# DIRECTION FOR USE

FOR THE

# MARNA

## 8—11 HP PETROL ENGINE

## 2 CYL. TYPE K

ENGLISH TRANSLATION

Mandals MOTORFABRIK

MANDAL — NORWAY

TELEPHONES 1210 AND 1594

TELEGRAMADRESS: KLEMSDAL

# CONTENTS

# ENGINE DIAGRAM

Refer original Direction for use.

n — Revolutions per minute.
N — Effective capacity in Horse Power.
b — Fuel consumption in grams per Horse Power hour.
B — Fuel consumption per hour.

The diagram shows the greatest capacity of the engine at different revolutions and the corresponding fuel consumption.

All engines are thoroughly tested, but an engine must be run in for an adequate period, before maximum capacity is attained. Therefore we reserve the right of making an allovance, not exceeding 10 % on figures obtained from the diagram, on delivery of an engine.

As an example of the use the diagram, a vertical dotted line is drawn from 933 revolutions per min., on the n scale, then a horizontal line is drawn from the intersection of the vertical line with the capacity and consumption curves, the result then being read on the appropriate scales.

Capacity N — Horse Power.
Corresponding fuel consumption.
B — 4.4 liter per hour.
b — 294 gram per horse-power-hour.

# SPECIFICATION

Capacity: 8—11 H.P. (European).

**Normal Numper of revolutions:** 800—1100 revolutions per minute.

**Bore:** 100 m/m.

**Stroke:** 110 m/m.

**Piston Displacement:** 1.731 L" (1728 cm.).

**Weight:** When equipped with Clutch, Rear Overhead Starting Crank and variable Pitch Propeller: 300 kg. — When equipped with gear and fixed Propeller: 290 kg.

**Cylinder Head:** Removable, and based on the Ricardo Principle.

**Cylinder Block and Crankcase:** Constructed in two sections, to facilitate removal of the Cylinder Block, The crankcase is cast in one piece, and also constitutes an oil reservoir for circulation lubrication. There is an easily removable inspection cover on the side of the crankcase.

**Piston:** Manufactured from the highest quality Cast Iron.

**Lubrication:** Circulation Lubrication with Oil Pump and filter. A hand pump is supplied for the drainage of used oil.

**Ignition:** First class H. T. Magneto with an Impulse Coupling.

**Carburetter:** With adjustable needle.

**Propeller Equipment:**

For an engine equipped with a Clutch: Variable, two bladed propellor. Diam. 430 m/m. Shaft and tube of Yellow Metal. Shaftdiam. 1", tube diam. 1¼", stern tube 1⅝".

For an engine equipped with Gear. Fixed, three bladed propeller diam. 400 m/m. Shaft diam. 1". Stern tube 1⅜".

**Connecting Rod:** Manufactured of Forged Steel, which ensures the highest security against fractures.

**Crank Pin Bearing:** Manufactured of special Alloyed Babbit Metal. Dimension: 1¾". Length: 44 m/m. The crankshaft Bearing is of Lead Bronze.

**Crankshaft:** Forged from the highest quality steel, strongly proportioned, with bearings 1¾" in diam. Joint length of bearings: 145 m/m.

**Timing Shaft:** Manufactured of tempered Steel, and ground on all sliding surfaces, the shaft and cam being integral.

**Valves:** Of Chrome Silicon Steel, and the linings are easily removable. The valve seatings are flush with the top of the Cylinder Block, ensure adequatecooling, and allow easy grinding in of the valves.

**Cooling System:** Operated by means of a Gear Type Pump.

The «MARNA» 8—11 H.P. Engine, Type K., is normally delivered with one of the following equipments:

**Equipment** G: Variable Pitch Propeller, Clutch, and Rear Overhead Starting Crank.

**Equipment D:** Fixed propeller, gear, and Rear Overhead Starting Crank.

The engine can also be despatched with a 6 Volt, or 12 Volt Dynamo. 6 Volt or 12 Volt Starter and Dynamo, and (or) 35 l/min. Bilge Pump. The engine is constructed so that it is delivered with a Rear Overhead Starting Crank, whether an Electric Starter is desired or not.

# INSTALLATION

Refer original Direction for use.

Correct and accurate installation is the first requirement for the satisfactory performance of a marine engine, as faulty and inefficient mounting can cause overheating, serious abrasion, loss of power, and excessive vibration, etc.

**The Foundation.** The wooden foundation for the engine must be of first class material, preferably of oak, and it should consist of two beams, of a minimum thickness of 3", These should be firmly fastened longitudially in the boat so as to avoid undue vibration, and when in position their height above the thwarts should not exceed 2½".

Careful attention to fitting the foundation will pay good dividends.

In most cases the Reversing Apparatus can be mounted on the engine foundation, and therefore the latter should be a proportionate length, while ensuring that there is sufficient clearance at the fore edges for the Fly-wheel. (Refer to the diagram, which gives dimensional and positional details for correct mounting).

Before the engine is bolted down, is it essential to ensure that the axis of the egine and propeller shafts are in alignment, and this should be done as follows:

The couplings of the two shafts should be fitted flush into other, and the propeller shaft turned by hand, then, if correct alignment has been attained, there will be no visible opening between the couplings. The engine can be finally bolted down, on completion of this test, although is will be necessary to check the alignment of the shafts again, after the engine is in position, and the couplings must therefore be slackened for this purpose.

**Examination of the Foundation.** After a period of time, the engine and propeller shaft couplings must be slackened yet again, in order that the continued accuracy of the shaft alignment can be checked. This is necessary as the foundatin beams have a tendency to warp when waterlogged.

When mounting the engine ensure that the Flywhee is fastened securely to it's shaft.

| | | | | |
|---|---|---|---|---|
| **Normal Boat** | Propeller shaft | 2.5 m | Tube | 0.65 m. |
| **Light Boat (for net fishing).** | » » | 2.0 m | » | 0.65 m. |

The «MARNA» 8—11 H.P. Engine Type K is equipped with a turn cock, fitted to the Exhaust Manifold, so that the warm water dicharged from the Cooling System can be conducted either directly out of the boat, via the outlet pipe, or, diverted into the Exhaust Pipe. By utilizing the water in this manner the exhaust pipe is cooled, and in addition an adequate muffling of explosion reports originating from the Compression Chamber, is attained. For this reason, a silencer is not included in the standard equipment of the engine.

The exhaust pipe can, in most cases, be laid longitudinally under the deck boards, to where it is led out under the stern counter, and it must be as straight as possible, and free from sharp bends.

The outlet pipe from the turn cock is curved down alongside the exhaust manifold, along the deck, and up the bulwark to it's point of outflow, which should be approx. 12—14 inches above the water line. A drain cock is installed at the lowest point of the pipe for usein the prevention of frost damage.

The turn cock is (as menioned above) installed for the sole purpose of controlling the dispersal of the water, either into the discharge pipe, or, the exhaust pipe. Therefore, it is important to ensure that water is not flowing into the latter, when the engine is stopped, or the heated metal will produce water evaporation, and the resulting steam, penetrating into the engine, will cause rust corrosion on the valves, etc.

Therefore, the water should be directed into the outlet pipe, when the engine is started, and then diverted into the exhaust pipe when the boat is under way. Conversly, the flow should be re-directed from the exhaust pipe, into the outlet pipe, a short time before intending to stop the engine, the latter being run at full revolutions about 30 seconds, as this has proved to be the most efficacious means of dispersing the remaining water from the exhaust pipe.

If the above method of exhaust cooling is not desired, then an additional outer pipe should be constructed, so as to enclose the actual exhaust pipe. The water will then circulate around the latter, and will eliminate the danger of fire. This is always a serious possibility, if a boat is driven for any considerable period with no means of cooling the exhaust pipe, as the woodwork will scorch and smoulder until there is a risk of the boat being destroyed.

It should be noted that a silencer will be necessary, if an additional conduit is employed, as described above.

The deck casing for the engine must be of solid construction, waterproof, and easily removable. The latter requirement can be fulfilled by the following method: — The rear wall of the casing should be firmly secured to the deck as a permanent fixture, and the two sides, and the front wall, (being constructed in one section in U-form) can then be fastened to it by means of hooks. Thus the front section can be easily with-

drawn from around the engine whenever that is necessary. The controls for regulating the carburettor damper valve, and the ignition, should be fastened on the outside of the rear wall, and thus it will not be necessary to disconnect the control rods to the carburettor and the magneto when the front section of the casing is to be removed. (ref. to Fig. K — 9—1.)

## INITIAL RUNNING

When the installation of the engine has been fully completed, and it is ready for running in, the following points should be noted:

Ensure that the bilge cock is open, so that a free flow of water to the Cooling System is assured, and when the engine has been started ensure that the waste water is being discharged through the outlet pipe, leading from the turn cock, It is always important to check this, as there can be a possibility of a leaky packing, which will enable air to be drawn into the pump, and this would obviously cause the engine to become quickly overheated. If the water is being steadily discharged then the Cooling System is operating satisfactorily.

Although it is self evident that the Flywheel must be fastened securely to the crankshaft, this point should be checked again before the engine is started, as a loose flywheel will immediately set up «knocking» in the engine, and this can be difficult to locate.

Every engine contains the full and correct supply of lubricating oil in the crankcase when despatched from the Factory, but nevertheless, this point should be checked, by ensuring that the oil level is recorded between the two marks on the gauge rod. A refilling plug is situated on top of the frame of the Rear Overhead Starting Crank.

It is most essential to ensure that the Reverse bearing, tube bearing and the bearing in the rear edge of the Clutch, are carefully greased on commensement of the «running in» period, and the three grease cups should be screwed down a little, prior to each period of running. Always ensure that there is a tightly closed container of good quality, non acid grease aboard the boat.

When starting, the engine chould be choked one or two times in order to produce a rich mixture in the cylinder. The air intake should be almost fully open, but as soon as the engine has started it should be throttled down, because if the air intake is opened excessively when the propeller is disengaged the engine will «race». This is undesirable and should be avoided.

If an engine is equipped with a Clutch and Reverse Apparatus, it will often be found that when the Reverse lever is put fully forward the full pitch of the propeller blades will consequently be too heavy for the engines power capacity. In that case the pitch must be adjusted, so that the engine runs at a full speed of 900—1100 revs per minute. The engine should not be run at more than three quarters of the full speed during the running in period, and no attempt must be made to alter the setting of the full and low speed jets on the carburettor as these have been correctly adjusted at the Factory during the engines Test Trials.

## NORMAL RUNNING

The engine can be considered to have been run in sufficiently after a duration of opprox. 40 hours, and it can then be run at full speed whenever and for as long as desired, although racing the engine should be avoided.

If the engine is equipped with Reverse apparatus it is important, (as mentioned in the preceeding section) to ensure that the propeller blades are correctly pitched, and the engine revolutions should not exceed 900—1100 R. P. M. These should be checked with a tachometer, although the beat of the engine will soon prove a sure indication of correct or incorrect pitch.

When in shallow water, and in the vicinity of flotsam, driftwood, rocks, etc., extreme care chould be taken in regard to the propellor blades as they can be easily bent, or broken, when in contact with such obstruction. It is advisable to have full control of the Clutch lever in the above circumstances, so that if necessary, the propellor can be disengaged immediately.

The following proceedure should be adopted when taking the boat into a mooring, or quay: — the engine should be throttled down to a suitably low speed when approximately 70—80 yards distant from the objective, and the propellor put into full reverse when the distance has decreased (depending upon such factors as wind, currents and tonnage.) to approx 30 yards. The propellor should be re-engaged when the boat has approached to within ten to five yards, and the resultant backing will entirely check the forward speed. This instruction, and the same distance of ten to five yards for checking the speed, will also apply to an engine equipped with Gear.

## CARE OF THE ENGINE

Efficient ignition is a primary requirement for the satisfactory performance of a petrol engine, and the magneto must always be kept dry. (Refer to the sections Magneto end Electrical Equipment.)

The petrol supply must also be in good order, and the petrol pipe should be blown through, and cleaned periodically.

The carburetter should be clean, and as after a time, a little water will always collect in the Float Chamber, (and also in the petrol tank itself) both should be drained from time to time, to avoid engine stoppages.

Difficulties with the engine will also be normally avoided if the circulation of the Cooling System is regularly checked, and correct lubrication is of the greatest importance. (Refer to the Section: Lubrication.)

