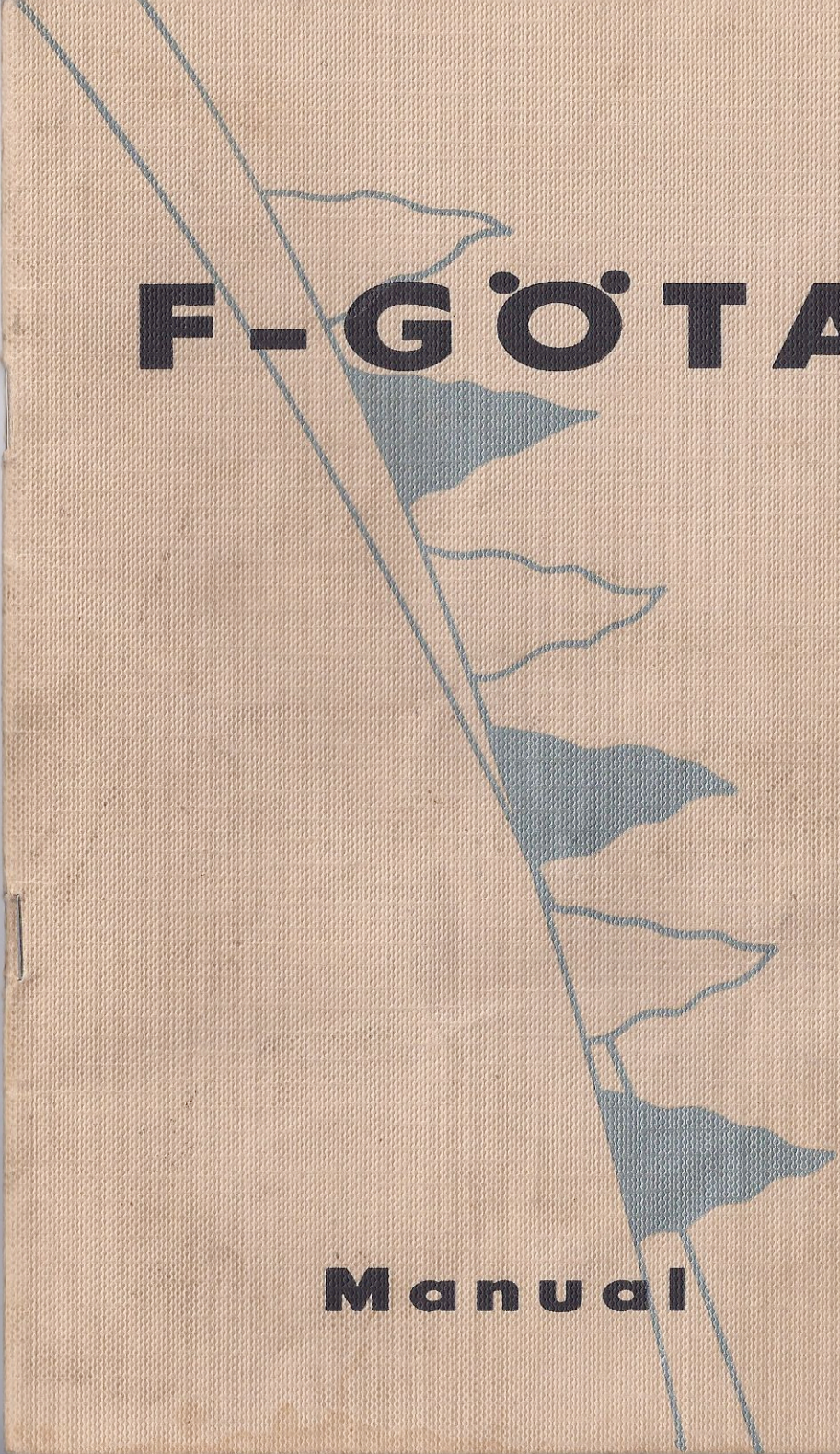
F-GÖTA



Manual

Please accept our heartiest congratulations. You are now one of the constantly growing number of satisfied owners of Göta engines. You can rest assured that your selection was a wise one. We at Götamotorer hope that your new engine will serve you long and faithfully.

AB Götamotorer was founded in 1918. Thus, nearly 50 years of valuable experience in the manufacturing of two-stroke marine engines is incorporated into your new Göta. Built for rugged duty with compact overall dimensions, its simple and reliable design assures you long, trouble-free service.

However, even the best technical equipment demands a certain amount of care and maintenance, and your Göta engine is no exception. We therefore recommend you to familiarize yourself with the contents of this manual before putting your engine into operation.

AB Götamotorer

MANUAL

OF

F-GÖTA

MARINE ENGINE

AB GÖTAMOTORER · OSBY · SWEDEN

TELEPHONE OSBY 100 25 · TELEGRAMS: GÖTAMOTORER · TELEX: 46 44 Opio Osby

TABLE OF CONTENTS

TECHNICAL DATA

Engine	F - GÖTA																		
Type*)	5	5 B	5 V	6 R	6 BR	6 VR	10	10 B	10 V	12 R	12 BR	12 VR	15 E	15 BE	18 RE	18 BRE			
HP	5	5	5	6	6	6	10	10	10	12	12	12	15	15	18	18			
Number of cylinders	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3			
Piston displacement cu.in.	16.48	16.48	16.48	16.48	16.48	16.48	32.95	32.95	32.95	32.95	32.95	32.95	49.40	49.40	49.40	49.40			
Stoke in.	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756			
Bore in.	2.756	2.756	2.756	2.756	2.755	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756	2.756			
Motor r.p.m.	2000	2000	2000	2500	2500	2500	2000	2000	2000	2500	2500	2500	2000	2000	2500	2500			
Propeller r.p.m.	2000	2000	2000	830	830	830	2000	2000	2000	830	830	830	2000	2000	833	833			
Net weight, motor lbs. ca.	88	132	88	110	143	110	132	176	132	154	188	154	198	243	209	253			
Gross weight, motor lbs. ca.	154	221	154	176	221	176	221	275	221	242	275	242	298	342	308	352			
Net weight, equipment lbs. ca	20	20	46	22	22	49	27	27	62	29	29	64	59	59	62	62			
Gross weight, equipment lbs. ca. ...	46	46	73	49	49	75	53	53	88	55	55	91	73	73	75	75			
Shipping box, motor c.ft. ca.	7.1	8.8	7.1	7.1	8.8	7.1	8.8	10.6	8.8	8.8	10.6	8.8	12.4	12.4	12.4	12.4			
Shipping box, equipment c.ft. ca. ..	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	3.2	3.2	3.2	3.2			
Fuel consumption U.S. g/h ca.	0.55	0.55	0.55	0.69	0.69	0.69	1.14	1.14	1.14	1.38	1.38	1.38	1.58	1.58	1.72	1.72			
Fuel	Gasoline or kerosene																		

*) Designation: B = Reverse gear, V = Reversible propeller, R = Reduction gear, E = Electric equipment

GENERAL INFORMATION

This manual contains directions for correcting only those types of trouble which every boat owner can fix himself. We advise you not to attempt any repairs or adjustments except those covered in this manual.
All major repairs should be done in authorized service shops or factories which have the special tools needed to do these more complicated jobs in an expert manner.
In all correspondence with your engine supplier it is important that you specify the type of engine, its serial number, the date of purchase and the special problems you are encountering.

INSTALLING THE ENGINE

Make a hole in the stern post or stern sheet of the boat of sufficient diameter for the stern tube and for the slant of the propeller shaft. Insert the tube in position and screw the propeller bearings on to the tube; then pack the space round the tube in the hole. Place the engine on the bed and insert the stern shaft in the tube. Now align the engine on the bed and the stern shaft in the tube very carefully with the aid of the flange on the engine, so that these parts will be in line with one another. Then bolt down the engine on the bed and screw fast the propeller bearing. When this has been done, check once more that the engine and stern shaft are in line. Adjust the length of the stern shaft, if necessary, so that the shaft reaches the bottom of the engine flange coupling and the propeller does not rest on the outer propeller bearing. Screw fast the bushing of the inner propeller bearing and the flange coupling with the set screws in the stern shaft after having made indentations in the shaft for the set screws with a 6.5 mm. drill. Then lock the set screws. Check the alignment of the engine and the stern shaft after the boat is launched and, if necessary, the engine should be realigned.
After the engine, shaft, tube, and bearings have been installed, locate the fuel tank and secure it, preferably some 200 mm. higher than the carburetter, and run the fuel supply pipe so that no air bubbles are formed and no sharp corners or edges come in contact with the pipe. Outlets for the fuel pipe are provided on the fuel tank: the outlet for a carburettor with pump is at the top; the outlet for other carburettors is underneath. The existing pipe bend can be used for venting.
The sea cock, its fitting, and the strainer are to be located close to the engine and in a position where is no danger of air being drawn in when the boat rolls and pitches. Then connect the sea cock with the pump

by a hose; locate the hose without any sharp bends. The cooling-water discharge should have an outlet trough the planking above the waterline. Finally, either a "dry" or a water-cooled silencer is connected up as close to the engine exhaust pipe as possible (no more than 80 cm) using the flanges and nipples supplied with the engine. These are provided with 1¼" pipe threads. A water-cooled silencer can be connected direct to the exhaust manifold. After the silencer, the discharge pipe is led out through the outside planking of the boat. The pipe bends should have radii as large as possible to ensure an unobstructed passageway. The pipe should discharge sufficiently high above the surface of the water to ensure that as little sea-water as possible enters from astern. The end-section of the pipe should therefore be gooseneck-shaped, i.e. it should rise gently, then drop abruptly before turning outward again.
"Dry" silencers require a ¾" discharge pipe; water-cooled silencers require a discharge pipe with a 28-mm outside diameter, soldered to the connecting nipple. The outlet of the water-cooled silencer should point downwards. It can then hold approx. ½ litre of water without risk of water entering the engine. A three-way cock can be mounted ahead of the water intake on the silencer so that water can be led out through the outside planking when starting and stopping, and through the exhaust pipe when the engine is running. No water is to be introduced ahead of the "dry" silencer.
Asbestos cloth or asbestos yarn can be applied to the silencer with waterglass or the like to provide heat insulation.

