



Göbler-Hirthmotoren KG

Operator's Manual



Engine

3503

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Operator's Manual

Engine

Model 3503

Read this operator's manual thoroughly before putting the engine into operation for the first time and comply strictly with the instructions given here.

In the interests of continual development of our engines we must reserve the right to change conditions of delivery for design, engineering and fixtures. We also request your understanding that no claims can be made against statements and Figures from this manual.

THIS ENGINE DOES NOT COMPLY WITH FEDERAL SAFETY REGULATIONS FOR STANDARD AIRCRAFT. THIS ENGINE CAN BE USED IN EXPERIMENTAL AND ULTRA-LIGHT UNCERTIFIED AIRCRAFT ONLY IN CIRCUMSTANCES WHICH AN ENGINE FAILURE WILL NOT COMPROMISE SAFETY. BEFORE OPERATING THE ENGINE READ OPERATOR'S MANUAL INFORMATION AVAILABLE FROM YOUR AUTHORISED HIRTH DISTRIBUTOR.

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1. Description of the Engine, Mounting Instructions and Technical Data

1.1. Overview

The 3503 engine (Figure 1.1.1-1) of Göbler-Hirthmotoren KG is a two cylinder in-line two-stroke liquid cooled engine.

The cylinders consist of an aluminium alloy with a Nikasil coated running surface that is highly resistant to wear. The cylinders are mounted onto the crankcase by stud bolts, discs and hexagon nuts. The cylinder heads consist of a special hypereutectic aluminium alloy that resists high temperatures while maintaining constant hardness. They are secured onto the cylinder by means of cylinder screws and washer using 'O' ring seals between the head and the cylinder.

The pistons consist of an aluminium alloy and are sealed off from the cylinder running surface by two piston rings. The piston is connected to the con-rod by the gudgeon pin and a needle bearing.

The crankshaft is made of chrome-molybdenum steel (42 Cr Mo 4) and is mounted in five deep groove ball bearings. It's an assembled crankshaft and the individual parts are pressed together to form a complete unit. Two deep groove ball bearings are installed on the PTO drive side, two between the con-rods and one on the ignition side. The drive shaft is tapered and has a centred thread in order to secure to the PTO shaft. The con-rods are connected to the crankshaft by crank pins and needle bearings.

The crankcase consists of an aluminium alloy and constructed as a case in two halves. It is secured together by eight fastening studs and nuts which secure the cylinders to the case. Opposite the PTO end of the crankcase, there is an ignition stator unit. This is fixed to the crankcase and is concealed by the flywheel and the fan housing..

Figure 1.1.1-1 (Engine 3503)



1.2. Description of the carburation system

The carburation system (Figure 1.1.2-1) of the 3503 engine consists of two Dellorto carburetors. Each carburettor is connected to the inlet aperture of the crankcase by a rubber flange and is secured to the inlet aperture by means of a clamp held in a rubber flange. The carburetors have a dry air filters installed.

Figure 1.1.2-1 (Dual Dellorto Carburation System)



1.3. Description of the Ignition System

The ignition system (Figure 1.3-1, 1.3-2) consists of an armature plate, a magneto, E-Box(s), ignition coils and the ignition cables with the required number of spark plug leads. The ignition system is completely electronic and possesses an E-PROM for a freely programmable ignition curve however, this can only be carried out by the manufacturer. Alternating Current (AC) power for electrical components during running and charging of the battery is provided. The engine is available with a single or dual ignition system installed.

An electronic stator plate is secured on the ignition side with the crankcase. A magneto is fixed on the crankshaft and encloses the armature plate. The fan housing covers the ignition system's magnetic wheel. The electronic E-box and ignition coils are mounted on a fixture plate secured to the crankcase as shown in figure 1.3.3.

Figure 1.3-1 (Single PVL ignition)

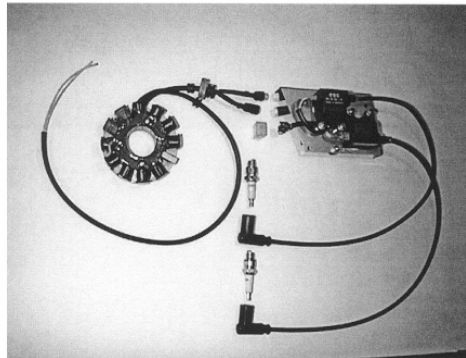


Figure 1.1.3-2 (Dual PVL ignition)

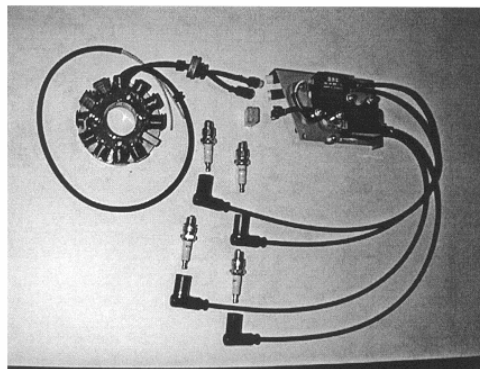
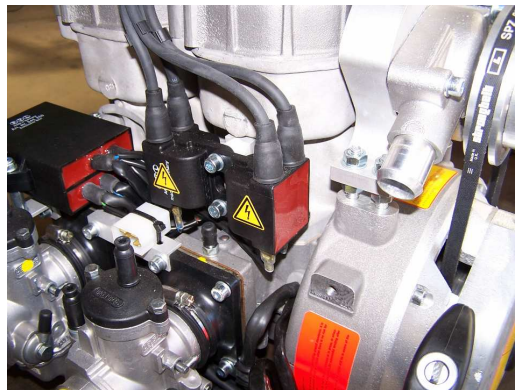


Figure 1.3-3

(View of ignition side with installed ignition system)



1.4. Description of the cooling system

The 3503 engine has a mechanically operated liquid cooling system. (Figure 1.4-1).

