation with the manufacturer.

All engines are shipped with inhibiting oil injected into and circulated through the engine. Since the function of this "sticky" inhibiting oil is to protect, not to lubricate the internal components (including the cylinder walls), it is recommended that the following procedure is carried out to flush the protected surfaces with lubricating oil before starting the engine for the first time. Because of the lack of proper lubrication at this point in time, **DO NOT** use the starter motor to turn the engine over.

1. Remove a spark plug from each cylinder.
2. Pour approximately 10 ml of slightly warmed up oil into one of the cylinders with the piston on the bottom of its stroke and turn the engine over by hand several times.
3. Repeat with another cylinder.
4. Replace the spark plugs and reconnect the ignition leads.

**Note:**

The engine will likely produce heavy smoke during the first few minutes of running but it should not be a cause for alarm.

**Note:**

Before first starting an engine with a propeller, it is necessary to open the throttle continuously and carefully so that engine speed doesn't exceed the maximal limit of 5000 RPM. In case this happens, it is necessary to set the propeller to bigger angle. In the first flight test, it is necessary to monitor the speed indicator carefully and mark that the maximal engine speed limit is not exceeded nor in the maximal plane speed.



**ALWAYS ADJUST THE PROPELLER BY CANTING  
THE PROPELLER BLADES SO THAT  
THE ENGINE SPEED LIMIT DURING LAND ENGINE TESTING  
DOESN'T EXCEED 4800 RPM**



During long-time test, we recommend to use the propeller of maximal diameter suitable for flight device, e.g.:

- WarpDrive diameter 1820 mm - 2 blade
- WarpDrive diameter 1720 mm - 3 blade

## 4. 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 15 seconds. If the oil warning lamp is installed, it has to turn off within 15 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.

### 5. 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 1<sup>st</sup> ignition circuit.
5. Move the throttle to minimal position.
6. Switch off the 2<sup>nd</sup> 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.



### 6. 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.

### 7. Items requiring periodic renewal

Some components require periodic renewal throughout the operational life of the engine and these items must be replaced at the intervals specified. Because of a number of operational variables however (atmospheric and weather conditions, frequency of operations, individual preferences, etc.) they require close and frequent inspection to assure that they remain serviceable throughout the recommended replacement interval. Should anything abnormal be noted before the item is due for replacement, it must be replaced without delay.

#### Note:

It is pointed out here that the recommended replacement/renewal periods represent only the reasonably, EXPECTED and not the unconditionally WARRANTED service life of the component in question. In all cases where a component has to be repeatedly replaced sooner than in a specified time, the manufacturer must be notified to investigate the reason and offer a solution for the recurring problem.

#### Battery

It is suitable to use a battery with as big storage capacity as possible (min. 17 Ah), engine cylinder capacity for one piston is nearly 700 cm<sup>3</sup> and this demands big starter power for which great energy has to be supplied. The engine can be started with small accumulator but its service life will be very short. An accumulator with the storage capacity above 21 Ah is recommended as the optimal one for VERNER 133M engine.

#### Spark plugs

The spark plugs should be cleaned in degreasing fluid or petrol, using only a stiff plastic brush, and they should NOT be cleaned by means of blasting or sand blasting or cleaned with a steel wire brush.

#### Note:

NEVER remove the plugs from a hot engine. Lubricate the threads of the plug with graphite grease before reinstalling them in the cold engine.

Use only spark plugs recommended by a producer; they are checked out in operation tests. For cold and damp environment, it is recommended to use conventional spark plugs with earth electrodes NGK CR9EK R diam. 10 mm or NGK DCPR9E R diam. 12 mm. Engine starting will improve even after longer down time.

#### Oil change / Oil filter

The oil should be changed at the recommended intervals which includes also the oil filter cartridge change. The producer recommends oil filters made for car petrol engines with thread diam. 20x1,5 mm. It is advisable to purge the oil from the hoses and cooling radiator and drain the oil from the system. This will assure that very little "old oil" remains in the system.

Attention: First oil change must be after 5 hour engine run. After according recommended intervals.



When filling the system with fresh oil, turn the engine over several times to prime the system. When the oil pressure gauge needle moves off its peg, it is a good indication that the system is filled up with oil. After the system is full, check the oil level with the oil checkstick situated near the oil filling cup. Or you can see the oil level through the transparent hose which connects the oil breather to the oil sump. The average capacity of the oil system is about three liters of oil.

Note:

The manufacturer recommends to use motorcycle oil semisynthetic class API SH-CF SAE 15W-50. (e.g. we use Denicol Pro 2000 racing motorcycle oil SAE 15W-50 semisynthetic).

Recommended oil filters: standard oil filters made for car petrol engines with thread diam. 20x1,5 mm. (we use filters made for Renault and Peugeot car diesel engines up to 2000 cc).

Max. consumption of oil: 0,012 l/kWh.

### **Reduction gear box**

Without maintenance.

### **Air filter**

The air filters should be cleaned in clean solvent periodically. The recommended interval for cleaning the filters in normal conditions is every 25 hours. If the aircraft is operated in exceptionally dusty conditions they should be cleaned more frequently. This is especially true if the aircraft is used for frequent “touch-and-go” operations when the weekly cleaning of the filters is not out of reason. The pulling torque 3 Nm maximum is used when tightening filter cramps; stronger tightening could cut rubber filter cups.

### **Fuel filter**

The fuel filter should be replaced at 25 hour intervals in situations when no pre-filtered fuel is available (e.g. the fuel is loaded from canisters) or at 50 hour intervals if the fuel is always loaded from a properly maintained and approved aircraft fuel tankers or pump. Only filters with a flow capacity of no less than 50 liters per hour should be used.

Note:

The producer recommends to use only nylon mesh filters.