DIRECTIONS FOR RUNNING-IN

All F-Göta engines are carefully tested, adjusted, and run on blocks before delivery. Nevertheless, it will be necessary to run the engine cautiously during the first 20 or 30 hours. The object is to obtain a hard and polished surface on the cylinder wall, piston, and bearings of the engine, the bearings and teeth of the reverse gear and magneto drive, so that the engine will run well and have a longer life. The directions given under "Table for running-in" should be closely followed.
We make sure before the engine leaves the works that all fits are satisfactory. We accept no responsibility, therefore, for scoring of piston and bearings. Our guarantee is forfeited unless the running-in of the engine is done with care and due observance of our instructions.

LUBRICATION

Close attention should be devoted to lubrication by the owner who wishes to keep his engine in good trim. Proper lubrication means long engine life, dependable operation, and high efficiency.

The Göta engine works on the two-stroke principle and lubrication is obtained by adding a certain amount of lubricating oil the fuel, which may be either petrol (gasoline) or kerosene. Very small drops of fuel combined with air enter the crankcase by way of the carburetter. The heat in the crankcase vaporizes the fuel, so that the drops contain a larger amount of lubricating oil. The main bearings and connecting rod bearings are lubricated by the diluted oil which adheres to them. The dilution of the oil puts its lubricating properties to a severe test, and therefore the oil used must be of the best quality. Unsuitable oil would in a short time result in worn-out bearings.

As the remaining drops are carried towards the hot combustion chamber, the fuel is more completely vaporized, and the remainder consists of the undiluted oil which lubricates the piston and piston rings.

To meet the problems inherent in the described method of lubrication, the lubricating oil must possess the following properties:

It shoud produce a homogeneous mixture with petrol (gasoline) or kerosene;

Even in a highly diluted state it should provide perfect lubrication;

It should provide a seal between the piston and cylinder wall so that there is no "blow-by" of combustion gases into the crankcase;

After lubricating, the oil should burn without leaving any appreciable deposit.

We recommend the following lubricants:

Cylinder and crankshaft bearing:

Caltex	Two Stroke Oil
Castrol	2 Stroke 30—40
Esso	2 T
Shell	2 T Two Stroke Oil
Gulf	Two Stroke Oil
BP	Two Stroke Energol

or equivalent

Reverse gear, reducing gear without reverse gear and magneto drive with excentric for driving water pump:

Caltex	Universal Turban 90
Castrol	Castrol S.T.-90
Esso	Gear Oil GP 80—90
Gulf	M.P.-90
BP	Gear Oil SAE 90 E.P.

or equivalent

Inner propeller bearing, water pump type Jabsco and reversible-blade propeller:

Caltex	Marfack MP 2
Castrol	Castrolease Water Pump
Esso	Multi-purpose Grease H
Shell	Shell Retinax A
Gulf	Guflex A
BP	Energrease C5

or equivalent

Note.

Upon delivery, the reverse gear, reducing gear, and magneto drive housings contain correct quantity of suitable oil.

TABLE FOR RUNNING-IN

It is the utmost importance that the engine is treated with care and run to a fit as instructed. The following table should be adhered to:

5 hours at half speed								with a mixture of 1:18						Gasoline Petrol						or kerosene as fuel.	
5 to 10 hours at ¾ speed					,,		,,	,, 1:18	,,					,,		,,		,,		,,	
10 or 20	,,	,,	full	,,		,,		,,	,, 1:18	,,				,,		,,		,,		,,	
20	,,	,,	,,	,,		,,		,,	,, 1:25	,,				,,		,,		,,		,,	

MIXING THE FUEL

The oil and the fuel must not be mixed in the tank but in a separate vessel — a jeep canister or the like.

To obtain a 1:25 mixture, add one litre of oil to 25 litres of fuel.

First pour a few litres of fuel into the container and then add oil several times. Shake the container well each time oil is added.

When the oil is well dissolved in the fuel, pour in the remainder of the fuel, close the container and turn it upside down a few times.

STARTING THE ENGINE

1—2 cyl. F-Göta

Open the bottom cock on the water intake. Check to see that there is fuel in the tank. Open the cock on the fuel tank. Check the carburettor to see that the main jet adjusting needle is opened ½ to 1¼ turns, and that the idle jet adjusting needle is open ¾ to 1¼ turns.

See description of carburettor.

The idling jet of the carburetter is adjusted at the works—about 1¼ turn — and should not be reset except in cold weather, when it should be screwed out slightly. Close the choke to start up a cold engine. Open the

throttle valve slightly and set the magneto lever for retarded ignition (turn counterclockwise as seen from the magneto breaker cap). See that the reverse gear, if any, is disengaged. Wind the starting cord clockwise in the pulley groove and pull the engine round slowly a few turns so that it will draw in some fuel. Wind on the cord again and pull till the compression is felt. Then give a strong, quick pull, so that the cord comes off the pulley. As soon as the engine starts running, the choke opens and lets in air.

3-cyl. F-Göta

As described above, but a Zenith 22 RX carburettor is used. A battery, coil and distributor are used for ignition. The engine is started by setting the distributor lever for advanced spark (turn counter-clockwise as viewed from the distributor cap) and turning on the ignition key (clockwise).

As the engine warms up, the choke should be opened wide. The choke is not required for starting up a warm engine. Merely set the throttle valve partly open. If the engine does not start up after 2 or 3 attempts, see before applying the choke whether fuel is supplied to the engine, and that the spark plug is in order; to check the plug, screw is out, earth the shell on the engine block, and see if there is a spark when the engine is turned over. If you think that the engine may have got too much fuel, let the crankshaft turn a few revolutions with the throttle wide open.

RUNNING

When the engine has started running, reset the magneto lever to advanced ignition (turn clockwise). See that the cooling water is circulating properly, and regulate the speed of the engine with the throttle.

CAUTION. The engine must not be allowed to race or run at a higher speed than 2,500 to 3,000 r.p.m.

When a reverse gear or a propeller with reversible blades is used, the engine should be slowed down at reversing, and the speed afterwards increased.

If the engine misfires, the cause is usually that it is getting too much fuel. Turn the main jet needle clockwise until the engine runs smoothly. When the engine is getting too little fuel, puffing and explosion can be heard in the carburetter.

As a rule it is not necessary to adjust the main jet, once it has been set, either when starting, running, or stopping the engine.

Keep the cooling water temperature between 65 and 75°C, as the engine runs best at this temperature.

When reversing with reverse gear or reversible propeller, the speed **must** be lowered with the throttle to keep the engine from racing. Reverse gently; avoid jerky movements. Protect the reverse gear from protracted running astern and heavier loads than necessary.

Tighten the stuffing-box glands of the circulating pump and carburetter main jet slightly if there is any leakage at these points.

STOPPING THE ENGINE

To stop the engine turn the throttle all the way to the carburetter stop screw. The stop screw can be set so that the throttle is closed entirely, bringing the engine to a stop, or into idling position, which latter is preferable. For idling, the magneto must be short-circuited, which is done with a short-circuiting button on the instrument panel furnished with the engine. If no such panel is on hand, an ordinary push button for a door-bell can be used, one pole being connected to the magneto clamp screw and the other to the engine block.

SEM magnetos include a red short-circuit button.

F-Göta engines with electric starters are stopped by turning the ignition key to the left and then depressing the ignition cut-out button.

When the engine has stopped, close the cock on the fuel tank, and the bottom cock on the water intake.

RUNNING ON KEROSENE

For running-in the engine we recommend petrol (gasoline) or a mixture of petrol (gasoline) and kerosene; for instance, half gasoline and half kerosene. When the engine has been run to a fit as directed, it may be run on kerosene alone.

However, the engine must always be started and run on gasoline a short while to warm up before changing over to kerosene. The main jet should be opened slightly wider (1/10th turn), and the idling jet turned in about 1/2 turn for kerosene. The heat range scale number of the spark plug should be equivalent to Bosch 145 T 1.

The cooling-water temperature should be 65 to 75°C at the discharge, and the change-over to kerosene should preferably not take place until the water has reached this temperature. The cooling-water temperature is easily regulated with the sea cock or a valve fitted in the suction line ahead of the pump.

3-cyl. F-Göta engines with Jabsco pump have a built-in water cock, and the bottom cock is not throttled.

To empty the carburetter of kerosene for the next start, the change-over to gasoline should be made before stopping the engine. If there is any kerosene left in the float chamber, however, it can easily be drained through the cock at the bottom. Note that the best motor kerosene is to be used, such as Caltex "Tractortex" or equivalent, and a two-stroke lubricating oil.

CARE OF THE ENGINE

The proper function of an engine, its resistance to wear and tear, and its length of life are entirely dependent upon the care it receives. It will pay you to keep your engine in good condition.

The time devoted to keeping your engine in condition is not wasted; you are well repaid for this attention because a well-tended engine will run much longer. The following advice and directions should be strictly observed. Failure to take due precautions may result in breakdowns, and the cost of repairs is likely to be high.

The lubrication is automatic inasmuch as the crank, bearings, piston, and cylinder are lubricated by the oil mixed into the fuel, and the magneto drive, water pump eccentric, reverse gear, and reducing gear by the oil contained in their respective casings. Lubrication therefore requires but little attention, provided that the right fuel mixture is obtained, and this is, as a rule, supplied correctly prepared by petrol (gasoline) stations.
To make sure that no water will get into the fuel tank, the fuel should be strained through a piece of chamois leather when poured in.

A strainer is fitted in the pipe leading to the carburetter. A filter can be fitted in the fuel supply pipe, but is not necessary.