The liquid pump is installed above the flywheel housing. It is driven by a V belt pulley that is fixed to the ignition system's magnetic flywheel. Coolant is pumped from the radiator system into the cylinder water jackets then to the cylinder heads. The hot coolant then exits the outlet of the cylinder returning back to the radiator system. The temperature of the cooled liquid is controlled by a thermostat located between the radiator and the inlet of the liquid pump.

Figure 1.4-1 (View of the fan housing and the liquid coolant pump)



2. Model Identification plate

The model plate is attached to the intake side on the upper part of the crankcase. This also includes the serial number of the engine and must be quoted should a warranty claim be required.

Figure 3.5-1 (Position of the Model Plate)



3. Installation instructions

3.1. Mounting and securing the engine

The six screw threads (M10) located on the underside of the 3503 engine crankcase is for fastening the engine to a suitable engine mount.

Figure 2.1-1 (Fastening thread points)



The engine should be mounted so that the moment from the engine to the mounts can be absorbed as widely as possible. The absorbing of the mounts should also be made as hard as possible, since the engine can become unstable if these mounts are too soft. This also leads to problems within the carburettors fuel bowl as well as uncontrolled vibration of the fuel pump diaphragm, intimating to an unsafe operation of the engine.

- Suggestion for securing the engine:

The engine is secured to a fastening plate that is about twice the width of the engine (the wider the better). On the two outer surfaces of the fastening plate six (or more) hard rubber absorber elements (three on each side) are attached in an axial direction. This complete substructure is secured by the rubber absorber elements on to a corresponding base plate.

3.2. The engine's air supply

The engine must be installed so the cooling air stream fed to the engine radiator is sufficient to ensure the engine is cooled and that air is also supplied to the carburettors.

3.3. The engine's fuel system and fuel supply

The engine's fuel supply is provided by a Mikuni diaphragm pump (Figure 2.3-1) that is driven by pressure pulsation from the crankcase.

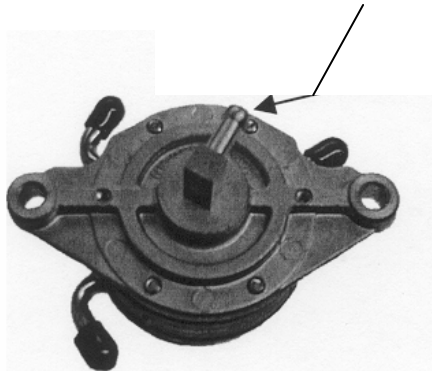
This diaphragm pump is positioned in the fuel line between the fuel tank and Dellorto carburettor(s). A fuel filter should always be installed between the fuel pump and fuel tank.

The Mikuni fuel pump should be secured to a location with the least influence of vibration or heat. It is important that it is installed upright with the fuel outlet at the top. The assignment of the fuel connection direction can be identified on the housing by arrows.

The central connection of the Mikuni pump is connected to the vacuum impulse line from the crankcase and should be as short and straight as possible. When choosing the impulse line and the fuel line it is important to ensure that rigid lines are used and do not expand under pressure. The impulse line should not exceed a maximum length of 150mm with a minimum inner diameter of 6 mm.

Figure 2.3-1

(Fuel-diaphragm pump with impulse connection)



The positioning of the fuel tank over the engine is advantageous as would ensure a reasonable fuel supply pressure. It is recommended to maintain a consistent fuel pressure under all conditions. Additional monitoring of fuel pressure by means of a fuel pressure gauge may also be considered.

When installing the fuel tank beneath the engine, the maximum fuel line length between the fuel tank and diaphragm pump should not exceed 2,000mm. The maximum suction head should not exceed 1,000m with a minimum inner diameter of 6mm.

Be aware of the possible gradient of the vehicle the engine is installed in during operation i.e. ascent-/descent with aircraft, uphill-/downhill with ground vehicles.

The maximum length of the fuel outlet pressure line should not exceed 500 mm with a minimum inner diameter of 6 mm. A maximum pressure head between the centre of the diaphragm pump and centre of the carburettor float chamber may not be exceeded.

If a Mikuni pump is installed on the engine, it is recommended the diaphragm of the pump stands vertical to the crankshaft axis (drive or ignition side). This will ensure that resonance produced by the crankshaft axis from the engine does not impair the action and function of the fuel pump.

3.4. The operation of dual carburettors

The throttle valves of the Dellorto carburettors are operated via two Bowden type cables. It is advantageous to run both cables from the throttle into a single cable by means of a Y-shunt or cable splitter.

If at all possible, both throttle cables between the Y-shunt and the carburettors should be the same length. In idling position (both throttle valves sit on the idle – adjusting screw) there should still be enough play in the throttle cable to ensure that the throttle valves can reach the idle position stop.