The engine should always be in a clean condition, and any rust should be scraped off, and the affected section repainted with heat resisting paint.

After a time the engine may become loose on its foundation, owing to vibration, and this point should be checked. The Flywheel should also be shecked at regular intervals to ensure that it is firmly secured to its Shaft.

The repair and overhaul of the engine should always be undertaken by a skilled mechanic, and it will always pay to have this done at a qualified workshop, or alternatively, to return the engine to the Manufacturers. «Marna»s Agents can generally supply Spare Parts, and substitutes for the authorised components should not be used.

The Cylinder Head should be removed, and the Piston, etc. decarbonised when this is thougt to be necessary, e. g. after a considerable period of use. The valve clearances should also be checked, and the suitable clearance is 0.4 m/m. This clearance is necessary as the valves become warmer than the cylinder, and expand when the engine is running. Therefore if there is no allowance for clearance the valves will leak and become burnt, thus causing engine stoppage.

We recommend that this work should be carried out at a workshop, (if the special tools required are not available,) or if the valve adjustment proves to be difficult.

## STARTING DIFFICULTIES

Starting difficulties can usually be traced to faulty ignition, or an obstructed petrol supply. When cold, the engine should normally start after the carburettor has been choked, although it may be advantageuos to prime the engine with a little petrol, sufficient for it to run for one or two revolutions.

If starting continues to be difficult after this, and providing there is good compression, the ignition should be checked. The spark plug should be removed, and the strength of the spark tested, by putting it in contakt with the Cylinder Head while the engine is turned once or twice. If the spark is weak, this can quite often be remedied. (Refer to Section: Magneto).

The engine can sometimes be turned without resistance and if this occurs the valves may be sticking, due to dirt, etc. lying in the valve seat. This can often be remedied by inserting a screwdriver into the valve-spring, and pressing it upward, then releasing it suddenly. This ought to clear the obstruction, but before doing this ensure that the valve is right down, that is to say, the valve pusher is in its lowest position.

If the engine starts and then stops again, the fault is nearly always due to failure of the fuel supply, and the pipe from the tank to the carburettor must be checked for possible obstructions. The carburettor must also be checked. (Refer to Section: Carburettor).

Another reason for this type of stoppage can be an over supply of petrol which can soak the plug. This must be removed and dried, and while the petrol supply is turned off, the engine should be turned over several times. It can be necessary, during cold weather, to choke the carburettor for a short time until the engine becomes warm.

## FROST PRECAUTIONS

Frosty weather is in no way detrimental to the normal running of the engine, providing the following precautions are carried out:

**The Cooling System must be drained whenever the engine is not in use, and this should be done when the engine is still warm.** It is important to remember that if water remains in the pipe and water packet it will freeze and expand, thereby ruining the Cylinder Block and Cylinder Head which are both expensive to replace.

When the engine has been stopped the drain tap on the Cylinder Block and Exhaust Manifold must be opened two or three turns, so that the flow can be clearly seen. The tap on the pump, and on the discharge pipe should also be opened, providing that the latter is so fitted that it cannot be self drained, and the bilge cock should be closed. Ensure that all these taps are opened when the engine is started again, and check that the water from the engine is being discharged satisfactorily, because if the discharge pipe has frozen, the pressure from the pump can burst the coupling which connects the pump shaft with the driving shaft.

It is obviously more difficult to start the engine during cold and frosty weather, as the oil is congealed, and the bearings work sluggishly. Therefore, extra choking and priming are necessary. It should be remem-

bered that the engine's normal temperatur is 65° C., and thus it is expedient to raise it's temperature as soon as possible.

An engine always wears more when it is run for many short periods, (with sufficient intervals for it to become cold) than when it is run for long periods at its correct temperature.

## COOLING SYSTEM

As the Marna 8—11 H.P. is a heat engine, it is obvious that it becomes hot when running, and the correct temperature, after a resasonable period of running is approx. 65° C. or when the hand cannot be held with comfort on the Crankcase. It is important therefore, to realize that engine wear is due more to a low temperature, than to a high one, and that a high grade oil will not be affected unless the engine's temperature clearly rises above 100° C.

The pump is mounted on a bracket, and the shaft is coupled to the driving shaft by means of a rectangular piece of metal, which fits into a slot on each of the above mentioned shafts. This coupling has been purposely weakened by being bored, so that in the event of the engine being turned when the pump frozen, this coupling will give way, thus preventing the cogs in the pump from being broken, and the pump being severely damaged.

A spare coupling piece is delivered with every engine.

The water is driven from the pump into the Exhaust Manifold, from where it enters and circulates the Cylinder and Cylinder Head, and is finally dispersed, via the turncock, either directly out of the boat through the discharge pipe, or through the exhaust pipe, as described under the Section: Installation.

**Always ensure that the water is diverted from the exhaust pipe into the discharge pipe, a short time prior to stopping the engine,** thereby avoiding difficulties with the valves, which is the reason why the turncock has been designed, and fitted to the engine.

**If the engine is used during frosty weather the water must be drained,** and the pump is equipped with a drain tap.

Lubrication is by means of a grease cup, situated on the pump, and this cup should be refilled with grease when it has been screwed down to its limit.

Always ensure that the intake pipe is connected tightly to the bilge cock, in order to prevent air penetration, as the latter can cause pump failure.

## BILGE PUMP

The «MARNA» 8—11 H.P. engine can be equipped with a bilge pump, with a capacity of approx. 35 litres per minute, and is mounted on a small casing over the flywheel. The pump is driven by means of a V Belt, and a belt pulley is screwed on to the front of the flywheel.

An engine which has been equipped with a flywheel casing for the purpose of mounting a dynamo and starter, can also be equipped with a bilge pump, as this casing has been constructed so that a pump can be easily ebbed. The majority of the engines delivered now have dynamo or starter installation, with a bilge pump.

The pump is lubricated by means of a grease cup, **and it must be greased daily when the pump is in use.**

The casing to which the pump is fastened, is equipped with a adjusting rod, to facilitate the removal of the V belt. This belt should not be tightened unduly when starting the pump, as overtightening will only cause the pump bearing to wear in proportion.

The water must be drained from the pump during frosty weather.

## MAINTENANCE

Careful and regular maintenance will always pay good dividends, as it will prolong the life of the engine, and will help in avoiding annoyances such as engine stoppages, and the unnecessary purchase of spare parts. Prevent rust on the iron parts, check the foundation and the propeller shaft regularly. Clean the engine at frequent intervals, and if the engine is dismantled the components must be consientiously and accurately reassembled. However, maintenance is first and foremost a matter of correct lubrication.

## WINTER STORAGE

If the boat is to be laid up ashore, during the winter months, there is one particular point to be observed, for even if the boat is to be stored in a boat house, the magneto should be removed, and kept in a dry place.

**It is obvius that all the water must be drained from the engine, and in every circumstance it is essential that this is complied with.**

It will be advantageous to pour oil into the water jacket of the Cylinder Block, after the water has been drained, to prevent the formation of rust, and if the engine is to stand in a damp exposed place, is should be packed with dry cloth, for the same reason.

Before the engine is brought into service again, it should be cleaned internally and externally, and any rust which may have formed, should be scraped off, the affected portions being repained with a heat resisting paint.

The Crankcase and Clutch must be refilled with fresh oil, and all the grease cups refilled with new good quality grease. The axis of alignment of the engine and propeller shaft must be checked, as the foundation may have warped during the course of the winter.

The petrol supply pipe, and the carburettor, must also be cleaned, as must the boat's water intake filter, and the intake for the Cooling system.

## LUBRICATION

The life of an engine is entirely dependent on correct lubrication, and only the highest quality lubricating oil should be used for this purpose. Mobiloil A. SAE 30 should be used during the summer, and Mobiloil Arctic in winter.

The engine is lubricated by the so called Circulation System, that is to say, oil is distributed to all vital bearings, etc., by means of a pump, which is situated on the external gear casing.

The cylinder and pistons are lubricated by oil being forced from the Crankshaft bearing into the Crankshaft, then out through the Crank bearing by means of a small hole, which is bored in the lowest part of the connecting Rod. Thus, a little oil is sprayed through this hole on to the cylinder walls, with each revolution.

The oil pump is a gear type, fitted with a tempered cog wheel, and it should not normally require inspection.

The oil passes from the pump to an overflow valve, which controls the oil pressure, and this can be seen when the cover nut on the valve is unscrewed. The pressure rises when this adjusting screw is tightened, and falls when it is slackened.

A tube leads from the pump to the manometer, which indicates whether the engine is being lubricated or not, and the suitable pressure at full speed is approx. 2 kg.

The pressure will decrease when the engine is running at minimum speed, but always ensure that a certain amount is being recorded, and if the pressure falls to O, the engine must be stopped immediately, and examined.

The engine must also be stopped if an abnormally high pressure is recorded, and the oil pipe should be examined, as it is possible that the high pressure has been caused by the filter having become clogged.

The engine is equipped with an oil gauge rod, situated an the port side, and this should be checked regularly, to ensure that the oil level in the crankcase remains constant, between the two marks on the rod.

Attention should altso be given to the fact that surplus oil can be detrimental, as this can cause overheating.

It is essential that the engine receives approx. 3.5 litres of oil, and when the engine is new this should be changed after the consumption of one hundred litres of petrol.

The oil can then be eventually changed after every two hundred and fifty litres of petrol have been consumed, but during the running in period approx. ½ lire of oil should be refilled after the consumption of each thirty litres of petrol.

The pump is supplied with oil via a strainer situated in the crankcase sump, and it is then passed on from the pump to the filter on the frame of the Overhead Starting Assembly.

This filter must be cleaned and washed with petrol regularly, at least two to four times a year depending on how much the engine is used, and it can be taken out for this purpose.

The cover nut should be unscrewed, and the filter can then be withdrawn with the cover.

Ensure that the oil is drained from the filter before it is removed, and this can be done by means of the drain tap, which is fitted to the lowest part of the filter pipe.

When the engine oil is to be changed, the engine should be run until it is warm, and then the oil withdrawn by means of the hand suction pump, provided for this purpose.

After as much oil as possible has been pumped out, the engine should be run for a few seconds at minimum speed to ensure that all the oil is removed from the Oil Pump and the filter.

The Crankcase is refilled by pouring oil into the filter plughole on the frame of the Overhead Starting Assembly.

The cover on the crankcase should be removed periodically and the sludge, which always collects in the sump after a time, should be cleaned out with a cloth.

The oil strainer in the sump should also be cleaned.

The oil should be changed as quickly as possible in the event of the engine being flooded by high waves, or heavy rain, etc., and care should be taken to ensure that no water remains in the engine.

When the crankcase has ben refilled with new oil, the engine should be immediately run for a short time, to prevent rust corrosion on the vital parts. The oil in the Clutch is the same as that which is in the engine.

The grease cups on the neck journal of the Clutch, (or Gear) on the Reverse Apparatus, and on the Shaft tube, and water pump should be screwed down a little daily, and it must be remembered that the propeller head on a variable pitch propeller must be filled regularly with grease, at least twice a year, if the boat is used all through the year.

## USE OF AN ALTERNATIVE FUEL TO PETROL

The Marna engine is constructed to operate on petrol fuel, and as other fuels will never give the same satisfactory result, their employment is not recommended. However, if circumstances necessitate the use of a substitute for petrol, the following proceedure should be adopted:

The best substitute fuel is a mixture of White Spirit and $^1/_{20}$ Lubricating Oil. Tractor petrol can also be used. There are certain disadvantages in the use of these fuels, i. e. the engine will be unable to run with advanced ignition, as this will cause knock.

The engine must be started on petrol, before the other fuel can be used, two fuel tanks, or a twin tank, must be fitted. The switch over of the two fuels should take place when the engine is sufficiently warm after starting. This proceedure must be reversed, before the engine is stopped, so as to ensure that the supply pipe and the carburettor only contain petrol.

The lower calorific value of substitute fuels is another rather dangerous disadvantage, as this factor is responsible for incomplete combustion. Thus the fuel can easily penetrate between the piston and the cylinder lining to the Crankcase, where it blends with the oil.

For this reason, it should be an invariable rule to check the quality of this oil very carefully, as the engine can wear out in a remarkably short time, if not beeing correctly lubricated.

Every Marna owner who uses an alternative fuel to petrol, must inevitably reckon on heavier engine wear.