### **Carburettor socket**

Unsatisfactory and/or erratic engine performance is often traceable to a small crack or split in the rubber carburetor mounting socket. A hairline crack can cause erratic running of the engine at a given throttle setting while allowing the engine to run quite normally at all other speeds. This creates the impression that something internal to the carburetor is the cause of the problem.

Regular replacement of the carburetor mounting sockets at the recommended intervals and daily checks for any sign of embrittlement of the material will assure that this problem is eliminated.

## **8. 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: 0.15 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

- Cylinder head bolts: 27 Nm (20ft/lb)
- All 8 mm dia. Bolts: 25 Nm (18ft/lb)
- All 6 mm dia. Bolts: 13 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.

## 9. Major overhauls

The current TBO of the engine is 800 hours, with a view on extending this time in the future. For the major overhaul of the engine it must be returned to the factory or to the fully authorized repair facility of VERNER-MOTORS in those countries where the manufacturer is represented by such an arrangement. In case the engine is impacted by a propeller strike or otherwise suffers a serious damage, it has to be revised by the manufacturer or authorized company.



### 10. Accessories

The following accessories are needed for the normal running of the engine:

- Oil cooler, c/w hoses and clamps
- Exhaust pipes with silencer
- Engine rubber shock-mounts
- Voltage regulator/rectifier\*
- Carburetor air filter\*
- Electric tachometer
- Dual CHT cylinder-head temperature gauge
- Oil temperature gauge
- Oil pressure indicator lamp
- Toolbox
- Cooling cover (tractor version of engine) not supplied

Common and special tools required for the maintenance items described in these Notes are also provided in a toolbox with the engine.

\*Items marked with asterisk are included in the weight shown in the Technical Specifications.

### 11. Guarantee

VERNER-MOTOR - engine manufacturer or its authorized dealers provide engine guarantee for 100 operation hours or 6 months which ever comes first. The guarantee period starts on the day marked in the certificate of warranty as the date of sale.

To exercise a claim, the owner of the engine is obliged to present regular certificates of engine purchase and confirmed certificate of warranty with the date of sale and engine maintenance logbook.

The guarantee cannot be applied on the following:

- damage caused by unauthorized use and not observing the periodic adjustment in accordance with Manual on assembly, operation and maintenance of VERNER 133M engine
- using components or accessories that are not original products of the engine manufacturer
- engine damage due to engine operation without propeller
- ordinary wear and tear of all components of the engine
- damage due to air crash with the engine installed
- using engine without dashboard instruments delivered with the engine
- unqualified repair work of mechanics that are not stipulated with the manufacturer
- when using engine for heavier type plane (above 450 kg of take-off weight) or other devices without written approval of the manufacturer

NOTE: When the new engine is stored for long time:

The protection of the engine made with "sticky" inhibiting oil, from the factory, guarantee a good preservation of inner parts of the engine from rust and oxidation up to a time of six months from the production date of the engine. After this time a preservation procedure must be repeated .



### 12. Appendix

List of illustrations for the installation and maintenance instructions.

1. **PERFORMANCE CHARACTERISTICS**

(Horsepower, torque, and fuel consumption curves)

2. **VERNER 133M ENGINE**

(Schematic illustration with reference dimensions for adapting the engine to the airframe / engine mount design.)

3. **TYPICAL FUEL SYSTEM INSTALLATION**

(Schematic illustration)

4. **LUBRICANT SYSTEM**

(Schematic illustration)

5. **IGNITION & ELECTRICAL SYSTEMS**

(Schematic illustration)

6. **MAGNETO GENERATOR & IGNITION**

(Rear view of the crankcase with maintenance instructions.)

7. **CYLINDER HEAD AND OHC DRIVE**

(Views of the cylinder head with maintenance instructions.)

8. **THE DRIVE CHAIN**

(Checking & adjusting)