It is essential to ensure that both throttle valves in the Dellorto carburettors are completely synchronised.

The idling position of the throttle valves must be equal in both carburettors. To do this, use the idle adjusting screw to bring the throttle valves to the same level in idle position.

Measure and match the size of the aperture of both slide valves.

When the slide valves are drawn upwards they should lift simultaneously from the idle-adjusting screws and open the outlet together.

Securing the spark plug leads in a hanging (inverted) installation

If the engine is installed in a hanging or inverted position, the sparkplug leads should be secured so that any breaking or interruption of contact by engine vibrations is prevented (support or secure by wires).

Switching off the Ignition System (dual ignition)

It is essential that both ignition circuit breakers are located on separate grounding switches. It is important each earthing wire is installed separately to avoid circuit failure. This method also aids the operator to check each ignition side when the engine is operating.

4. Monitoring Apparatus

It is recommended that the coolant temperatures, the exhaust gas temperature and the fuel pressure be monitored.

The basic setting of the engine guarantees a problem-free engine function under the general installation conditions. It is very important for safe running of the engine that the cylinder head, exhaust gas temperature and the fuel pressure are monitored.

The equipment listed in Table 3-1 can be purchased from Göbler-Hirthmotoren KG.

Table 3-1

Description	Part No.
Westach Exhaust gas temperature measuring device (2x, as a set)	029.30
Westach Coolant temperature devise	029.36
Westach Fuel pressure measuring device	029.20
Westach Tachometer	029.14

4.1. Exhaust gas temperature

A gauge that we recommend on all Hirth two stroke engines is the Westach Exhaust Gas Temperature gauge (EGT) as in figure 3.2.1. This gauge is a reliable measurement tool that measures the exhaust gases as they exit the engine. A rich fuel/air mixture which can be caused by improper jetting, clogged air filter, improper prop setting, will generally show up as a cooler temperature. A too lean mixture can be caused by an air leak or fuel blockage, can result in overheating and engine seizure.



Figure 3.2.1 Westach Dual EGT 029.30

The proper location of the EGT probe on the exhaust manifold is extremely important. Mounting the probe too close or too far from the piston will result in an incorrect reading.

If the engine is installed with one carburettor, the probe needs to be located in the centre of one of the exhaust manifold ports 85mm from the exhaust outlet of the engine cylinder exhaust port. If the engine is installed with two carburettors, each probe needs to be located in the centre of each of the exhaust manifold port, 85mm from the exhaust outlet of the engine cylinder exhaust port. Install the probe before reinstalling the manifold and make sure the probe will not touch the other side of the manifold wall.

The 50mm round EGT the gauge will mount from the front of the panel and will require a 52.388mm round hole, a U bracket holds it in place from the rear.

The EGT gauges require probes which come with 100mm of lead. To install the probe, drill a 4.763mm hole in the centre of the exhaust pipe at the recommended distance above. Install the probe into the hole, and tighten up the clamp. As an option, manifolds are provided to suit the "bayonet probe" type. The terminal cable can be lengthened to a maximum of 4.5 metres without affecting the accuracy of the instrument.

Route all wires away from the manifold and other heat sources. Support the wires every 300mm intervals, using tie wire or similar. When going through firewalls etc, use rubber grommets to prevent damaging the wiring. Do not route these wires with any wires from an AC source, such as a lighting coil, spark wires, tech wires, etc. The EGT operates on .004 millivolts. Running near an AC source will result in incorrect readings.

It is important that you verify the EGT readings by careful examination of the spark plugs. A reading on an EGT of 1100 to 1200 degrees F should give a nice tan coloured spark plug. Lower readings should give darker colours while higher readings grey/white colours. Once you have verified a spark plug colour and seen where your gauge reads with the proper colour then it is now more important to watch for a CHANGE in the gauge reading from this "normal reading."

It is important to set your engine up for proper fuel to air mixture, your EGT gauge and probes can aid in doing this. A lean mixture will run hotter on the EGT. A rich mixture will run cooler on the EGT but will make increasingly less power. Ideally the highest EGT temps should come in at settings usually 5200 to 5800 rpm.

Reason for EGT temperature changes include:

- Air intake leak.
- Air fuel mixture too lean
- Air fuel mixture too rich
- Changes in density altitude
- Changes in relative humidity
- Changes in air temperature
- Pre-ignition or detonation
- Fault spark plug or ignition system
- Improper prop load
- Poor quality or grade of fuel
- Improper fuel air ratio, plugged main jet, failed needle jet, or clip

4.2. Fuel Pressure

As mentioned previously, it is recommended to maintain a constant fuel pressure under all conditions. Additional monitoring of fuel pressure by means of a fuel pressure gauge may also be considered. One such suitable gauge is manufactured by Westach and is available for pressure of 16psi and 80psi.

