150 Years of GARDNER Engineering Excellence

Lawrence Gardner *

In 1868 Lawrence Gardner at the age of 28 established a business as a machinist. This started in the cellar of a normal house in Upper Duke Street, Manchester. Getting the 10 ½" centre lathe and an 8 ft boiler into the cellar required a little ingenuity. The history books record that it was done using pulley blocks and planks hanging out of a bedroom window. There was little Health and Safety in those days! By the time he established the business,Laurence had a family consisting of six sons and two daughters. Although the business started off machining other people castings, it quickly developed into a general engineering concern, manufacturing machines to do a variety of jobs, a machine to score cardboard, another to cut dovetails in it and another to hammer them into place. Even an early coffee roaster, "no brought in parts" master gears were cut and finished by hand to serve as patterns for casting replica parts.

After some early difficulties the business grew, with twelve employees as well as the family members who were learning their trade. There was more work than could be managed by the existing workforce and with the need to expand, a move was made to Cornbrook Park Road, not far from the original premises.

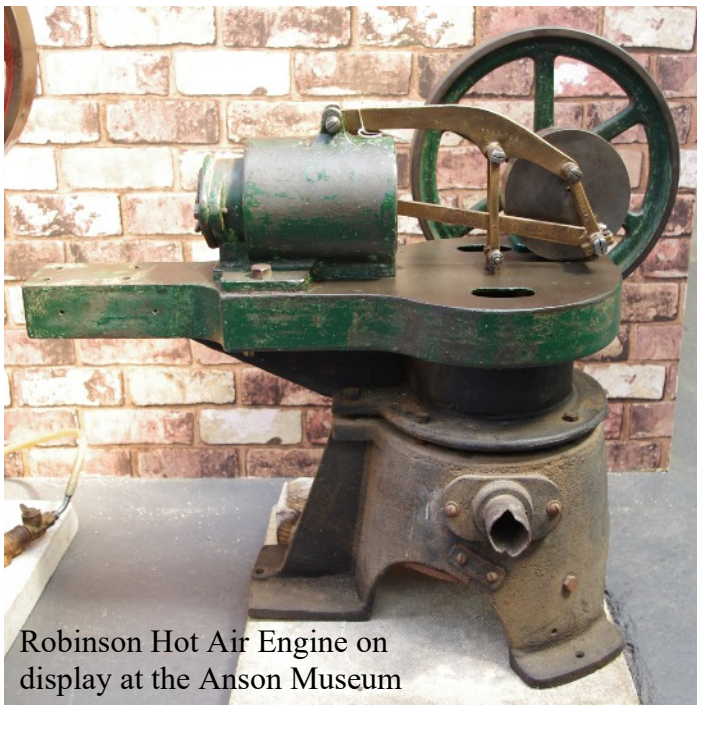
At the relatively early age of 50, Lawrence Gardner passed away leaving the business to his wife. His son Thomas Harry Gardner, who had not always seen eye to eye with father returned to the firm. Thomas and his brother Edward had received an education that was not available to their father, having attended the prestigious Manchester Victoria University as recipients of scholarships established by Sir Joseph Whitworth.

The firm continued to prosper and another move was made a larger premises in Lund Street, where they now employed 80 people. With this move they were able to handle larger items, dynamos up to 3 tons in weight, dentists chairs with their own modifications. It is know that 106 were made in the first 3 years and that in 1968, when Gardner's were celebrating their centenary, there were still two in use in the Manchester area.

Ten years after the death of their father, the company changed name from "L Gardner Machinist" to "L Gardner and Sons Ltd". One would like to think that it was a tribute to their father.

In 1891 details of the A.E & H Robinson hot air engine were published in the *Illustrated Magazine of Practice and Theory.* Gardner's arranged to manufacture this engine, which was the start of their foray into engine building.

This arrangement continued until 1894. In the meantime they were developing their own engines, By 1893 Gardner's had built and sold a Gas powered unit at a price of £12.10s which was profitable.



Robinson Hot Air Engine on display at the Anson Museum

#

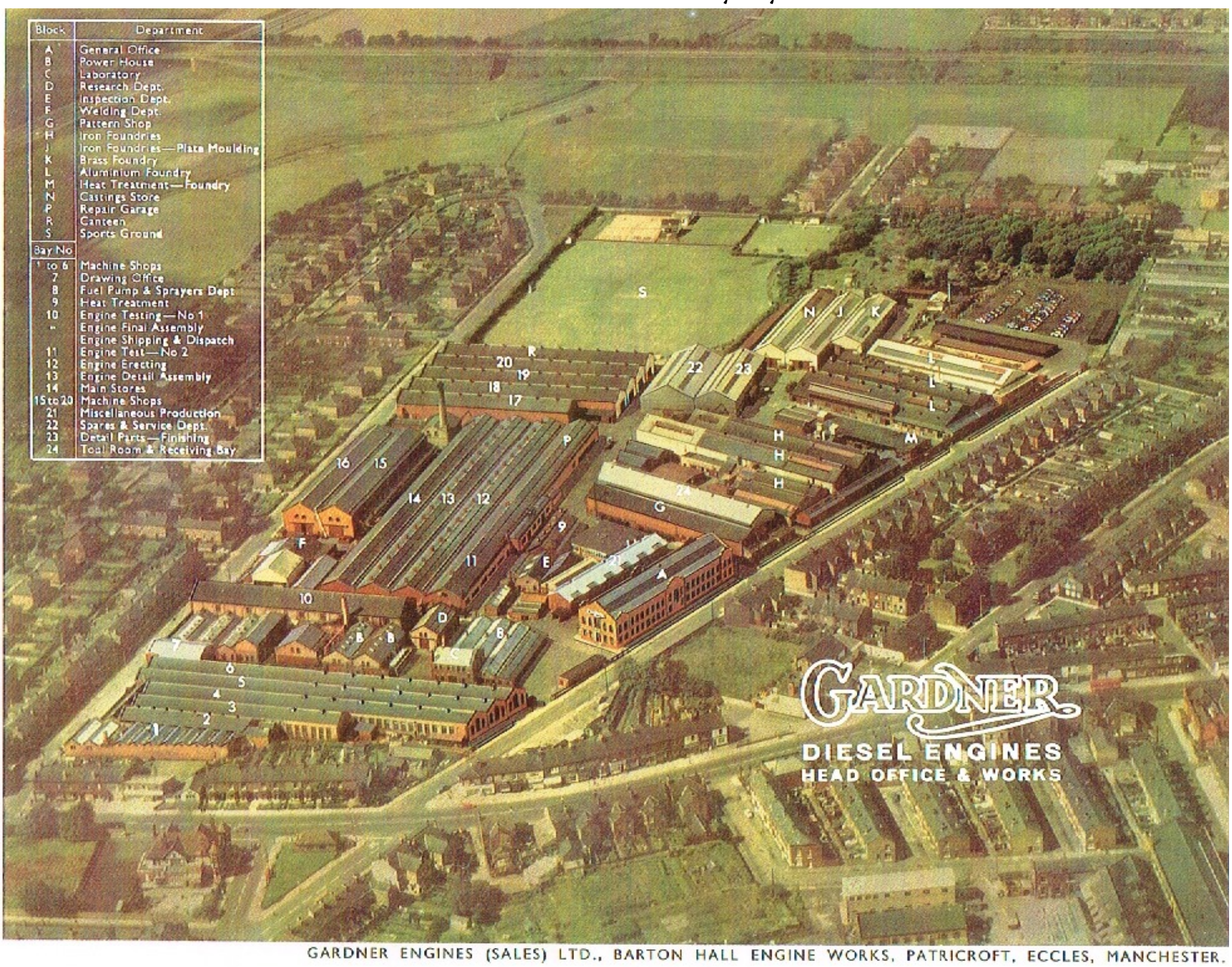
In 1894 the first Oil Engine was produced using paraffin oil. This was fed into a vaporiser, then drawn into the combustion chamber with a mixture of air before being detonated by a hot tube, in a similar manner to the hot tube gas engines. It had the benefit of portability, not being tied to the need for a piped town gas supply.

By 1898 production was once again outgrowing the space available and new premises were needed. Previous moves had all been a short distance from the original workshop in Upper Duke Street. This next move proved to be inspired. The decision to purchase 3 acres of land, which was part of the Old Barton Hall Estate, gave the company the scope to grow without the need to move again in its lifetime. Workshops were built over a half acre of the land and the Barton Hall Engine Works was born.

As none of the brothers was sales orientated, the need for a sales agent had become evident. One of the agents selected was Norris and Henty of London, they were to become the principal sales arm for Gardner products.

Barton Hall Engine Works in 1908

The Works in its Heyday



GARDNER ENGINES (SALES) LTD., BARTON HALL ENGINE WORKS, PATRICROFT, ECCLES, MANCHESTER.

The First Engines

"Gardner" Engines

SECTION E

F TYPE

GAS AND

SPIRIT

Horris Henty & Gardners Ltd.

Registered Office :- 87 Queen Victoria St. London, E.C.

also at 77 & 81 Queen Victoria St

45 Bothwell St. Glasgow,

11 King St. Belfast.

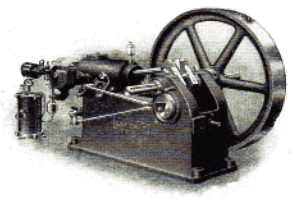
220 Tower Building, Liverpool.

Works - L. Gardner & Sons, Ltd

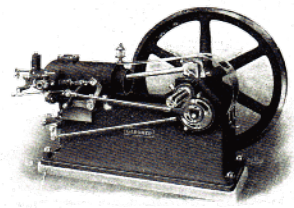
Parton Hall Eggine Works - Patricroft.

Small "Gardner" Horizontal Gas and Paraffin Engines.

¾ BHP to 14 BHP.



"F" Type Oil Engine.



"F" Type Gas Engine.

It was with these engines that the "Gardner" series first commenced, and they are now as popular as ever, The utility of the horizontal gas and oil engines is too obvious to need enumeration, but as they are built for heavy commercial duties and long continuous runs, it may not be out of place to indicate their suitability for electric lighting,driving compressors,and also for high pressure gas systems

In connection with the latter there are hundreds of the small gas engines in constant use at such important installations as Buckingham Palace, several of the London and Thames Bridges, at large public Intuitions, Railway Stations,etc Economy of Fuel, perfect lubrication,and sensitive governing, enables these engines to respond to varying load requirements with a minimum fluctuation. The governor is inertia type, and of sensitive construction ,capable of hand adjustment to the greatest nicety,and is undoubtedly one of the simplest and most efficient of its class ever produced

TABLE OF SIZES, POWERS, Etc.

Engine No.	BRAKE HORSE POWER. Paraffin.	Gas.	Petrol.	Speed Revs. per minute.	CYLINDER. Bore.	Stroke.	FLYWHEEL. Ordinary.	Electric.
0 F	¾	¾	¾	450	2½in.	4in.	18in.	18in.
1 F	1½	1½	1½	400	3½in.	5in.	24in.	36in.
1a F	2½	2½	3	380	4½in.	6in.	30in.	39in.
2 F	3½	4	4½	360	5in.	7in.	36in.	45in.
2a F	4½	4½	5½	360	5½in.	7in.	36in.	45in.
3 F	6½	6½	7½	300	6in.	9in.	39in.	54in.
4 F	7½	8	9	280	6½in.	10in.	42in.	56in.
4a F	9½	10½	11½	270	7in.	11in.	45in.	60in.
5 F	12½	13	14	260	7½in.	12in.	48in.	66in.

Introductory Remarks

SINCE the introduction by Messrs. GARDNER, in 1892, of a series of well-built and carefully designed Horizontal Engines at a reasonable price, there has been a steadily increasing popularity, until the present output numbers several thousands.

Reliability, efficiency and substantial proportions, coupled with undoubted economy in fuel and upkeep, are features which have rendered these engines particularly suitable for heavy commercial duties or long continuous runs, such as Electric Lighting, Pumping, or Driving Compressors for High Pressure Gas Systems.

In connection with the latter duty alone, there are hundreds of these small engines in constant use at such important installations as Buckingham Palace, the Thames Bridges, Public Buildings, Railway Stations, &c.

The workmanship and design of the smallest size (developing ¾ B.H.P.) being in all respects as high-class as that of the largest, places the small power user on an equality with the large manufacturer, so far as the engine is concerned; nor does this high standard of quality necessitate high prices, but, on the contrary, tends to cheapness in prime cost as well as in running—due to the exceptionally fine system of production in quantities rendered possible by the huge demand.

NOTES ON ILLUSTRATIONS.

Although every effort has been made to embody all the latest improvements, it should be distinctly understood illustrations are not binding as to detail. In particular, we would draw attention to the fly wheels.

The Standard Engine has only one fly wheel of the size given in the table on page 7, but for special requirements two wheels are occasionally fitted, as on page 6.

Obviously, changes in fly wheels can be made to apply to any engine, regardless of fuel. Driving pulleys are not supplied unless specially ordered, and are extra.

Specification

F TYPE GAS ENGINES

Sizes ¾ B.H.P. to 13 B.H.P.