The quantity of oil in the casings is indicated by the combined filler, level, and drain cock on the magneto drive, reducing gear, and reverse gear casings. These casings are supplied with the right quantity of oil when the engine is delivered, but after the installation of the engine and launching of the boat it is advisable to see that the oil is up to the level plugs. Oil is best added with a small oil gun. Change oil with an oil gun after 10 hours' running to remove metal particles. Then check the oil level after 10 to 25 hours' running. The normal quantity of oil in the magneto drive casing (nearest the flywheel) is about 1 dl, in the reducing gear casing (reducing gear without reverse gear) about 3 dl and in the reverse gear about 10 dl. In cold weather the oil can be warmed slightly to make it flow better.

Without oil the gears will seize

The inner propeller gear is filled with waterproof ball bearing grease. Add oil occasionally through the oil cup on the bearing. Check the bearing at intervals to see if it is overheating because of faulty alignment or lack of grease.

The circulation of the cooling-water should be checked regularly, so that the temperature at the discharge stays between 65 and 75°C. The engine must be stopped **immediately** if the circulation stops, and the fault looked into and remedied. In spite of the strainer at the sea cock, rubbish may have entered the pump and prevented the valves from working. Should this happen, screw out the top plugs in the pump and examine the discs, taking care not to lose the springs of the discs. Before screwing back the plugs, fill the pump with water. To remove air from the pump unscrew the valve plug nearest the pump suction end slightly. If there is any leakage at the pump stuffing box, tighten it while the engine is running until the leak stops. Beldams 1/8" Tartan 116 is suitable for repacking.

Piston-type cooling-water pump for 1- and 2-cyl. F-Göta

554-1 Pump casing
555 Valve disk
556 Spring
557 Suction disk plug
558 Pressure disk plug
561 Stuffing box
562 Seal ring
563 Seal ring
564 Piston
564-2 Wrist pin
592 Gasket
596 Packing for stuffing box
904 O-ring
905 Spacer ring
906 Collar

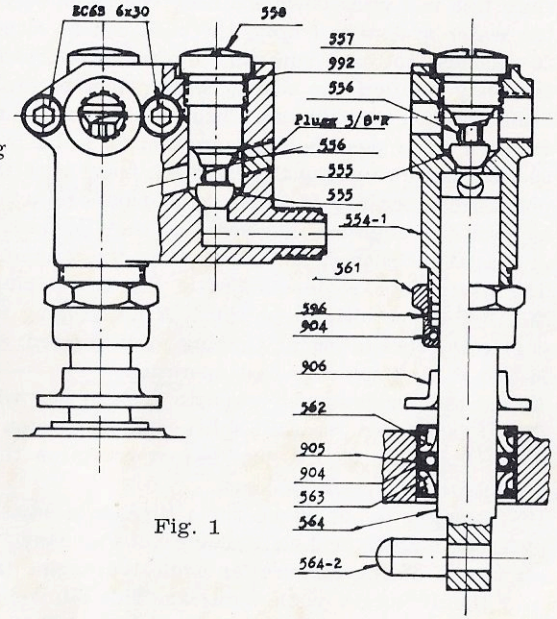


Fig. 1

Cooling-water pump type Jabsco AL ¼-208

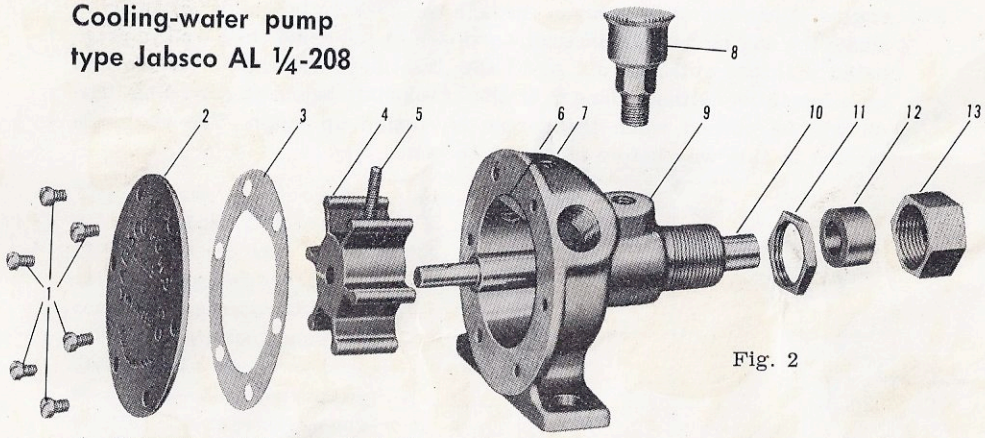


Fig. 2

1 Screws — end cover to body
2 End cover (Model AL ¼-200)
3 Gasket
4 Impeller Model AL ¼-200
5 Screw — impeller to shaft
6 Cam Model AL ¼-200
7 Cam Screw
8 Grease Cup
9 Body
10 Shaft
11 Lock Nut
12 Packing
13 Packing Nut

The Jabsco pump on the 3-cyl. F-Göta must not be permitted to run dry, since this will wear down the neoprene rotor very rapidly. However when the water system is empty, the cock can be closed for a moment (max. 20 seconds) to make sure that the pump is drawing water.

In frosty weather the cooling water must be drained off by opening the drain cock on the cylinder. Then pull the engine round a few revolutions, or run it **a few seconds** to be sure that all water is removed from the pump as well. Before turning the flywheel, make sure that the pump plunger is not frozen, because if it is, some part of the pump may be damaged by even the slightest movement of the flywheel.

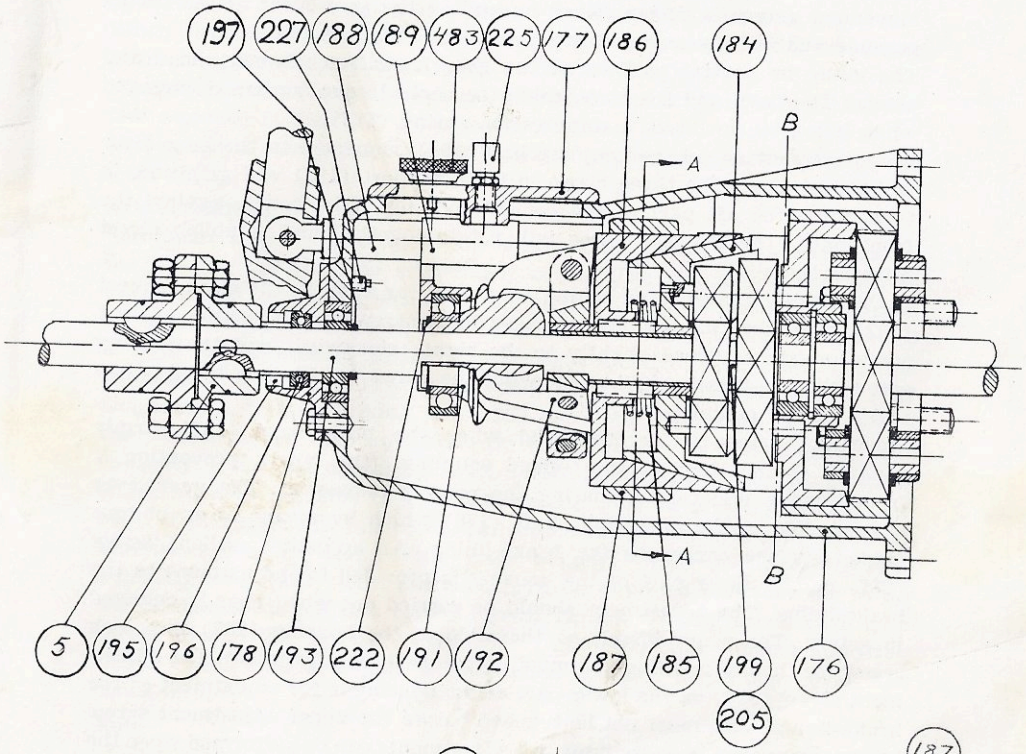
A special instruction is furnished for the magneto.

The heat range scale number of the spark plug corresponds to Bosch M 175 T 1 for normal operation. A hotter plug should be used when the engine is often idling or running at low speed, and a colder plug Bosch M 225 P 11 S for very fast operation.

Adjust the distributor or magneto gear so that when the magneto (distributor) is set for retarded spark and the piston has 5.5 mm remaining before top dead centre, the contact points on the magneto (distributor) should be just ready to open.

If the engine is out of use for a time, it is advisable, to prevent damage by rust, to spray a little Vacuum Oil Company "Sova-Kote 501" into the air intake of the carburetter while the engine is idling; hold your hand over the air intake while spraying. This oil, which possesses strong rust-protective properties, will be found in an oil can which comes with the engine. When the oil is sprayed through the carburetter intake, it tends to choke the engine, but the interior parts are at the same time well impregnated with the anti-rust oil. After this treatment the engine can be laid up a long time without danger of the crankshaft bearings corroding. The oil will be burned when the engine is started up again. The engine is treated in this way before shipment to you.

REVERSE GEAR



The reverse gear mechanism consists of a housing (176) together with a conical coupling, which in turn consists of a cone (184) and a bowl (186) for propulsion ahead, and a reversing coupling (199—205) for driving astern. The reversing coupling is housed in the front half of the conical coupling. In the aft part of the housing an axial thrust bearing is placed together with an oilseal.