9. **CYLINDER HEAD MOUNTING**

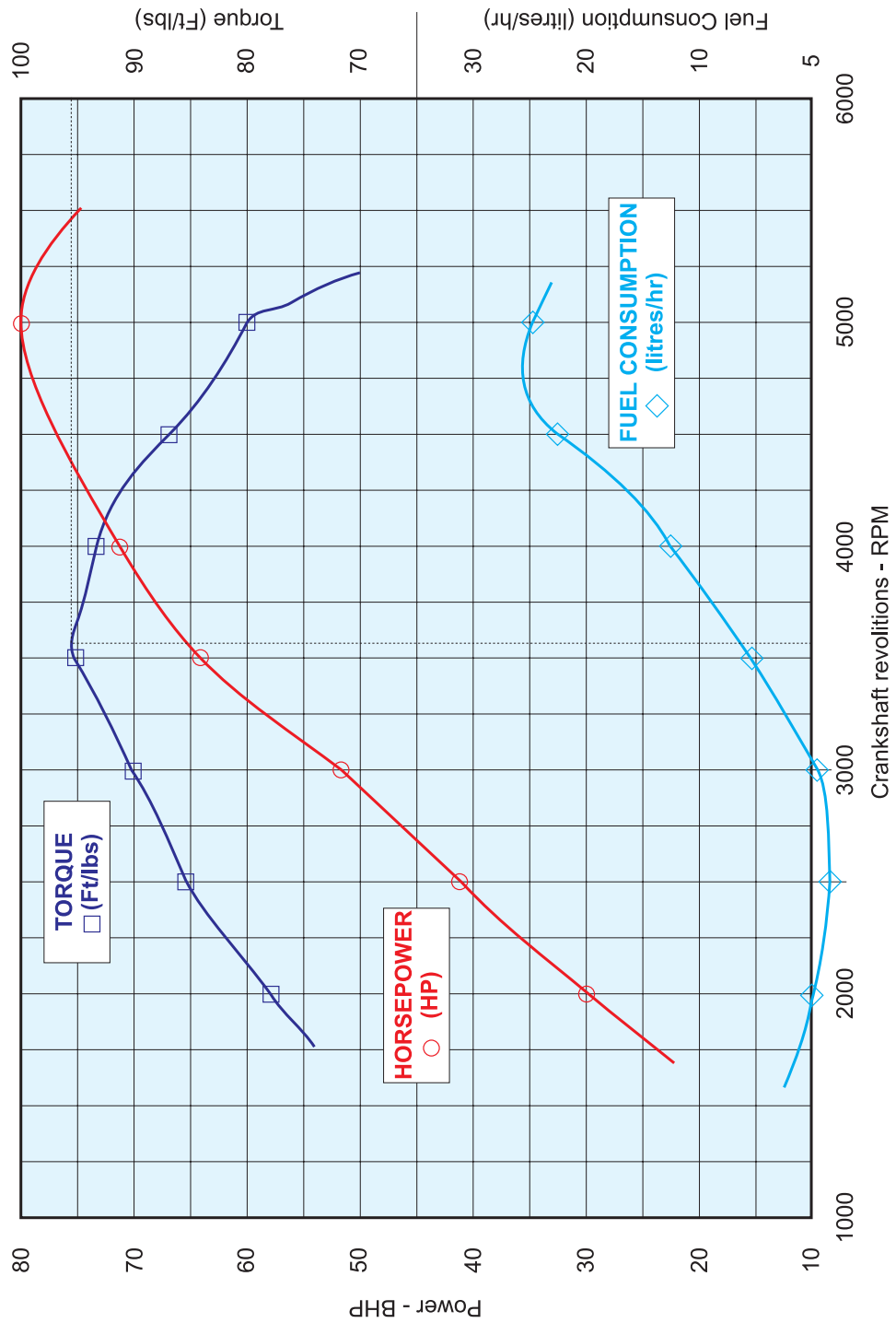
(Application, examples for cylinder head mounting)

10. **PERIODIC MAINTENANCE SCHEDULE**

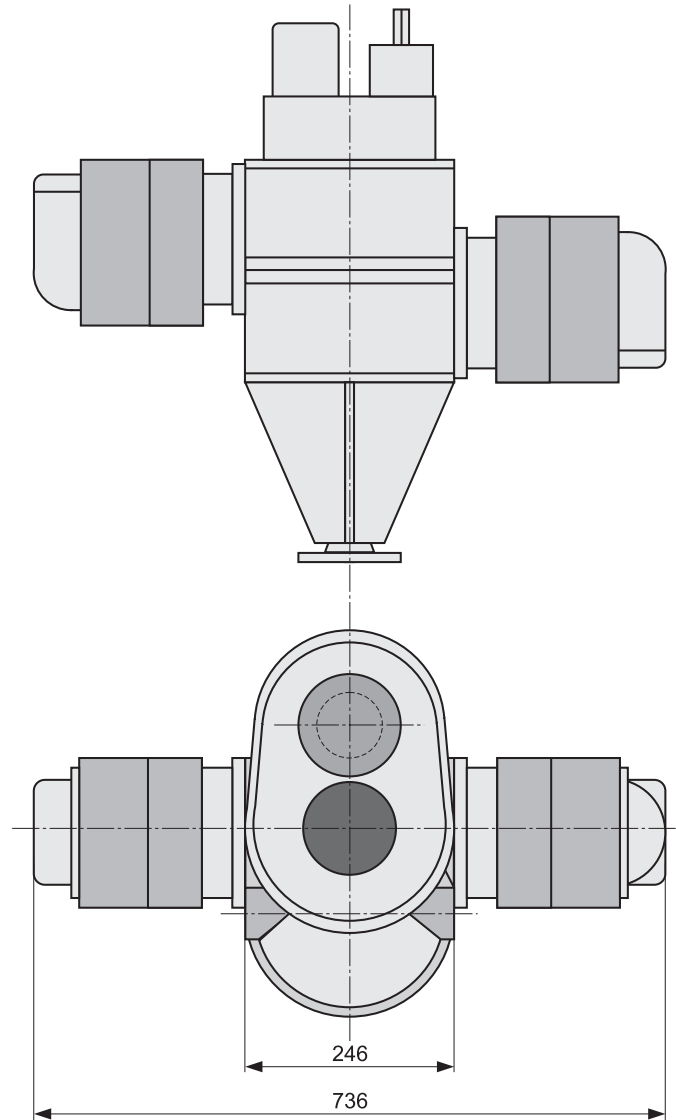
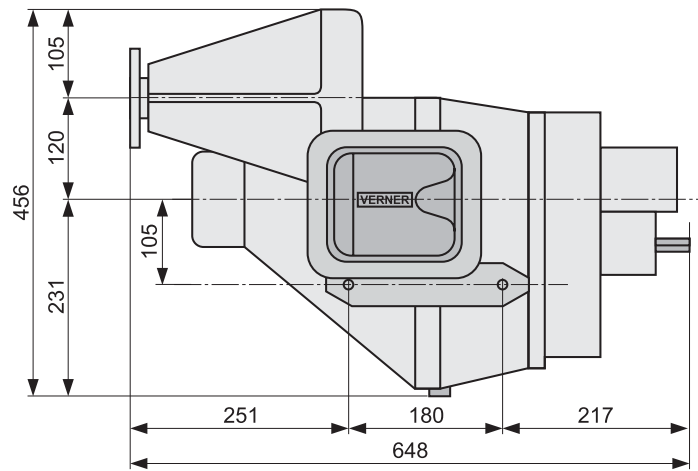
(Table of required maintenance items/actions.)