ENGINE BED.	Massive box bed, cast in one piece, and of sufficient height to allow the flywheel to clear the ground, which materially reduces the cost of foundations. An oil gutter or save-all is formed round the base.
FLYWHEEL	is above the average weight and turned true on the face, edges of the rim, and boss. It is accurately bored and fitted to the crank shaft, being secured by a key of standard size, made to limit gauge and interchangeable.
CYLINDER.	The cylinders of F type engines are cast from specially selected hard close-grained iron, in one piece with the jacket and bolted to the machined surface of the engine bed.
PISTON.	Trunk type, made from specially selected cast iron.
PISTON RINGS	are ground to limit gauges, and sufficient in number to secure a perfect joint. Steady pins are provided to prevent them rotating in the grooves. They are specially formed to ensure even bedding on the cylinder walls.
GUDGEON PIN	is of large diameter, hardened and ground to limit gauge, and is fitted and secured in the piston by locking screws.
CONNECTING ROD	of specially selected steel, machined throughout from a solid forging and finished bright all over. The big end is provided with loose brasses having special anti-friction metal linings; the small end is provided with an adjustable bush of special bronze.
CRANK SHAFT	is of unusually massive rectangular web type, cut from solid forging on a specially designed machine. It is made to limit gauge and finished bright all over.
BEARINGS.	The crank shaft bearings are carried in steps, cast solid with the engine bed, and are of ample length to ensure long life. The bearings themselves are of liberal thickness, strong enough to resist all legitimate strains, and are lined with anti-friction metal.
VALVE GEAR.	The F type engines have the "Gardner" double eccentric valve gear, driven from the crank shaft by machine cut gears, the valves being actuated through tappet levers.
VALVES.	All valves are machined from solid steel bars or steel forgings, and are accurately ground to limit gauges.

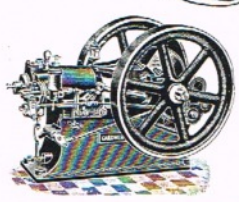
Specification

F TYPE GAS ENGINES

Sizes ¾ B.H.P. to 13 B.H.P.

VALVE BOXES	are fitted with removable covers, giving easy access to the valves without removing the cylinder. The valve seatings are formed in one piece with the boxes. They are of large area and have ample substance.
GOVERNOR.	This is of the inertia type, spring loaded by a coiled spring in tortion. Provision is made for the easy adjustment of this spring for regulating the speed. The control consists of a governor finger engaging with a lever which operates the inlet and gas valve. Great sensitiveness is obtained by the introduction of a shaped steel block controlling the path travelled by the governor finger.
LUBRICATION.	This has been carefully considered and amply provided for. A sight feed lubricator with a detachable needle valve is arranged for the cylinder, piston and gudgeon pin. Syphon feeds are provided for the main bearing. For the crank pin the oil is syphoned from a large oil box formed in the cap of one of the main bearings. Thence a wiper conveys it to a rotary ring lubricator on the crank web, and from this to the centre of the crank pin brasses by centrifugal force.
IGNITION.	The standard arrangement for gas engines is by tube, heated by the "Gardner" Adjustable Atmospheric Gas Burner, but electric ignition can be fitted, if desired, at a proportional increase in cost.
ANTI-FLUCTUATOR.	This consists of a cast-iron casing having a textile fabric diaphragm at the back. A graduated inlet valve is operated by the diaphragm.
GAS COCK	is of gunmetal, fitted with pointer and index plate carefully marked when the engine is tested.
COMPRESSION RELEASE.	On all engines above size 2 F, a compression relief lever operating on the exhaust valve is fitted, so as to decrease the compression, and thus enable the engine to be easily and safely pulled round by hand when starting.
EXHAUST SILENCER.	A cast-iron expansion box of suitable size for ordinary purposes is supplied as part of the equipment, but, if absolute silence is a feature of the installation, special arrangements can be introduced based upon the circumstances and requirements.

Spirit Engines



F Type Spirit Engine, with Magneto Ignition and an extra Flywheel.

The fuel referred to under this heading is that known as petroleum spirit, and embraces such fuels as petrol, gasolene, benzine, &c., but not alcohol.*

All the main details of the spirit engines are exactly like the gas engines, the differences being as follows :—

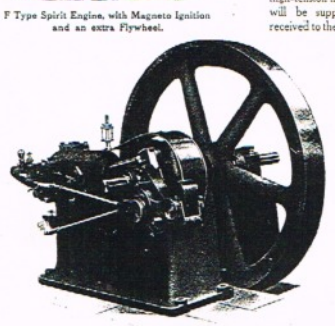
IGNITION. Spirit engines are not fitted with tube ignition, but are usually fitted with high-tension magneto. This form of ignition will be supplied unless instructions are received to the contrary (see foot note † p. 7).

FUEL FEED.

A specially designed fuel feeder is fitted to the induction pipe of a spirit engine—it is arranged to automatically admit fuel in response to the suction stroke of the engine when the inlet valve is opened. Hand adjustment—a pointer and index collar—is provided, and provision is also made for a supply of heated air to the fuel feeder.

FUEL TANK.

A small wall tank, having about six hours' capacity, is supplied in place of the anti-fluctuator.



F Type Spirit Engine, with Electric Light Type Flywheel and Outer Pedestal Bearing.

* Engines for this fuel more nearly follow the specification of the "Gardner" Oil Engine. (See Catalogue A F.)

Particulars and Codes

"Gardner" F Type Horizontal Town's Gas Engines.

TABLE OF PARTICULARS.

List No.	Brake Horse Power.	Revs. per Minute.	Standard Flywheel.	Electric Flywheel.	Tank Sizes.	Capacity in Gallons.
0F	¾	450	18"	18"	18" × 36"	28
1F	1½	400	24"	36"	18" × 36"	33
1aF	2½	380	30"	39"	22" × 42"	75
2F	4	360	36"	45"	22" × 72"	100
2aF	4½	360	36"	45"	22" × 72"	100
3F	6½	300	39"	54"	30" × 72"	180
4F	8	280	42"	56"	33" × 72"	210
4aF	10½	270	45"	60"	33" × 72"	260
5F	13	260	48"	66"	30" × 72" (2)	360

EQUIPMENT.

Included with each Engine are the following :— Metal anti-fluctuator, cast-iron silencer, spare piston ring, ignition tube, oil can, two sets of packings, one foot-pump wrench, set of springs, governor blade, chimney liner, set of spanners, book of instructions and erecting plan.

"Gardner" F Type Horizontal Spirit Engines.

FOR USE WITH PETROL, GASOLENE, &c.

In general details the Spirit Engines closely conform to the Gas Engines, the chief difference being a fuel feeder in place of the gas cock, and electric ignition instead of hot tube. As the high-tension magneto has now been so perfected, it is without doubt the best type of ignition for these engines, and will be fitted unless special instructions are received to the contrary.

List No.	Brake Horse Power.	Revs. per Minute.	Standard Flywheel.	Electric Flywheel.	Tank Sizes.	Capacity in Gallons.
0F	¾	450	18"	18"	18" × 36"	28
1F	1½	400	24"	36"	18" × 36"	33
1aF	2½	380	30"	39"	22" × 42"	75
2F	4	360	36"	45"	22" × 72"	100
2aF	4½	360	36"	45"	22" × 72"	100
3F	6½	300	39"	54"	30" × 72"	180
4F	8	280	42"	56"	33" × 72"	210
4aF	10½	270	45"	60"	33" × 72"	260
5F	13	260	48"	66"	30" × 72" (2)	360

EQUIPMENT.

Wall fuel tank for six hours' supply, cast-iron silencer, piston ring, oil can, two sets of packings, one foot-pump wrench, one set of springs, fuel feeder diaphragm, book of instructions and erecting plan.

TABLE OF CODE WORDS* referring to "F" Type Gas and Spirit Engines.

Engine No.	GAS ENGINES. With Tube Ignition.	With Magneto.	Arranged for H.T. Battery and Coil.	SPIRIT ENGINES. With Magneto.†	Arranged for H.T. Battery and Coil.
0F	FACE	FACEMAG	FACETRIC	SAGEMAG	SAGETRIC
1F	FEIN	FEINMAG	FEINTRIC	SCANMAG	SCANTRIC
1aF	FIRK	FIRKMAG	FIRKTRIC	SKETMAG	SKETRIC
2F	FLAM	FLAMAG	FLAMTRIC	SHUEMAG	SHUETRIC
2aF	FOLI	FOLIMAG	FOLITRIC	SILAMAG	SILATRIC
3F	FONT	FONTMAG	FONTRIC	SLAYMAG	SLAYTRIC
4F	FRAG	FRAGMAG	FRAGTRIC	SMEFMAG	SMEFTRIC
4aF	FUSA	FUSAMAG	FUSATRIC	SPORMAG	SPORTRIC
5F	FYLO	FYLOMAG	FYLOTRIC	SYLMAG	SYLTRIC

* For Electric Light Engines, PREFIX "EL" to the Code Word.

† Note.—Although Spirit Engines can be arranged with tube ignition, it is a most unusual equipment in modern practice, and has therefore not been provided for on these engines. The standard arrangement being Magneto, which will be provided unless instructions are received to the contrary.

Two bearing dynamos are preferable for direct coupling to these engines, otherwise a separate bearing will be needed between the flywheel and dynamo.

Good concrete is the material most usual for foundations, its thickness varying with the nature of the ground.

Guarantee

¶ The manufacturers guarantee "Gardner" Engines to be built with all reasonable precautions to secure excellence of material and workmanship and that should any unforeseen defective part be revealed within twelve calendar months from the date of such engine being installed they undertake to exchange such defective part for a similar new part, paying carriage both ways provided the alleged defective part is returned to the works carriage paid and accompanied by a written statement concisely setting forth the circumstances and nature of the defect.

¶ If on inspection of the part received at the works it should be found the defect arises from negligence, insufficient or unsuitable foundations, wrong treatment, improper lubrication, wear and tear, or other causes outside the control or prevention of the manufacturers, then they shall not be liable to supply any part or parts free of charge, but shall make reasonable charges for any replacement or other costs incurred by the demand of the owner either directly or through his agents or servants.

¶ This Guarantee expressly excludes any claim founded on any implied guarantee or warranty (statutory or otherwise) for consequential or other damages, expenses incurred, or loss due to stoppage or other reasons attributed to the alleged defect or in the substitution or fitting on of the new part.

"V" Type Available in Oil, Gas & Spirit Versions Manufactured between 1903 and 1935

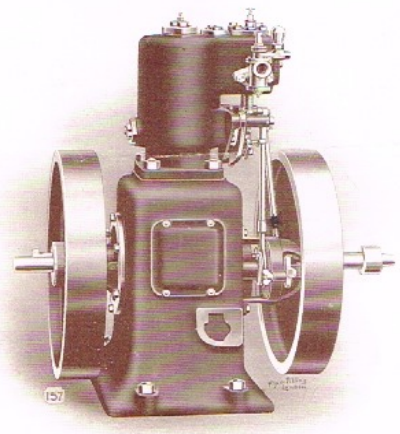
THE

"Gardner" V Type Engines

(MEDIUM SPEED VERTICAL.)

NORRIS & HENTY,
87, Queen Victoria Street, LONDON, E.C.
Telegrams: "Nonodesto, London."
Telephone No. 896 Bank.

Works:
L. GARDNER & SONS, Ltd.,
Barton Hall Engine Works, PATRICROFT.
Telegrams: "Theorem, Patricroft."
Telephone No. 48 Eccles.



INTRODUCTION.

WE have put the Vertical Single Cylinder type of Petroleum, Petrol, Alcohol, and Gas Engines on to the market to meet the Continental and Colonial demand for a simple and inexpensive engine to be as compact as possible, but which at the same time shall be a thoroughly commercial long-lifed engine, having ample strength and ample bearings to ensure low wear-and-tear bill; we can confidently recommend this engine, not only to Colonial and Foreign buyers, who will find a saving in shipping and porterage charges, but also to home users who are looking for a low price, but at the same time, thoroughly efficient engine.

DESCRIPTION AND SPECIFICATION OF ENGINE.

FUEL.—Either PETROLEUM, PETROL, ALCOHOL, BENZOL, &c., or TOWN GAS; but each fuel is treated differently, therefore fuel to be used must be specified when ordering.

DESIGN.

In general principles these engines are exactly the same as the well-known "Gardner" Horizontal Type, but the "V" engines have the crank and connecting rod enclosed in the base of the engine, which thus forms the crank case, and at the same time is used as the container of the lubricating oil. Although these engines are built to run at higher speed than the Horizontal Type, this increased inertia is provided for by careful balancing of all moving parts, and the "Gardner" V Engine **is designed and built to stand long hours of continuous full power work,** and therefore **must not be** classed with the motor car type converted to services for which it was never intended.

SYSTEM.

VAPORIZER OR CARBURETTOR. — Depends upon the Fuel; thus, **Petroleum** is transformed into gas in a vaporizer as follows:—

An extension of the valve box receives an initial heating from a hand lamp of the "Aetna" Type which raises the temperature to the point at which petroleum vaporizes freely. Into this heated chamber the petroleum is fed in charges measured by a "Gardner" feeder; every charge delivered is of equal quantity, i.e., the right amount to provide gas, which, when mixed with air, forms the requisite charge. After the initial heating, the vaporizer is kept at proper heat by leading round it the heated exhaust.

Petrol and those spirits which vaporize at normal temperature are fed direct into a carburettor where the fuel is sprayed and atomized into a certain proportion of air, and in this form is drawn into the cylinder as the explosive mixture.

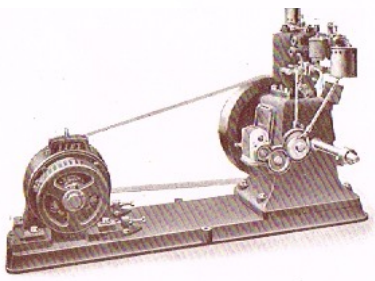
Alcohol is treated much in the same way as petroleum, but in a modified form.

Gas is of course treated as in an ordinary gas engine.