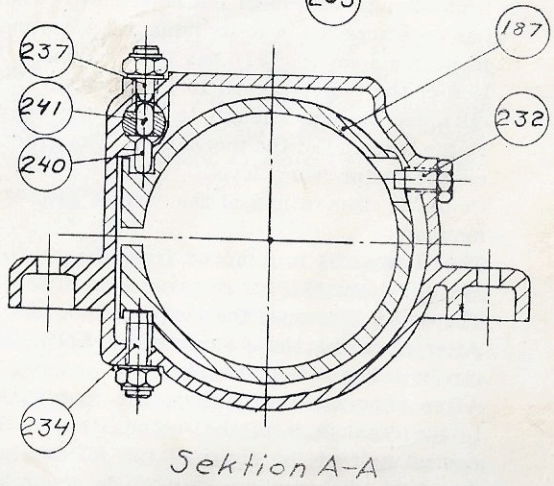


Fig. 3

Movement ahead is accomplished by pushing the gear lever forward when the conical coupling engages.
Movement astern is accomplished by pulling the gear lever aft as far as possible and is fully engaged after weak resistance is felt.
The idling or neutral position of the gear lever lies between ahead and astern. The bowl and the cone inside the conical coupling are disengaged when idling by means of a compression spring (185).
For movement ahead the coupling ball (191) connected to the gear lever will move ahead, the three claws in their support (192) will grip and, in turn, force the aft part of the conical coupling, (the bowl), against the front half, (the slutch). These will rotate together and establish direct drive to the shaft.
If this coupling slips after having been used for a while, the claw support (192), after first having been released by unscrewing the locking (Allen) screw, must be turned slightly to the right (clockwise) and the locking screw then re-tightened, thus allowing the claws to obtain a tighter grip and a firmer coupling.
Movement astern is accomplished when the brake-band (187) firmly engages the aft half of the conical coupling, (the bowl), preventing it from turning and thus actuating the reverse movement. The gear lever is connected to the operating shaft (188) which by means of an oblique angled surface constricts the brake-lining. An adjusting (Allen) screw (237) on the upper part of the housing is provided for adjustment to the brake-lining. The adjustment should be carried out when gear is engaged in astern. The screw visible on thermide of the housing (232) is a lock screw for the brake-lining and must not be used for adjustment. The adjustment screw (234) on the lower part of the housing is for adjustment of the brake-lining. This must not be touched before the upper adjustment screw has been screwed in to its limit. All adjustments can be performed when the inspections cover (177) has been removed. In no case should the inclination of the motor exceed 15°, and within this limit the level of lubrication oil must be high enough to cover the cogwheels of the equalizing gear at the fore end of the mechanism. The graduation of the dip-stick is based on the motor being level.
Complete dismantling of the reverse gear is accomplished in the following manner:
The flange (5) is removed from the shaft.
The end-cover (178) is removed by means of a special tool.
Thereafter dismount the coupling link (189) entirely.
After removing the six connecting bolts, the housing of the reverse gear can be taken off completely.
After removing the housing, the coupling itself is still firmly connected to the crankshaft of the motor. Release the locking screw in the front conical half of the cover of the reverse gear (182 — not shown in the drawing), the coupling can then be separated from the motor.
When the assembly is equipped with reduction gear (shown on the drawing

to the right of the line B-B), dismantling is carried out in the same manner as before, except that the original coupling is attaced to the motor by means of a ball-bearing only, which facilitates its removal.
When dismantling and later reassembling the cog-wheels in the traversing gear, careful note should be made of the markings.
When considering engine repairs, it should be borne in mind, that the best engineer is the least expensive in the long run.
Unless one is competent, a "do it yourself" repair may turn out to be the most costly.

ADJUSTMENT

Movement Astern: The operating shaft (188) passes below the hole in the housing for the fine adjustment screw. The fine adjustment screw (237) should be turned clockwise as far as possible, thereafter released by one turn anti-clockwise. The bottom screw (234) should be screwed in until the brakelining appears to be tight enough. Then check the fine adjustment screw (237) whilst holding the fine adjustment screw (237 and/or 234), tighten locking nuts (235 and 238). Take care not to injure the fibre washers (236 and 239). On the after end of the housing near the gear lever and operating shaft (188) is the travel adjusting screw which must be adjusted to give definite engagement of set-pins (241 and 240). If this screws is turned too far anticlockwise slip will also occur.
Movement Ahead: Rotate the claw support (192) clockwise on the adjusting ring (222) until sufficient grip is obtained to avoid slip when the mechanism is put into forward gear. Tighten locking screw (220 with spring washer 221, not on drawing but located on claw support adjusting ring). Check and re-adjust if necessary. Replace inspection cover and check oil level.

Note

In either ahead or astern gear, if, the coupling or propeller is held stationary and the engine, in gear, cannot be turned by the starting cord then no slip will occur in usage. If, on the other hand, the adjustment are too tight, it will be difficult or impossible to fully engage the gears. It should not be necessary to apply a leverage of more than 50 lb/ins. to engage the gears.

WINTER STORAGE

If the engine is out of use for a time, it is advisable, to prevent damage by rust, to spray a little Vacuum Oil Company "Sova-Kote 501" into the air intake of the carburetter while the engine is idling; hold your hand over the air intake while spraying. This oil, which possesses strong rust-protective properties, will be found in an oil can which comes with the engine. When the oil is sprayed through the carburetter intake, it tends to choke the engine, but the interior parts are at the same time well impregnated with the anti-rust oil. After this treatment the engine can be laid up a long time without danger of the crankshaft bearings corroding. The oil will be burned when the engine is started up again. The engine is treated in this way before shipment to you.

THE CARBURETTER type Zenith 24 T-2

up to and including Motornumber 11476.

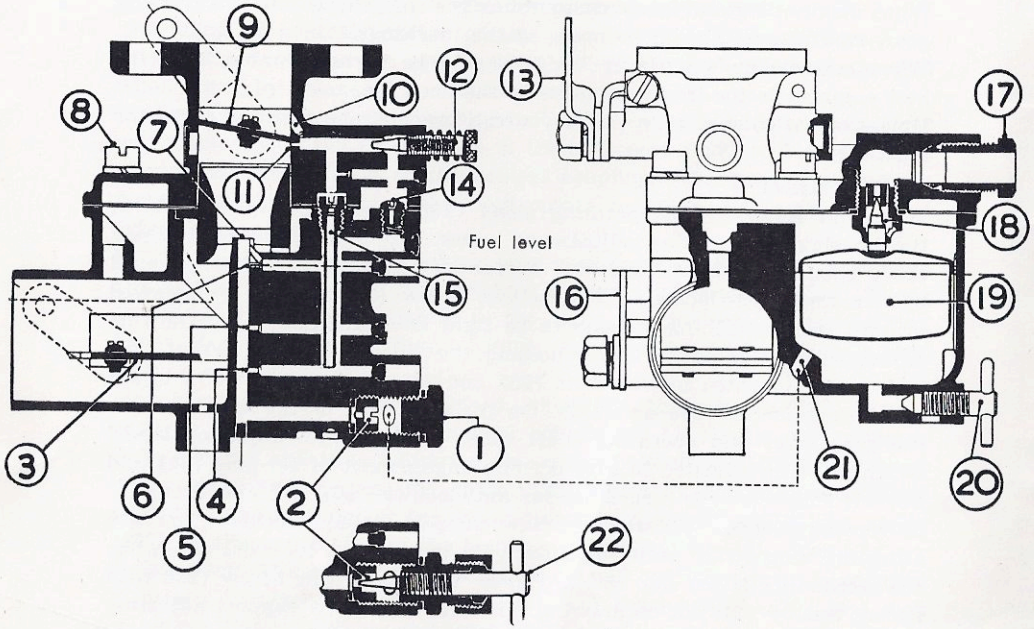


Fig. 4

General description

The 24 T-2 carburetter, shown in section above, is of the vertical type commonly used on light trucks, small marine and stationary engines, and various types of engines for agricultural implements. The float chamber is integral with the carburetter body, so as to be as close as possible to the main fuel passage. This ensures high efficiency in all positions without flooding or starving the engine. The carburetter can be adjusted to admit all the air through the main intake.

The carburetter is composed of two main parts: the top part or cover which is fastened to the lower part—the float chamber—with five screws, one of which is shown at (8). In order to simplify this carburetter as much as possible we use one main jet and one idling jet. Devices are arranged to adapt the air flow for atomization of the fuel and to maintain the correct mixture at all engine speeds. The drawing shows the main jet (2) covered by plug (1). The idling jet is seen at (15). The air supply

to the main jet system is controlled by the air jet (14) to which the air is conducted from the main intake. It should be noted that this air passes through orifices (4), (5) and (6) at high engine speeds, when the fuel in main passage (7) drops to its lowest level. The fuel supplied to the idling jet (15) is atomized by air coming from the main intake, and the supply is controlled by screw 12. This mixture is drawn into the carburetter through the idling duct (10) and auxiliary duct (11). The float (19) is of normal type, as is the customary needle valve (18). The correct fuel level is automatically regulated by the size of the float chamber and float, and the position of the needle-valve in its seat. There is usually one washer against the seat, but two washers can be applied if desired for regulating the fuel level in the float chamber.

Principal adjustments

The venturi, main jet, and air jet combination is correctly adjusted for F-Göta, and there is no need of readjusting them if minor troubles arise. Cleanliness is the major consideration for good operation. Be particularly careful to use the right screwdriver when detaching the main jet to protect the threads in the carburetter body from damage. A tapered needle (22) enters the mouth of the main jet and controls the supply of fuel. When it is screwed in clockwise all the way, the flow of fuel through the nozzle is stopped. If the adjusting needle is screwed counterclockwise more than two full turns, the jet is wide open. Do not screw in the needle too hard, as this will damage it and distort the flow through the jet. Tighten the gland slightly in case of leakage at the needle stuffing box. A gasket must always be placed between the two halves of the carburetter.

Cold starting

The rich fuel mixture required for cold starting is obtained by closing the choke (3), and opening the throttle (9) somewhat. As soon as the engine has picked up speed, the choke is automatically opened and lets in air. As the engine warms up, the choke control must be opened again.

Starting a warm engine

The choke is not necessary when the engine is warm. Should the engine fail to start, check in the usual way the {petrol / (gasoline)} supply, ignition, etc.

If it appears that the engine has been given too much fuel, let the crankshaft rotate a few revolutions with the throttle open.