Figure 3.3.1 Westach fuel pressure gauge 029.20/029.21

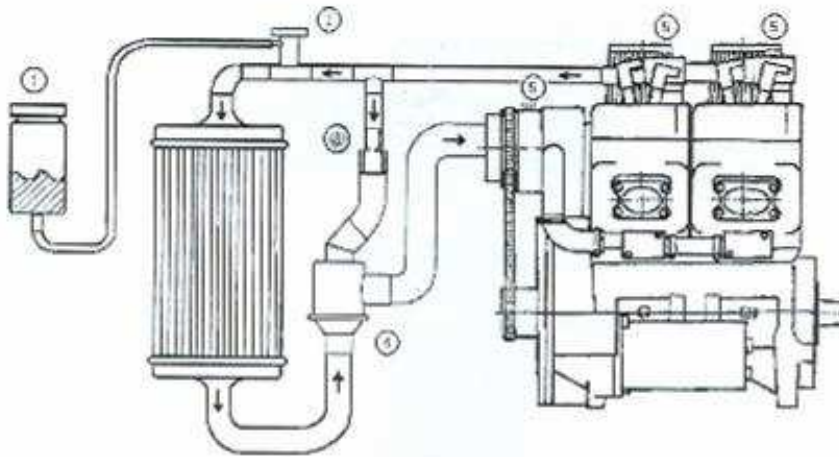


4.3. Coolant Temperature Gauge

The temperature probe is located on top of the cylinder head. Replace the hex screw on the cylinder head that exits the hot coolant to the radiator system for a correct reading.

Figure 34.1 Westach Liquid Coolant Temperature gauge 029.36

5. Instructions for assembling the coolant system



1. Compensation tank
2. Filler cap with integrated expansion tank
3. Reduction with throttle
4. Thermostat
5. Ventilation screws

5.1. Operation

The pump forces the coolant into the cylinder jacket the passes into the heads. From which it flows back via the bypass through the thermostat into the coolant pump. By throttling the flow speed, the reduction resulted in a faster heating of the engine. As soon as the operating temperature is reached, the thermostat opens the inlet and closes the bypass opening. Now the cooling liquid is flowing from the engine through the radiator via the thermostat into the pump.

- The diameter of the hose must be at least 22 mm (internal diameter)
- The material used for the hose must be resistant against cooling withstanding an operation temperature of 120°C continuously and 140°C shortly with a system pressure of 1.5bar (21.7psi).
- Take care not to exchange the connections of the thermostat.
- Install reducer in the bypass lead.
- Mount the water filler cap on the topmost point of the cooling system.
- Take care to install the cooling system in a way that steam bubbles arising in the engine can escape into the expansion tank of the filler cap.
- The compensation tank must be placed at a maximum of 200mm below the filler cap.

- Take care to operate the engine in warmer climates with anti-freezing solution (for aluminium engines) (protection against corrosion)
- The water filling cap must be filled to the brim.
- In cold conditions the compensation tank must be filled about one third of coolant.
- Take care to vent the cooling system thoroughly before the engine is started,
- Take care to warm up the engine at mid speed (about 3000 rpm) until the coolant temperature is decreasing (because of retarded thermostat opening the temperature shortly can be more than 90°C)
- When the engine has run for some time it is necessary to check the level of the coolant water and top up if necessary.
- The coolant temperature should not exceed 118°C.

6. Specifications – 3503 engine

Table 4 .1

Manufacturer	Göbler-Hirthmotoren KG
Model	3503
Operating mode	Two stroke
Number of cylinders	Two in line
Piston Capacity	625 cm ³ (38.1 cu in)
Stroke Length	69 mm (2.72 in)
Bore	76mm (2.99 in)
Compression ratio	9.5:1
Performance	51.5 kW (70 HP) @ 6,500 rpm.
RPM, max.	6500 rpm
Direction of revs	Left, looking towards the drive shaft
Starter	Electric Starter and/or Recoil Starter
Ignition System	PVL CDI system, single or dual
Generator	250 W, 12 V
Sparkplugs	BR 8 ES (NGK) WR 4 CC (Bosch), W 24 ERS (ND)
Ignition Timing	18 ⁰ v. OT (at 2000 rpm)
Carburation	2 DELLORTO PHBE 34 BD 6832, 2 Air filters
Cooling	Liquid cooling
Mixing	1:50
Fuel	Premium unleaded, 95 Octane
Two Stroke oil	Branded two stroke oil for hot (air-cooled) engines
Cylinder head temperature Max	
Exhaust gas temperature max	680 ⁰ C / 1256 ⁰ F
Fuel pressure min.	0.3 bar / 5.8 psi
Engine weight with exhaust System	36kg / 79lbs

Operation of the Engine

6.1. General

It is important to observe the instructions provided in this chapter in order to maintain a safe and economical operation of the engine.

- USE ONLY THE PRESCRIBED TYPE OF TWO STROKE OIL AND THE PROPER GRADE OF FUEL.
- INSURE THAT FUEL IS MIXED IN THE CORRECT GAS/OIL RATIO. REMOVE THE FUEL FROM THE CARBURETOR BOWLS AND FUEL TANK WHENEVER THE ENGINE IS NOT GOING TO BE USED FOR AN EXTENDED PERIOD. AFTER A LENGTHY STANDDOWN, REMOVE ANY LEFTOVER FUEL IN CARBURETOR BOWLS AND FUEL TANK BEFORE OPERATING THE ENGINE.
- TAKE CARE THAT THE AIR CIRCULATION IS SUFFICIENT SUPPLY THE CARBURETORS.
- ENSURE THAT HEATED EXHAUST AIR FROM THE COOLING SYSTEM IS NOT SUCKED INTO THE CARBURETORS.
- USE ONLY RESISTOR TYPE SPARK PLUGS AND RESISTOR PLUG CAPS.
- ALWAYS ALLOW THE ENGINE A WARMUP AND COOL DOWN PHASE:

6.2. Running in - Recommendation

Göbler-Hirthmotoren KG does not give explicit instructions for running in its engines, since the nickel-silicium coating of the cylinder and the aluminium pistons do not have to wear to each other. The engines are ready for full throttle from the time they are built if the maximum temperatures of the cylinder head and exhaust gases mentioned earlier are not exceeded.