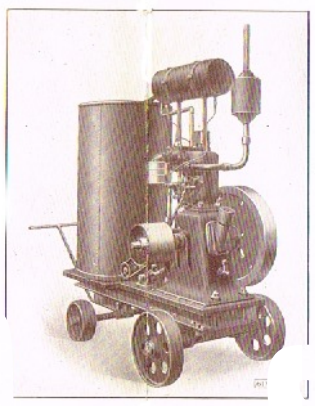
V ENGINES

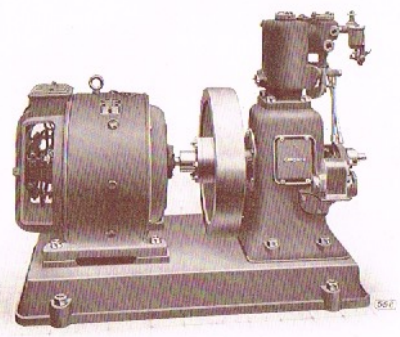
FOR A VARIETY OF PURPOSES

A FEW EXAMPLES



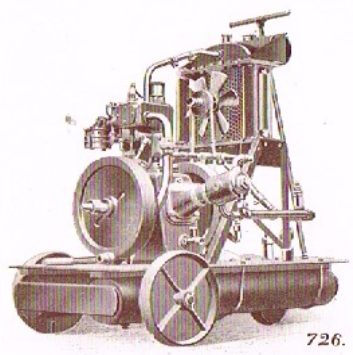
2 V (3½ BHP) Petrol - Paraffin Engine driving by belt a dynamo mounted on a common bedplate.





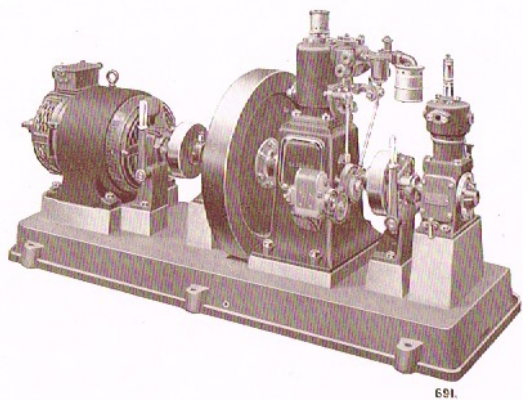
2V. (3½ BHP) Petrol-Paraffin Engine direct coupled to dynamo, mounted on common bedplate.

A battery charging set of 2KW Ideal for Country House Lighting.



Portable Paint Spraying Plant embodying an OVC Compressor Set.

726.



Combined Air Compressing and Lighting Set, specially designed for Marine auxiliary purposes.

The Engine illustrated is a 1AV (3 BHP) Petrol-Paraffin Engine.

691.

IGNITION.—Gas is ignited by means of hot tube.

The other fuels by means of electric ignition, which may be either magneto or coil and accumulator. Generally, however, magneto is preferable for petroleum and alcohol engines, while for spirit engines coil and accumulator may be used as being rather cheaper in first cost.

GOVERNING.—In all the foregoing systems the fuel is delivered in the right quantity for each charge, therefore, when governing, a decreasing load is automatically met by reducing the number of charges; this is done by an inertia governor which opens or leaves unopened the inlet valve according to the requirements of the power absorbed by the load.

LUBRICATION.—The lubricating oil is contained in a well in the enclosed crank case, and a plunger distributes it in small but constant supply all through the working parts of the engines.

CONSTRUCTION.

CYLINDERS.—Built of specially selected close-grained iron, and provided with large water-cooling jacket. The valve boxes, which are attached to the cylinder head, are easily accessible for purposes of examination, without disturbing cylinder or piston.

CRANK CASE.—Is totally enclosed, but large inspection doors are provided which make the interior quite accessible for cleaning or adjustment.

PISTON.—Trunk Type Piston made from specially selected cast iron and fitted with piston rings ground to limit gauges, and of sufficient number to ensure a gas-tight joint. A gudgeon pin of large diameter, hardened and ground to limit gauge, is secured in the piston by locking screws.

CONNECTING ROD.—Is a drop forging of specially selected steel; the big end is provided with loose bearings of "Gardner" special bearing metal; the small end is provided with a bush of special bronze.

CRANK SHAFT.—Is of the flat web marine type and unusually massive, cut from a solid forging on a special machine tool; is made to limit gauge and finished bright all over.

BEARINGS.—Crank-shaft bearings are of ample length to ensure long life, and of thickness more than enough to resist all working strains; they are made of "Gardner" special bearing metal.

GOVERNOR.—Is of the inertia type, and is spring loaded, provision being made so that the spring load can be adjusted to suit the speed at which it is desired to run the engine.

FLYWHEELS.—Two disc flywheels, turned true and bright on the rim, are fitted to standard engines of all sizes (except No. OV, which has one wheel only), but one heavy electric lighting type wheel can be fitted for direct coupled jobs when desired.

GENERALLY.—All gears have machine-cut teeth.

All working parts, such as valves, studs, and the like, are ground by machinery to accurate limit gauges; our system of jigs and gauges enables us to claim **absolute interchangeability.**

Design, workmanship, and finish are of the highest order.

"GARDNER" V TYPE ENGINES.

Table of Power, Code Words, and Shipping Measurements.

List No.	Bore and Stroke	Power B.H.P.*	R.P.M.	Code Words for Petroleum	Gas	Spirit	Alcohol
0V	2⅜ in. × 4 in.	1·24	700	Vidar	Vakma	Vekes	Vocat
1V	4 in. × 4 in.	2·5	600	Vikal	Vabre	Velan	Vogue
2V	4½ in. × 5 in.	3·2	500	Ville	Vadan	Venda	Volta
3V	5¼ in. × 6 in.	5·5	450	Vince	Vagne	Vertu	Vomsa
4V	6½ in. × 7 in.	7·25	370	Virgo	Vaige	Verzi	Vorte

ADD to Gas, Spirit and Alcohol Engine Code "Mag" if Magneto Ignition is desired.
* Spirit Engines develop approximately 10% more power.

COOLING TANKS.

List No.	0 V	1 V	2 V	3 V	4 V
Capacity	75 galls.	100 galls.	180 galls.	210 galls.	260 galls.

APPROXIMATE SHIPPING WEIGHTS AND MEASUREMENTS.

List No.	0 V	1 V	2 V	3 V	4 V
Nett Weight ...	220 lb.	420 lb.	625 lb.	1070 lb.	1575 lb.
Gross ,, ...	320 lb.	545 lb.	760 lb.	1300 lb.	1850 lb.
Cube Measurement	13 ft.	21 ft.	31 ft.	46 ft.	74 ft.
Cube of Tanks ...	14½ ft.	20 ft.	36 ft.	45 ft.	54 ft.

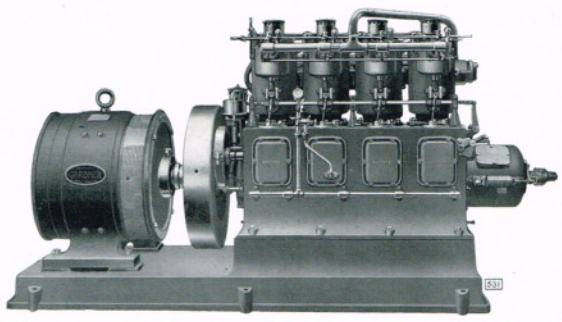
"M" Type Available in Oil, Petrol and Gas Versions Manufactured between 1902 and 1933
Available as Marine with gearboxes or Stationary versions coupled to a variety of accessories

GARDNER

VERTICAL

Oil, Petrol and Gas Engines

(M. SERIES—Stationary Multi-Cylinder Type).



Norris, Henty & Gardners Ltd.
(Proprietors: L. Gardner & Sons Ltd.)
BARTON HALL ENGINE WORKS,
Patricroft, Manchester.

Telephone: 401 ECCLES (4 lines).
Telegrams: "Theorem," Patricroft.

GARDNER ENGINES.

GARDNER M. TYPE ENGINES are vertical, four cycle engines designed to use Petrol, Paraffin, Town's Gas, and Producer Gas.

They are of massive design, and run at moderately high speeds. Three distinct types are included in the series, which vary according to the fuel used.

It is over 18 years since these engines were first placed on the market, since when they have been considerably improved. It is no exaggeration to say that they have been a complete and unqualified success, having proved suitable for every conceivable class of power generation.

FUELS. Engines can be supplied to suit the following Fuels:—

Refined Petroleum (Paraffin); specific gravity .8 to .825.
Petrol, Gasoline, Benzol and similar fuels.
Town's and Producer Gas.

Paraffin is the most usual fuel on account of its cheapness.

OPERATION. They operate on the four cycle system, having mechanically operated inlet and exhaust valves, circulating water pump, centrifugal governor, and hand speed control.

PRESSURE FEED. The Gardner system of pressure fuel service can be arranged for any size of petrol or paraffin engine, for use in cases where the head room is insufficient for gravity feed.

GARDNER ENGINES.

VAPOURISER ON PARAFFIN ENGINES. The Gardner Lamp-heated Vapouriser is recommended for Paraffin engines, because of the peculiarity of the fuel, which is only capable of perfect vapourisation at a fairly high temperature, and with little marginal range, Petrol starting parts, however, can be supplied, if desired.

PETROL AND GAS ENGINES. Engines using Petrol or Gas partake of the same general design, but, owing to difference in compression and other incidentals peculiar to the fuel, it is not possible to convert an engine from one fuel to another, each type being built on distinct lines with a view to obtaining the best possible results from each fuel.

The Purposes for which Gardner Engines are used.

BEING capable of sustaining long continuous runs at the rated power and speed, engines of this series are particularly suitable for combination with the following machines, the list being by no means exhaustive of their scope of application:—

Electric Generators for Lighting, Wireless, etc.
Centrifugal Pumps, Winches, Cranes, Tractors, Locomotives, Compressors, Welding Sets, and Portable Plants of various kinds.

They have proved of great utility in Cinematography: in Film Production, Projecting and Theatre Lighting. Several London and Provincial Cinemas and Theatres have been constant users of this type of engine for many years.

It should be added that they are extensively used by the leading Shipping Companies for Emergency Lighting and Wireless Sets, and by Wireless Companies for Radio Stations in all parts of the world.

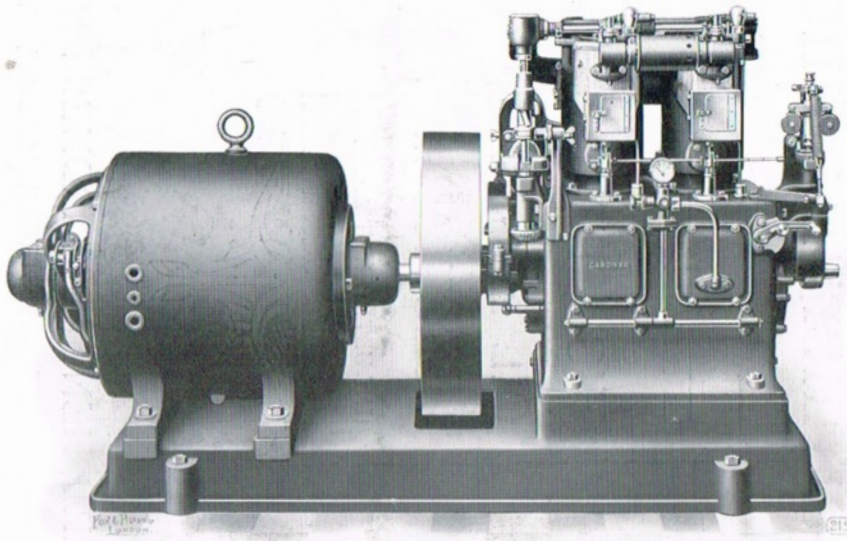
TABLE OF DETAILS OF M. TYPE ENGINES.

List No.*	B.H.P. on Town's Gas	B.H.P. on Prod. Gas	B.H.P. on Paraffin	B.H.P. on Petrol	R.P.M.	Cylinder Dimensions		Approx. Engine Weight		Approximate Shipping Dimensions in Inches	Approximate Weights and Dimensions of Combination Bedplates for Engines & Dynamos		Extreme Measurements of Engine only in Inches	CODE WORDS.			
						Bore	Stroke	Gross	Nett					Town's Gas	Producer Gas	Petrol	Paraffin
						Ins.	Ins.	Cwts.	Cwts.		Cwts.	Inches	Lgth. Width Height				
2BM	12	9	10	12	800	4½	5	14	11	Case .....46×35×41 " Wheel, etc. 39×30×26	5¼	57×28¾×9	37 × 33 × 34	*Banquet*	*Cablegram*	*Dalesman*	*Aster*
3BM	17	13	15	18	800	4½	5	17	14	Case .....57×31×41 " Wheel, etc. 42×30×26	6¼	66×28¾×9	46 × 33 × 34	*Banshee*	*Cabriole*	*Dalmatic*	*Astride*
4BM	23	18	20	24	800	4½	5	21	16	Case .....65×35×41 " Wheel, etc. 39×30×26	8	75×28¾×9	55 × 33 × 34	*Banyan*	*Cachalot*	*Damascus*	*Assign*
2DM	18	14	15	18	750	5¼	6	18½	14	Case .....51×37×46 Crate, Wheel .....28×28×6 Case, parts .....42×30×26	6	64×28¾×10	45 × 36 × 39	*Barilla*	*Cadestre*	*Daneus*	*Amber*
3DM	27	21	22½	27	750	5¼	6	23½	17½	Case .....63×36×45 Crate, Wheel .....27×27×8 Case, parts .....42×30×26	7¼	74×28¾×10	55 × 36 × 39	*Baromet*	*Cadence*	*Dasturine*	*Amend*
4DM	35	28	30	36	750	5¼	6	25½	19½	Case .....71×36×44 Crate, Wheel .....27×27×8 Case, parts .....47×31×31	9	84×28¾×10	65 × 36 × 39	*Baronial*	*Cadmian*	*Dauphin*	*Ambient*
2FHM	28	21½	24	27	600	6½	7½	31	25	Case .....63×41×53 Crate, Wheel .....38×38×11 Case, parts .....39×30×26	10½	78×34×12	51 × 43 × 48	*Baroque*	*Caesarean*	*Decachord*	*Anatomy*
3FHM	42	32	36	40	600	6½	7½	40	31	Case .....82×42×54 Crate, Wheel .....38×38×11 Case, parts .....45×29×29	12¾	90×34×12	63 × 43 × 48	*Barwood*	*Cayman*	*Decagram*	*Analyse*
4FHM	56	43	48	54	600	6½	7½	50	37	Case.....100×41×54 Crate, Wheel .....38×38×11 Case, parts .....56×35×35	14	102×34×12	75 × 43 × 48	*Basanite*	*Calabash*	*Decalitre*	*Adante*
3KM	65	54	55	60	500	8	9	69	61	Case .....84×48×64 Crate, Wheel ..41½×41½×12 Case, parts .....47×29×29 Silencer .....39×28×28	15	105×39×12	76 × 50 × 62	*Bascule*	*Calamanco*	*Decamonde*	*Adamic*
4KM	85	72	75	80	500	8	9	81	69	Case.....105×48×69 Crate, Wheel ...41½×41½×12 Case, parts .....59×35×35 Silencer.....39×28×28	16	120×39×12	90 × 50 × 62	*Basilisk*	*Calamite*	*Decapod*	*Adept*
6KM	130	108	110	120	500	8	9	100	84	Case.....129×48×60 Crate, Wheel .....46×46×12 Case, parts .....59×41×41 Silencer .....39×28×28	22	156×39×12	121 × 50 × 62	*Bastion*	*Calcine*	*Decarbon*	*Addenda*
3NM	135	112	...	...	400	11	12	...	...	.....	...	.....	.....	.....	*Canescent*	.....	.....
4NM	180	150	...	...	400	11	12	242	198	Case, Engine.....150×55×55 " parts.....114×54×48 Silencer .....71×26×26 2 Cases (Cydrs.),...50×38×45 Crate, Wheel .....56×56×16	...	.....	146 × 60 × 96	*Banicular*	*Canicular*	.....	.....