THE CARBURETTER type Tillotson HL

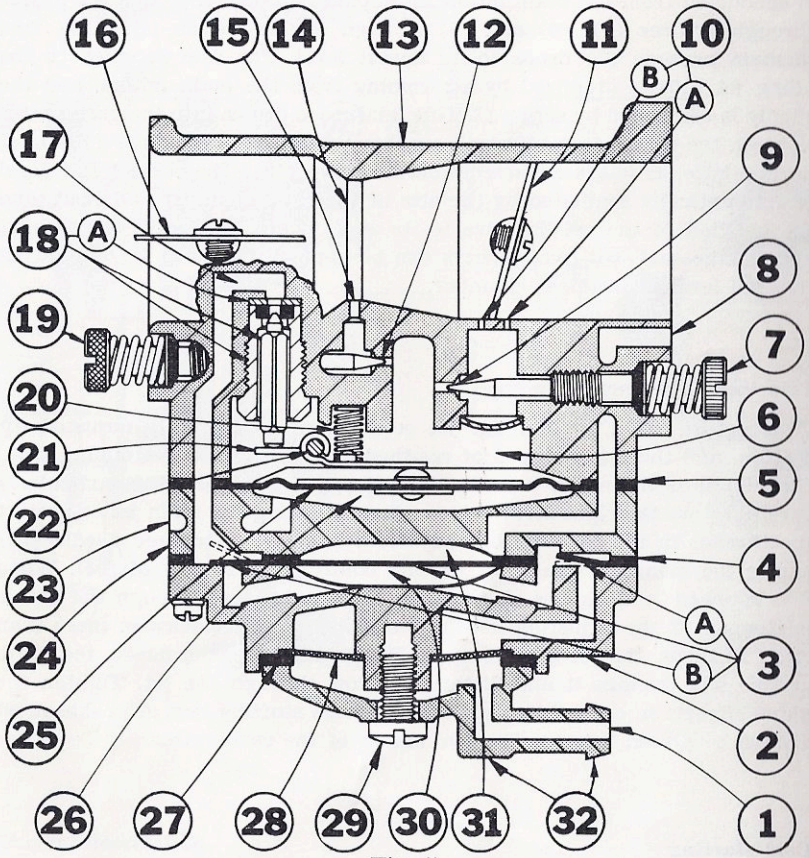


Fig. 5

1 Fuel Inlet
2 Fuel Pump Body
3 Fuel Pump Diaphragm
3A Diaphragm Pump inlet Valve
3B Diaphragm Pump Outlet Valve
4 Fuel Pump Gasket
5 Diaphragm Cover Gasket
6 Metering Chamber
7 Idle Adjustment Screw
8 Impulse Channel
9 Idle Fuel Adjustment Orifice
10A Primary Idle Discharge Port
10B Secondary Idle Discharge Port
11 Throttle Shutter
12 Main Fuel Adjustment Orifice
13 Body
14 Venturi
15 Main Fuel Discharge Port
16 Choke Shutter
17 Fuel Inlet Supply Channel
18 Inlet Needle & Seat
18A Copper Gasket
19 Main Adjustment Screw
20 Inlet Tension Spring
21 Inlet Control Lever
22 Fulcrum Pin
23 Atmospheric Vent Hole
24 Diaphragm Cover
25 Diaphragm
26 Atmospheric Chamber
27 Strainer Gasket
28 Fuel Inlet Screen
29 Strainer Cover Retaining Screw
30 Fuel Chamber
31 Pulse Chamber
32 Strainer Cover

Construction data

The "HL" series carburetor is a lightweight, aluminum die cast carburetor composed of four basic parts: metering body, main diaphragm cover plate, fuel pump body and strainer cover. The diaphragm carburetor incorporates many of the same type components found in float type carburetors: choke, throttle, idle and main mixture adjustment screws, idle speed screw and inlet needle and seat.

Two styles of main and idle adjustment screws are available: "O" ring type and spring loaded packing type. Both types are designed to perform the dual purpose of sealing the metering chamber and providing adjustment screw friction.

A special insert, housed in a brass cage, forms a seat for the inlet needle. An inlet tension spring exerts a pre-determined force on the inlet control lever which holds the needle on its seat.

A metering diaphragm is subjected to engine suction on the metering chamber side and atmospheric pressure on the vented side. Atmospheric pressure on the vented side pushes the diaphragm toward the inlet control lever, opening the inlet needle to allow fuel to enter the metering chamber, from which it is then delivered into the mixing passages.

The vented side of the metering diaphragm may be vented either directly to the atmosphere, or in the case of a belanced carburetor, may be balanced (internally vented) to the choke bore. The balanced type can be recognized by a brass tube in the choke bore which is connected internally to the vented side of the diapragm. The purpose of internal balance is to offset the enriching or choking effect of a partially dirty air cleaner.

Some carburetor metering systems include a ball check type main nozzle. These can be identified by the brass cage located in the venturi choke band of the body casting. The ball check valve allows fuel to flow into the mixing passage and prevents air from flowing into the metering chamber.

The movement of the pump diaphragm draws fuel into the fuel chamber and a reverse movement of the diaphragm forces fuel out of the fuel chamber through the inlet needle and seat into the metering chamber. Movement is caused by pulsations from the engine, acting on the diaphragm.

A plastic turret type inlet connection is the cover to the fuel strainer section of the carburetor and can be rotated 360 degrees for any required fuel connection location. The strainer consist of a fine mesh screen to insure clean fuel supply to the metering section of the carburetor.

Adjustment instructions

To properly adjust carburetor for best performance the engine must be thoroughly warm.

Initial adjustments:

DO NOT FORCE ADJUSTMENTS INTO SEATS!
To start a cold engine, first carefully close, by turning clockwise, both idle and main adjustment screws. Open main adjustment screw counter-clockwise approximately one and one quarter (1-¼) turns. Open idle adjustment screw three quarters (¾) turn. Back idle speed regulating screw off its contact with throttle stop lever, then turn it inward about one (1) full turn so as to slightly open throttle shutter.
Open fuel line shut off valve, close choke shutter, partly open throttle shutter and pull starting cord. When engine fires, open choke shutter slightly and idle the engine. Do not race engine. Then as engine warms, open choke shutter. To start a warm engine it should only be necessary to pull starting cord, if the carburetor is properly adjusted.

Final adjustments:

Completely close throttle shutter and readjust idle speed regulating screw so engine idle speed is approximately 1200 RPM for lawn mowers — 2000 to 2500 RPM for chain saws — then slowly readjust idle adjustment screw to obtain smooth and even engine performance. Poor acceleration may result from setting the idle mixture too lean.

Starting (choke) operation

Starting an engine with the "HL" Carburetor involves the same methods that are used in a conventional float feed carburetor. However, since a diaphragm carburetor does not have the advantage of a great reservoir of fuel upon which to operate, the technique changes somewhat.
When starting a cold engine, place the choke shutter in the closed position and throttle shutter in a cracked or open position. Several pulls on the starter may be needed to raise the fuel pressure to the required amount. As the engine is pulled through with the choke in closed position, engine suction will be transmitted to the diaphragm fuel chamber through both primary and secondary idle discharge ports as well as the main fuel discharge port, creating a low pressure area on the fuel side of the main diaphragm. Atmospheric air pressure on the opposite side will force the main diaphragm upward causing the diaphragm button to depress the inlet control lever, overcoming inlet tension spring pressure, permitting fuel to enter through the inlet seat, by forcing inlet needle off its seat contact, then into the fuel chamber side of main diaphragm, up through the idle and main fuel supply orifices and channels, and out the discharge ports to the engine.
In starting an engine that has been idle and not running for more than an hour, it will be necessary to operate and maneuver the choking mechanism for approximately three (3) to ten (10) seconds depending on how cold the engine has become. The length of time spent warming

the engine is only necessary to the extent that the engine can be made to idle, accelerate and run satisfactorily under wide open throttle conditions.

Idling operation
When engine is idling, throttle shutter is in a partially cracked position. Engine suction is transmitted through the primary idle fuel discharge port to the fuel chamber side of main diaphragm via the idle fuel supply channel. Again, the main diaphragm is forced upward by atmospheric pressure, depressing the inlet control lever overcoming inlet tension spring pressure and permitting fuel to enter through inlet seat, by forcing inlet needle off its seat contact, and filling the fuel chamber side of main diaphragm. The fuel is then drawn up through idle fuel adjustment orifice and delivered to the engine through primary idle discharge port.

Intermediate operation
Fuel is delivered into and through the carburetor in the same manner as when the engine is idling. However, as the throttle opens and engine speed increases, more fuel is demanded from the carburetor and supplied to the engine by valving in the secondary idle discharge port located immediately behind the throttle shutter.
As the throttle shutter continues to open and engine speed increases, the velocity of air through the venturi creates a low pressure area at the venturi throat and diminishes the suction on engine side of the throttle shutter. When the pressure at the venturi throat is less than that existing within main diaphragm fuel chamber, fuel is drawn up through main fuel adjustment orifice and out main fuel discharge port into the air stream entering engine intake.

High speed operation
As the throttle shutter progressively opens from intermediate position to full open position, the air velocity through the venturi increases and fuel is metered up through main fuel adjustment orifice and main fuel discharge port in accordance with the power requirements of the engine. The action of the main diaphragm is the same as previously described with suction required to operate the diaphragm being transmitted through the main fuel discharge port.

HOW TO DISASSEMBLE
For Cleaning and Repair:
The model "HL" carburetor can be cleaned under adverse conditions — working on a clean surface with a minimum of tools. Before disassembling carburetor it is IMPERATIVE to flush it clean of sawdust and dirt by pouring gasoline over it and tools.