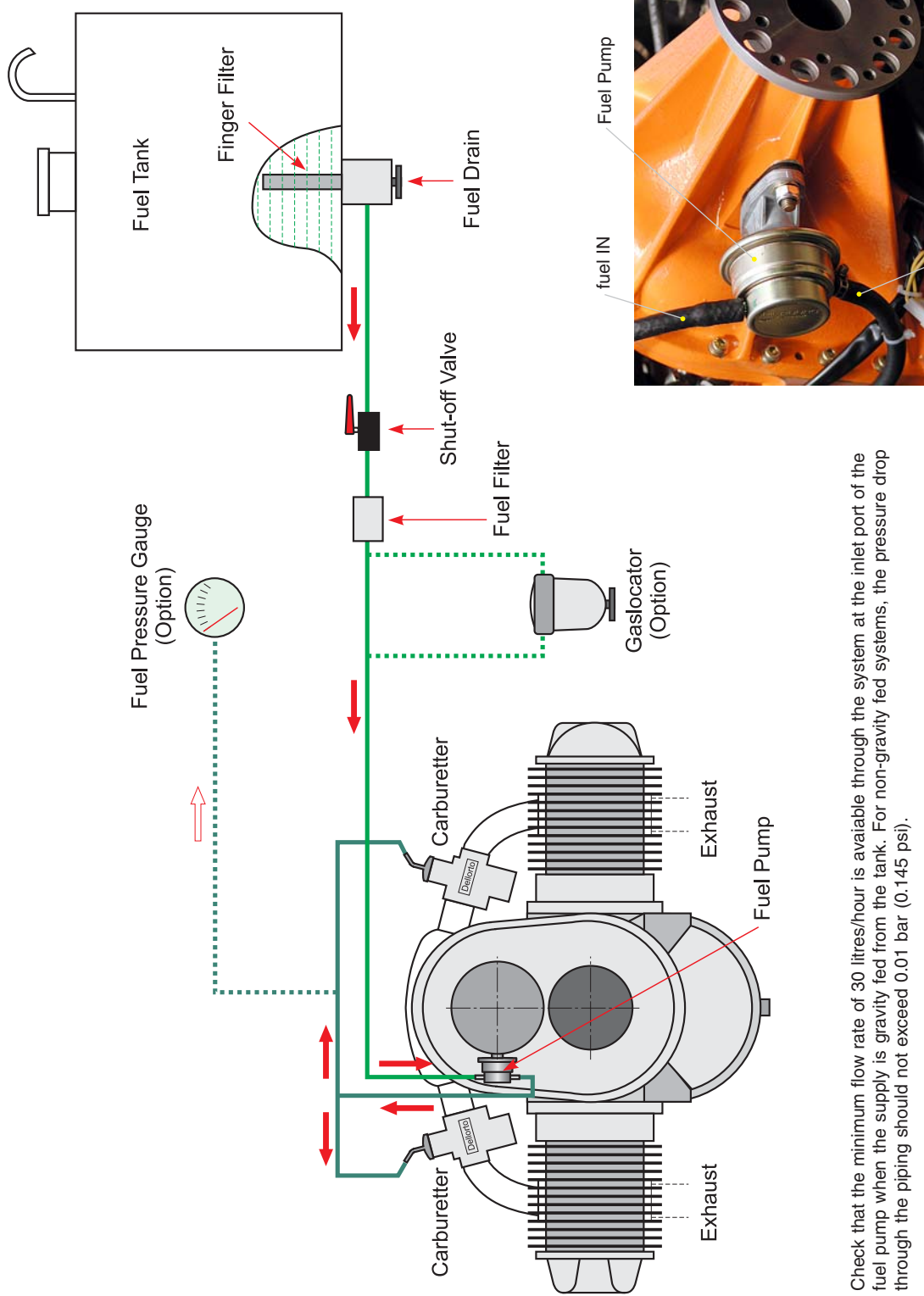
**1. PERFORMANCE CHARACTERISTICS - HORSEPOWER, TORQUE, FUEL CONSUMPTION**  
(engine VERNER - 133M)