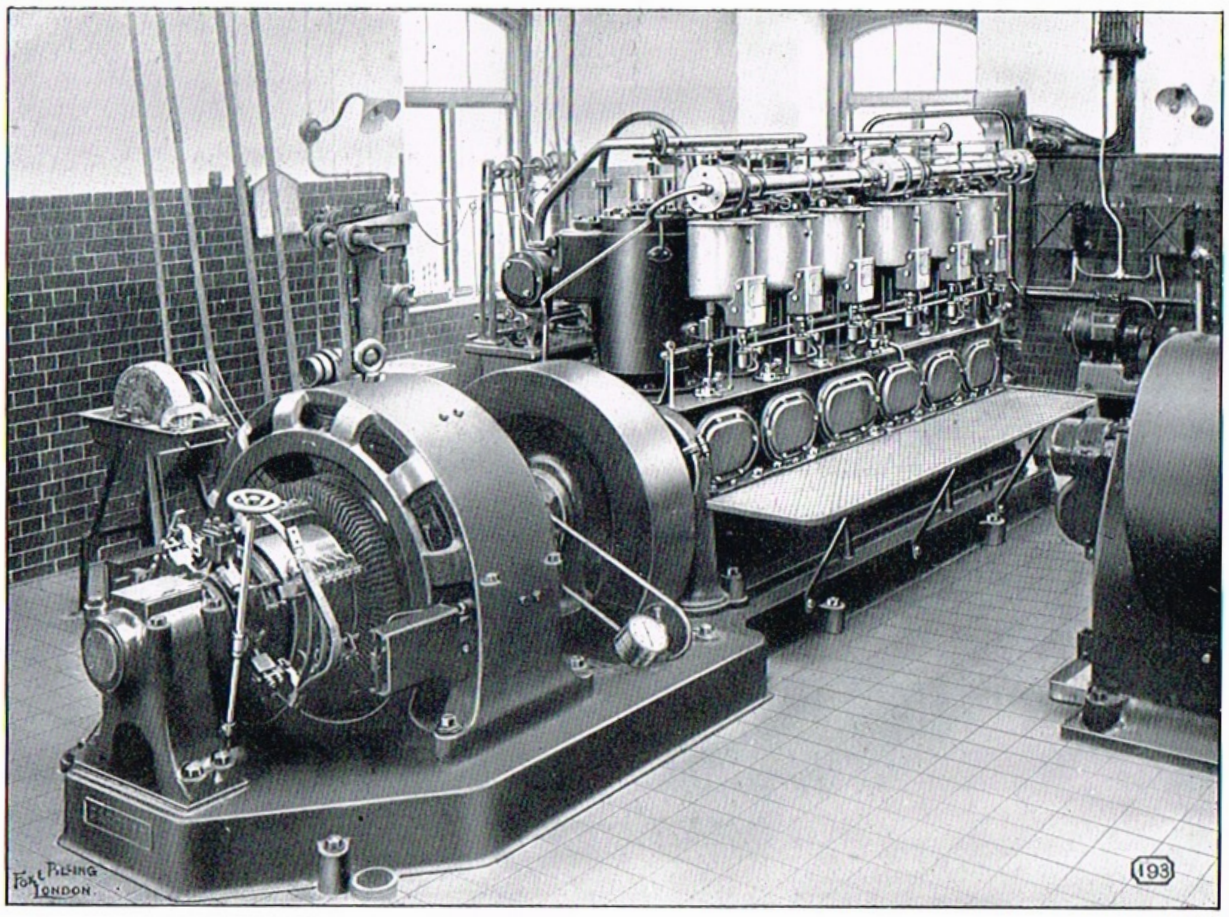
*The Numeral denotes the number of Cylinders.

The powers given for Town's Gas Engines are based on gas having a calorific value of 620 B.Th.U.

SPECIAL NOTE.—The particulars given in this table are those obtaining at the time of printing, but they must be taken as approximate only, as they necessarily depend on changes which experience may dictate from time to time.



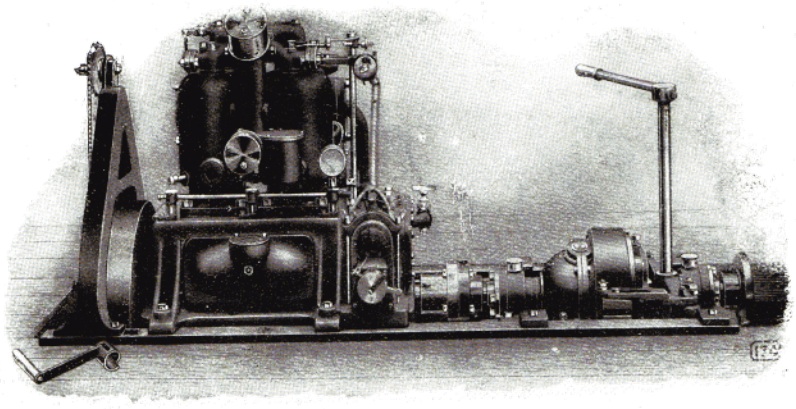
2 B.M. OIL ENGINE AND DYNAMO. 10 B.H.P. @ 800 R.P.M. 6 K.W. Set.



6 S.M. OIL ENGINE AND DYNAMO. 220 B.H.P. @ 475 R.P.M. 150 K.W. Set.
(As supplied to the British Admiralty.)

"BCR & DCR" Type manufactured between 1910 & 1936

"GARDNER" BCR Type Engines.

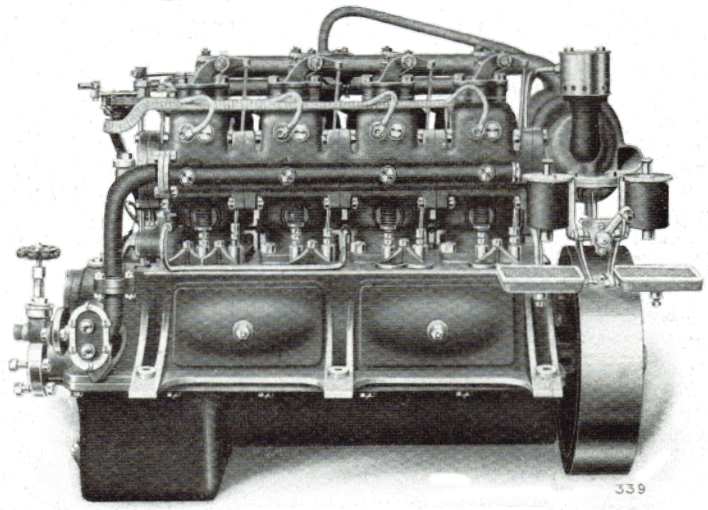


2 BCR PETROL ENGINE AND REVERSE GEAR.

SIMPLE.—QUIET.—RELIABLE.
ECONOMICAL.

THIS Series is extensively used for Admiralty Cutters, Ships' Lifeboats to B.O.T. requirements; Pleasure and Passenger Launches, and also for Electric Lighting and Welding; Wireless Telegraphy Sets; Emergency Lighting; Pumping, and Cinematograph Outfits for use on land or sea.

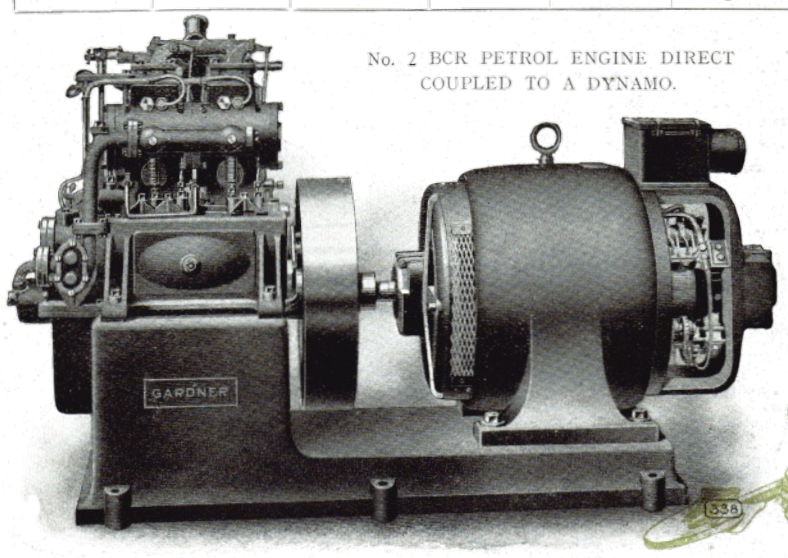
"GARDNER" BCR Type Engines.



No. 4 BCR PETROL-PARAFFIN ENGINE showing Vaporiser, Double Float Chamber, Change-over Cock, etc.

TABLE OF SIZES AND POWERS.

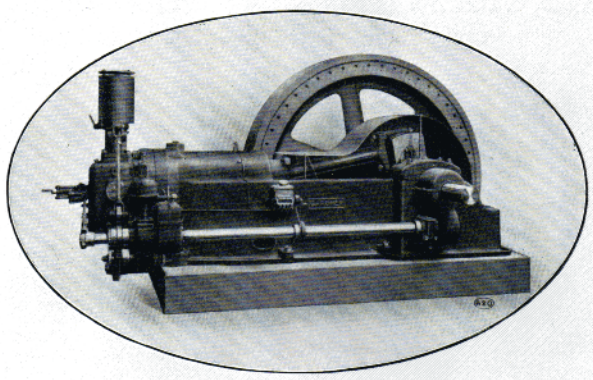
List No.	BRAKE H.P. ON		Revs. per minute.	CYLINDER.	
	Paraffin.	Petrol.		Bore.	Stroke.
2 BCR	8½	10	1000	4in.	4½in.
3 BCR	12¾	15	1000	4in.	4½in.
4 BCR	17	20	1000	4in.	4½in.



No. 2 BCR PETROL ENGINE DIRECT COUPLED TO A DYNAMO.

The "H" Series Cold Start Horizontals, manufactured between 1910 and 1942

GARDNER ENGINES



HF TYPE
HEAVY-OIL
ENGINES

Compression-Ignition — Cold Starting
Four-Cycle — Airless Fuel Injection

for
GENERAL POWER PURPOSES
& ELECTRIC LIGHTING
RANGE OF POWERS FROM 8½ TO 232 B.H.P.

NORRIS, HENTY & GARDNERS LTD.
(*Proprietors:* L. GARDNER & SONS LTD.)
BARTON HALL ENGINE WORKS
PATRICROFT, Manchester

GARDNER HEAVY OIL ENGINES

COMPRESSION-IGNITION.
AIRLESS FUEL INJECTION.
COLD STARTING.

SECTION 1.
Sizes 6HF to 14HF (single cylinder)
Powers 20 BHP. to 116 BHP.

DETAILS OF POWERS, SPEEDS, CODES, ETC.

Type	BHP	Revs. per Minute	Bore	Stroke	Flywheels		Code* Compressed Air Starting	Weights (in cwts.)	
					Industrial	Electric		Engine complete with Industrial Flywheel and Air Bottle	
								Gross Cwts.	Nett Cwts.
6 HF	20/23	330	7¾″	14″	62″ × 6″	66″ × 8″	FRIOS	48	42
7 HF	26/29	320	8½″	16″	66″ × 7″	68″ × 10″	FRIDE	60½	53½
8 HF	34/37	300	9½″	17″	72″ × 7″	72″ × 12″	FREKO	81½	72¾
9 HF	42/46	290	10½″	18″	75″ × 8½″	75″ × 12″	FRIKA	102½	89¾
10 HF	53/57	275	11½″	20″	76″ × 9″	80″ × 14″	FRASE	122	109
11 HF	63/68	255	12½″	22″	82″ × 11″	85″ × 16″	FROMO	152¾	137¾
12 HF	72/77	250	13½″	22″	83″ × 11″	87″ × 16″	FRETE	179	162½
13 HF	89/94	240	14½″	24″	90″ × 12″	91″ × 17″	FRAMS	203½	186
14 HF	116/124	210	16½″	27″	102″ × 13″	104″ × 19″	FRELU	308	282¾

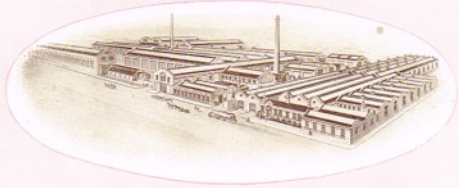
* NOTE.—For Electric Type prefix EL.