1. Remove strainer cover retaining screw and plastic cover.
2. Remove strainer cover gasket and strainer screen.

3. Remove screws and fuel pump body.
4. Remove fuel pump diaphragm and gasket.
5. Remove main diaphragm cover plate.
6. Remove main diaphragm.
7. Remove main diaphragm gasket.
8. Remove inlet control lever fulcrum pin, lever and tension spring.
9. Remove inlet needle.
10. With a thin wall $^{5}/_{16}$" Hex socket carefully remove the inlet seat. Remove inlet seat gasket. When reinstalling seat, tighten only from 25—35 inch-pounds or 34 Kg-Cm.
11. Remove idle and main adjustment screws.
12. When reinstalling "O" ring type adjusting screws, lubricate with 30 SAE oil to prevent seizing. Packing spring type adjustments do not require lubrication.
13. The ball check type main nozzle can be removed by tapping it out of the body casting into the venturi with a small punch. A replacement ball check nozzle should be pressed into the casting with the cross holes in line with the main adjustment needle. The brass cage should be pressed flush with the metering chamber casting.

Before reassembling the carburetor (in reverse order as outlined above), wash ALL component parts in clean gasoline and blow off with compressed air. The channels in the metering body should be cleaned by blowing through the idle and main adjusting orifices.

All fuel passages in the three castings should be cleaned with compressed air. Do not clean orifices or passages with wires or drills as this might cause damage and incorrect operation of the carburetor.

Trouble data

Trouble	Possible cause	Remedy
Carburetor floods	Dirt or foreign particles preventing inlet needle from seating.	Remove, clean and replace
	Diaphragm lever spring not seated on lever dimple.	Remove lever and reinstall
	Diaphragm improperly installed in carburetor.	Replace diaphragm or correct installation
Engine will not accelerate	Idle adjusting screw set too lean.	Enrich idle adjustment
	Incorrect setting on diaphragm lever.	Reset
	Diaphragm cover plate loose.	Tighten
	Diaphragm gasket leaking.	Replace

Trouble	Possible cause	Remedy
	Main fuel orifice plugged.	Remove diaphragm cover, diaphragm, diaphragm lever and main adjusting screw. Clean out orifice by blowing through main adjustment theraded hole.
Engine will not idle	Incorrect idle adjustment.	Reset to best idle
	Idle discharge ports or channels clogged.	Blow out with compressed air, or, if compressed air is not available, clean and flush with gasoline.
	Diaphragm lever set incorrectly.	Reset diaphragm lever so it is flush with the floor of the diaphragm chamber.
	Throttle shutter cocked in the throttle bore causing fast idle.	Reset
	Dirty nozzle check valve.	Clean or replace
	Welch plug covering the idle discharge ports does not seal. This causes the engine to idle with idle adjustment shut off.	Replace welch plug, following instructions outlined in service hints.
Engine runs out lean	Tank vent not operating correctly.	Clean, if possible, or replace
	Leak in fuel system from tank to pump.	Tighten or replace fittings or line
	Ruptured fuel pump diaphragm.	Replace
	Main fuel orifice plugged.	Clean
Carburetor runs rich with main adjustment shut off	The $^{1}/_{8}$" diameter nozzle channel plug, or nozzle check valve cage, is not sealing.	Install new plug or new cage

NOTE: IN MAKING CARBURETOR ADJUSTMENTS TURN ADJUSTMENTS CAREFULLY AND GENTLY — DO NOT RAM ADJUSTMENTS INTO SEATS.

Set endinge idling speed in accordance with engine manufacturer's recommendation.

CARBURETTOR, type Zenith 22 RX

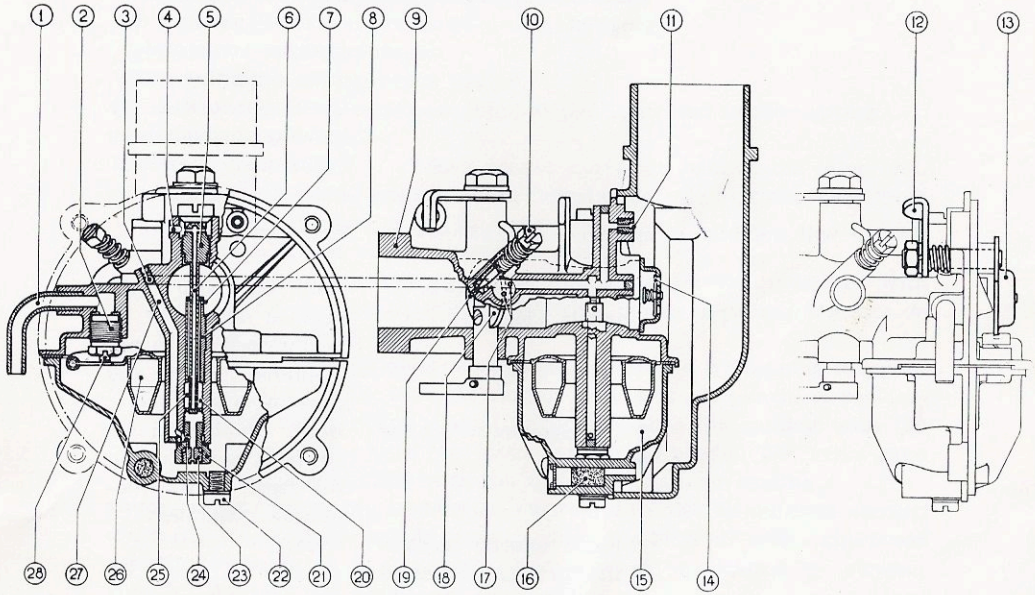


Fig. 6

The 22 RX carburettor is built for use in industrial and marine engines. The jet assembly is arrenged in the ring-shaped float shaft in the float chamber. The engine with carburettor can thus be tilted considerably without affecting the constant fuel level — which would, in turn, affect the operation of the carburettor.
The carburettor is fully enclosed, which means that the secondary air intages (for mixing air and float chamber for example) are connected to the main air intake which receives filtered air.

Description

The carburettor comprises a main assembly called the carburettor body (9), a float chamber (15), and a bent air-intake pipe (11).
The main assembly (9) includes a throttle, choke, and a fuel intake.
The float chamber (constant level fuel chamber) contains the float.
The bent air-intake pipe does not include any components which are of interest in connection with the functioning of the carburettor.

Operation

The fuel reaches the carburettor via the fuel-intake pipe (1), passes through the needle valve seat (2) and runs into the float chamber (15).

The fuel level in the float chamber is kept constant by means of the float (26), which actuates needle valve (28).

Normal running

The fuel passes through the main jet (23), which is screwed into the main jet carrier (21) and flows into the ring-shaped chamber (20). Air flows from the other side through the theraded holder (5) for the spray nozzle. It enters via opening (4), passes through pipe (6) and holes (25) into the ring-shaped chamber (20). The air-fuel mixture thus obtained is drawn out by the vacuum maintained in the intake manifold by the engine. It is drawn through the holes (7) in the outer pipe (8). The positioning and dimensions of holes (25) make certain that the automatic features built into the carburettor function properly. These automatic features guarantee trouble-free engine operation by supplying the most suitable air-fuel mixtures at different speeds and loads ranging from full load to idling.

Idling

When idling, metered fuel is supplied through the calibrated hole (24) at the side of the main jet carrier (21). This fuel is drawn through the idle fuel passage (27) to point (3). Point (3) is joined to another passage which originates at the calibrated idle air intake (11). Metered air passes through it, and the resulting air-fuel mixture flows to the needle valve seat (10). The mixture is atomized as it is discharged through the idle discharge hole (19) and into the carburettor body.
Two other openings, called the acceleration holes, (17) supply the correct air-fuel mixture both quantitatively and qualitatively during the earlier stages of throttle (18) opening, when the engine is accelerating or otherwise heavily loaded.

Cold engine starting

When starting with a cold engine, a richer fuel-air mixture is required than for normal hot-engine operation. A choke (13) provides sufficiently rich mixtures. It is operated by the hand lever (12). This choke should be closed when starting with a cold engine. In order to avoid obstruction of the fuel flow after the engine has started, choke (13) is provided with a flap valve (14) which is opened automatically by the vacuum which the engine rotation creates in the intake pipe.
As soon as the engine has started, open choke (13) gradually with the hand lever (12). As soon as the engine has reached the required temperature, the choke should be opened all the way; it should remain fully open during normal operation.

Adjustment and maintenance

On delivery, every carburettor is correctly adjusted for the type of engine with which it is to be used. No additional adjustment is reqired.

The operation of the engine when idling or with light loads is regulated with the idling-adjustment needle.
Note that this adjustment should always be made when the engine is hot. The richness of the fuel-air mixture can be increased by backing off screw (10) and decreased by screwing it in. The stop screw located on the throttle arm is used for adjusting the idling of the engine.
Carburettor maintenance is kept to a minimum. All that is required is an occasional cleaning of the float chamber to remove impurities which may have been admitted with the fuel. This is accomplished by unscrewing the bottom screw (22). See to it that the filter (16) at the base of the bend in the air intake is not clogged with dirt.

Air filter

Zenith manufacture an "FA. 38 P.13" pleated-paper filter. It provides a large filtering surface and was designed especially for the 22 RX carburettor. It guarantees trouble-free air filtration and thus prolongs the service life of the engine.

IGNITION EQUIPMENT on the 1- and 2-cyl. F-Göta

DESCRIPTION

SEM Magnetos type E-IR45 and E-2R35 are of a design employing the rotating magnet principle. The permanent magnet of Alnico-steel is diecast in a single unit with the laminated pole pieces and the spindles to form the magneto rotor. The less robust parts, such as the coil and condenser, are stationary. The contact breaker, which does not rotate, is of the pivotal type and entirely enclosed in a metal casing. The magnetos are designed for service under the most arduous conditions. The entire units are enclosed within a dust- and moisture-proof metal frame. The coil is effectively insulated by a method which protects against deterioration and power leakage under adverse running conditions.