## CARBURETTOR

The majority of the «MARNA» 8—11 H.P. engines are now equipped with the 30 millimetre «Simplex» vertical carburettor, which is, in our opinion ideally suitable for the engine, and it was selected after extensive experimental work. In addition, this carburettor is manufactured in Norway, and therefore there is always an adequate supply of spare parts in stock.

The air intake of this carburettor has been adapted for the fitting of an air filter, and this is constructed so that the oil gas, which occurs in the valve cover, is absorbed into the engine.

**Operation.**

The petrol supply pipe is connected to the swivel (N) which can be turned in any direction required, by loosening the screw (K) and this screw must also be loosened if the filter (which the petrol must pass) and which is situated in N, is to be removed for cleaning.

The carburettor is equipped with two adjustable jets for regulating the quantity of petrol, and full speed is obtained by the adjustment of jet A, while jet B regulates the quantity of petrol required for low speed. The jets are correctly adjusted when the carburettor is despatched from the Factory, but if further adjustment is necessary the following directions should be followed:

**Jet A. For full speed running.**

To adjust this, open the screw A approx. 1—1½ turns, or so much that it is certain that there is enough petrol to enable the engine to start. When the engine has become normally warm, the screw should be tightened until the revolutions decrease, or also when there is banging report from the carburettor. This is a sure indication that the engine requires more petrol, and the screw A must be opened again gradually until a satisfactory result is attained.

**Jet B. For low speed running.**

The adjustment of this jet is entirely opposite to that required for jet A, as the maximum amount of petrol is supplied from B, when the screw B is fully screwed down.

This screw should be opened a little, so that less petrol is supplied to the engine, and the speed of the latter can be regulated by adjusting screw E, until a satisfactory rate of revolutions has been achieved.

The correct quantity of petrol which should be supplied by the jet can also be gauged by careful listening, and as a rule this amount can be obtained by opening screw B approx. a quarter of a turn from its fully screwed down position.

Any water which may have mixed with the petrol will settle at the bottom of the carburettor, from where it can be removed by means of the drain tap.

The opening or closing of the air damper D regulates the engine running, and if, when starting, it is necessary for the engine to be choked, the damper must be closed, and the engine turned over one or twice.

A. Full speed nozzle.
B. Idling nozzle.
D. Air Damper.
E. Adjusting Screw for Air Damper.
F. Choke for Starting.
H. Float Valve.

## LIST OF COMPONENT PARTS

00 Carburettor Body. Lower Section.
01 —»— —»— Upper Section.
02 Swivel Union. For ¼" or 5/16" flanged pipe.
03 Base Screw.
04 Strainer.
05 Nut for flanged pipe (for ¼" or 5/16" pipe)
06 Upper Packing for Swivel Union.
07 Lover —»—
08 Seat for Float Needle.
09 Cover. Cover Complete. (09 - 13 - 14 - 15 - 16)
10 Cover Spring Clip.
11 Ball Grip.
12 Float.
13 Float Needle.
14 Roller.
15 Plummet.
16 Clamp.
17 Main Nozzle. (Main Nozzle Complete. (17 - 18 - 19 - 20)
18 Nozzle Needle.
19 Regulating Screw for Needle.
20 Spring.
21 Idling Nozzle. Idling Nozzle Complete (21 - 22 - 23)
22 Regulating Screw.
23 Spring.
24 Screw with seat for Nozzle.
25 Petrol pipe.
26 Packing for petrol pipe.
27 Choke Bush. 26 m/m. 14 - 15 - 16 - 17. internal dia.
27 Choke Bush. 30 m/m. 18 - 19 - 20 - 21 - 33 internal dia.
28 Spindle for Choke Damper.
29 Choke Damper.
30 Lever for mixture and Choke Damper Complete. (30 & 47)
31 Spring for Choke Damper.
32 Impact Stud.
33 Stud for Choke Spindle.
34 Spindle for mixture damper.
35 Mixture Damper.
36 Impact Back Square.
37 Stop Ring.
40 Plug for Float Chamber.
41 Double tightning cone.
42 Plug for Petrol pipe.
43 Screw for Choke Damper Stop.
44 Screw for Mixture and Choke Damper.
45 Screw for securing the Shoke Damper.
46 Suction Pipe.
47 Screw in Lever. (30)
48 Screw with nut for idling adjustment.
49 Screw for securing Body. Upper Section. (01)
50 Screw for cover spring clip.
51 Nut for Part 50.
52 Stud for Impact Back Square (36)
53 Tightening screw, in channel for idling power petrol.
021 Swivel Union. For ¼ or 5/16 pipe with double tightening cone.
051 Nut for ¼ or 5/16 pipe with double tightening cone.

*When ordering the Choke Bush please state the internal and external diameter required.*

## MAGNETO

The «MARNA» engine is equipped with a High Tension Magneto with an impulse coupling, and a sparking plug of an adequate heat value should be used in conjunction, as a strong spark is a vital factor in guaranteeing starting. The various manufacturers of plugs employ different designations for the heat value of their products, but generally speaking, a comparatively hot plug should be selected, and the distance between the electrodes should be approx. 0.8 m/m.

The leads from the magneto to the plugs may become worn and cracked after the engine has been in service for some time, and these should be checked to ensure that they retain their insulation, and that they do not short circuit the system.

The lead originating from the distributer nearest to the cylinder, connects to the plug of the first cylinder, and the plug guard should always be checked, to ensure that it is firmly screwed to the lead. The latter is connected to the magneto by being screwed down on to a taper screw, situated in the base of the distributer, and when fitting a new lead the end should be guided on to this screw with an awl, or a similiar pointed tool.

The magneto is secured firmly to it's bracket, but it can be removed quite easily when necessary, by

slackening the lock nut underneath the bracket, and the retaining clamp can then be unscrewed. There is no difficulty in replacing the magneto in the correct position on the bracket, as the shape of the latter ensures that the magneto cannot be replaced at an oblique angle.

If magneto failure occurs, the cover should be removed, and the platinum pins examined and if the latter appear to be burnt they should be cleaned with a nail file, or any suitable thin file. In addition, the clearance of the pins at the two points of ignition should be checked, to ensure that it is approx. 0.3 milimetres.

The lead should also be examined for possible faults, but if neither the lead, or the pins appear to be the cause of the failure, the magneto should be returned to the Manufactures, or to a qualified workshop, for a complete overhaul.

**New dry plugs should be kept in reserve on board.**

The engine is easy to start, because the magneto's impulse ensures a strong spark from the plug, even if the engine is only turned slowly by hand. The impulse couples out automatically immediately the engine is running.

**Timing of the Ignition.**

The spark emitted by the plug must occur the moment prior to the piston reaching Top Dead Centre position. This is known as Preignition, or, Advanced Ignition, the quantity being dependent on the revolutions of the engine. High revolutions demand greater Preignition, and a corresponding reduction is required when the engine is running at slow speed. The appropiate amount of Preignition for the «MARNA» 8—11 H. P. engine, when at full speed, (and with the magneto suitably adjusted) is 17 degrees, the spark emitted by the plug being coincident with the opening of the platinum pin.

**Proceedure for timing the Ignition.**

The flywheel should be turned to bring the piston into exact Top Dead Centre position, that is to say, when the keyway on the crank is in accurate alignment with the first Crank Pin Bearing, and the highest point of the Flywheel should then be marked. This mark should consequently be directly in line with the above mentioned keyway.

A second mark should then be made at a distance of 50 millimetres to the right of the first one (as seen from the front of the engine) this distance being the equivalent of 17 degrees of the circumference of the flywheel and ignition will accordingly take place when this second mark reaches the highest point of the circumference.

Therefore, the magneto is correctly timed when the opening of the pins coincides with the mark attaining that position.

If the pins do not open at the correct time, an adjustment must be made on the disc attached to the magneto's driving shaft. This disc is in two parts, with a screw which enables the outer disc to be turned in relation to the inner.

When the accurate timing of the magneto has been attained, the timing operations are completed by the adjustment of the impulse timing, and attention should be given to the fact that there must be a variation between the normal time of ignition of the magneto, and of the impulse, since that of the latter must always occur later than of the magneto. That is to say, there must be a certainty that the impulse will not operate before the piston reaches Top Dead Centre, as this occurence can cause back stroke. The time of ignition for the Bosch magneto can be adjusted as follows:

When the screw situated in the front of the magneto is unscrewed, the cover can be pulled off, and two screw heads will be revealed. These should be slackened until the plate which they hold in place can be rotated and the impulse ignition is advanced when this plate is turned against the direction of the arrow, and retarded when turned towards it.

## ADJUSTMENT OF THE CHAIN

The chain may require adjustment after the engine has had a period of use, and the magneto shaft should be examined in order to determine this, as lateral movement of the magneto bolt will be an indication that the chain is slack. If this happens to be the case, the two small covers which are situated on each side of the Rear Overhead Starting Assembly frame, (under the crank and magneto) should be removed, and then the nut on the $\frac{5}{8}$" bolt which secures the tension pulley should be loosened until friction has been relaxed. The tension pulley can now be regulated by means of the adjusting screws situated on the right side of the frame, and the chain should be tightened until a minimum amount of play is attained. This can be ascertained by finger pressure or by means of a bent wire inserted into the rear aperture, and the engine should be turned over once or twice so that the tension of the chain can be tried at several points. The tension pulley must be firmly secured and the covers replaced on completion of the adjustment.

# ELECTRICAL EQUIPMENT

One of the following three items of electrical equipment can be mounted on all «MARNA» two cylinder 8—11 H. P. engine which have been manufactured since that numbered 6482:

1. Electric Starter 6 Volt.
Dynamo 6 Volt — 75 Watt.

This equipment is delivered with a 6 Volt Battery, Switch, ammeter and a fuse box, the dynamo and battery giving adequate current for both navigational and interior lighting.
The flywheel must be equipped with Ring Gear.

2. Dynamo:
If an electric starter is not required, the engine can be supplied with a dynamo for lighting purpose only, and two methods of mounting can be chosen:

(a) As mentioned under (1) but without the starter and the necessary flywheel ring gear, although a starter can be easily mounted if subsequently required.

(b) The dynamo is mounted on a simplified casing, situated between the crank case and the flywheel. This is intended for the dynamo only, and therefore a starter cannot be added later. This equipment is cheaper than that under (a) although the dynamo itself is the same.

(3) Electric Starter 12 Volt.
Dynamo 17 Volt — 130 Watt.

This equipment has been designed particularly for the engine of the light boats employd in the herring fishing industry, as their echo sounding apparatus requires 12 volt current, and a 12 volt battery must also be used. The starter can be delivered, or omitted, as required, although as a rule it is not used in this type of boat. It can be fitted later however, as the equipment (flywheel casing, etc.) is always made so as to facilitate this eventuality, and a 35 l/min Bilge Pump can also be mounted if, and when, required.

**The Dynamo.**

This is a small, regulated voltage, Direct Current dynamo, and it operates with a proportionate high number of revolutions, (this applies to both the 6 and 12 Volt types.) These dynamos are always equipped with a voltage regulator which automatically connects or disconnects the supply, according to the high or low number of revolutions, and connection will normally take place when the engine is running at 600—700 R.P.M.

The dynamo will then begin charging the battery, assuming that the latter is not fully charged. This supply will increase a little when the engine developes a higher number of revolutions, but it will be reasonably constant even if the engine is running at 800 or 1000 R.P.M. This is known as the charging current, and the amount can be read on the ammeter.

Normal charging current for a 6 volt — 75 watt dynamo will be approx. 12 to 13 amps, and approx 11 amps for the 12 volt—130 watt type, decreasing if the battery is almost fully charged.

The voltage regulator on this type of dynamo is sealed by the Manufacturers **and the guarantee becomes invalid if this seal is broken.**

The adjustment of a voltage regulator demands accurate gauges, although it is seldom that any fault occurs. However, in the event of this, the regulator must be returned to the vender to be checked.

A dynamo must always be given the utmost protection against water and damp, and must also be maintained in a clean and oil free condition.

**The Battery.**

The battery is a normal accumulator, and its voltage must be equivalent to that of the particular dynamo with which it is used.

When the battery is on board, it should be placed in a low wooden box, adapted to the battery's external dimensions. The bottom and sides of this container must be lined with lead plates, soldered together at the joints thus making it entirely leak proof. The acid which drips from the battery in the course of time, will then collect in the bottom of the box, and be prevented from running into the boat. The battery should always be stored in a dry place on board.