**2. MAIN DIMENSIONS - SCHEMATIC ILLUSTRATION - FOR DIMENSIONAL REFERENCE ONLY**  
 (VERNER - 133M engine)

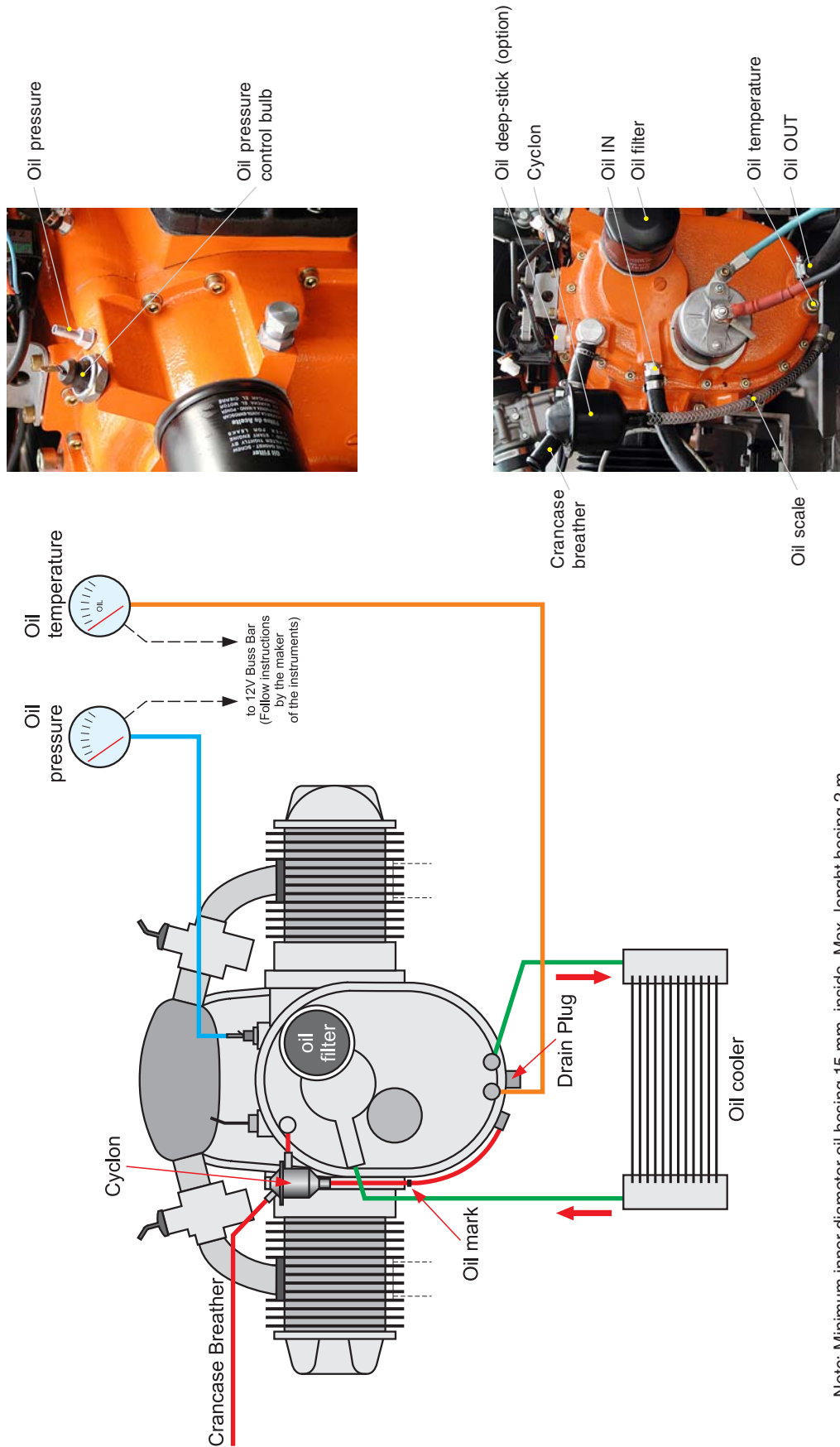


### 3. TYPICAL FUEL SYSTEM INSTALLATION - SCHEMATIC ILLUSTRATION (engine VERNER - 133M)



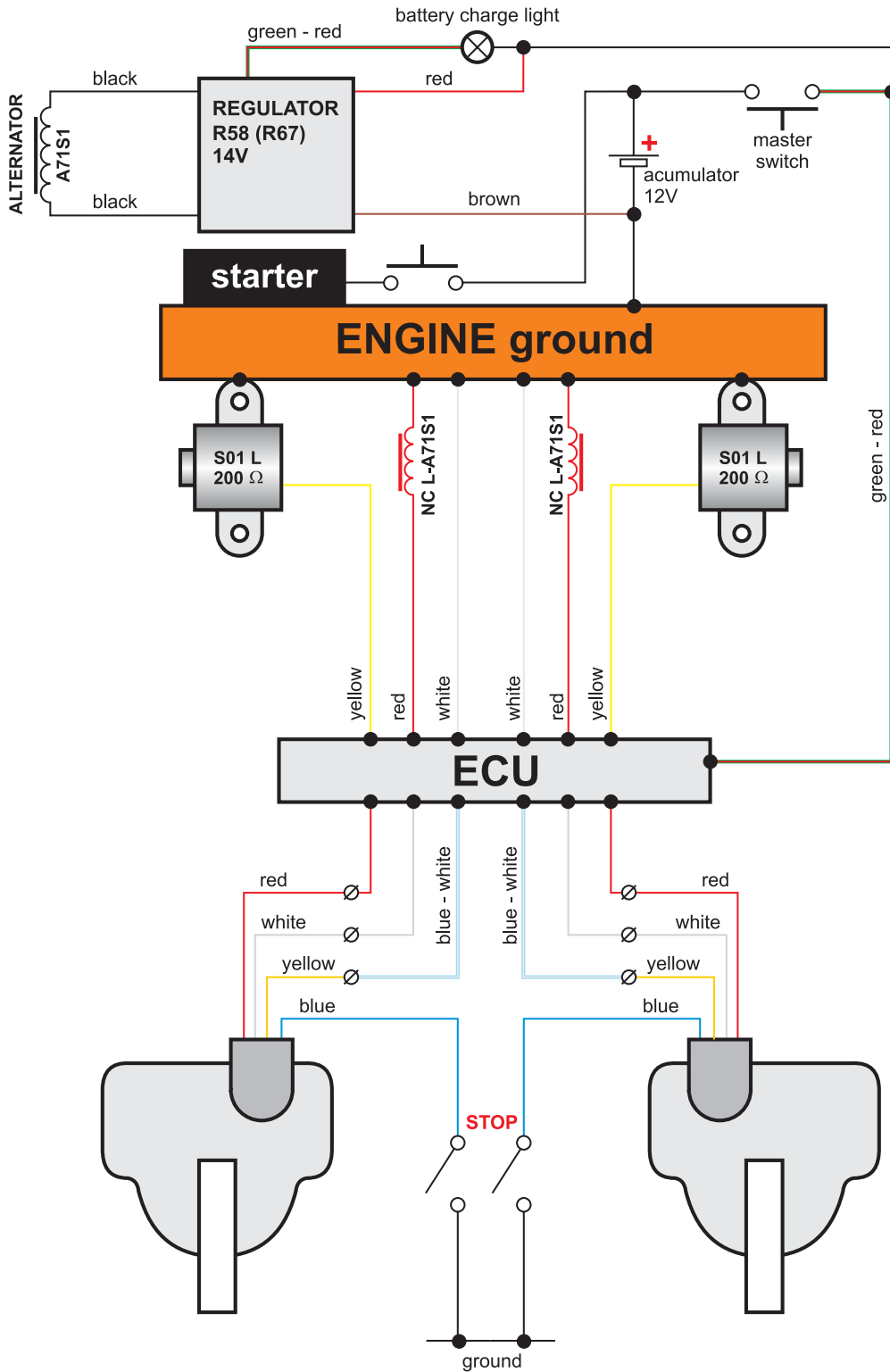
Check that the minimum flow rate of 30 litres/hour is available through the system at the inlet port of the fuel pump when the supply is gravity fed from the tank. For non-gravity fed systems, the pressure drop through the piping should not exceed 0.01 bar (0.145 psi).