However, it would be wise when the engine is first started, to run the motor at half throttle and load (not over 4000 rpm) for the first hour of operation. Please note, the engine has been initially run at the factory to set the electronic timing so it is possible when the engine is first started, there may be more smoke than usual. This is generally due to excess oil possibly still in the engine during assembly and will reduce to normal after the engine has been running for a couple of minutes.

6.3. Initial Inspection

After the first 10 - 15 hours in operation or after a large service the following service tasks should be carried out:

- Tighten the engine fitting screws as a safety measure
- Re-torque the cylinder head screws as a safety measure
- Tighten the sparkplugs as a safety measure
- Visual check (leakage, loose nuts/screws etc.)

Note:

It is recommended that the following inspection be carried out for safety reasons before each use of the engine:

- Starter (check connections, fitting and condition)
- Carburettors (check connections, fixtures and condition)
- Ignition system (check connections, fitting and condition)
- Liquid cooling system (check fitting and condition; check pump fan belts for condition and tension)
- Cylinder head (check connections, fitting and condition)
- Cylinders (check fixtures and condition)
- Exhaust gas manifold (check fitting and condition)
- Exhaust system (check fixtures and condition)
- Sparkplugs and sparkplug leads (check fitting and condition)
- Fuel system (check for leakage and dirty filter)

6.4. Starting Procedure

- Secure the fuel supply (fill the tank, open the fuel cock,...)
- If the engine is cold, engage the choke(s). If the engine is warm or hot do not engage the choke.
- Move the throttle lever into a fast idle position.
- Switch on the ignition system (ON-Position of the ignition switch)
- Start the engine (Activate starter maximum 10 seconds)
- When the engine has started, reduce the choke slowly to the off position and apply a small amount of throttle.
- Allow the engine to warm up at a ¼ load or 3000 rpm for about 3 minutes.
- The engine should now be ready for operation.

Please note: If the engine has a centrifugal clutch installed within the drive system, then engine should be run with the clutch firmly engaged to avoid unnecessary wear of the clutch lining.

6.5. Operating condition of the engine

While the engine is running, the liquid coolant temperatures and the exhaust gas temperatures of both cylinders should be monitored. So long as the maximum temperatures of the coolant and/or exhaust temperature are not exceeded, the engine can be run without a time limit in the set load range (also full load)

at maximum performance). It is further recommended during operation to monitor the fuel pressure. Lack of fuel pressure will lean the fuel mixture and lead to a loss of performance and cause the engine to fail.

6.6. Powering down the engine

Before the engine is switched off, it should be run for a short period at fast idling revs. This will allow the cooling system to reduce the temperature of the engine gradually without stressing any components and overheating.

Maintenance

6.7. General

This chapter contains the necessary directions to allow technically qualified persons to carry out the smaller repairs and inspections such as:

- Periodic inspections of the engine
- Maintenance of engine parts
- Troubleshooting

6.8. Tools, special tools and torques

The specifications and sizes of tools are given according to the metric system and can be procured commercially in specialty shops.

Tools:

Description	Size	Description	Size
Adjustable wrench	7	Adjustable wrench	8
Adjustable wrench	10	Adjustable wrench	13
Hexagon socket screw key	3	Hexagon socket screw key	4
Hexagon socket screw key	5	Hexagon socket screw key	6
Sparkplug wrench		Sparkplug wrench	20.6/20.8
Torque wrench	0 -100 Nm	Screwdriver	

Special Tools:

The special tools are available for purchase under the indicated G.-H. numbers from AATI Pty Ltd or a Hirth distributor.

Description	GH-Number
Magnetic wheel - extractor	W 138
(Piston ring clip (Piston -aid in assembly))	W 108/15

Torque settings

Description	Initial Torque	Description	Initial Torque
M4 x	2.8 – 3.3 Nm	M5 x-	4 –4.4 Nm
M6 x	9 -11 Nm	M8 x	23-28Nm
M16 x	70-80 Nm	Sparkplug	16 Nm

7. Maintenance rate - Daily inspections

Before operating the engine, a thorough daily inspection should be carried out. Observe the following points:

1. Air filter - check condition and installation
2. Starter - check condition and installation
3. Ignition system - check condition, fastening, and connections
4. Pump V belt - check condition and belt tension
5. Cowling - check overall condition and the fasteners
6. Crank case and cylinders - check for leaks overall condition of installation
7. Spark plug caps - check condition and the connections

Periodic Inspections

Inspection Rate	25 h	100 h	500 h
Cooling:			
Airway: check for free flow and freedom from pollutants	X	X	X
Check V belts for deterioration and damage	X		
Carburettors:			
Clean the air filters	X	X	X
Check the carburettor setting	X	X	X
Clean the carburettors	X	X	X
Fuel system:			
Clean the fuel filters	X	X	X
Check fuel lines and –connections	X	X	X
Check the impulse line to the diaphragm pump	X	X	X
Ignition:			
Clean the spark plugs	X	X	X
Check the sparkplug air gaps	X	X	X
Exhaust system:			
Check for firm fitting and deterioration	X	X	
Check outlet ports for carbonisation		X	X

Replacement of Parts

The parts listed in Table 3.3-1 should be replaced after the specified number of operating hours. Consideration should be given to components which may show signs of premature failure and replaced accordingly.