The capacity of a battery is indicated in ampere hours (Ah) and 90 Ah is an adequate amount.

A battery always requires a little care and attention and it should be kept as clean and as dry as possible.

Especial attention is required when connecting the leads to the terminals, and both the terminals, and lead clamps, should be well cleaned before connection, when the latter must be firmly secured.

The battery terminals should be smeared with vaseline after being connected, at this helps to prevent exidisation, and poor contact caused by the latter. Precautions should always be taken to ensure that the battery never short circuits, as the result of this can be directly inflammable, and an acid filled battery should be topped up with distilled water, if the level of the liquid falls below the top of the cells.

## ELECTRIC STARTER

The starter type which is used on the 2 cyl. 8—11 H. P. engines has an electromagnetic connection from the pinion, — the switch operating a master or control current, which in turn operates the electromagnetic connecting mechanism, thus connecting the starter so that current is obtained from the battery.

The starter switch itself can be mounted in the position considered most suitable by the individual owner, and in many cases it will be found that this will be on the rear of the engine casing, near to the controls.

A large amperage is brought into use when the engine is electrically started, and therefore the leads between the starter and battery, and from the latter to the engine must be as strongly dimensioned as is shown on the Wiring Diagram, which also idicates how the connection between dynamo—battery-starter and, possible, lamps is accomplished.

The lead from the starter to the battery should not be longer than 1.5 metres, and if this length is exceeded the lead must be of a greater crossection, than that which is shown on the Wiring Diagram.

It is important to ensure that all connections make good contact, and especial attention must always be given to this. Care must also be taken in soldering the terminals and clips to their respektive leads, and the connecting screws and nuts must be securely tightened, therefore a prudent owner will always entrust the connection of all electrical equipment on board to a skilled mechanic who is familiar with such work.

## REAR OVERHEAD STARTING CRANK

The «MARNA» 8—11 H. P. engine is equippedwith a Rear Overhead Starting Crank to facilitate starting, and the magneto is mounted on the frame of this assembly, in the opposite direction to the crank,so that it is thus situated in the highest and driest possible position in the boat. The crank operates by means of a single chain, of $\frac{5}{8}$"$\times\frac{1}{4}$" dimension, and the shaft is constructed, so that the crank can be engaged in two different positions, proportionate to the position of the piston.

When starting, the crank should be engaged in it's lowest position and pulled up and over, as it is incorrect to engage at it's highest point so that it has to be pushed downwards. It should be pressed in a little to engage, so that the crank key can be felt when it makes contact, and the crank will automatically disengage and return to it's stationary position when the engine has started.

The engine's deck casing should preferably be constructed so that only the crank protrudes from the rear, and the crank shaft bearing at the securing end of the crank should be lubricated with a little oil at regular intervals.

## THE CLUTCH

The function of the clutch is to allow the propeller to be disengaged when the engine is running, and it has a cast iron friction spring which expands when the control lever is moved into forward position. The spring then grips a bell coupling thus connecting the engine and propeller shafts.

The forward movement of the control lever forces a tapered cylinder to the rear, which allows two arms in the friction spring to bend outwards, and if the clutch becomes slack the adjustable hardened screws situated on these arms must be tightened. This can be done by loosening the lock nuts, and the screws should then be turned in a clockwise direction until a suitable adjustment has been attained, but always ensure that both arms are equally readjusted if their position is altered.

A sliding bearing is situated in the rear of the clutch assembly for the purpose of preventing the penetration of sea water if the deck becomes awash, and the shaft is covered. This bearing must be lubricated daily if it is to fulfill it's purpose.

The grease cup on this bearing should be screwed down a little whenever the engine has finished running, for example in the evening, as this will help to stop the penetration of water in the event of the latter rising over the bearing, and a periodical check should be made to ensure that the clutch assembly contains a satisfactory amount of oil. (Refer to the Section Lubrication.)

If water does happen to penetrate into the clutch assembly and crankcase, they must be drained carefully, and then refilled with clean oil.

The engine should be run as soon as the refilling has been completed, so that all parts are sprayed with clean oil.

The oil which is used in crankcase and by the clutch is identical.

## THE GEAR

In addition to operating as a clutch forward running, the «MARNA» gear fulfills the purpose of disengaging the propeller, and of altering the dierction of rotation. It is constructed on the Differential Principle, and for forward running it operates approximately the same as a normal clutch. That is to say a cast iron

friction spring expands when the gear lever is moved forward, and engages firmly in a bell coupling, thus connecting the engine and propellor shafts.

The forward movement of the gear lever forces a tapered cylinder rearwards which allows two arms in the friction spring to bend outwards, and if the gear coupling becomes slack the adjustable hardened screws situated on these arms must be tightened. This can be done by loosening the lock nuts and the screws should then be turned in a clockwise direction until a suitable adjustment has been attained, but always ensure that both arms are equally readjusted if their position is altered.

When the boat is reversed the gear lever is moved into the rear position and an internal steel bar is drawn back, thereby exerting tension on a cast metal expansion band, which grips the internal gear housing and locks it. Thereafter, and by means of several cog wheels the propeller shaft is driven in counter rotation to the engine shaft.

The steel draw bar is connected to the expansion band by a bolt, one end of which contains a oller, the other being threaded for a nut, and lock nut. The purpose of the roller is to facilitate the rearward movement of the bar, and when that is in position it is retained by the roller engaging in a recess in front of the bar's inclined edge.

It is possible that the front corner of this recess will become worn in the course of time, and the gear will then be unable to function properly. This can be rectified by filing the recess accordingly, and it may also be necessary to adjust the bolt nuts if the gear slips when the boat is being reversed.

The oil which is used to lubricate the cog wheels of the gear originates from the Oil Pump, and is fed through the rear crank bearing to the crankshaft from where it is passed in the gear assembly. Thus, the oil which lubricates the gear is the same as is used in the engine.

A sliding gearing is situated in the rear of the gear assembly for the purpose of preventing the penetration of sea water, if the deck becomes awash and the shaft is covered.

This bearing must be lubricated daily if it is to fulfill it's purpose, and also when the engine has finished running. If water does happen to penetrate into the gear assembly and crankcase, they must be drained carefully, and then refilled with clean oil. The engine should be run as soon as refilling has been completed, so that all parts are sprayed with clean oil. A large inspection cover is situated on the top of the gear assembly, to facilitate the drainage mentioned above.

**Additional Equipment.**

The «MARNA» 8—11 H. P. engine can be supplied with various additional equipment, as has been mentioned previously in the sections: Bilge Pump and Electrical Equipment.

1) Elektric Starter 6 Volt.
Dynamo 6 Volt — 75 Watt.
(6 Volt Battery, switch, ammeter, and fuse box)

Refer to the drawing, K — 9 — 9 which shows how this is effected, and the allied components.

A drain cock, (the turn grip of which is situated directly above the casing) is mounted on the Flywheel casing of this equipment, to facilitate the removal of any water which may collect within. With reference to this, a special point should always be made of examining the casing before the engine is started, to ensure that it does not contain water. If this examination, and drainage is neglected, the electric starter will be filled with water sprayed by the rim of the cog which is on the flywheel, and it will thus be rendered unserviceable.

2) a. Dynamo only, but the engine is fitted with the same casing as above so that a starter can be mounted later, if so required.
(Refer to the drawing mentioned above).

b. The dynamo is mounted on a simplified casing, and a starter cannot be added later.

A. V Belt pulley is situated on the rear of the flywheel.
A. 35 l/min Bilge Pump can also be supplied with this equipment.

Refer to the drawing K — 9 — 8 6 Volt Dynamo and, or, Bilge Pump.

3) Electric Starter, 12 Volt.
Dynamo 12 Volt — 130 Watt.
(12 Volt battery, switch, ammeter, and fuse box.)

Although the flywheel casing of this particular equipment is constructed for the mounting of the dynamo and a starter, the latter need not be supplied if the purchaser does not require it. 35 l/min Bilge Pump can also be fitted, in addition to a dynamo and starter, and the casing is supplied with a water drainage cock.

Refer to Drawing K — 9 — 10: 12 Volt starter, dynamo, Bilge Pump.

4) 35 l/min Bilge Pump only.

The engine is equipped with a small casing formounting the pump, and a V Belt pulley is fitted on the front of the flywheel.

Drawing K —9 — 8. Wiring Diagram for 6 Volt starter and Dynamo.
Drawing K. 9 — 11 Wiring Diagram for 12 Volt Dynamo.

## REVERSE APPARATUS

The Reverse apparatus for the 8—11 H.P. engine can be supplied in three types: A., B. and the .MARNA» Screw Reverse, and it consist of the following main parts:

A: Base. B: Bearing Slide. D: Bearing. E: Handle and connecting arm, and H: Propeller Tube.

All types are lubricated by means of a grease cup, which must be screwed down a little each day if the engine is in constant use, and which must be refilled when it has been entirely screwed down.

The three types work on a common principle. There is a bored steel disc (reversingclip) screwed to the tube, and when the control lever is operated, this clip is twisted, thus causing the tube to move longitudially in relation to the propeller shaft, thereby altering the pitch of the propellor blades. This clip must therefore be screwed firmly to the tube at the point where the propeller attains it's maximum forward and reverse positions.

**Types A and B.**

These two types are equipped with a handle, with axial movement for attaining the forward, neutral and reverse positions, and type A has been designed so that it can be mounted on the engine's foundation. This fact should therefore be taken into consideration, when deciding the length of the foundation, prior to installation, and a suitable distance at the rear of the engine should be allowed for.

Type B is designed for craft in which the engine is mounted right aft, and altso for boats in which a sharply pointed bottom presents difficulty in fitting the more normal type A. But with the exception of this difference in the mounting positions, the two types are similar.

There must be a certain friction between the slide B and the Bearing D in order that the propeller blades maintain the pitch required, and do not, at any time, change position on their own volition. This friction can be adjusted by turning nut K.

It is customary to mount the apparatus so that the forward movement of the control lever accords with the forward movement of the boat, but it can be fitted inversely.

**Marna Screw Reverse.**

This is mounted in the same way as Type A, but the handle has a rotating movement for the three positions, and it should be turned approx. 180° from maximum forvard to maximum reverse, neutral position being between the two extremes.

The apparatus should be adjusted so that the hand grip points straight ahead, when the apparatus is in max. forward position.

The apparatus is easy to handle, with the additional advantage that a wheel can substituted for the hand grip, so that with the assistance of a shain, wire, etc. control can be established from one's seated position.

The shaft which transfers the turning movement of the handle to the eccentric pulley inside the apparatus is fitted with a stuffing box which serves to prevent penetration of water, and it must be suitably tightened.

There is a possibility that after a periode of use, the propellor blades will tend to change their position during speed, and this can be rectified by tightening the stuffing box a little.

**Fitting Regulations for all types.**

The apparatus should be carefully directed into position, and bolted to it's foundation. This operation can be done as follows:

The two screws (F) situated on the side of the apparatus should be loosened, until the slide (B) can be moved in relation to the base, and then the slide and bearing (D) will guide themeselves in, after the centre of the propellor shaft.

The slider contains recessed sections which allow clearance for the two bolts (F), so that it can rise and fall as the angle with the base changes.

The slide, and the bearing, should be checked, to ensure that they have guided themeselves in correctly after the centre of the propellor shaft, and then the bolts can be firmly tightened again. The bearing should then be so fitted, that there is no bend in relation to the shaft.

Such bend may occur later, due to a possible warping of the foundation members, and therefore, (particularly in the case of a newly fitted craft) the two bolts should be slackened again, in order to straighten the bend.

This simple method of rectifying any bend that may occur, is of considerable importance for the life of the propellor tube.

## PROPELLER INSTALLATION

The «MARNA 8—11 H. P. two cylinder engine with Clutch and Variable Pitch propellor is equipped with a 1" shaft 1.¼" tube and 1.⅝" stern tube.

The «MARNA» 8—11 H.P. two cylinder engine with gear and Fixed propellor is equipped with a 1.⅛" shaft and a 1.½" stern tube.

When the shaft has been installed, it is important to check that it remains free from bends, as a bent shaft can easily result from a warped foundation. Therefore, a periodical check should be made, to ensure that the shaft revolves evenly. (Refer to Section: Installation.)