Note on BHP—The lower figure in the table denotes the maximum power at which the engine is guaranteed to run continuously. At this power the engine attains maximum efficiency and lowest fuel consumption.

The higher figure denotes the overload which the engine will carry in cases of emergency like the peak loads which often occur in practice.

"VT" Type manufactured between 1913 & 1938.
The "VT" range was initially only single cylinder models sized between 3.5bhp and 35 bhp
The range was increased to incorporate a 2 cyl range designated 2/4VT, 2/5VT and 2/6VT

GARDNER
ENGINES



BARTON HALL ENGINE WORKS, PATRICROFT

VT TYPE

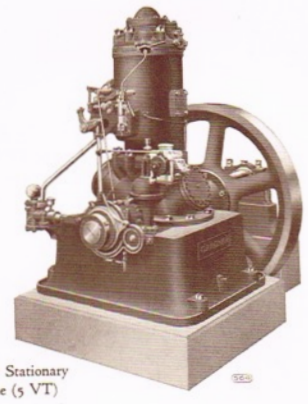
HIGH COMPRESSION, HEAVY OIL
(Two Stroke; Semi-Diesel)

ENGINES

for MARINE PROPULSION
ELECTRIC LIGHT &
GENERAL POWER PURPOSES

NORRIS, HENTY & GARDNERS LTD.
(*Proprietors:* L. GARDNER & SONS LTD.)
BARTON HALL ENGINE WORKS
PATRICROFT, Manchester

GARDNER
HEAVY OIL
ENGINES



18 BHP Stationary
Engine (5 VT)

PRELIMINARY

THIS engine is of the type now generally known as the Semi-Diesel Engi
In effect, it is a Two-Cycle Vertical Engine of high compression, specia
designed to burn Heavy Oils. The principle on which such engines work
now so well known that a detailed description of it is hardly necessary. Condens
in a few words :

A charge of pure air is drawn into the crank case and thence is forced into t
cylinder. Practically the whole of the charge is then compressed into a combusti
chamber, part of which is formed in the cylinder breech and is water-jackette
the other part is a small non-jacketted dome which, during work, remains at
" black hot " temperature. Just before compression is completed a charge of fu
oil is injected in the form of a spray into the combustion chamber and is ignit
by contact with the surface of the " black hot " dome. The admission of the

GARDNER
HEAVY OIL
ENGINES

PRELIMINARY (*continued*)

charge to the cylinder and the expulsion of the products of combustion are effected by ports in the cylinder wall, which are covered and uncovered by the piston.

The present Gardner Heavy Oil Engine is the result of many years' original research, supplemented by the thirty years' experience which the makers have had in the building of, and the experimenting with, an enormous variety of types and sizes of Oil Engines.

This research has been attended by complete and unqualified success, which has been amply confirmed by the experience of the many users.

Among the many desirable properties possessed by the Engine, the following may be mentioned :

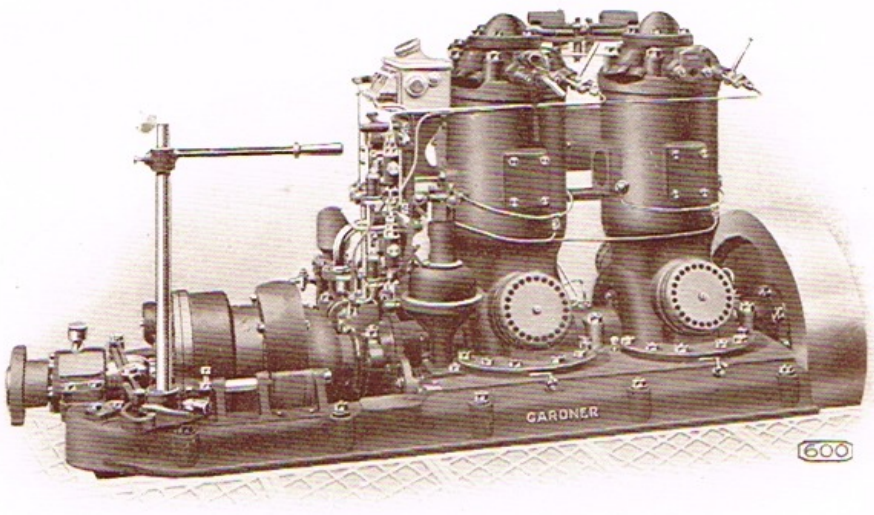
Starts from cold within three or four minutes from the word of command.
Will stand up indefinitely to the maximum load for which the engine is sold.
Will run indefinitely at no load, ready at any moment to take up full load.
Runs equally well at all intermediate loads.
The engine burns efficiently a variety of the heavier and cheaper grades of fuel-oil, and with very low consumption per BHP per hour.
The consumption of lubricating oil is remarkably low, not exceeding that of $\frac{1}{70}$ of the fuel-oil (actually it is much less than this).

It will be seen in the sequel that the VT engine is a very perfect machine, in that it responds to so many desirable conditions and demands. In appearance it is costly to build, yet the perfect administration of the works, together with very special methods of production, enable the engine to be put upon the market at an extremely low price.

GARDNER
HEAVY OIL
ENGINES

MARINE ENGINE SECTION

DOUBLE CYLINDER SERIES

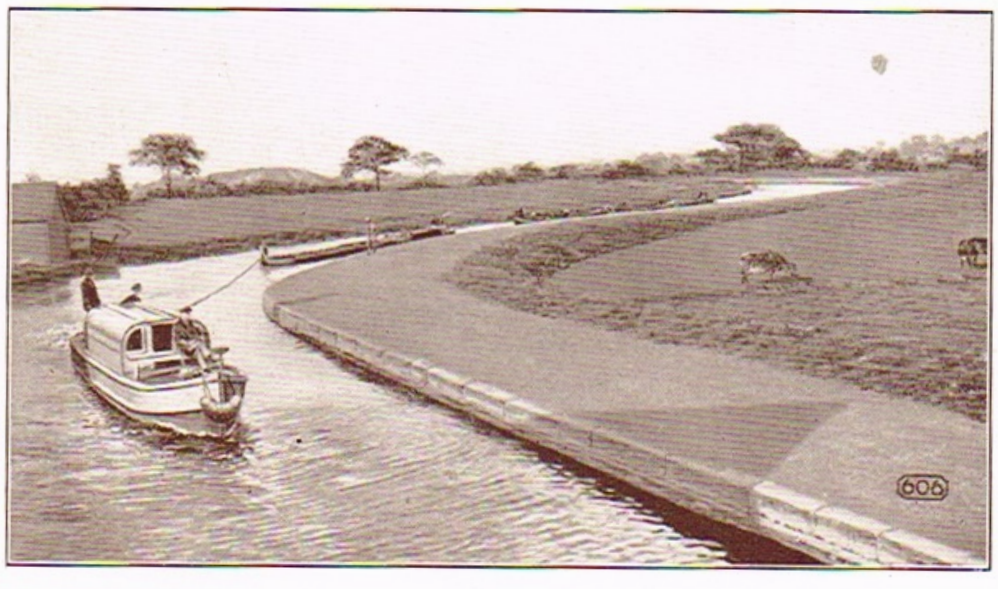


24 BHP Two-cylinder Engine & Reverse Gear (2/4 VT). (Front View)

GARDNER
HEAVY OIL
ENGINES

TABLE OF DETAILS
of
SINGLE *and* DOUBLE CYLINDER VT ENGINES

POWERS, SPEEDS, Etc.							WEIGHTS					
							Engine with Ordinary Flywheel		Electric Light Engine		Marine Engine	
ENGINE	B.H.P.	R.P.M.	No. of Cylinders	BORE	STROKE	CODEWORD	Gross Cwts.	Nett Cwts.	Gross Cwts.	Nett Cwts.	Gross Cwts.	Nett Cwts.
				Inches	Inches							
4VT	11½	450	1	7	8	Vimpa . .	19 Two Flywheels	16½	32¼	29¾	21½	18½
5VT	18	400	1	8½	9½	Vipet . . .	30¼	25¾	49½	45	35	28½
6VT	24	370	1	9½	10¾	Volas . . .	46	39	72	65	48½	38½
7VT	30	340	1	10½	12	Vurst . . .	61½	54¾	100¼	91¾	..	..
8VT	35	320	1	11½	12½	Vyrat . . .	76½	69½	117½	110½	..	..
2/4VT	24	450	2	7	8	Vyala . . .	36	30	61	47¼	35½	29½
2/5VT	36	400	2	8½	9½	Vyrol . . .	58	42	81	65	57½	42
2/6VT	48	370	2	9½	10¾	Vysek . . .	65	52	108	96½	64½	52
						Prefix "O" for Ordinary Stationary Type, and "EL" for Electric Light Type	The weights in this column include Engine with Stationary Fed, Ordinary Wheel, Silencer, and Air Receiver (where necessary)		The weights in this column include Engine, Bedplate, Stands, Electric Light Wheel, Silencer, and Air Receiver (where necessary)		The weights in this column include Engine, Marine Flywheel, Reverse Gear, and Air Receiver (where necessary)	



Canal Barge fitted with a 36 BHP Engine (2/5 VT)

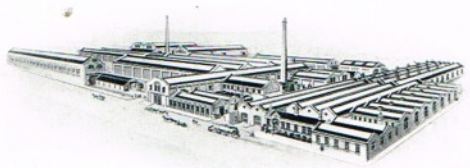
“VT & T” Type manufactured between 1913 & 1938.

1st Edn

GARDNER

Heavy Oil Engines

(VERTICAL TYPE.) SERIES VT & T.



Norris, Henty & Gardners Ltd.

(Proprietors: L. Gardner & Sons Ltd.),

Head Office and Works:

BARTON HALL ENGINE WORKS,
PATRICROFT, MANCHESTER.

Telegrams: "Theorem," Patricroft. Telephone: Eccles 401 (4 lines)

••••

London Office and Showrooms:
Gardner House, 115 Queen Victoria St., London, E.C.4
Telegrams: "Normodeste, Cent, London." Telephones: City 9493, 9494.

••••

BRANCHES:

LIVERPOOL: 701-802 Tower Building.
GLASGOW: 124 St. Vincent Street.
NEWCASTLE-ON-TYNE: Milburn House.
BELFAST: 16 Donegal Square South.

In compiling this Catalogue every effort has been made to embody only up-to-date information in the letterpress and illustrations, but neither should be taken to be binding as to detail, being subject to modification without notice in order to allow for improvements which may come into force from time to time.

GARDNER Heavy Oil Engines

(VERTICAL TYPE).

Series VT	... ...	One Cylinder.
„ T	... ...	Two, Three and Four Cylinders.

SYSTEM..Single Acting, Hot Plate Ignition, Two Stroke Cycle. Solid Fuel Injectors.

TYPES ... **Marine:** For all kinds of commercial and pleasure craft.
Stationary: For all ordinary commercial power purposes.
Electric Light: For driving electric generators, and other purposes where low speed variation is essential.

SPECIAL FEATURES.

Many of these are not to be found on other engines of this type that are at present on the market. (Fuller details of these Special features will be found on pages 6 and 7.)

Direct Reversing. This can be effected at all speeds with absolute certainty.

Quick Starting. By means of Patent Burner. Time taken to start engine, including the time for the Burner, from 1 to 3 minutes according to the size of engine.

Speed Control.—Will run at any speed between full and dead slow speed, by means of hand lever control. Will also run at slow speed, from full to light at either full or dead slow speed, without the use of the burner.

Fuel.—Will run on a wide range of fuels from Heavy Residuals to Refined Paraffin without any adjustment being necessary.

Fuel and Lubricating Oil Consumption.—The fuel consumption averages ·5 pint per B.H.P. per hour and the lubricating oil ·006 per B.H.P. per hour.

Power Rating.—The powers are rated on low revolution speed of engine, thus permitting the use of a large and therefore efficient propeller.

Governing.—Perfect Governing on all loads for both the marine and stationary types.

Water Drip.—This is entirely abolished as the engines will carry their full load without the use of water.

Lubrication.—This T. Series of engines are fitted with Forced Lubrication to main bearings of crankshaft and Governor, also to the Governor and fuel pump driving gears. Pistons and connecting rod large and small ends, are lubricated by means of a mechanical lubricator. Ring Oilers are fitted to the main bearings of the VT. Series; oil consumption for these parts is, therefore practically nil.

Mechanical Lubricator.—This is of our own design and manufacture. It is positive in its action and may be depended upon to deliver no more and no less than the predetermined quantity of oil to the bearings that it supplies.

Twin Screw Set.—For twin sets, right and left hand engines are supplied.

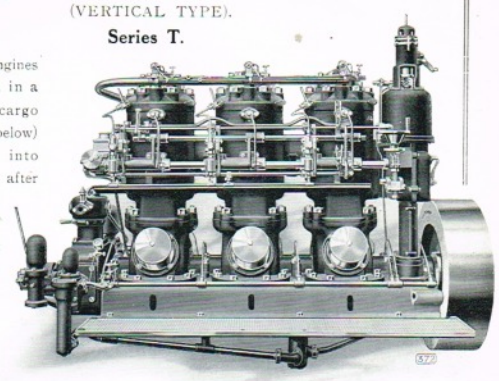
Lloyd's Survey.—Design of engine parts is such that the latest Lloyd's regulations are fully complied with.

GARDNER Heavy Oil Engines

(VERTICAL TYPE).

Series T.