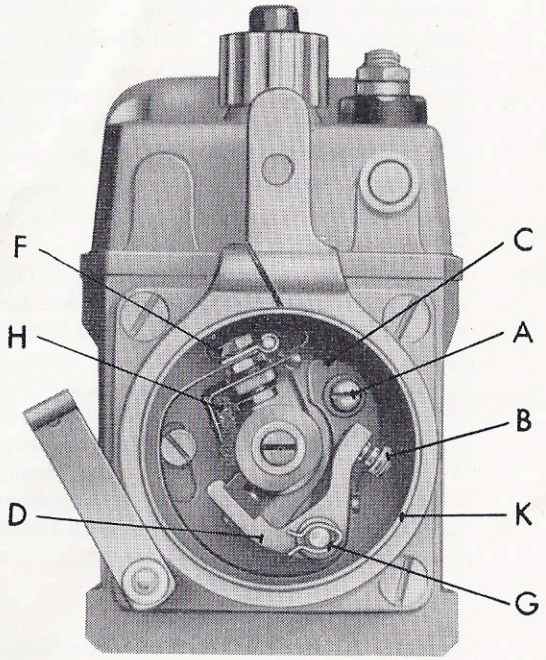


Fig. 7

INSPECTION AND MAINTENANCE

When faulty ignition occurs, the high tension cables and sparking plugs should first be examined. If the insulation shows signs of deterioration or craking, the cables must be exchanged. For this purpose the main cover of the magneto housing need not be removed. Unscrew the nut on the cable outlet and remove the cable. The new cable should not be bared but must be cut off flush to the required length. The rubber bush is pulled onto the cable for a distance of at least 40 mm from its end and the cable is pushed well down into the b o t t o m of the insulator. The nut on the cable outlet must then be screwed home.
The plug electrodes burn away slightly in service whereby the gap length gradually increases. Examine and clean them from time to time, adjusting them to the right setting if necessary. The distance should normally be 0,4 mm.

Adjustment of breaker points

The contact breaker should be inspected from time to time. It is important that the contacts should be kept clean. If they are burned or blackened, they may be cleaned with a very fine carborundum stone or emery cloth. Care must be taken that all particles of dirt or metal dust are wiped away. This can be done with a cloth moistened with petrol.
The gap between the contacts, when fully opened, should be 0,4 mm. The distance can be checked by means of the gauge on the adjusting spanner. If adjustment is necessary, proceed as follows. Slack off the screw A (See fig.) slightly. Insert the screw driver of the adjusting spanner in the slot C. Turning the spanner to the left decreases, and turning to the right increases, the distance between the contacts. When the gap is set to the thickness of the gauge tighten the screw A.
If the cam is removed from the shaft for any reason, make sure that it is replaced in its original position. The end surfaces of the cam are marked with an R and an L respectively. On magnetos for a right-hand drive the letter R must be turned towards the breaker cover. On magnetos for a left-hand drive the letter L shold have the same position.
If the moving contact D is to be replaced, unscrew the nut F with the adjusting spanner and remove the split pin G. Fill the groove of the contact breaker pivot with ball bearing grease and install the new moving contact. If the felt lubricator H is dry, add a few drops of thin machine oil onto the felt. When replacing the contact breaker housing, fill its lubricating groove with ball bearing grease before assembly.

Replacement of condenser

When replacing the condenser remove the two retaining screws. When reassembling ensure that the cable connections from the contact breaker and the wound core are replaced in their original positions. The eyelet from the winding and the nickelplated cable terminal from the contact

breaker are placed under one of the retaining screws. The brass cable terminal from the contact breaker and the eyelets from the ignition coil and condenser are placed under the retaining screw for the shorting spring clip.

Cleaning of high tension moulding and slip ring

The high tension moulding should be removed about once a year and cleaned. Wipe off any deposits and polish with a fine dry cloth. See that the pick up brushes move freely in their holders. Before replacing the high tension moulding, clean the slip ring by inserting a soft cloth and at the same time slowly turning the engine. When reassembling ensure that the cable connections from the wound core, the condenser and the contact breaker are made according to the instructions for replacement of the condenser.

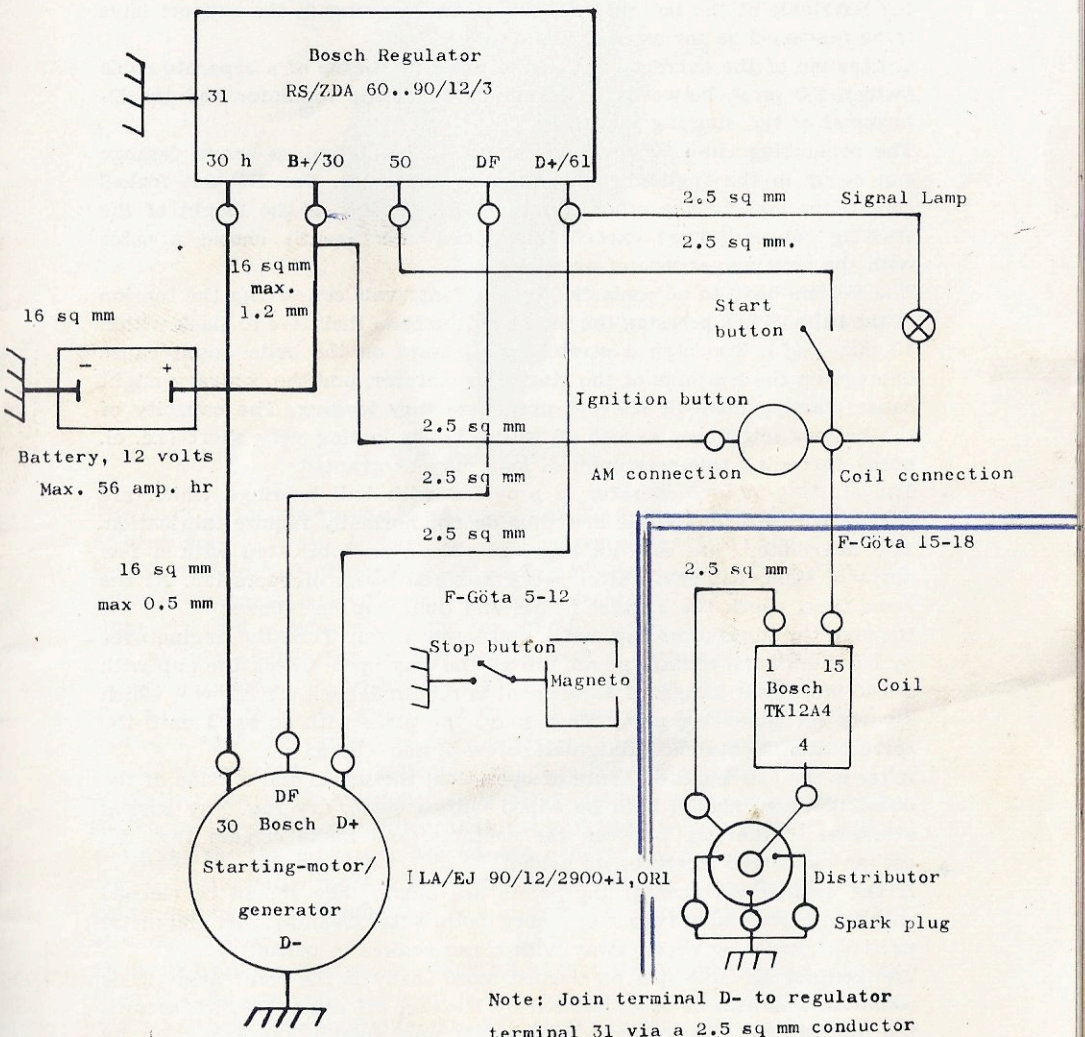
IGNITION EQUIPMENT on the 3-cyl. F-Göta with electric starting generator

Description

The ignition equipment comprises a Bosch starting-motor/generator, type 0010 350 007 J-14V 11A30 12V 1PS (LA/EJ 90/12/2900+1.0 R1); Bosch charging regulator, type 0190 219 001 (RS/ZDA 60...90/12/3); Bosch distributor, type 0231 120 016 VJ 3BR4T (WNK 1Z13X); Bosch coil, type 0021 102 003 TK 12A4 (TK 12 A4) and a 12-volt battery. The hook-up is shown in the wiring diagram at right. Number in parentheses are old type-designations.

WIRING DIAGRAM FOR ELECTRIC EQUIPMENT, F-GÖTA 5 - 18 HP, BOSCH 12 VOLT

NOTE: Join regulator terminal 31 to starting-motor/generator terminal D-, via a 2.5 sq mm conductor



Note: Use a spade lug for terminal DF, ring lugs for the other terminals.

Note: Join terminal D- to regulator terminal 31 via a 2.5 sq mm conductor

Fig. 8

The regulator should not be mounted too close to the motor, so that risk for its heating up appears. When too high a regulatortemparature the tension of loading becomes altered with the result of unsatisfactory loading of the battery.
The regulator has to be mounted in such a manner, that it is well protected against splaching water. The mounting is to be made vertically with the terminals at the bottom end. Vibrations occuring in the support have to be repressed as far as possible.
Connection of the current has to take place by means of a separate cable (wire), 2,5 mm², between the terminals 31 of the regulator and the D-terminal of the starting generator.
The connecting cables (wires) ought not to be shifted as heavy damage can occur in the regulator and starting generator. For DF use forked cable clips and for the other terminals closed clips. If the lenght of the starting cables (wires) exceeds mentioned max. length, choose a cable with the next bigger size of area.
The V-belts have to be controlled by even intervals concerning the tension of the belts. When pressing the thumb on the belts thei have to slack within 10 mm (⅜"). Too high a stretching pressure on the belts might cause damage on the bearings of the starting generator, and the contrary might cause starting difficult ies and unsactisfactory loading. The capacity of the battery might not exceed 90 watts. Loads lasting very short (i.e. el. horn) exceeding this maximum of load may be granted.
The starting-motor/generator is provided with ball bearings which are packed with special grease and thus do not normally require lubrication. The distributor cam and its bearings should be lubricated with a few drops of clean engine-oil after every hundred hours of operation. At the same time, check the contact points and their gap as follows:
Remove the distributor cap, rotor and lower cover. Turn the engine over by hand until the contact points are all the way open. Check the gap with a 0.40 mm feeler gauge. If adjustment is required, back off screw 4 which secures the mounting plate. Then move the plate with screw 3 until the correct gap is obtained. Retighten screw 4. See Fig. 9.
After every two hundred hours of operation, the inside and outside of the distributor cap should both be wiped with a clean, dry rag. Pay special attention to the gap between the contacts, and make certain that the carbon can move freely in its holder.
If the contact surfaces of the points are burnt, they should be cleaned with fine carborundum stone or emery cloth. After cleaning, dirt and metal particles should be wiped away with a rag soaked in petrol.
The contact surfaces can be cleaned more easily if the rotor arm (2) is removed. This can be accomplished by backing off nut (6) which secures the leaf spring. Then remove spring (7) and, finally, the arm with its spring. After cleaning and reassembly, check the setting of the contact points. Remember that the contact points must always be kept free from grease and oil.