The stern tube is realed internally and externally by means of a tallow joint, and this should be checked yearly, to ensure that it remains waterproof, otherwise water will enter the boat.

The tube of the reversing apparatus is also similarly sealed with a tallow joint, which should be regularly inspected.

The propellor head is filled with grease, and this should be checked periodically, to ensure that it contains a satisfactory amount. It can be refilled by unscrewing the plug which is situated in the head.

## PETROL TANK

A petrol tank is supplied with each engine, also supply pipe from tank to carburettor, and the tank must be fitted so that it is at least 8" above the level of the carburetter, as it must be remembered that the boat rises when under way.

The supply pipe should be laid as straight as possible, as this fecilitates cleaning.

If a vacuum occurs in the tank, the petrol will have difficulty in flowing to the carburettor, and a small hole is bored in the lid of the tank, to prevent this contingency. In the case of a tank being situated under the deck, this hole is bored in the connecting pipe, between the tank and the deck screw cap, and care must be taken to ensure that this hole is not filled.

The petrol will often contain a little water, and the latter can also penetrate into the tank through the filler cap, so the tank should be drained at regular intervals. Water is easily drained, as being heavier than petrol it will always collect at the bottom of the tank.

## ORDERING OF SPARE PARTS

The «MARNA» engine is being continually inproved, and therefore, the Manufacturers reserve the right to modify, or vary construction, at any time, without giving prior warning. It is thus absolutely essential, that the type and the number of engine is given when spare parts are ordered. Noncompliance with this rule will lead to the risk of the receipt of unsuitable components, and delay in despatch.

Each part of the engine has a number. It is not arbitrary, having been built up in a special system, and to ensure convenience in the selection of a required part, these are divided into different groups, which are as follows:

01. Cylinder.
02. Cylinder Head.
03. Piston. — Connecting Rod.
04. Exhaust Manifold.
05. Turn Cock.
06. Carburettor.
10. Crankcase.
11. Crank.
12. Timing Shaft.
13. Internal Lubrication System.
20. Pinion Casing.
21. Eternal Lubrication System.
22. Oil Pump.
23. Pressure Valve.
24. Oil Filter.
25. Hand Pump.
30. Magneto, Bracket and Clamp.
35. Pump, for Cooling System.
40. Rear Overhead Starting Crank.
45. Clutch.
46. Reverse Apparatus.
47. Variable Pitch Propellor.
48. Ferrule.
50. Gear.
51. Fixed Propellor.
55. Electrical Starting Equipment.
60. Standard Equipment.
71. Bilge Pump.

The number of the 8—11 H. P. Cylinder Head, for example, is 90201, the primary figure 9 being the distinguishing number for all components of the «MARNA» 8—11 H. P. type K engine. Then follows 02, the group number for the Cylinder Head, and finally, 01, which is the particular number for the Cylinder Head itself.

Thus, all parts for the Cylinder Head will be numbered 902, followed by two other figures, which decide the particular part required.

For example, the Sparking Plug is numbered 90240, while the number for the piston is 90306.

Instances will occur when parts do not belong to a precise group, or engine type, such os nuts, bolts, and screws, which have only an ordinary number, for example 108, which is the number for the bolt securing the side cover of the crankcase. In addition, there are a number of standard fittings which are common to all types of Marna engines, — for example, the ⅛" Pipe threaded Drain Cock, which is numbered S.F. 60.

The drawing should be studied before a part is ordered, in order to ascertain the required number, and the latter should be checked against the List, then ordered as follows:

For «MARNA» 8—11 H. P. K. no. 6745. Year ordered 1952. One Cylinder Head Gasket No. 90202.

A rapid and faultless depatch can then be relied on.

In conclusion, we would mention that in our opinion a Marna puchaser will find it profitable to study and to follow these Instructions as closely as possible.

A Marna engine will give good and faithful service for many years, providing it receives proper care and attention.

# PARTS LIST

## CYLINDER ASSEMBLY

*GROUP 01*

| Number | Total | |
|---|---|---|
| 90101B | 1 | Cylinder Block |
| 90102 | 1 | Joint |
| 138 | 6 | Hexagonal Nut ½" |
| 90103 | 4 | Tappet Guide Bush |
| 90104 | 4 | Valve Tappet |
| 90105 | 4 | Tappet Adjusting Screw |
| 166 | 4 | Tappet Adjusting Lock Nut ⅜" |
| 90106 | 4 | Valve Guide |
| 90107 | 7 | Valve 38×154 |
| 90108 | 4 | Valve Spring |
| 90109 | 4 | Valve Spring Cup |
| 90110 | 4 | Valve Spring Cup Cotter |
| 90111 | 1 | Valve Chamber Cover |
| 90112 | 1 | Joint |
| 90113A | 1 | Stud Bolt ⅜"×122 |
| 136 | 1 | Hex. Nut ⅜" |
| 90116 | 9 | Stud Bolt ½"×97 Cyl. Hd. |
| 90117 | 2 | » » » » Ex. Man. |
| 90118 | 4 | Plug ¾" Pipe Thread |
| 90119 | 1 | Nameplate |
| 198 | 2 | » Screws 5/32×10 Round Head. |
| S.F.60 | 1 | Drain Cock |

## CYLINDER HEAD ASSEMBLY

*GROUP 02*

| Number | Total | |
|---|---|---|
| 90201A | 1 | Cylinder Head |
| 90202 | 1 | Cylinder Head Gasket |
| 138 | 9 | Hex. Nut. ½" |
| 90203 | 1 | Brass Elbow |
| 90204 | 1 | Joint |
| 212 | 2 | Screw. Round Head 5/16"×¾" |
| 90206 | 2 | Plug. Cast Iron 48,6 |
| S.F.70 | 2 | Priming Cock ¼" Pipe Th. |
| 90240 | 2 | Sparking Plug |

## CONNECTING ROD AND PISTON ASSEMBLY

*GROUP 03*

| Number | Total | |
|---|---|---|
| 90301 | 2 | Connecting Rod. cc—225 |
| 90302 | 4 | » » Bolt ⅜" SAE×1½" |
| 90303 | 2 | Hex. Bolt ⅜" SAE×1¼" |
| 90304 | 6 | Washer ⅜" |
| 90306A | 2 | Piston |
| 90307 | 2 | Gudgeon 1"×92 |
| 90308 | 6 | Compression Ring 100×4 |
| 90309 | 2 | Oil Scraper Ring 100×6 |
| 90311 | 4 | Connecting Rod Bush |

## EXHAUST MANIFOLD

*GROUP 04*

| Number | Total | |
|---|---|---|
| 90401B | 1 | Exhaust Manifold |
| 90402 | 1 | Exhaust Manifold Joint |
| 138 | 2 | Nut ½" |
| 90415 | 1 | Exhaust Pipe Elbow |
| S.F.10 | 1 | Union ½"×½" Pipe Th. |
| 90404 | 1 | Exhaust Outlet Joint |
| 172 | 2 | Nutted Bolt ⅜"×1½" |
| 109 | 2 | Hex Bolt 5/16"×1" |
| 135 | 2 | Nut. 5/16" |
| 90412A | 1 | Elbow ½"×¾". Int. Nozzel ½" |
| S.F.44 | 1 | Nut ¾" Pipe Thr. |
| S.F.55 | 1 | Plug ¾" Pipe Thr. |
| S.F.56 | 1 | Plug ¾" Pipe Thr. with ⅛" Pipethr. |
| S.F.12 | 1 | Union ½"×¾" |
| S.F.60 | 1 | Drain Cock ⅛" Pipe thr. |
| 90416 | 2 | Stud Bolt 5/16" |
| 90417 | 1 | Joint. Cock — Exhaust |
| 135 | 2 | Nut 5/16" |
| 90418 | 1 | Copper Tube ½" Cock — Exh. |
| S.F.25 | 2 | Union Nut ½" Pipe thr. |
| S.F.81 | 2 | Packing for S.F.25. |

## TURN COCK

*GROUP 05*

| Number | Total | |
|---|---|---|
| 90510 | 1 | Turn Cock Body |
| 90511 | 1 | Union with seating |
| 90512 | 1 | Spindle |
| 90513 | 1 | Neck Bush |
| 90514 | 1 | Stuffing Box |
| 90507 | 1 | Hand turn Grip |

## CARBURETTOR

*GROUP 06*

| Number | Total | |
|---|---|---|
| 90601 | 1 | Carburettor. Simplex |
| 90602 | 1 | Joint |
| 109 | 2 | Nutted Bolt. $^5/_{16}$"×1" |
| S.F.60 | 1 | Drain Cock ⅛" Pipe thr. |
| 90603A | 1 | Air Filter |
| 90604 | 1 | Brass Tube 1⅝"×30 |
| 199 | 1 | Round Head Screw $^3/_{16}$"×6 |

## CRANKCASE

*GROUP 10*

| Number | Total | |
|---|---|---|
| 91001B | 1 | Crankcase |
| 91002 | 5 | Stud Bolt ½"×55 |
| 91003 | 1 | Stud Bolt ½"×65 |
| 91004B | 1 | Front Crank Bearing |
| S.F.4 | 1 | Union and Olive ¼" |
| 91005A | 1 | Crank Bearing Cover |
| 118 | 4 | Hex. Bolt ⅜"×1" |
| 91019 | 1 | Packing Cover for 91001B. |
| 91020 | 1 | Joint for 91010 |
| 108 | 3 | Hex. Bolt $^5/_{16}$"×¾" |
| 91021 | 3 | Stud Bolts $^5/_{16}$" |
| 91010A | 1 | Triangular Stuffing Box |
| 91011A | 1 | Joint. Square $^5/_{16}$" |
| 276 | 3 | Lock Washer $^5/_{16}$" |
| 91006A | 1 | Rear Crank Bearing |
| S.F.3 | 1 | Union ¼" Pipe thr. |
| 91007A | 1 | Front Timing Bearing |
| 91008 | 1 | Joint for 91007A |
| 91017 | 1 | Cover for 91007A |
| 91018 | 1 | Joint for 91017 |
| 109 | 2 | Hex. nut. $^5/_{16}$"×1" |
| 91009 | 1 | Rear Timing Bearing |
| 108 | 3 | Hex. Bolt $^5/_{16}$"×¾" |
| 135 | 3 | Hex. Nut $^5/_{16}$" |
| 91012A | 1 | Gauge Rod (Dipstick) |
| 91013 | 1 | Button for Gauge Rod. |
| 91014 | 1 | Joint for 91013 |
| 91015A | 1 | Side Cover. |
| 91016 | 1 | Joint for 91015A |
| 108 | 4 | Hex. bolt $^5/_{16}$"×¾" |
| 112 | 1 | Bolt $^5/_{16}$×1½" inlet Strainer |
| S.F.6 | 1 | Union |

## CRANKSHAFT

*GROUP 11*

| Number | Total | |
|---|---|---|
| 91101C | 1 | Crank with thread for 91116 |
| 91102 | 1 | Crank Driver (or Gear) |
| 91103 | 1 | Crankshaft Chain Wheel |
| 91104 | 1 | Key for Driver $^5/_{16}$" |
| 91105 | 1 | Nut for Driver |
| 51110 | 1 | Ball Bearing S.K.F. |
| 91116 | 1 | Oil Thrower |
| 91110 | 1 | Flywheel |
| 91114 | 1 | Key for 91110 $^5/_{16}$" |
| 91115 | 1 | Nut for Flywheel. |

## TIMING SHAFT

*GROUP 12*

| Number | Total | |
|---|---|---|
| 91201 | 1 | Timing Shaft |
| 91202 | 1 | Timing Driver (or Gear) |
| 91203 | 1 | Key for 91202 |
| 91206 | 1 | Washer for 91202 ½"×1½" |
| 159 | 1 | Hex. Bolt ½"SAE×1¼" |

## INTERNAL LUBRICATION SYSTEM

*GROUP 13*

| Number | Total | |
|---|---|---|
| 91304 | 1 | Inlet Strainer |
| 91305 | 1 | Strainer Gauze Square 110×110 |
| 91306 | 1 | Iron Wire 1.8 |
| 91307 | 1 | Union ⅜" Pipe thr. |
| S.F.41 | 1 | Nut ⅜" Pipe thr. |
| S.F.2 | 1 | Union ¼" Pipe thr. |
| S.F.85 | 1 | Elbow ¼" Pipe thr. |
| 91303A | 1 | Distribution Nipple |
| S.F.1 | 1 | Union ⅛"×¼" Pipe thr. |
| 91309A | 1 | Copper tube ¼" 490 Front Crank Bearing |
| S.F.30 | 4 | Olive ¼" |
| S.F.20 | 4 | Double Cone Nut ¼" |
| S.F.41 | 1 | Nut ⅜" Pipe thr. |
| 91310 | 1 | Copper Tube ¼"×290 Rear Crank Bearing |