TWO of these Engines were installed in a North of Scotland cargo boat (see illustration below) which was placed into service immediately after its trial, and which covered a distance of 30,000 miles without trouble of any description.



No. 377—MARINE ENGINE 85 B.H.P. at 340 R.P.M.

Suitable for
Barges,
Ferries,
Fishing Boats,
Commercial Craft
and
Heavy Auxiliaries.

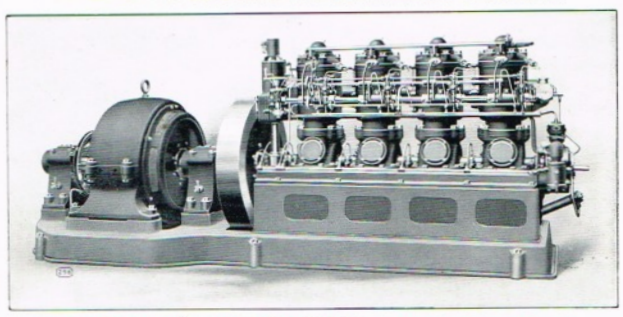
For Table of Sizes, Powers, &c., see page 8.

GARDNER Heavy Oil Engines

(VERTICAL TYPE).

Series T.

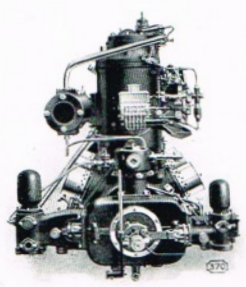
For ELECTRIC LIGHTING and STATIONARY PURPOSES.



No. 475—STATIONARY ENGINE 70 B.H.P. at 400 R.P.M., direct coupled to a Dynamo on Baseplate built for an India Office Contract.

The exceedingly even turning effect and close governing of these Engines makes them particularly suitable for direct coupling to dynamos.

END VIEW



SHEWING PUMPS, ETC.

Description.

Crankcase.—Bottom half of Crankcase is in one casting, carrying the main bearings. The top portion of each crank chamber is a separate casting, and is not combined with the cylinder except on the smaller sizes.

Cylinders.—Each cylinder is a separate casting with a water jacket of ample capacity, with easy access to the water space, exhaust and inlet ports for cleaning and scraping when necessary.

Cylinder Head.—Is a separate casting bolted to the cylinder, forming the lower water jacketed portion of the hot bulb, and carries the fuel injection valve.

Hot Bulb.—The upper unjacketed portion of the hot bulb is a plain hemispherical casting secured to the cylinder head by a clamp ring.

Pistons.—Trunk type with four or more rings.

Connecting Rods.—Machined from solid steel forging. The crank pin bearings are hard brass castings lined with white metal. The small end bearings are special bronze.

Crankshafts.—Machined from solid steel forging and finished bright all over. Balance weights are bolted to the webs. The flywheel of the "T" type Engines is bolted to a flange forged solid with the crankshaft.

Main Bearings.—Special bronze.

Lubrication System.—Forced Lubrication is provided for the main bearings of the "T" type Engines, those of the stationary type "VT" series being ring oiled. The cylinders, pistons and connecting rod bearings are lubricated by separate oil pumps, one pump being provided for each cylinder, which is lubricated at two points. A separate oil pump is provided for each crank pin and connecting rod. These oil pumps can be operated by hand for flushing with oil before starting, or at any time whilst the engine is running.

DESCRIPTION—*continued.*

Fuel Injection.—There is a separate fuel pump for each cylinder, operated from a camshaft on the "T" type Engines, and from an eccentric on the "VT" Engines.

Fuel Pump.—Ram type with solid steel ram, metallic gland packing and steel ball valves.

Fuel Injection Valve.—Special design of rotable injector, adjustable to suit varying conditions of load.

Governing System.—A centrifugal governor varies the stroke of the fuel pumps and the timing of the injection.

Quick Starting Burner.—Compressed air and oil spray burners of special design are provided for the initial heating of the bulbs on the "T" type Engines. No preliminary heating of the burner itself is required, and the engine can be put to work within three minutes of the lighting of the burners, which are not required after starting.

Pumps.—The "T" type Engines are fitted with circulating and bilge water pumps for marine installations.

Starting.—Compressed air starting gear is fitted to all "T" type Engines, and to the larger sizes of "VT" Engines which cannot conveniently be started by hand. The three and four cylinder engines can be started from any position by means of compressed air: it is not necessary to bar them round into any special position before starting. A water cooled air compressor is fitted on the "T" type Engines, driven direct from the crankshaft: it can be put in or out of action as required for charging the air receivers. A safety valve is provided on compressor cylinder to prevent overloading the compressor and the receiver.

Reversing.—The three and four cylinder engines are directly reversible for marine purposes by means of compressed air, a friction clutch between the engine and the propeller shaft is not necessary, but desirable. A separate mechanical reversing gear is required for the two cylinder "T" type Engines and the single cylinder "VT" series.

1st Edn

Table of Details for the VT and T Series of HEAVY OIL ENGINES.

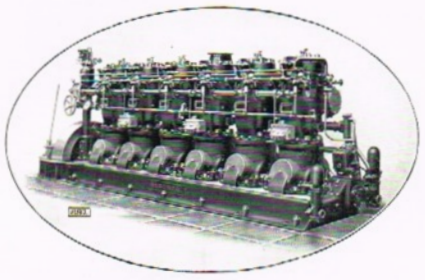
Type	B.H.P.	R.P.M.	No. of Cylinders	Bore	Stroke	Codeword	Approx. Weight, Engine only (less Flywheel.)	Particulars of Flywheel			Overall Dimensions		
								Dia.	Width	Weight	Width	Length	Height
4VT	10½	450	1	7″	8″	*Vimpa*	10 cwts.	23″	8″	2¾ cwts. (2 each)	30″	40″	57⅝″
5VT	16½	400	1	8½″	9½″	*Vipet*	16¼ „	27″	8½″	5¾ „ (1 each)	34¼″	43 3/16″	65⅛″
6VT★	22	370	1	9½″	10¾″	*Volas*	25 „	46″	6″	12 „ „	46″	70⅜″	68¾″
7VT	28	340	1	10½″	12″	*Vurst*	28½ „	36″	11″	16 „ „	46″	51½″	71″
8VT★	33	320	1	11½″	12½″	*Vyrat*	32 „	39″	12″	21 „ „	53″	86″	78⅛″
2T4	22	450	2	7″	8″	*Maba*	22 „	24″	6″	4 „ „	44″	57⅛″	57⅝″
3T4	33	450	3	7″	8″	*Mace*	25¼ „	24″	6″	4 „ „	44″	73¼″	57⅜″
2T5	35	400	2	8½″	9½″	*Mafer*	29 „	29″	6″	6 „ „	44″	63½″	62⅝″
4T4	45	450	4	7″	8″	*Madre*	33 „	24″	6″	4 „ „	44″	89″	57⅝″
2T6	45	370	2	9½″	10¾″	*Magno*	36 „	33″	6″	7¾ „ „	45½″	69½″	68¼″
3T5	52	400	3	8½″	9½″	*Magic*	41 „	29″	6″	6 „ „	44″	82″	62⅝″
2T7	57	340	2	10½″	12″	*Makra*	43 „	36″	7″	—	—	—	—
2T8	67	320	2	11½″	12½″	*Manor*	50 „	39″	7½″	—	—	—	—
3T6	68	370	3	9½″	10¾″	*Maila*	53 „	33″	6″	7¾ „ „	45½″	89½″	68¼″
4T5	70	400	4	8½″	9½″	*Magma*	54¼ „	29″	6″	6 „ „	44″	100½″	62⅝″
3T7	86	340	3	10½″	12″	*Malas*	79½ „	36″	7″	—	—	—	—
4T6	91	370	4	9½″	10¾″	*Major*	66 „	33″	6″	7¾ „ „	45½″	109″	68¼″
3T8	101	320	3	11½″	12½″	*Maori*	89 „	39″	7½″	20½ „ „	—	—	—
4T7	114	340	4	10½″	12″	*Mamon*	97 „	36″	7″	16½ „ „	—	—	—
4T8	134	320	4	11½″	12½″	*Marat*	111¾ „	39″	7½″	20½ „ „	—	—	—

Codewords given are for Marine Engines. For Ordinary Stationary Type prefix "O," and for EL Type prefix "EL." ★ Stationary Type only.

The weights shewn above are for Marine Engines and consequently do not include land type Silencers, which must be allowed for in the case of stationary jobs. In Electrical Combinations (belt or direct driven), allowance must be made for Extras, such as Bedplates, Stands and EL Wheels, the respective weights of which can be obtained on application.

"J" Type manufactured between 1928 & 1940.

GARDNER ENGINES



J TYPE
HEAVY-OIL
ENGINES

Compression-Ignition Cold Starting
Airless Fuel Injection
for
MARINE PROPULSION

NORRIS, HENTY & GARDNERS LTD.
(Proprietors L. GARDNER & SONS LTD.)
BARTON HALL ENGINE WORKS
PATRICROFT, Manchester

GARDNER HEAVY-OIL ENGINES

J TYPE MARINE

Vertical Two Cycle
Compression-Ignition Cold Starting
Airless Fuel Injection

PRELIMINARY

THE Gardner J Type Engine marks the very latest phase in the development of the Heavy-Oil Engine. It is designed essentially as a marine engine and, as will be seen from the description, possesses all the necessary and desirable attributes of a perfect marine engine. It is easily and quickly reversed; it has a great range of speed (r.p.m.); it is under complete control of the automatic governor at all speeds and the speed can be instantly varied, all of which combine to give perfect manœuvring.

The starting and reversing are effected by the aid of compressed air generated by a 2-stage compressor forming part of the engine.

The fuel is injected and sprayed into the combustion chamber *without* the aid of compressed air, hence the term "Airless Injection." The ignition of the fuel charge is effected solely by the temperature of the compressed air charge which temperature is sufficiently high to ignite the fuel charge with precision and certainty whether when running at varying speeds and loads or when starting from "all cold." Hence the terms "Compression-Ignition" and "cold starting." The operation of the engine is described on page 6.

GARDNER HEAVY-OIL ENGINES

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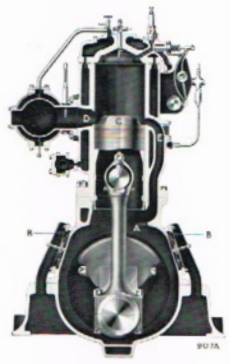
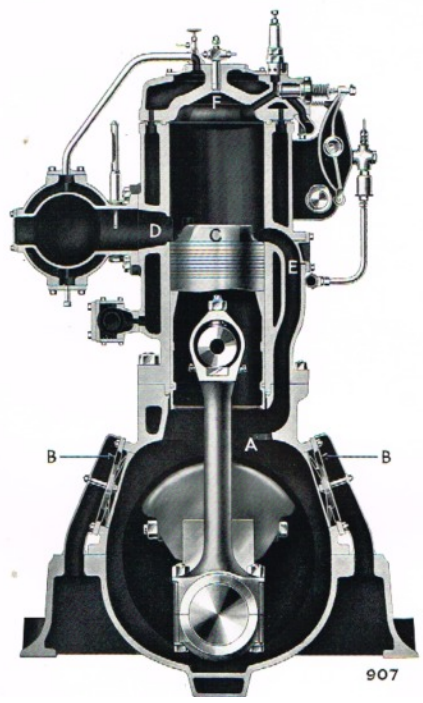


OPERATION OF THE ENGINE

A charge of pure air is drawn into the crank case A through the air valves B by the piston C during its upward stroke. On the downward or power stroke this air is compressed in the crank case and, as the piston approaches the lower end of the stroke, it uncovers the exhaust ports D in the cylinder wall and allows the escape of the exhaust gases from the preceding power stroke. Almost at the same time, the air that has been compressed in the crank case is admitted to the cylinder through the conduit and air ports E, thus displacing the remaining burnt gases and filling the cylinder with a charge of pure air, ready for the next power stroke. This charge is then compressed during the upward stroke of the piston into the combustion chamber F formed by the cylinder head and the head of the piston.

The temperature, generated by the compression of the air charge, suffices to ignite the fuel charge just about to be injected. Just before the compression stroke is completed and while the piston is sensibly at rest, a charge of fuel is injected into the combustion chamber in the form of a cloud or spray which is immediately ignited and burned. The resulting rise of pressure in the cylinder drives the piston downward and so completes the cycle of operation.