**4. LUBRICANT SYSTEM - SCHEMATIC ILLUSTRATION**  
(engine VERNER - 133M)



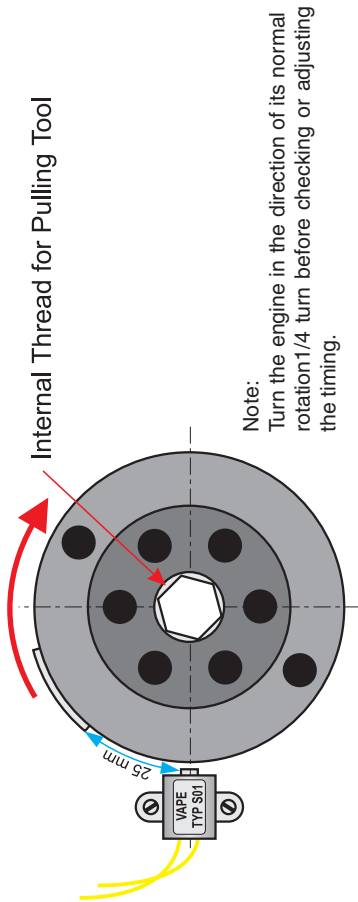
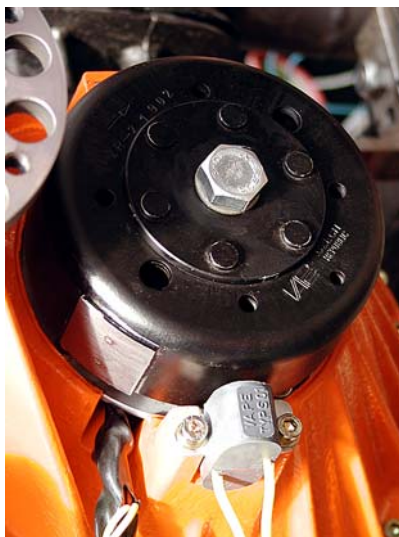
Note: Minimum inner diameter oil hosing 15 mm inside. Max. length hosing 2 m.