## DRIVE CASING

*GROUP 20*

| Number | Total | |
|---|---|---|
| 92001A | 1 | Drive Casing |
| 92002 | 1 | Joint for 92001A |
| 118 | 5 | Hex. Nut 3/8"×1" |
| 119 | 1 | Hex. Nut 3/8"×1¼" |
| 92003 | 1 | Ball Bearing Cover |
| 108 | 3 | Hex. Nut 5/16"×¾" |
| 92018 | 1 | Oil Pump Cover |
| 118 | 3 | Hex. Nut 3/8"×1" |
| 92019 | 1 | Joint for 92018 |
| 92020 | 1 | Bearing Liner for 92018 |
| 92021 | 1 | Set Screw for 92020 |
| 92012 | 2 | Stud Bolt ¼"×64 |
| 92034 | 1 | Water Pump Bracket |
| 92023 | 1 | Joint for 92034 |
| 92024 | 1 | Bearing Liner for 92034 |
| 92025 | 1 | Set Screw for 92024 |
| 118 | 3 | Hex. Nut 3/8"×1" |
| Mim. 2540 | 1 | Oil ring. |
| 92027 | 1 | Intermediate Plate |
| 92028 | 1 | Stuffing Box Plate |
| 92029 | 1 | Joint for 92028 |
| 275 | 3 | Lock Washer |
| 101 | 3 | Hex. Bolt ¼"×¾" |
| 92014A | 1 | Chain Wheel Spindle |
| 92014A | 1 | Chain Wheel |
| 92030 | 1 | Key for 92013A |
| 92031 | 1 | Water Thrower for 92014A |
| 92016 | 1 | 5/8" Single Roller Chain |
| 92017 | 1 | 5/8" Chain Lock |

## EXTERNAL LUBRICATION SYSTEM

*GROUP 21*

| Number | Total | |
|---|---|---|
| 92101 | 1 | Manometer |
| 92102 | 1 | Tightening band |
| S.F.5 | 1 | Union Sleeve ¼" Pipe thr. |
| 92103 | 1 | Copper Tube ¼"×270 Pump-Rear Overhead Starting Crank |
| 92104A | 1 | » » ¼"×730 to the manometer |
| 92105 | 1 | » » 5/16"×290. Pump — Inlet Strainer |
| 92106A | 1 | Copper Tube 3/8"×320 Pump-Filter |
| 92107A | 1 | » » 3/8"×210 Filter-Overflow |
| 92108 | 1 | » » 3/8"×380 Overflow-Sump |
| S.F.30 | 4 | Olive ¼" |
| S.F.32 | 2 | » 5/16" |
| S.F.33 | 6 | » 3/8" |
| S.F.20 | 4 | Union nut ¼"Pipe thr. |
| S.F.22 | 8 | » » 3/8" Pipe thr. |

## PRESSURE VALVE

*GROUP 21*

| Number | Total | |
|---|---|---|
| 92120 | 1 | Valve Body |
| 92121 | 1 | Pressure Valve |
| S.F.23 | 1 | Base Nut 3/8" Pipe thr. |
| S.F.41 | 1 | Nut 3/8" |
| S.F.80 | 1 | Joint for Base Nut |
| 92122 | 1 | Steel Ball 3/8" |
| 92123 | 1 | Helical Spring 0.75×10×42 |
| 92124 | 1 | Governing Screw ¼" Pipe thr.×8. |

## OIL PUMP

*GROUP 22*

| Number | Total | |
|---|---|---|
| 92201 | 1 | Pump Body |
| 92202 | 1 | Pump Body Cover |
| 92203 | 1 | Joint |
| 101 | 2 | Hex. Bolt ¼"×¾" |
| 92204 | 1 | Drive Gear |
| 92205 | 1 | Cog Wheel |
| S.F.6 | 1 | Union 3/8" Pipe thr. |
| S.F.2 | 1 | » ¼" Pipe thr. |
| S.F.50 | 1 | Plug 1/8" Pipe thr. |
| 92206 | 1 | Joint (Pump-bracket) |
| 134 | 4 | Hex. Nut ¼" |
| S.F.6 | 1 | Union 3/8" Pipe thr. |

## OIL FILTER

*GROUP 24*

| Number | Total | |
|---|---|---|
| 92401 | 1 | Tube |
| 92402 | 1 | Tube Packing |
| 92403 | 1 | Filter Cover |
| 92404 | 1 | Joint |
| 92405 | 1 | Filter Gauze 0.5 square×56×230 |
| 92406 | 1 | Iron Wire 1.8×250 |
| 92407 | 1 | Tightenning Bolt with oil outlet |
| S.F.42 | 1 | Nut ½" Pipe th. for bolt |
| 92409 | 1 | Base Nut 3/8" Pipe th. |
| 92410 | 1 | Copper Tube 3/8"×100 |
| S.F.60 | 1 | Drain Cock 1/8" Pipeth |
| S.F.6 | 1 | Union 3/8" for 92410 |

## HAND PUMP

*GROUP 25*

| Number | Total | |
|---|---|---|
| 92501 | 1 | Pump Body |
| 92502 | 1 | Bush with outlet nozzle |
| 92503 | 1 | Base Valve |
| | 1 | Pin 2×27 |
| | 2 | Steel Ball 3/8" |
| 92504 | 1 | Pump Body Cover |
| 92505 | - | Cover Gland |
| 92506 | 1 | Pump Rod 5/16" |
| 92507 | 1 | Piston Valve |
| | 1 | Pin 2×12 |
| 92508 | 1 | Union with Piston Valve |
| | 1 | Split Pin |
| 92509 | 1 | Washer Union — Packing |
| 92510 | 1 | Pump Rod Bush |
| 92511 | 1 | Piston Packing |
| 92512 | 1 | Pump Rod Button |
| 92513 | 1 | Pump Holder. |
| 92514 | 1 | Copper Tube. Pump — Sump |
| S.F.33 | 2 | Olive 3/8" |
| S.F.22 | 2 | Olive Nut 3/8" |
| 108 | 2 | Hex. Bolt 5/16"×3/4" |
| 118 | 1 | Hex. Bolt 3/8"×1" |

## MAGNETO, BRACKET, AND CLAMP BAND

*GROUP 30*

| Number | Total | |
|---|---|---|
| 93001 | 1 | Magneto Bracket |
| 93002 | 1 | Packing |
| 108 | 3 | Hex. Bolts 5/16"×3/4" |
| 93003 | 1 | Bearing Bush. |
| 93004 | 1 | Set Screw 1/4" |
| 93005 | 1 | Magneto Drive Spindle 1 1/8"×136 |
| 93006 | 1 | Magneto Drive |
| 93007 | 1 | Key 1/4"×18 |
| 93008 | 1 | Gudgeon Pin. |
| 93009 | 1 | Plug 5/16" |
| 93050 | 1 | Magneto |
| 93051 | 2 | Leads |
| 93052 | 2 | Cable Shoe |
| 93053 | 1 | Lead Clamp |
| 200 | 1 | Round Head Screw 3/16"×10 |
| 93055 | 1 | Bosch Magneto Coupling |
| 93056 | 1 | Driver Disc. |
| 93057 | 1 | Set Screw |
| 143 | 1 | Hex. Bolt 3/8" SAE×1 |
| 93058 | 1 | Sparking Plug Protector |
| 93020 | 1 | Metal Band 1×25 |
| 93021 | 1 | Base |
| | 4 | Rivet 3/16"×14 |
| 93022 | 1 | Tightening Screw 7/16"×40 |
| 137 | 1 | Hex. Nut. 7/16" |
| 93059 | 1 | Rubber Hood. |
| 93060 | 1 | Coupling Part for the Sem Magneto. |

## PUMP — COOLING SYSTEM

*GROUP 35*

| Number | Total | |
|---|---|---|
| 93570 | 1 | Body |
| 93571 | 1 | Body Cover |
| 93572 | 1 | Packing |
| 206 | 4 | Round Head Screw 1/4"×3/4" |
| 121 | 1 | Hex. Bolt 3/8"×1 1/2" |
| 120 | 1 | Hex. Bolt 3/8"×1 3/8" |
| 93573 | 1 | Driving Shaft |
| 93574 | 1 | Driving Gear |
| 93575 | 1 | Key for 93574 |
| 93576 | 1 | Idler Shaft |
| 93577 | 1 | Driven Gear |
| 93578 | 1 | Stuffing Box |
| 93579 | 1 | Stop Nut |
| 93580 | 1 | Joint |
| S.F.10 | 2 | Union 1/2" Pipe th. |
| S.F.25 | 4 | Box Nut 1/2" |
| S.F.81 | 4 | Packing Ring. |
| 93511 | 1 | Copper Tube Cylinder Head-Exhaust Manifold 1/2" |
| 93565 | 1 | Copper Tube Pump-Exhaust Manifold 1/2" |
| S.F.60 | 1 | Drain Cock 1/8" Pipe th. |
| S.F.90 | 1 | Grease Cup No. 4. |
| S.F.5 | 1 | Sleeve Union 1/4" |
| 93564 | 1 | Coupling |

## REAR OVERHEAD STARTING CRANK ASSEMBLY

*GROUP 40*

| Number | Total | |
|---|---|---|
| 94001A | 1 | Starting Assembly Frame |
| 94002 | 1 | Packing for 94001A |
| 118 | 4 | Hex. Bolt 3/8"×1" |
| 94003 | 1 | Oil Plug |
| 94004A | 1 | Bearing Cover |
| 94005 | 1 | Bearing Lining for 94004A |
| 94006 | 1 | Set Screw |
| S.F.2 | 1 | Union |
| 94007A | 1 | Crank Housing |
| 94008 | 1 | Packing |
| 113 | 4 | Hex. Bolt 5/16"×45 |
| 94009 | 1 | Adjustable Chain Drive |
| 94010 | 1 | Lining for 94009 |
| 94011 | 1 | Journal for Chain Drive |

| | | |
|---|---|---|
| 94012 | 1 | Journal Screw 5/8" |
| 94013 | 1 | Washer for 94012 |
| 94014 | 1 | Hex. Bolt 7/16"×2" |
| 137 | 1 | Hex. Nut 7/16" |
| 94015 | 1 | Front Cover |
| 94016 | 1 | Joint for 94015 |
| 113 | 2 | Hex. Bolts 5/16"×1¾" |
| 94017 | 1 | Rear Cover |
| 94018 | 1 | Joint for 94017 |
| 108 | 2 | Hex. Bolt 5/16"×¾" |
| 94030A | 1 | Crank |
| 94033 | 1 | Crank Claw with shaft |
| 94034A | 1 | Pin for Crank |
| 94035 | 1 | Pin 3/8"×52 |
| 94019A | 1 | Packing for 94004A |