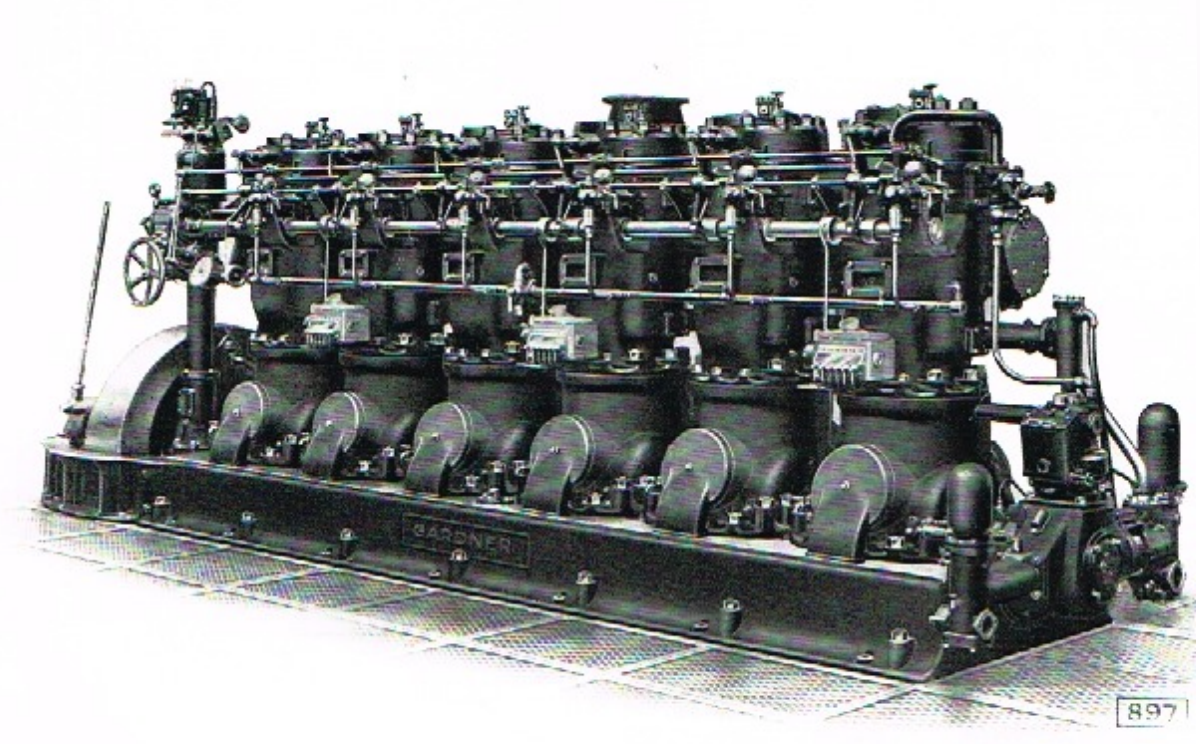


GARDNER J TYPE HEAVY-OIL MARINE ENGINES
PRINCIPAL FEATURES

Before proceeding to a detailed description of the engine it may be helpful at this stage to catalogue some of the salient features of the engine, as thus :—

1. Ignition by the temperature of compression, therefore no other ignition devices such as lamps, hot surfaces, electric plugs, etc.
2. Cylinder Heads, entirely water-cooled : of extremely symmetric and simple design.
3. All engines directly reversible.
4. Main bearings and other principal parts lubricated by a circulation-pressure system.
5. Cylinders and Big Ends lubricated by measured pressure feed.
6. Perfectly quiet burning of the fuel : not the slightest sign of heavy pressure or explosive shocks.
7. Starts instantaneously from cold.
8. Runs perfectly at all loads from no load to full load : no adjustments to make for varying loads.
9. Will run as long as desired without load.
10. Every engine is furnished with the following organs :—

    Friction Clutch and Thrust Bearing.
    Special Marine Governor and Variable Speed Gear.
    Two-stage Air Compressor.
    Circulation Water Pump.
    Bilge Pump.
    Compressed Air Storage Bottles with all fittings.
    And many other necessary or desirable accessories.



Engine 6J9 : 300 BHP : Speed 290 R.P.M.

TABLE OF SIZES, POWERS, WEIGHTS, ETC.

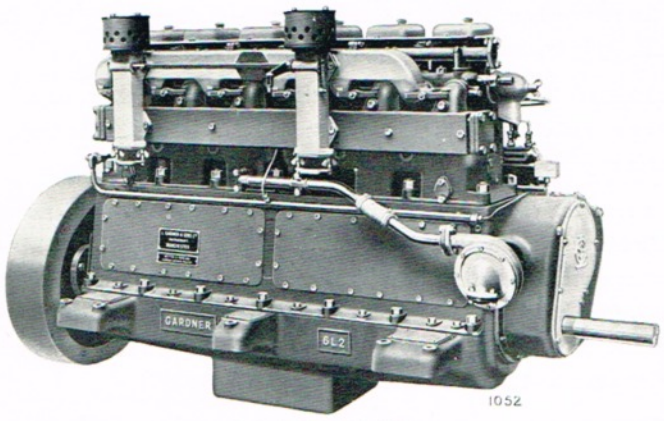
SIZES, POWERS, SPEEDS, &c.							WEIGHTS (in cwts.)			
Engine	B.H.P.	R.P.M.	No. of Cylinders	Bore	Stroke	Code	Engine with Flywheel and Clutch	Air Bottles	Engine complete with Flywheel, Clutch and Air Bottles	
							Nett cwts.	Nett cwts.	Gross cwts.	Nett cwts.
3J5	54	400	3	8	9¾	ZABTE	70	5	90	75
4J5	72	400	4	8	9¾	ZABIC	84	5	104	89
3J6	72	370	3	9	11	ZAFUL	98	6	117	104
4J6	96	370	4	9	11	ZEDYR	110	6	131	116
5J6	120	370	5	9	11	ZIMBO	140	7	165	147
6J6	144	370	6	9	11	ZOMAC	170	7	199	177
3J7	90	340	3	10	12	ZECLA	132	6	156	138
4J7	120	340	4	10	12	ZIGUP	154	6	181	160
5J7	150	340	5	10	12	ZALUT	194	7	225	201
6J7	180	340	6	10	12	ZONOB	230	9	270	239
3J8	114	320	3	11	13½	ZEJAT	150	7	176	157
4J8	152	320	4	11	13½	ZILSH	180	7	212	187
5J8	190	320	5	11	13½	ZIPAD	225	9	264	234
6J8	228	320	6	11	13½	ZIQUE	270	10	315	280
3J9	150	290	3	12½	15	ZIRKA	210	10	246	220
4J9	200	290	4	12½	15	ZOTAB	280	10	322	290
5J9	250	290	5	12½	15	ZOSLY	340	11	389	351
6J9	300	290	6	12½	15	ZOVEF	400	13	461	413
8J9	400	290	8	12½	15	ZUKEL	553	23	657	576

"L2" Type manufactured between 1930 & 1951.

GARDNER
COLD START

HIGH-SPEED OIL ENGINES

Vertical Four Cycle Compression Ignition
Cold Starting Airless Fuel Injection



1052

Admirably suited for
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Leaflet No. 636

GARDNER
L2
TYPE

HIGH-SPEED OIL ENGINES

The introduction of the Gardner High-Speed Oil Engine into the Motor Transport World has given rise to a great amount of interest on account of the many unique features which it possesses—features it may be added, which equip it admirably for a Motor Transport unit.

ECONOMY. The most outstanding of these features, is perhaps, its ability to run on fuel oils that cost about 4½d. per gallon, with half the consumption that is required for a petrol engine.

As a result, an enormous saving in running cost is effected. For example, a Gardner engined bus (32 seater) which has been in service since March last has covered in ten months a distance of 60,000 miles at a fuel oil cost of ½d. (one halfpenny) per mile. When propelled by a petrol engine the fuel cost was 2½d. per mile. A total saving of about £500 in running costs during the ten months was therefore effected.

STARTING. Hitherto the drawback to Diesel Engines for transport work has been the starting difficulty. This, however, has been entirely overcome by the Gardner High-Speed Oil Engine which can be easily and safely started immediately by hand from cold without preliminary heating or electric devices of any description. Back-fires with this engine are impossible.

Other principal features may be summarised as follows :—

Forced Lubrication. Silent Gearing. Accessibility.
Simplicity. Durability. Irreproachable Workmanship.

Compared with a petrol vehicular engine the Gardner High-Speed Oil Engine will give : ***Better Pulling Power and with less Gear Changing.***
Better Hill Climbing. Cooler and Sweeter Running.
Immunity from Fire Risks.

GARDNER
L2
TYPE

HIGH-SPEED OIL ENGINES

LUBRICATION. The engine is provided with a forced lubrication system which supplies oil to the main bearings, crankpins, and, through the tubular connecting rods, to the gudgeon pins. Also the whole of the valve mechanism, including the fuel pump cams and rollers, is supplied with oil under pressure from the main system.

GOVERNING. This is effected by a totally-enclosed centrifugal governor, which automatically controls the amount of fuel injected so as to suit the load on the engine at any given moment. For vehicle work, the governor is connected to the foot accelerator. The engine is thus controlled in the same manner as a petrol engine, with the additional advantage that the engine is under the control of the governor throughout a speed range of from idling slowly to the maximum speed. For example—a laden vehicle may be manoeuvred without the use of the foot accelerator because the governor automatically "takes up" the load as the clutch is engaged and similarly controls the speed of the engine when the clutch is withdrawn.

COMPRESSION IGNITION. The ignition for the fuel charge is effected by the temperature attained by the air charge after compression, this temperature being sufficiently high to ignite the charge when running at varying loads or when starting from cold.

SAFETY. The fire risk is reduced to a minimum as the fuel-oil used is practically uninflammable. The flash point is about 170° F., whereas that of petrol is about 90° F. below freezing point.

For Table of Sizes, Powers and Speeds see overleaf.

GARDNER
L2
TYPE

HIGH-SPEED OIL ENGINES

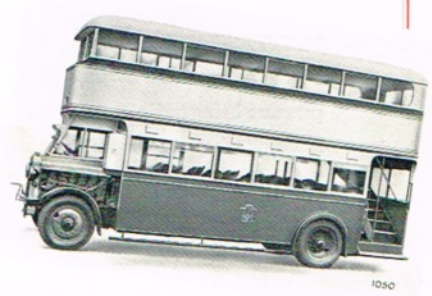
TABLE OF SIZES, POWERS AND SPEEDS

NOTE.—In the following table, the first numeral in the size of the engine refers to the number of cylinders : for example—5L2 means an L2 engine with 5 cylinders.

Engine	B.H.P. at 1000 r.p.m.	B.H.P. at 1100 r.p.m.	B.H.P. at 1200 r.p.m.	B.H.P. at 1300 r.p.m.
1L2	9½ (not used for vehicle work).			
*2L2	19	21	23	24½
*3L2	28½	31	34	37
4L2	38	42	46	50
5L2	47½	52	57	61½
6L2	57	63	68	74

* Two and three cylinder engines are not recommended for lorry use. They are however quite suitable and satisfactory for the heavier type of vehicle such as light locomotives, tractors, road rollers and similar vehicles.

Pagefield-Gardner Lorry
fitted with a Gardner 4L2 Engine
(38/50 B.H.P.)


1050

Crossley-Gardner Bus (57/74 B.H.P.)
as supplied to the Manchester, Leeds and Sheffield Corporations.

The “L2” series engine was to kick start a revolution in road transport propulsion and enhance the reputation of Gardner's engineering excellence.

The following pages from the Gardners of Patricroft 1868-1968 Centenary Book by David Whitehead give some insight into the developments of that era.

FIRST IN THE FIELD

Thomas Gardner, Mr Parkinson of Walker Bros, and Joseph Gardner on Parbold Hill

'Gardners achieved in 1928 or 1929 what no other firm in the world had succeeded in making, viz., a small high-speed open-chamber engine with a multiple-orifice injector which was consistently reliable. The Gardner engine stood in a class by itself thanks to the meticulous skill and care in its design and to superlative workmanship.'

The speaker was Sir Harry Ricardo and the event a meeting of the British Association seven years after the achievement he was describing. It was warm praise, but the market which had developed for Gardners' new engine confirmed that it was justified. History may never repeat itself precisely but the thirties were like the first years of the century, with the world thinking up ways to use Gardner engines as fast as they could be made.

Mr Joseph's new engine was not like so many previou Gardner engines, a development from a previous rang embodying logical forward steps in technology. It was a entirely new engine, like nothing that had gone befor It was a four-stroke. It ticked over at 400 rpm, the max mum speed of the fastest-revving J-type engine. It ha forced lubrication to all bearings and principal movin parts and the cylinders were cast together in block. Thes were its main features.

But none of these factors, however important, sep rated the L2 engine from the rest. It was the decision t persevere with the design of an open-cylinder type whic made the real break with the past. Again, Gardners we to take a piece of theoretical knowledge and make work, the true rôle of the engineer.

However various in design were diesel-engine cylinder heads, the theory was clear enough. If fuel was injected into an ante-chamber of one shape or another, and ignited there as in the case of the T- and HC-type engines the explosion spread into the cylinder head proper and gave the piston a steadier push than if the explosion was confined to the space bounded by the piston crown and the inner surface of the cylinder head.

But if you could do without an ante-chamber, less heat would be lost through the walls, saving fuel. Less energy would be wasted creating turbulence. The engine would start from cold more easily. It would be more efficient as a pump, clearing out more of the products of combustion with the exhaust stroke, promoting the more efficient burning of fuel. In short, the engine would run more smoothly, wear less and burn less fuel.

However, it was one thing to know these theoretical advantages, another to design a piston crown and cylinder head that would mix fuel and air properly and an injection system that could take the full force of the explosion. Others had tried and given up but these were to be the achievements of the L2-engine.

The development took time, and wrong turnings had to be explored. Both an original research engine, built in 1925, and a second, smaller engine, in 1928, were originally conceived as two-strokes and much work was done by Joseph and his elder son Hugh on this principle before the change to the four-stroke cycle. But perserverance paid.

In its production form the engine had a capacity of 1·4 litres per cylinder, a bore of 4¼ in. and a 6-in. stroke. The four-cylinder version, designated 4L2, developed 38/50 bhp at 1,000/1,300 rpm. As a stationary or marine engine it would run for 40 hours at 1,000 rpm for £3 14*s*. Gardners guaranteed a fuel consumption of not more than 0·41 lb per bhp per hour.

It was this economy, and the engine weight, that Mr Trevor Barton, of Barton Transport Ltd, Beeston, Nottingham, noted during his visit to the 1929 Marine Show at Olympia where the L2-engine was unveiled to the public. He came away with more than the customary information leaflets. He came away with an idea. And on visiting the Barton Hall Engine Works he was struck by more than the coincidence of the shared name.

Trevor Barton was a man of big ideas. Often they were too big to express in the conventional way and he would get down onto the floor and draw what he wanted on the larger space afforded. The upshot of his visit to the works was that a 4L2-engine was delivered to his Nottingham garage in the new year. It was installed in a single-deck Lancia bus and was put on trial. After only a month, in March 1930, the bus went into regular service to become the first vehicle engine conversion from petrol to diesel with a British-made diesel, the first all-British diesel engine to be used in a road vehicle and the first to go into regular service on a bus route. The performance advantage can be put quite simply. The bus ran more than twice as far on oil as it had on petrol.