Table 7-3-1

Number	Designation	Order number	Operating Hours
2	Sparkplug Single	023.29	50
4	Sparkplug Dual	023.28	50
2	Sparkplug cap	024.22	100
4	Sparkplug cap	024.22	100
2	Piston set		1000
1	Crankshaft	271 AC1U	1000
2	Cylinder Head Single ignition		1000
2	Cylinder head Dual ignition		1000
2	Cylinder		1000
2	Carburettors	Dellorto 54/38/141	1000
2	Air filter	066.16	100

7.1. Maintenance instructions - Carburetors

The Dellorto carburettor jets are jetted by the manufacturer so the engine is guaranteed to run thermally secure. Tampering with the jet systems of the carburetors can lead to overheating and damage to the motor and should be avoided. Only original replacement parts should be used. Information concerning the carburettor assembly may be obtained from AATI Pty Ltd or your Hirth distributor. Should any parts be required, the carburettor specification should be quoted. This is identified on the side of the carburettor intake (.../...).

7.2. Synchronisation of dual Dellorto carburetors

In order to ensure performance and smooth running of the engine, the two carburetors must be synchronised precisely. Note that the idle adjustment screw holds the slide in the same position on both carburetors. Measure and adjust the opening height on both carburetors for this. The two cables which move the slide in the carburettor usually come together in a Y fitting leading to a single throttle cable. The cables between the Y fitting and the carburetors need to be adjusted so that there is some play in the cable at the idle position. This will insure the proper idle position of the slides. When the throttle cable is pulled, the slides of the carburetors should move upward simultaneously from the idle position. Lubricate cables if difficult to operate. Defective or frayed cables have to be exchanged for new ones immediately. Bent cable must be changed immediately.

7.3. The basic setting of the mixture regulating screw

The idle mix regulating screw in the basic setting is opened half a turn in both carburetors. To do this, screw the idle mix regulating screw lightly in towards the stop, then open half a turn.

7.4. Cleaning of the carburetors

Turn off the fuel valve before cleaning carburetors. Open the spring clip which holds the float chamber against the carburettor. Move float chamber downward carefully since it is filled with fuel. Remove the fuel from float chamber along with any debris. Should debris be in float chamber, the fuel filter in the intake line between tank and fuel pump should be checked and, if necessary, replaced.

Pull plastic strainer from around the mixing tube and, if necessary, clean with fuel. Screw out the main jet from the mixing tube and check for damage or grime. Replace immediately if damaged; clean with gasoline if dirty, then blow out with compressed air. Never push a sharp object through the main jet as that will destroy it.

Reassemble in logical reverse order. When putting the float chamber back on, insure that the bolts are properly seated. Torn and/or frayed gaskets must be exchanged immediately for original replacement gaskets.

7.5. Inspecting the air filters

To remove the air filters, loosen the clamp on the air filter with a screwdriver, and slide the air filter off from the carburettor flange.

Wash out the air filter with fuel and then dry. To do this, blow out the filter with compressed air from inside to out. Check the filter for damage and replace any defective filters and clamps.

To install the air filter, insert over the carburettor flange and fasten the clamp with a screwdriver again.

7.6. Inspecting the fuel lines

Check the fuel lines between fuel – diaphragm pump, carburetors and fuel tank for leakages and/or other damage. Replace leaking and/or damaged fuel lines.

7.7. Inspecting pulsation lines

Check the pulsation line between the vacuum nipple on the crankcase and the pulse connection of the fuel – diaphragm pump for leakage and/or other damage. Replace the leaking and/or damaged pulsation line.

7.8. Spark plugs and sparkplug leads

It is recommended that the spark plugs be checked one after the other to avoid mixing up the sparkplug leads and their connecting positions.

7.9. Inspecting the condition of the sparkplug leads

Remove the sparkplug leads and check the contact socket inside for corrosion. Check the SAE-contact (the screwed on contact hood) of the sparkplug for corrosion or "deposits". If there is corrosion or "deposits", replace the sparkplug lead and SAE- contact of the sparkplug (usually here the sparkplug would be completely exchanged - see next paragraph).

7.10. Installing and removing sparkplugs

To uninstall the sparkplug, remove the sparkplug lead. Loosen the sparkplug with the sparkplug wrench and unscrew it.

Before installing the new or still serviceable sparkplug, the air gap (0.8 mm) is to be checked with a feeler gauge and adjusted as required.

Screw the sparkplug into the cylinder head with a sparkplug wrench and torque to the correct setting.

7.11. Condition of the sparkplug

The spark plug should have a dry bright brown colour tone on the central electrode, the insulator of the central electrode and the earth side of the case. If the colour tone changes to a bright very dry grey, the engine is running very hot and the mixture is too lean. Where there is a wet dark brown to black colouring, the engine is running with too thick a mixture. In both cases, AATI Pty Ltd or your Hirth distributor should be contacted.