## CLUTCH ASSEMBLY

*GROUP 45*

| Number | Total | |
|---|---|---|
| 94501A | 1 | Coupling Box |
| 94502 | 1 | Joint for 94501A |
| 121 | 5 | Hex. Bolt 3/8"×1½" |
| 94503 | 1 | Coupling Bell |
| 94504 | 1 | Neck Journal 20 |
| 94511 | 1 | Coupling |
| 94520A | 1 | » Shaft |
| 94521 | 1 | » Cover |
| 94522 | 1 | » Cover Joint |
| 94523A | 1 | Handle |
| 94524 | 1 | Right Packing Washer |
| 94525 | 1 | Packing |
| 94526 | 1 | Left Packing Washer |
| 94527 | 1 | Packing |
| 94528 | 1 | Stud. Bolt 3/8"×40 |
| 136 | 2 | Hex. Nut 3/8" |
| 94540 | 1 | Bronze Bearing |
| 118 | 4 | Hex. Bolt 3/8"×1" |
| 94541 | 1 | Packing |
| 94542 | 1 | Stuffing Box. |
| 94543 | 1 | Graphited Oil Packing |
| 94544 | 1 | Stuffing Box Stopper |
| 94547 | 1 | Bolt 5/16"×1½" |
| S.F.91 | 1 | Grease Cup No. 6 ¼" Pipe Th. |
| S.F.86 | 1 | Half Bend ¼" Pipe Th. Int.and Ex. |
| Mim. 3047 | 1 | Packing Ring |
| 94545 | 1 | Oil Thrower Thrust Plate |
| 191 | 1 | Grub Screw 7/16"×1" |
| 192 | 1 | » » for Coupling Bell |
| 94552 | 1 | Key 5/16"×60 |
| 94553 | 1 | Friction Spring |
| 94554 | 1 | Key 5/16"×40 |
| 94555 | 2 | Coupling Lever |
| 94556 | 2 | Adjusting Screw ½" SAE×39 |
| 168 | 2 | Hex. Nut ½" SAE |
| 94557 | 2 | Roller. Coupling Lever. |
| 94558 | 2 | Pin for Roller |
| 94559 | 1 | Coupling Cone. |
| 94560 | 1 | Half Moon. |
| 94561 | 1 | Coupling Fork. |
| 94562 | 2 | Screw ½" SAE |
| 192 | 1 | Set Screw 7/16"×¾" |
| 94563 | 1 | Taper Pin 5/16" Thread |
| 135 | 1 | Hex. Nut 5/16" |
| 108 | 4 | Hex bolt 5/16"×¾" |
| 94564 | 1 | Key ¼"×65 for Coupling |
| 6204 | 1 | SKF radial Bearing 20. |

## REVERSE ASSEMBLY

*GROUP 46*

| Number | Total | |
|---|---|---|
| 94601 | 1 | Base Type A and B. |
| 94602 | 1 | Slide |
| 94603 | 1 | Stud Bolt 7/16"×92 |
| 94604 | 1 | Wheel |
| 94605 | 1 | Galvanised Tube 3/8"×47 |
| 180 | 2 | Nutted Bolt ½"×5 |
| 94606 | 2 | Washer Brass ½" |
| 94607 | 2 | Hex. Nut Brass ½" |
| 94608 | 2 | Liner (Clamp Bush for 108) |
| 94609 | 1 | Handle Securing Section |
| 94610 | 3 | Stud Bolt ¼" Pipe th. Brass |
| 94611 | 3 | Hex. Nut. ¼" Pipe th. Brass |
| 94612 | 3 | Hex. Lock Nut. Pipe th. Brass |
| 118 | 3 | Hex. Bolt 3/8"×1" |
| 144 | 1 | Hex. Bolt 3/8" SAE×1¼" |
| 94613 | 1 | Hex. Box Spanner |
| S.F.91 | 1 | Grease Cup. ¼" Pipe Th. no. 6. |
| 94620 | 1 | Bearing (Lead Bronze) 1¼" |
| 94621 | 1 | Front Piece for Bearing 1¼" |
| 94622 | 1 | Clamp Disc. (Clip) 1¼" |
| 94623A | 1 | Long Handle |
| 94624 | 1 | Handle Piece |

## SCREW REVERSE

| Number | Total | |
|---|---|---|
| 94650 | 1 | Base |
| 94651 | 1 | Slide |
| 94652 | 1 | Lower Half Part for 94651 |
| 94653 | 1 | Packing |
| 118 | 4 | Hex. Bolt 3/8"×1" |
| 94654 | 1 | Adjustable Handle Bearing |
| 94655 | 1 | Stop Nut |
| 94656 | 1 | Packing (Hemp) |
| 94657 | 1 | Stuffing Box |
| 94658 | 1 | Handle Column |

| | | |
|---|---|---|
| 94659 | 1 | Eccentric for 94658 |
| | 1 | Cone 65×55 m.m. |
| 94660 | 1 | Slide (Square) |
| 94661 | 1 | Arm for Handle Column |
| 139 | 1 | Hex. Nut 5/8" |
| 94662 | 2 | Bush for Securing Screw |
| 181 | 2 | Black Nutted bolt 1/2"×6" |
| 94663 | 2 | Washer |
| S.F.91 | 1 | Grease Cup no. 6. 1/4" Pipe Th. |
| 94665 | 1 | Bearing (Lead Bronze) |
| 94666 | 1 | Front Piece for Bearing |
| 118 | 3 | Hex. Bolt 3/8"×1" |
| 94622 | 1 | Clamp Disc (Clip) 1 1/4" |
| 144 | 1 | Hex. bolt 3/8" SAE×1 1/4" |
| 94607 | 2 | Nut 1/2" Brass (Substitute for nut for bolt) |

## VARIABLE PITSH PROPELLER AND SHAFT

*GROUP 47*

| Number | Total | |
|---|---|---|
| 94701 | 1 | Propeller Head for 1" Shaft and 1 1/4" Tube |
| 94702 | 1 | Tube Head 1 1/4" |
| 94703 | 2 | Hex. bolt 94702 1/4" Pipe Th. |
| 94704A | 2 | Propeller Blades |
| 94705 | 1 | Flange Coupling for shaft 1" |
| 94706 | 1 | Shaft 1"×2500. Turned, milled, and trued complete. |
| 94707 | 1 | Draw Tube 1 1/4"×2300 Threaded and trued complete. |
| 94708 | 1 | Key 1/4" |
| 94709 | 1 | Hex. nut 3/4" |
| 94710 | 1 | Box Nut for draw Tube |
| 94711 | 1 | Packing for 94710 |
| 94712 | 1 | Plug 1/4" Pipe Th. for Propeller Head. |
| 94713 | 1 | Pin (Copper Wire) |
| 94714 | 1 | Key for Coupling |
| 192 | 1 | Set Screw 7/16"×3/4" |
| 173 | 4 | Nutted Bolt 3/8"×1 3/4" |

## STERNTUBE ASSEMBLY

*GROUP 48*

| Number | Total | |
|---|---|---|
| 94820 | 1 | Stern Tube. External 1 1/4" |
| 94821 | 1 | Stern Tube. Internal 1 1/4" |
| 94812 | 1 | Stuffing box for Internal tube |
| 94813 | 1 | Stuffing box for External tube |
| 94814 | 1 | Securing Nut for External tube |
| 94815 | 1 | Securing Nut for Internal tube |
| 94807 | 2 | Tallow Packing |
| 94822 | 1 | 1 5/8"×675 stern tube |
| 94809 | 2 | Bolt (Tinned) 1/2" |
| 223 | 2 | Hex. Nut 1/2" Brass |
| | 4 | Wood Screws 1 1/2"×no. 20. (Internal tube) |
| S.F.5 | 1 | Joining piece for grease cup |
| S.F.91 | 1 | Grease Cup no. 6 1/4" Pipe Th. |

## GEAR ASSEMBLY

*GROUP 50*

| Number | Total | |
|---|---|---|
| 95001 | 1 | Bearing Liner |
| 95002 | 1 | Bevel Pinion 40 |
| 95003 | 1 | Key 5/16"×40 |
| 95004 | 1 | Bevel Pinion 1" |
| 95005 | 1 | Key 1/4"×49 |
| 95006 | 3 | Differential Gear |
| 95007 | 1 | Triangle Shaft |
| 95008 | 1 | Gear Case |
| 95009 | 1 | Gear Case Cover |
| 119 | 6 | Hex. Bolt 3/8"×1 1/4" |
| 95010 | 1 | Iron Wire 1.8 |
| 95011A | 1 | Gear shaft for 95070 |
| 95012 | 1 | Gear Cone |
| 95013 | 1 | Key 5/16" for Friction Spring |
| 95016 | 1 | Gear Fork |
| 95017 | 1 | Half Moon |
| 95018 | 2 | Screw 1/2" SAE×27 |
| 192 | 1 | Set screw 7/16"×3/4" |
| 95019 | 1 | Taper Pin 5/16" Thread |
| 135 | 1 | Hex. Nut 5/16" |
| 95020 | 1 | Gear Box Cover |
| 95021 | 1 | Joint |
| 108 | 6 | Hex. Nut 5/16"×3/4" |
| 95022 | 1 | Plug 1" Pipe th. Gear Box |
| 95027 | 1 | Flange Coupling 1 1/8" for Gear Shaft |
| 192 | 1 | Set screw 7/16"×3/4" |
| 95028 | 1 | Key 1/4"×65 for coupling |
| 95030 | 1 | Gear Box |
| 95031 | 1 | Joint |
| 118 | 5 | Hex. Bolt 3/8"×1" |
| 95040 | 1 | Handle |
| 95041 | 1 | Stop Ring. Left |
| 95042 | 1 | Stop Ring. Right |
| 95043 | 1 | Stud Bolt 3/8"×28 |
| 136 | 2 | Hex Nut. 3/8" |
| 95044 | 2 | Packing for Handle |
| 95050 | 1 | Friction Spring |
| 95051 | 2 | Coupling Arm |
| 95052 | 2 | Adjusting Screw 1/2" SAE |
| 168 | 2 | Hex. Nut 1/2" SAE |
| 95053 | 2 | Coupling Arm Roller |
| 95054 | 2 | Pin. for roller. 10 |
| 95060 | 1 | Brake Ring |
| 95061 | 1 | Guide Screw 3/4" SAE |
| 170 | 1 | Hex. Nut 3/4" SAE |
| 95062 | 1 | Tightening Screw 5/8" |

| | | |
|---|---|---|
| 95063 | 1 | Roller for 95062 |
| 95064 | 1 | Pin for Roller 8.5 |
| 95065 | 1 | Nut 5/8" for Tightening Screw |
| 95066 | 1 | Splint for 95065 1.8 |
| 95067 | 1 | Slide for Brake Ring |
| 144 | 1 | Hex. Nut 3/8" SAE×1¼" |
| 95068 | 1 | Crown Nut 3/8" SAE |
| 95069 | 1 | Splint 2.5 for 95068 |
| 95070 | 1 | Bronze Bearing |
| 95071 | 1 | Packing for 95070 |
| 118 | 4 | Hex. Bolt 3/8"×1" |
| 95072 | 1 | Stuffing Box |
| 95073 | 1 | Graphited Oil Packing |
| 95074 | 1 | Stopper for Stuffing Box |
| 95075 | 1 | Oil Thrower Thrust Plate |
| 51112 | 1 | SKF Thrust Bearing |
| 197 | 1 | Set Screw 7/16"×1½" |
| 95076 | 1 | Brass Screw 5/16"×1½" for 95074 |
| Mim. 3047 | 1 | Oil Packing Ring |
| S.F.91 | 1 | Grease Cup no. 6 ¼" Pipe Th. |
| S.F.86 | 1 | Galvanised Half Bend |
| 95077 | 1 | Thrust Plate. |

## FIXED PROPELLER

*GROUP 51*

| Number | Total | |
|---|---|---|
| 95101 | 1 | Propeller |
| 95102 | 1 | Shaft 1"×2500. Turned, milled and trued, complete. |
| 95103 | 1 | Key ¼"×60 |
| 95104 | 1 | Hex. Nut ½" Pipe Th. |
| 95105 | 1 | Coupling 1" |
| 95106 | 1 | Key for 95105 |
| 192 | 1 | Set screw 7/16"×¾" |
| 173 | 4 | Nut Bolt 3/8"×1¼" |

## STERN TUBE ASSEMBLY FOR FIXED PROPELLOR

*GROUP 48*

| Number | Total | |
|---|---|---|
| 94801 | 1 | Stern Tube External 1" |
| 94802 | 1 | » » Internal 1" |
| 94803 | 1 | Stuffing Box for 94802 |
| 94804 | 1 | » » » 94801 |
| 94805 | 1 | Securing Nut for 94801 |
| 94806 | 1 | » » » 94802 |
| 94807 | 2 | Tallow Packing |
| 94808 | 1 | Stern tube 1⅜"×675 |
| 94809 | 2 | Stern-Tube Bolt ½" (Tinned) |
| 223 | 2 | Hex. Nut ½" Brass |
| | 4 | Wood Screw 1½" no. 20 (Int. Tube) |
| S.F.5 | 1 | Joining Piece for Grease Cup |
| S.F.91 | 1 | Grease Cup no. 6¼" Pipe Th. |