5. INGITON & ELECTRICAL SYSTEMS - SCHEMATIC ILLUSTRATIONS  
(engine VERNER - 133M)

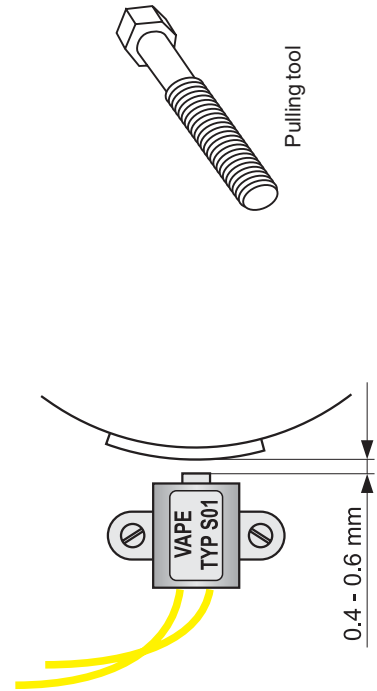




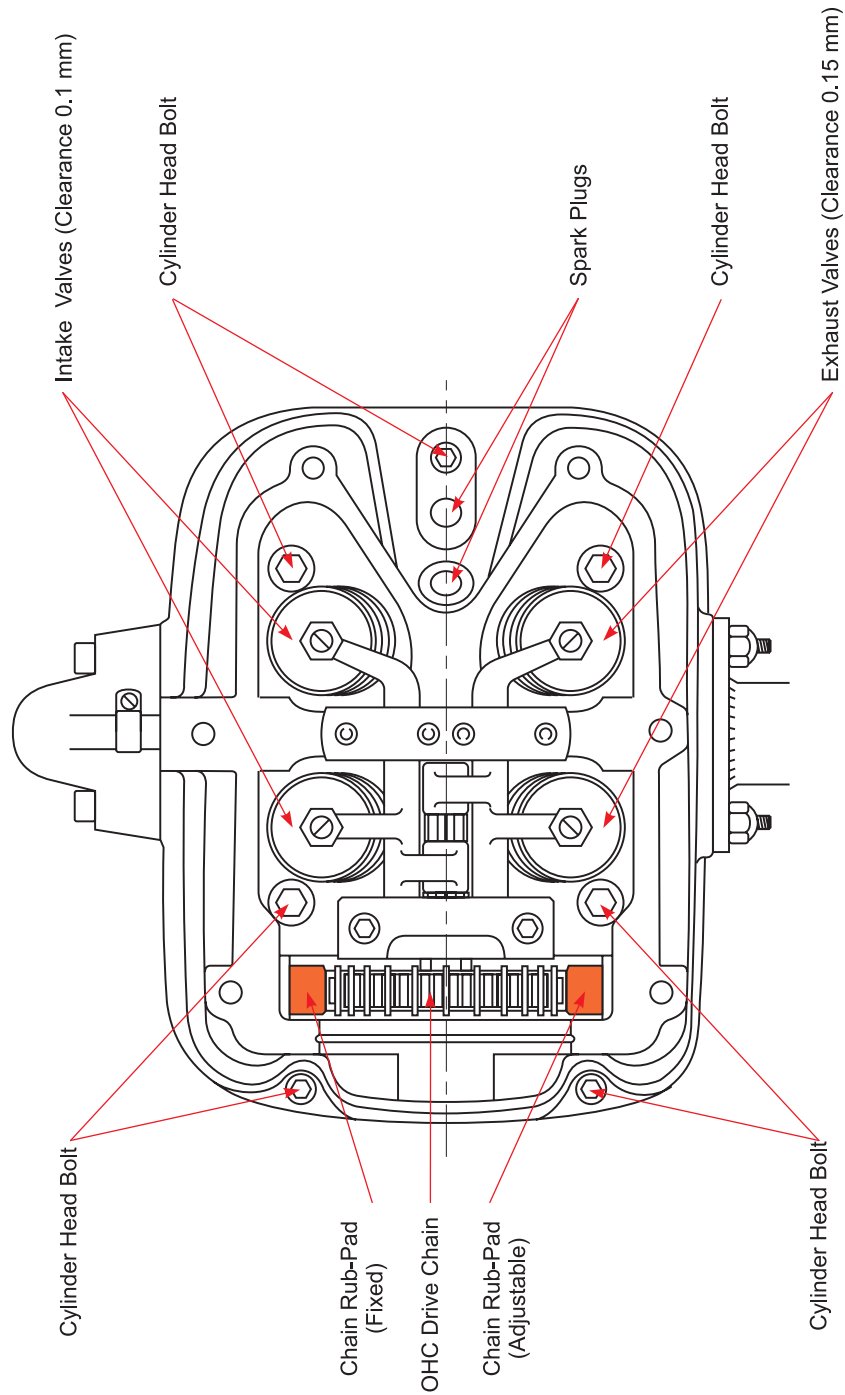
### 6. MAGNETO GENERATOR & IGNITION (engine VERNER - 133M)



1. Remove center bolt from flywheel (with washer)
2. Using the pulling tool (furnished with the tool kit) pull the flywheel free from the shaft
3. Set one the pistons on TDC.
4. Turn the flywheel so that pole is 25 mm past the magnets of the ignition pick-up units from corner to corner.
5. Reinstall the center bolt with “Locite” and tighten slightly.
6. Check the timing and if correctly set, torque the bolt to 13 Nm.