Check the sparkplug central electrode and earth strap for corrosion (burning). If signs of burning are detected, the sparkplug should be replaced. For more information on how to read sparkplugs, go to the maintenance pages on the www.hirth-engines.de web site.

8. Coolant Pump

It is necessary that the Pump and V belt remain unobstructed. The belt tension should be about 5 mm of movement as shown below:



Figure 10.1 Belt tension.

Adjustment of the belt tension is made by undoing the upper lock nut and adjusting the belt tension by turning the lower nuts thereby moving the pump up or down. When the satisfactory tension is gained, retighten the upper locknut.



Figure 10.2 Lock nut locations

8.1. Changing the coolant pump V belt

To change the V belt, loosen lock nuts previously mentioned. Remove the manual recoil starter on the front of the engine. Replace V belt and reassemble manual recoil starter. Tighten the adjustment nuts to obtain the correct tension and retighten the lock nuts to secure the pump.

9. Trouble Shooting

9.1. Engine does not start or is difficult to start

- Cause: Lack of fuel
Solution: Insure fuel switch is on
Insure fuel filter is clean
Insure that fuel is in the tank
- Cause: Defective or discharged battery
Solution: Replace battery
Charge the battery
- Cause: Lack of compression on one or both cylinders, due to a loose spark plug or a defective piston, piston ring, cylinder head, or cylinder:
Solution: Tighten spark plug to prescribed torque, or ship engine to the manufacturer or an authorized Hirth service centre
- Cause: No spark or weak spark due to defective spark plug, spark plug cap, or a defective ignition
Solution: Replace spark plug, spark plug cap, or have the manufacturer or an authorized Hirth service centre replace the defective ignition

9.2. Engine will not Idle

- Cause : Idle speed set too low
Solution: On the carburettor, screw the idle stop screw in
- Cause: Idle speed set too high
Solution: On the carburettor, screw the idle stop screw out
- Cause: Idle mixture set incorrectly
Solution: Turn the low speed adjuster so that correct idle is insured
- Cause: Defective ignition
Solution: Ship engine to Göbler-Hirthmotoren or an authorized Hirth service centre

9.3. Engine Runs Rough, Uneven, and with Insufficient Power

- Cause: Dirty air filter
Solution: Clean or replace air filter
- Cause: Dirty or defective spark plugs
Solution: Clean or replace the spark plugs
- Cause: Dirty fuel filter
Solution: Clean or replace fuel filter
- Cause: Fuel mixture has too much oil in the gasoline
Solution: Empty tank and fill with fuel of the proper mix
- Cause: Defective sparkplug caps
Solution: Replace the spark plug caps

9.4. Engine does not develop full power

- Cause: Dirty air filter
Solution: Clean or replace filter
- Cause: Dirty fuel filter
Solution: Clean or replace the fuel filter
- Cause: Fuel mixture has too much oil in the gasoline
Solution: Empty tank and fill with fuel of the proper mixture
- Cause: Incorrect adjustment of carburetors, butterfly valve not fully open
Solution: Adjust butterfly valve accordingly
- Cause: One of the two E-Box circuitry is defective
Solution: Send engine to Göbler-Hirthmotoren or an authorized Hirth service centre
- Cause: Defective piston, piston ring, cylinder head, or cylinder
Solution: Send engine to Göbler-Hirthmotoren or an authorized Hirth service centre
- Cause: Incorrect timing
Solution: Adjust the timing; contact your Hirth service centre for the correct procedure

9.5. Excessive Liquid Temperature

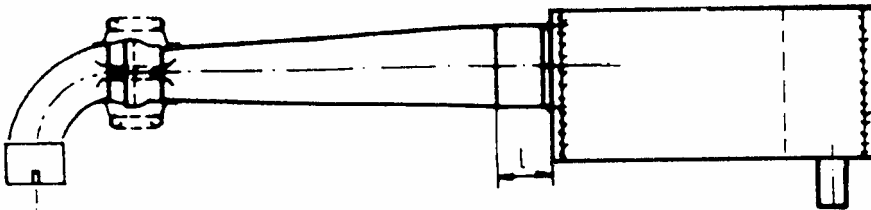
- Cause: Coolant pump belt too loose or defective
Solution: Tighten coolant pump belt or replace
- Cause: Defective coolant pump
Solution: Replace the coolant pump
- Cause: Insufficient cool air reaching the radiator
Solution: Install radiator so that fresh air passes through unhindered
- Cause: Dirty carburettor leaning mixture
Solution: Clean carburettor

10. Exhaust System

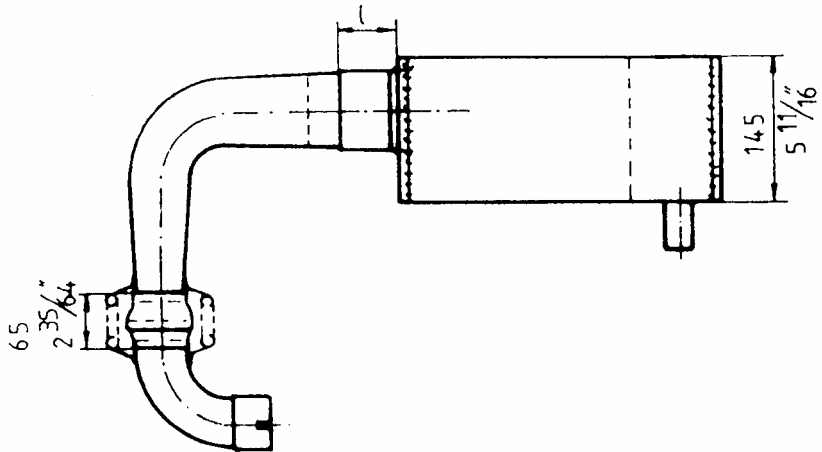
Detailed below are the three basic exhaust versions suitable for the 3503 engine. It is extremely important to note the distance where the diffuser is inserted into the silencer. On the 3503 engine, the distance of "I" is 0mm therefore the diffuser MUST be inserted completely into the silencer then withdrawn 0mm.