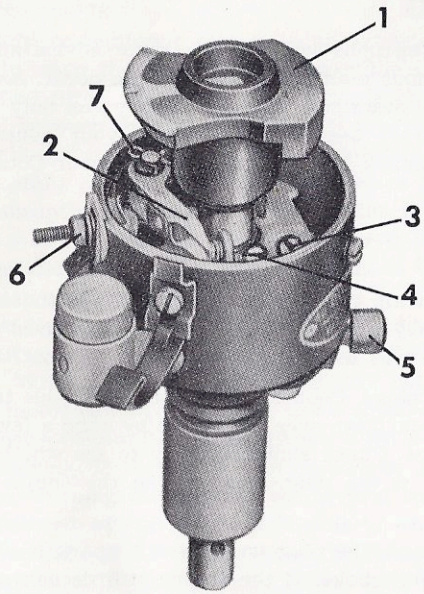


Fig. 9 Distributeur

The level of the electrolyte in every cell of the battery should be checked at least once a month. If required, distilled water should be added so that the electrolyte just covers the plates. Tap water must not be added, and a naked flame must not be used to check the cells.
Wipe dirt and moisture from the top of the battery.
The battery charge can be determined with a hydrometer which sucks up enough electrolyte to lift its float freely so that the specific gravity can be read from the graduated tube. A specific gravity of 1.28—1.30 indicates that the battery is fully charged. 1.21 shows that the battery is half charged, and 1.15 indicates that it is fully discharged.
A reading can be taken immediately after distilled water has been added to the battery; the calibrations are for a liquid temperature of +16°C. Readings for the different cells should provide approximately the same result. If the value for any cell differs considerably from the others the plates can be short-circuited. In such a case the battery should be checked at a repair shop.
Never permit the battery to stand uncharged for a long period. Always keep it fully charged. It's a good idea to give it a little extra charging now and then. This will eliminate any tendency for sulphate to form on the plates.
If the electric system fails in some other way, the fault should be located and corrected at an electrical repair shop.

FAULT TRACING

The following paragraphs will provide some advice and instruction for correcting the various malfunctions which can occur. As a rule, relatively minor troubles are described. Sometimes they can only be corrected at a repair shop. A great deal will depend on your general knowledge of engines and your knack for "getting to know" your Göta-F.

Engine won't start

Check to make certain that fuel is reaching the carburettor. Unscrew the spark plugs. It they are wet, the engine has received plenty of fuel — perhaps the choke was used when the engine was hot.

Dry off the spark plugs. Connect up the bakelite cable terminal and touch the plug to the block. Turn over the engine by hand a few times to exhaust air from the engine. Check simultaneously to see whether a definite blue spark is obtained at the plug. Don't choke the engine when starting it again.

If, on the other hand, the plug is dry and a spark is obtained it may be necessary to use full choke. If the engine still doesn't start, the fuel line may be plugged up. Empty the fuel filter (which should always be used) and study the contents of the bowl. If it is full of water the tank must be drained, after which fresh fuel can be added.

If a poor spark is obtained (yellow colour) the magneto may not be operating properly. We recommend that only experienced boat owners attempt to do this repair job. Satisfactory results require electrical testing equipment; we therefore advise you to take your engine to the repair shop.

The total absence of spark can also result from a faulty spark plug. A new, spare plug should therefore be tested outside the engine, i.e. against the block. Always keep a spare set of spark plugs handy, rated within the correct heat range. Check spark plugs every season.

If it becomes evident that there is water on the crowns of the pistons, the cylinder head gasket is faulty and should be replaced immediately. It is important to ascertain the reason for the faulty gasket. If the cylinder head is not pitted or otherwise faulty, it may be deformed and require planing at the repair shop. Probable cause of deformation: the head was removed when it was hot and became lopsided as it cooled. Another reason might be improper scavenging.

If the engine can be turned over by hand without noticeable resistance, it is excessively worn throughout. In such case an overhaul in the repair shop is absolutely necessary. Another reason can be faulty fitting of pistons or piston rings.

Engine stops while running

The most commonly encountered reason is an interruption of the fuel supply, particularly when the fuel lines run from the tank to the carburettor without a fuel filter. The spark plug can also be fouled so that a "bridge" is formed between the two electrodes. If this has happened, clean the plug and it will operate as usual. The risk for this sort of trouble is greater with highoctane petrol, which should therefore be avoided.

The engine stops abruptly with a screech or loud knock. It has overheated and jammed. The water circulation has been interrupted or there is too little oil in the fuel. See the "water pump" section in the repair instructions for information about the **water pump.**

Proceed as follows. Unscrew and remove the spark plugs to permit more rapid cooling. Wait a while. If available, pour a little light oil into the spark plug holes. Wrap on the starting cord and pull it. If the crank mechanism in the motor cannot be budged, use a chisel or the like as help by pressing i against a piston. Rock the flywheel a little to try and get the piston or pistons moving. If there has been no serious damage, the piston should now release. Turning the engine over several times by hand with the spark plugs removed will give you an idea as to whether or not there was any serious damage. If there was none, the engine can be started again for a few moments. If cooling water flows, the most probable cause of trouble was too little oil in the fuel. After mixing in more oil, the engine can be run as usual and, with luck, your engine will recover from this ill-treatment with only insignificant damage.

An abrupt stop can result from the sudden malfunctioning of the ignition equipment or from the fact that one of its transmission gears is worn out. You can easily ascertain whether or not the contact points are moving, by removing the magneto cap. In such case the only thing to do is take the engine to the repair shop.

Engine starts but does not accept any load

Soot is deposited in the engine. In addition to the fact that the passages and exhaust manifold become coked up, (which doesn't take much time), the "dry" silencer is usually at the root of the trouble. A "dry" silencer is a standard silencer through which no water passes. After a certain period, soot begins to be deposited in the silencer, and there comes a day when it won't permit enough exhaust gases to pass through.

By holding your hand in front of the exhaust pipe you can tell whether the familiar two-stroke exhaust "puff" is absent. In addition, the engine runs very silently. The silencer will have to be replaced by a new one.

Engine starts poorly, but then runs quite well

An engine which never starts before a good many attempts have been made is troubled by one or more minor faults.

Unfortunately, all too many boat owners let the entire season go by

whithout doing anything except pulling the starting cord and cursing the designer and maker of this engine of theirs which "never runs properly". Many of these boat owners own wonderfully efficient but complicated cameras. If these cameras aren't set correctly before making an exposure, and if they aren't given proper care, the pictures will be out of focus. The camera must then be sent to an expert for overhaul. But the owner can do a great deal to alleviate this situation. He can keep the lenses clean, and always remember the instructions he has read to obtain the best results. In other words he can carry out the proper procedures in their proper order.

The same thing holds true with your engine. Do not try to do things which are the business of the expert. There's nonetheless a great deal you can do yourself. The results of a survey conducted in America show that 90 % of all engine trouble stems from the fuel system. We would like to add that the rest stems from the ignition system.

In regard to the fuel system, the importance of providing a fuel filter has been pointed out previously. It not only filters out impurities in the fuel; it also filters out water. A considerable amount of water condenses in the fuel tank on a boat, especially if the tank is located near the deck where it is heated up during the day and cooled at night — adding fresh condensed water every 24 hours.

If water enters the carburettor, the engine is difficult to start. In spite of the filter, water will gradually be admitted to the carburettor in the form of many extremely fine droplets which gather before and in the jets. Since the idling jet has one of the smallest orifices, it often clogs up.

Flooding, i.e. fuel running into the carburettor, is simply an indication of dirt. Small dirt particles accumulate between the needle valve and its seat. As a result the valve fails to seat properly and the fuel level in the float chamber rises too high.

The carburettor is very simple in design and construction, and is quite simple to assemble. Remember, however, that every single part must be in its proper place.

Naturally, the carburettor will, in time, be worn to such an extent that it will require repair or replacement. However, it is a rugged piece of machinery which will serve you faithfully for many years. One sign of carburettor aging is the appearance of so much play in the choke shaft and throttle shaft so that an effective seal is no longer obtained.

THINGS TO REMEMBER

1. Only fuel mixed with lubricating oil may be used.
2. Observe carefully the directions for running-in.
3. Check the amount of oil in the gear casings.
4. Check the cooling-water circulation.
5. Drain out the water in the water jackets in frosty weather.
6. Do not let the engine race. Reduce the fuel supply to the idling speed when reversing. Do not run astern with full throttle.
7. Make no jerky movements with the reverse gear, and do not let the gear slip.
8. If it is operated on kerosene, the engine should be run on petrol before being stopped.
9. Do not stop the engine when running on kerosene.
10. Start on retarded spark, not on advanced spark.
11. Keep the boat dry, free from bilge water, fuel, and dirt.
12. Protect the engine bearings from rust when it is laid up.

Hultbergs Boktryckeri AB — Osby 1965

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