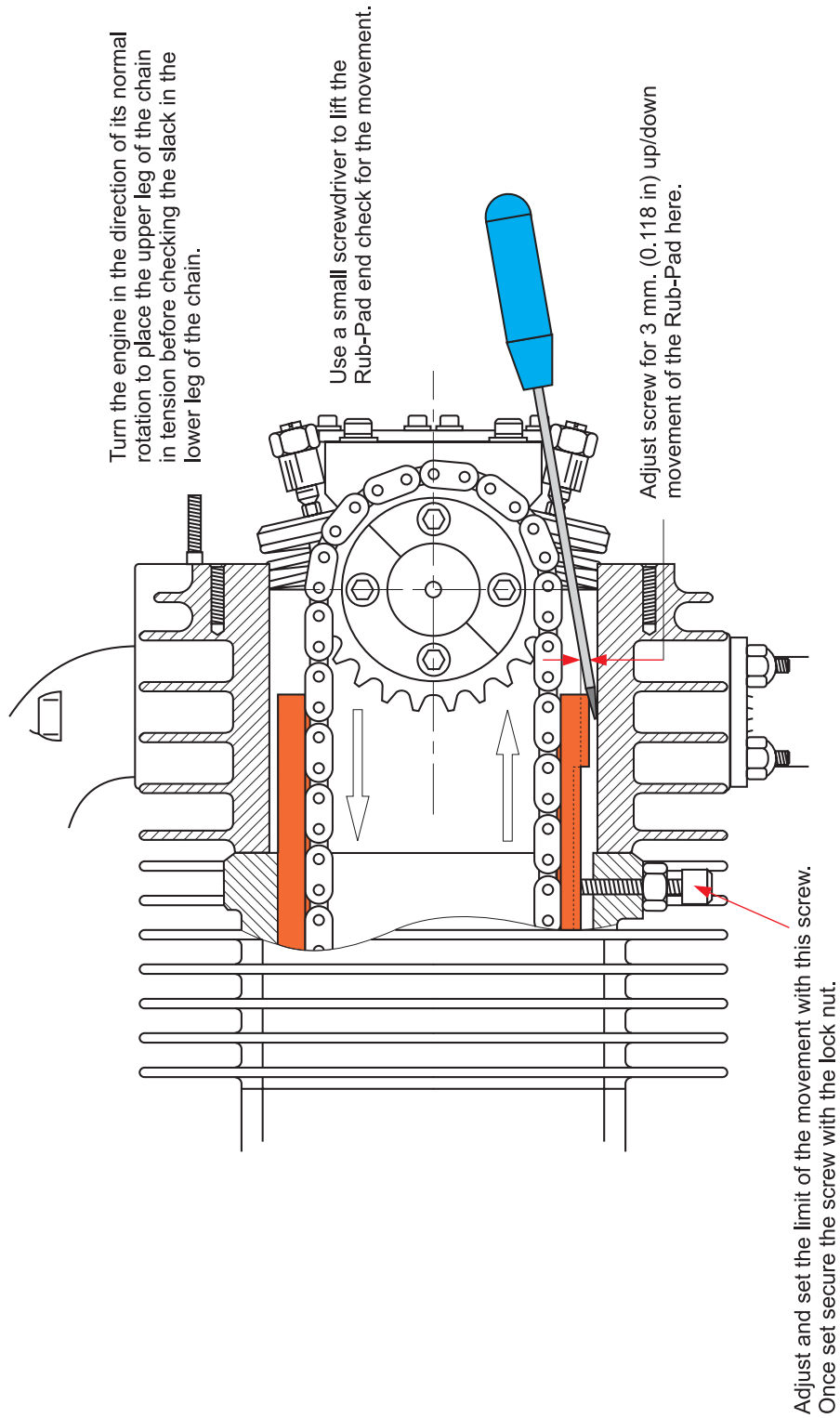


**7. CYLINDER HEAD AND OHC DRIVE**  
(engine VERNER - 133M)

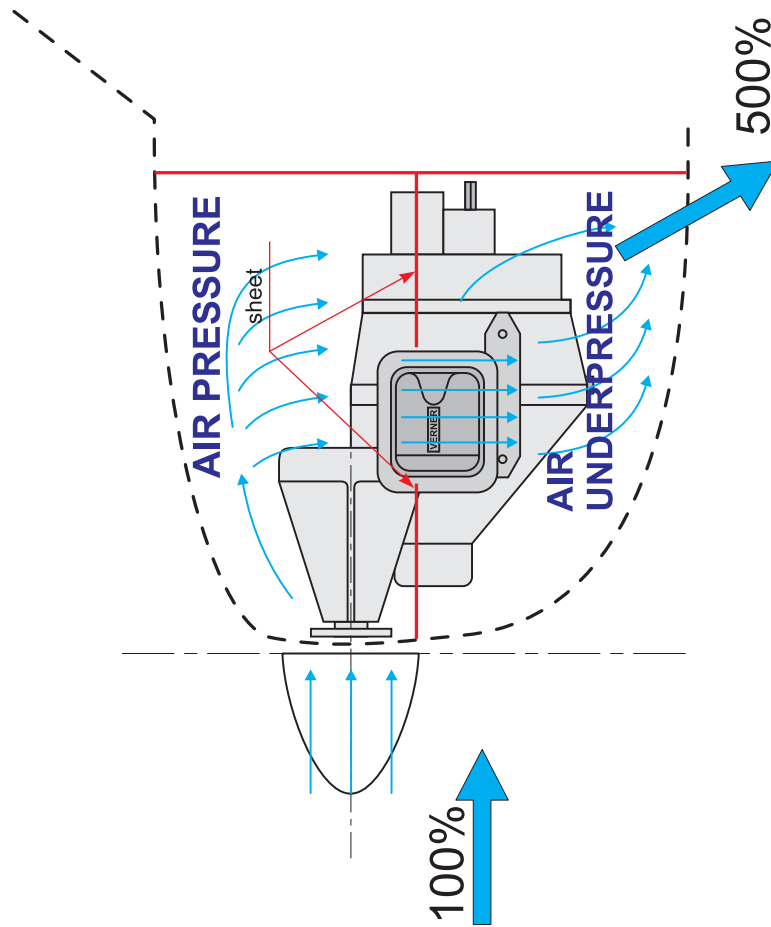


Note: Check torque 27 Nm (20ft/lbs) on the seven cylinder head bolts each 25 hour service.

### 8. CHECKING AND ADJUSTING THE DRIVE CHAIN (engine VERNER - 133M)



**9. CYLINDER HEAD MOUNTING - EXAMPLES**  
(engine VERNER - 133M)





### 10. PERIODIC MAINTENANCE SCHEDULE VERNER 133M ENGINE

Periodic maintenance / replacement time for limited life components - required actions

Item	Daily	25 hours	50 hours	100 hours	250 hours	Remarks
Spark plugs	-	clean	replace	replace	clean	See note in Appendix
Carburettor air filters	check	clean&re-oil	replace	replace	replace	Clean&re-oil weekly if operated in dry and dusty environment
Fuel filters	-	-	replace	replace	replace	Replace at 25 hour intervals if the fuel is loaded from “jerry cans” or drums
Oil	check	(1 <sup>st</sup> change after 5 hour) replace	replace	replace	replace	replace every 50 hours
Oil filters	-	(1 <sup>st</sup> change after 5 hour) replace	replace	replace	replace	replace with each oil change
Oil hoses	check	check	check	check	replace	replace after 3 years regardless or hours in service
Fuel hoses	check	check	check	check	replace	replace after 3 years regardless or hours in service

Periodic maintenance checks for components requiring adjustment - required actions

Item	Daily	25 hours	50 hours	100 hours	250 hours	Remarks
OHC drive chain	-	Check/Adjust	Check/Adjust	Check/Adjust	Replace	See illustrated instructions
Valve stem gaps	-	Check/Adjust	Check/Adjust	Check/Adjust	Check/Adjust	See illustrated instructions
Ignition timing	-	-	Check/Adjust	Check/Adjust	Check/Adjust	See illustrated instructions
Propeller tracking	-	Check	Check	Check	Check	Re-torque bolts if required
Compression	-	Check	Check	Check	Check	9-12 bar (130÷174 psi) max. diff. between cylinders ≤ 3 bar (43 psi)
Cylinder head bolts	-	(1 <sup>st</sup> check after 5 hour) Check re-torque	Check re-torque	Check re-torque	Check re-torque	25 Nm (19 ft/lbf)