		1x	F308 A5U	Connection Bow	
	Ver. 1	1x	278 T19U	Diffuser cone (straight)	I = 15 mm
or	Ver. 2	1x	278 T20U	Elbow (90°)	I = 65 mm
or	Ver. 3	1x	278 T21U	Elbow (180°)	I = 35 mm
		1x	278 T4U	Silencer	

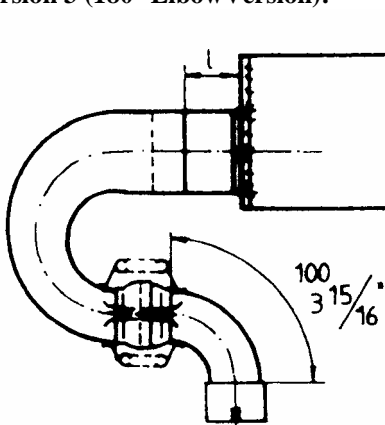
Version 1 (Straight Version):



Version 2 (90° Elbow Version):



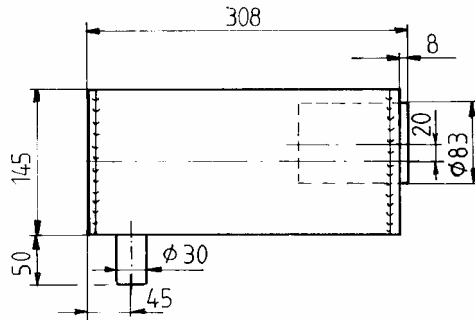
Version 3 (180° Elbow Version):



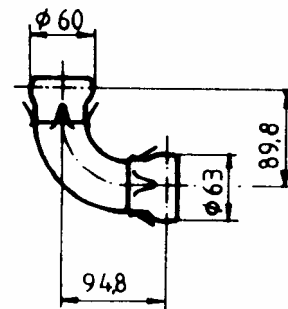
Please note, the performance specified for this engine will not be obtained if an exhaust variant is used which differs from the three basic versions. As a result from such modifications, it is possible that damage may occur to the engine. There will be no liability by Göbler-Hirthmotoren KG to provide any warranty for any malfunction or damage incurred by such modifications.

10.1. Exhaust parts and measurements

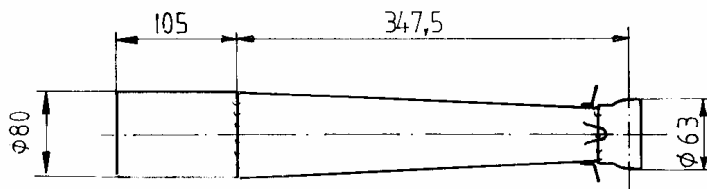
278 T4U Silencer Complete
Weight : 3,2 kg



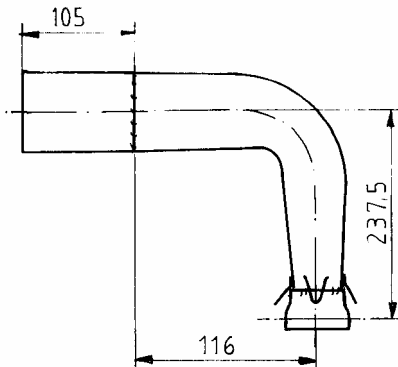
F308 A5U Connection Bow
Weight : 0,56 kg



278 T19U Diffuser Cone, Complete
Weight: 1,5 kg



278 T20U Elbow 90°, complete
Weight : 1,4 kg



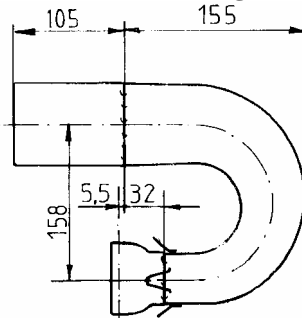
268 A11U Clamp



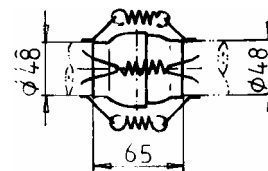
54.1 Spring



278 T21U Bow 180°, complete
Weight : 1,4 kg



278 H4U Ball Joint
Weight : 0,26 kg



11. Wiring Diagrams

The following two diagrams for the single- and dual-ignition systems show the PVL ignition system. These wiring diagrams should be understood as suggestions for the periphery of the ignition system.

Cross section in general: 1.5mm²

Cross section from/to Electric Starter: 16 mm²

11.1. Single PVL Ignition system - 3503

11.2. Dual PVL ignition system – 3503