## 12 VOLT INSTALLATION

**Comprising: Flywheel Casing, Starter, Dynamo, and Bilge Pump 35 l.**

*GROUP 55*

| Number | Total | |
|---|---|---|
| 95580 | 1 | Flywheel. Casing |
| 95581 | 1 | Packing for 95580 |
| 188 | 5 | Hex. Bolt 3/8"×1" |
| S.F.53 | 1 | Plug for 95580 ½" Pipe Th. |
| 95567 | 1 | Blank Cover for 95580 |
| 95584 | 1 | Cock Spindle |
| 95585 | 1 | Seating for 95584 |
| 95586 | 1 | Spindle Guide |
| 90507 | 1 | Wheel |
| 95545 | 1 | Front Bearing for Pump Bolt |
| 95546 | 1 | Rear Bearing for Pump Bolt |
| 95582 | 1 | Flywheel Casing Cover |
| 95583 | 1 | Joint for 95582 |
| 108 | 8 | Hex. Bolt 6/16"×¾" |
| 95532 | 1 | Flywheel for Starter |
| 95533* | 1 | Flywheel Ring Gear |
| 95587 | 1 | Intermediate Section for V Bolt Pulley |
| 95584 | 4 | Stud Bolt ½"×121 |
| 138 | 4 | Hex. Nut ½" |
| 95562 | 1 | V Belt Pulley |
| 95589 | 1 | Dynamo Holder for R.K.C. 130/12/825 l. |
| 95571 | 1 | Clamp Band |
| 95539 | 1 | Stop Nut for 95589 |
| 95543 | 1 | Tightening Screw |
| 135 | 1 | Nut 5/16" |
| 95544 | 1 | Washer 5/16" |
| 199 | 2 | Round Head Screw 3/16"×¼" |
| 95590 | 1 | V Belt Pulley for R.K.C. 130/12/825 l. |
| 46A | 1 | V Belt 46 A. |
| 95591 | 1 | Belt Case |
| 171 | 3 | Screw 5/16"×2½" |
| 118 | 2 | Hex. Bolt 3/8"×1" for Startar Flange |
| 95552 | 1 | Gauge Rod Button (Long) |
| 95516* | 1 | Starter Cable 1.5 m.×35 m.m.² |
| 95517 | 2 | Pole Claw for Battery |
| 95518 | 1 | Cable Shoe |
| 95519 | 1 | Dynamo Lead 2.5 m×4 mm² |
| 95520A* | 1 | Start Switch |
| 95521 | 1 | Fuse Box |
| 95522 | 1 | Ammeter |

| | | | | | |
|---|---|---|---|---|---|
| 95525* | 1 | Start Switch Lead | 95527* | 1 | Bosch Starter E.G.D. 1/12 AL. |
| 95526 | 1 | Battery 12 Volt | 95529 | 1 | Bosch Dynamo R.K.C. 130/12/825 l. |

**Note.** Part Number 95567 is not required when the engine is delivered with a Starter.
Parts which are marked with an asterisk are not included if a Starter is not required.
The Dynamo R.J.H. 130/12/2000 R.I. can also be used with this equipment, but in that case the following are required:

| Number | Total | |
|---|---|---|
| 95578 | 1 | Bosch Dynamo R.J.H. 130/12/2000 R.I. |
| 95565 | 1 | V Belt Pulley for R.J.H. 130/12/200 R.I. |
| 95563B | 1 | Dynamo Holder for » » » » » |
| 95564 | 1 | Clamp Band for » » » » » |

## 6 VOLTS INSTALLATION

### Flywheel Casing, Starter, and Dynamo.

*GROUP 55*

| Number | Total | | Number | Total | |
|---|---|---|---|---|---|
| 95580 | 1 | Flywheel Casing | 95539 | 1 | Stop Nut for Holder |
| 95581 | 1 | Packing for 95580 | 95540 | 1 | Clamp Band |
| 108 | 7 | Hex. Bolt 5/16"×¾" | 95543 | 1 | Tightening Screw |
| S.F.53 | 1 | Plug ½" Pipe Th. for 95580 | 135 | 1 | Hex. Nut 5/16" |
| 95584 | 1 | Cock Spindle | 95544 | 1 | Washer |
| 95585 | 1 | Spindle Seating | 199 | 2 | Round Head Screw 3/16"×¼" |
| 95586 | 1 | Spindle Guide | 95541 | 1 | V Belt Pulley for Dynamo 6 V. |
| 90507 | 1 | Wheel | 42A | 1 | V Belt 42A |
| 95567 | 1 | Blank Cover for 95580 | 95552 | 1 | Gauge Rod Button (Long) |
| 95545 | 1 | Front Lining for Pump Bolt | 95516 | 1 | Starter Cable 1.5 m×35 m.m.² |
| 95546 | 1 | Rear Lining for Pump Bolt | 95517 | 2 | Pole Claws for Battery |
| 118 | 2 | Hex. Bolts ⅜"×1" for Starter Flange | 95518 | 1 | Cable Shoe |
| 95592 | 1 | Cover with Dynamo Housing | 95519 | 1 | Dynamo Lead 2.5 m.×4 m.m.² |
| 95593 | 1 | Joint for 95592 | 95520A* | 1 | Start Switch |
| 108 | 7 | Hex. Bolts 5/16"×¾" | 95521 | 1 | Fuse Box |
| S.F.57 | 1 | Plug 1" Pipe Th. for centre Hole | 95522 | 1 | Ammeter |
| 95532 | 1 | Flywheel for Starter | 95525* | 1 | Start Switch Lead |
| 95533* | 1 | Flywheel Ring Gear | 95515 | 1 | Battery 6 Volt |
| 95534 | 1 | V Belt Pulley | 95523* | 1 | Bosch Starter E.G.D. 06/6 AL. |
| 110 | 4 | Hex. Bolt 5/16"×1¼" | 95524 | 1 | Bosch Dynamo R.E.E. 75/6/2000 R. |
| 95538 | 1 | Dynamo Holder 6 V. | | | |

**Note.** Part number 95567 is not required when the engine is delivered with a Starter.
Parts which are marked with an asterisk are not included if a starter is not required.

## EQUIPMENT FOR 6 VOLTS DYNAMO

*GROUP 55*

| Number | Total | | Number | Total | |
|---|---|---|---|---|---|
| 95550 | 1 | V Belt Casing | 95541 | 1 | V Belt Pulley for Dynamo 6 V. |
| 118 | 4 | Hex. Bolts ⅜"×1" | 35A | 1 | V Belt 35A. |
| 95532 | 1 | Flywheel for Starter | 95551 | 1 | Deck Plate for 95550 |
| 95534 | 1 | V Belt Pulley | | 3 | Screws ¼"×½" |
| 110 | 4 | Hex. Bolts 5/16"×1¼" | 95515 | 1 | Battery 6 volt 90 amp. Ih. |
| 95538 | 1 | Dynamo Holder 6 V. | 95517 | 2 | Pole Claws for Battery |
| 95539 | 1 | Stop Nut for Holder | 95518 | 1 | Cable Shoe |
| 95540 | 1 | Clamp Band | 95519 | 1 | Dynamo Lead 2.5 m×4 m.m.² |
| 95543 | 1 | Tightening Screw for 95540 | 95521 | 1 | Fuse Box |
| 135 | 1 | Nut 5/16" Thread for 95543 | 95522 | 1 | Ammeter |
| 95544 | 1 | Washer 5/16" | 95524 | 1 | Bosch Dynamo R.E.E. 75/6/2000 R. |
| 199 | 2 | Screws 3/16"×¼" Round Head | | | |

## SECURING BRACKET FOR BILGE PUMP 35 L.

*GROUP 55*

| Number | Total | |
|---|---|---|
| 95595 | 1 | Bilge Pump Bracket |
| 95596 | 3 | Bracket Spacers (long) |
| 121 | 3 | Hex. Bolts 3/8"×1½" |
| 95545 | 1 | Front Liner for Pump Bolt |
| 95546 | 1 | Rear Liner for Pump Bolt |

| Number | Total | |
|---|---|---|
| 95532 | 1 | Flywheel |
| 95561 | 1 | Intermediate Section for V Belt Pulley |
| 70103 | 4 | Stud Bolt ½"×108 |
| 138 | 4 | Hex. Nuts ½" |
| 47017 | 1 | V. Belt Pulley |

**Note.** This equipment and that for the 6 Volt Dynamo can be combined, but in that case, the following parts are required for securing the V Belt Casing and Bilge Pump Bracket.

| Number | Total | |
|---|---|---|
| 118 | 2 | Hex. Bolts 3/8"×1" |
| 121 | 3 | Hex. bolts 3/8"×1½" |

| Number | Total | |
|---|---|---|
| 95596 | 1 | Bracket Spacers (long) |
| 95597 | 2 | Bracket Spacers (short) |

## STANDARD EQUIPMENT

*GROUP 60*

| Number | Total | |
|---|---|---|
| 96001 | 2 | Regulating Arms |
| 96002 | 1 | Intermediate Section |
| 96003 | 1 | Helical Spring |
| 215 | 1 | Round Headed Brass Screw 5/16"×35 |
| 220 | 1 | Hex. nut 5/16" brass |
| 206 | 2 | Round Headed Brass Screws ¼"×¾" |
| 96004 | 1 | Angle Iron for Deck Casing |
| 96005 | 1 | Angle Iron Securing Piece |
| 206 | 2 | Round Headed Brass Screws ¼"×¾" |
| 96006 | 1 | Throttle Button |
| 96010 | 1 | Petrol Tank 30 Litre. |
| 96011 | 1 | Filling Flange 1" Pipe Th. |
| 96012 | 1 | Plug for 96011 |
| 96013 | 1 | Union for Cock |
| S.F.60 | 1 | Drainage Cock |
| 96015 | 1 | Petrol Tank Cock Body |

| Number | Total | |
|---|---|---|
| 96016 | 1 | Spindle |
| 96017 | 1 | Spindle Pin. |
| 96018 | 1 | Spindle Nut |
| S.F.32 | 1 | Olive 5/16" |
| S.F.22 | 1 | Union Nut 3/8" |
| 96020 | 1 | Copper Tube 5/16"×2500 m.m. |
| 96025 | 1 | Strainer |
| 96026 | 1 | Bilge Intake ½" |
| 96027 | 1 | Washer for 96026 |
| S.F.42 | 1 | Securing nut ½" Pipe Th. |
| 96078 | 1 | Inlet Cock |
| 96029 | 1 | Copper Water Pipe ½"×2500 m.m. |
| S.F.25 | 3 | Union Nuts ½" |
| S.F.81 | 3 | Union Nuts Packing |
| | 1 | Adjustable Spanner 10" |

## BILGE PUMP

*GROUP 71*

| Number | Total | |
|---|---|---|
| 97130 | 1 | Pump Body |
| 97131 | 1 | Pump Body Cover |
| 97132 | 1 | Joint for 97131 |
| 260 | 8 | Brass Screws Round Head ¼"×¾" |
| 97133 | 1 | Driving Shaft |
| 97134 | 1 | Driving Gear |
| 97135 | 1 | Driven Gear |
| 97136 | 1 | Gear Key ¼"×43 m.m. |
| 97137 | 1 | Idler Shaft |
| 97138 | 1 | Nut for 97137 |
| 97105 | 1 | Nut for 97133 |
| 97106 | 1 | Washer for 97105 |
| 97107 | 1 | Key for V. Belt ¼"×20 m.m. |
| 97108 | 1 | Stuffing Box |
| 97109 | 1 | Locknut |
| 97110 | 1 | 5/16" Graphited Packing |
| 97114 | 1 | V. Belt Pulley |

| Number | Total | |
|---|---|---|
| S.F.60 | 1 | Drain Cock ¼" Pipe Th. |
| S.F.90 | 1 | Grease Cup no. 4 |
| 42B | 1 | V. Belt 42B |
| 97115 | 1 | Hose Nozzles |
| 97116 | 1 | Strainer |
| 97117 | 1 | Securing Bolt |
| 117 | 1 | Set screw 3/8"×¾" |
| 97118 | 1 | Tension Bar |
| 172 | 1 | Nutted Bolt 3/8"×1½" |
| 97119 | 1 | Stud Bolt 3/8"×1¼" |
| 97120 | 1 | Washer |
| 292 | 1 | Wing Nut 3/8" |
| 97123 | 1 | ¾" Hose. Strainer — Pump |
| | 1 | Hose Clip for Strainer |
| 97124 | 1 | ¾" Hose. Pump — Overboard |
| | 2 | Hose Clips for Pump |