In the fiercely competitive world of road transport, with many private concerns competing against each other, and, in passenger transport, against corporation undertakings, savings of this order would not long remain to the advantage of a few. Other engine makers were also in the field but the first all-British lorry conversion from petrol to diesel was with an RAF Leyland vehicle belonging to Frank H. Dutson Ltd, of Hunslet Low Road, Leeds, using a Gardner 4L2-engine. With it, a gallon of oil, at 4¼*d*, carried 6½ tons for 12 miles.

The works manager responsible for this conversion, Mr T. H. Parkinson, left shortly afterwards to become rolling-stock engineer for Leeds City Transport. There, in September, he supervised the installation of a six-cylinder 6L2-engine of 57/75 bhp at 1,000/1,300 into a new Crossley 'Condor' bus chassis so that Leeds Corporation became the first municipality in Great Britain to use a Gardner diesel and to operate the first entirely British double-deck passenger vehicle with an oil engine. Sheffield and Manchester Corporations followed suit, and the Walsall local authority tried a 4L2-engine in a Dennis E-type 32-seater bus. T.S. Motors Ltd (Tilling Stevens) began to offer the TSM express chassis with a 4L2-engine for passenger or goods vehicles and, by the end of 1930, Peerless Lorries & Parts Ltd were producing the Peerless goods chassis with a 4L2-engine, Karrier

The first British diesel-engined bus, powered by a Gardner 4L2 *engine.*

Motors had a heavy-goods chassis powered by a 6L2-engine, and Walker Brothers of Wigan were offering the Pagefield/Gardner 5/6 ton lorry with a 4L2-engine.

The hill-climbing ability of the last combination was proved on Parbold Hill, a 1 in 7 gradient on the road between Wigan and Southport. Fully loaded, the vehicle ascended comfortably in second gear without boiling. This trial was to be recalled thirty-four years later, when the pulling power of another new Gardner engine was demonstrated on the same incline.

Two-and-a-half years after the original test, when the 4L2-engine had completed 115,000 miles, it was stripped down at Patricroft when the cylinders were found to have worn between 0·014 and 0·017. All the overhauling that had been required was a valve grind at 26,000 miles, when a newer type of water pump was fitted, a new impeller bush and water-pump packing, one replacement set of sprayers, four new exhaust valves and some new parts in the fuel pump. A short list for 115,000 miles.

However, the L2-engine was designed for marine and industrial uses. It may have opened up the automotive market, but once a lighter version was developed specifically for the purpose, no more L2-engines were added to the two hundred which found their way into road vehicles.

The new engine was appreciated in the market for which it was intended. It began to spread throughout the world, in every type of craft from Arab dhow to Chinese junk. It was said then to be the ambition of every Chinese fisherman to own a Gardner engine. This is still true today.

Probably the first high-speed Gardner diesel installation in a sea-going craft was in May 1930. The owner was Mr E. B. A. Rose, who twice gave his initials to converted naval pinnaces. *Ebar I* was petrol-engined, but *Ebar II* was equipped with a pair of three-cylinder L2-engines. She was 48 ft in length with a 12-ft beam and had tanks to hold 400 gallons of oil which gave her a cruising range of 1,500 miles. She used 1,300 of these in a trial run into the Bay of Biscay in her first season, a trip that cost £10 in fuel and lubricating oil. Compared with his earlier conversion, Mr Rose found the engine-room smelled less, because the engine ran cooler. In her first two seasons, covering 2,600 miles, the *Ebar II* was trouble-free. The only maintenance required was the removal and cleaning of a fuel injector, an operation found to be as easy as changing the sparking-plug.

In contrast to this life afloat, another L2-engine began one of almost total solitude. It was installed in a brick hut at Wirksworth where it pumped water for 4,000 inhabitants, entirely automatically. It started and stopped according to the water level and was left quite alone, apart from a weekly check. At the time, electricity prices varied from 1*d* to 3*d* a unit but even at the cheapest rate the running cost was reckoned to be only half that of a similar all-electric installation.

By August of 1931, two years after the introduction of the L2-engine at the Marine Exhibition, Gardners had a new automotive engine on the market: type LW. Aluminium alloy brought the weight of the four-cylinder LW-engine down to 9½ cwt and the power-to-weight ratio was reduced still further, to 15 lb per bhp (under two-thirds that of the four-cylinder L2) by increasing the output. The engine developed 68 bhp at 1,700 rpm. Fuel consumption was reduced even further, to less than 0·370 lb per bhp per hour.

The first LW-engine operated by a municipality was in a Leeds Corporation double-deck bus. The six-cylinder engine developed 102 bhp at 1,700 rpm and this engine

The first British motor lorry converted from petrol to diesel power, powered by a Gardner 4L2 *engine.*

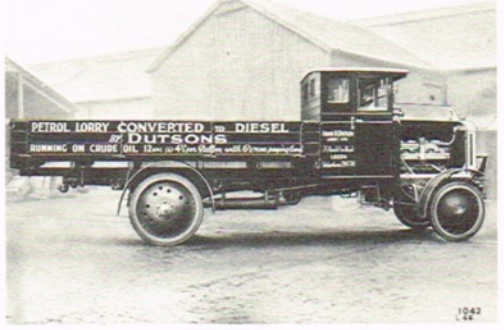
setting remained a standard for road transport duties for nineteen years.

In November, Gardners were back at Olympia. Their first exhibits at the Commercial Motor Transport Exhibition included a Guy 'Goliath' eleven-ton rigid six-wheeler and a Karrier 'Consort' fifty-eight-seater double-deck bus, both equipped with the 6LW-engine. Fodens, who had taken delivery of their first Gardner engine earlier in the year, had a six-ton lorry powered by a 6L2-type. Walker Bros had two of their L2-engined lorries, the 4L2 Pagefield 5/6 tonner, and the Pagefield 'Plantagenet' which was probably the first road vehicle to be powered by a five-cylinder diesel engine, the 5L2.

The new engines were more reliable than their petrol equivalent and this helped their spread. It needed help, for even the breath-taking eighty per cent improvement in economy over petrol consumption would not have been enough had the engines proved difficult to maintain. Engines imported from the Continent had given diesels a bad name, a point Sir Harry Ricardo touched on, at the same British Association dinner. They had disappointed, he said, 'for their noise, smoke and smell were intolerable, whilst their heavy maintenance costs went far to counter their advantage in the way of fuel costs'. A reputation to live down.

For a large fleet owner, the problem of achieving the saving, whilst providing two sets of maintenance facilities for a mixed fleet was acute. Mr Clive Clarke, of the London coal merchants, Coote & Warren, told the trade press that the reliability of his six Gardner-engined TSM delivery wagons, which were scattered over the Eastern Counties at small seaports, was almost as big an advantage as their low operating costs for it was impossible to maintain strict mechanical supervision for each vehicle, or institute special workshops for each small section of the fleet, while to place them in charge of the local garage had been found too expensive.

Gardners helped. They arranged to give week-long courses at Patricroft to fitters. The old LMS Railway Company, which had two thousand goods vehicles at this time and had successfully tested L2-engines over 40,000 miles, converted ninety-one vehicles the following



year. The road motor engineer, Mr J. Shearman, sent every leading fitter on the course, and every inspector responsible for training the drivers.

Mr Shearman wrote at the time: 'The putting into service of a large number of vehicles fitted with an entirely new type of engine is one which is attended with a certain amount of risk and anxiety. Vehicles are necessarily grouped in small numbers and are widely scattered all over the United Kingdom.'

However, Mr Shearman was not to regret his essay into diesel power. 'The drivers and operating department took kindly to them and practically no teething troubles were experienced,' he reported. The only dissatisfaction was expressed by a driver used to a hot petrol engine beneath his feet. The 4LW Gardner engine left his cab cold in the winter, he complained. This was, Mr Shearman recorded straight-faced, 'more a matter for the welfare department than the engineering department'.

The small haulier was often luckier. Some worked out that if a vehicle ran 500 miles a week or more, the conversion, at cost of between £300 and £350, could be completed on hire-purchase with the deposit as the only expenditure. The monthly saving on fuel would match the repayments. By early 1936 some 46 different makes of passenger and goods vehicles, comprising 195 models, British, Continental and American, had successfully been converted with Gardner LW-engines.

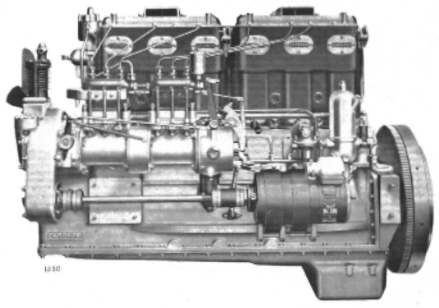
The “LW” series manufactured between 1931 and 1974

GARDNER
COLD START

HIGH-SPEED OIL ENGINES

(commonly known as Diesel Engines)

LW TYPE



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GARDNER
LW
TYPE

HIGH-SPEED OIL ENGINES

Principal Features

The ignition of the fuel charge is effected by the temperature of compression and by no other means.

The engine is easily and readily started by hand from "all cold" without any preliminary heating: cartridges, electric heating coils, compressed air and all such-like auxiliary devices are entirely dispensed with.

Forced lubrication is applied to all bearings and principal moving parts.

The engine runs at all speeds from 400 r.p.m. to the maximum always under the control of the governor

The fuel injectors (sprayers) are extremely simple: when reassembling there are no adjustments whatever to be made by the user

The ratio of power to weight is about that of a well-made modern petrol engine.

Prolonged research work on the phenomena of ignition and combustion has resulted in an engine which burns its fuel *quietly* and with unusual efficiency

The fuel consumption is less than 0.370 lb. (0.344 pint) per B.H.P per hour

All working parts are completely enclosed without sacrifice of accessibility

An especially generous system of strainers is inserted in the fuel service and lubrication systems.

Accessories

The illustration of the engines show a variety of accessories such as the fan, the electric starter, the dynamo and the exhauster for the Servo brakes. These are furnished only when specifically ordered and are not included in the list price of the engine.

GARDNER
LW
TYPE

HIGH-SPEED OIL ENGINES

Gardner LW Type

The Gardner LW Engine is specially designed as a power unit for goods and passenger road transport. By skilful design, the use of light alloys and materials possessing great strength, the power to weight ratio has been reduced to that of a well-built petrol unit of the same output.

Engines can be supplied for converting the great majority of petrol-engined chassis, embodying the various types of mounting, unit construction, oil sumps, exhaust manifolds, and many other special details. Enquiries for conversion need only specify the chassis type and No., as in most cases they have already been dealt with.—*See page 29.*

The Principle of the Modern Oil Engine

The modern oil engine differs from the petrol engine in that, during the suction stroke, the latter draws in a cylinderful of air mixed with petrol, while in the oil engine the charge drawn in consists of *nothing but air*. In both classes of engines the inward stroke of the piston compresses the charge, and it is common knowledge that the higher the degree of compression the greater is the efficiency of the engine. Unfortunately, in the petrol engine, the compression is very much limited because the compressed charge consists of a mixture of air and fuel which, when ignited by the spark detonates if the compression be too great: the efficiency of the petrol engine is therefore relatively low. In the oil engine, since the compressed charge consists of nothing but air, the only limit to the degree of compression is the mechanical one of providing for the stresses generated by the pressure, consequently, the oil engine is ever so much more efficient than a petrol engine as will be realised later on.

It is common knowledge that when a gas-like air is compressed, its temperature rises and if the degree of compression be high enough, the resulting temperature will ignite oil when injected into the compressed air charge. This phenomenon is known as spontaneous ignition.

LW MARINE PROPULSION UNITS

B.H.P., R.P.M., WEIGHT, ETC.

LW denotes the mark of the engine, the numeral denotes the number of cylinders. 4LW, for example denotes the LW series engine of four cylinders. The Bore and Stroke of all engines is $4\frac{1}{4}$" × 6" (107·952 mm. × 152·4 mm.) respectively.

FOR HEAVY DUTY COMMERCIAL AND SIMILAR CRAFT

Cast Iron Construction Engine, Reverse Gear and Reducing Gear

Engine	Swept Volume LITRES	B.H.P.	R.P.M.	Approximate Weights (lb.) Direct Drive	With 2 : 1 Reducing Gear	With 3 : 1 Reducing Gear	Drawing No.
2LW	2·8	24	1200	1,792	1,988	2,044	12800
3LW	4·2	36	1200	2,100	2,296	2,352	12801
4LW	5·6	48	1200	2,240	2,436	2,492	12802
5LW	7·0	60	1200	2,464	2,660	2,716	12803
6LW	8·4	72	1200	2,688	2,884	2,940	12804

FOR YACHTS, CRUISERS, AUXILIARY VESSELS and other MARINE use

distinct from commercial craft, which may operate continuously at maximum hours per annum.

Cast Iron Construction Engine, Reverse Gear and Reducing Gear

(for special application and subject to individual consideration Aluminium Units can be supplied).

Engine	Swept Volume LITRES	B.H.P.	R.P.M.	Approximate Weights (lb.) Direct Drive Aluminium	Direct Drive Cast Iron	2 : 1 Reducing Gear Aluminium	2 : 1 Reducing Gear Cast Iron	3 : 1 Reducing Gear Aluminium	3 : 1 Reducing Gear Cast Iron	Drawing No.
2LW	2·8	30	1500	—	1,792	—	1,988	—	2,044	12800
3LW	4·2	45	1500	1,736	2,100	1,876	2,296	1,916	2,352	12801
4LW	5·6	60	1500	1,848	2,240	1,988	2,436	2,028	2,492	12802
5LW	7·0	75	1500	2,044	2,464	2,184	2,660	2,224	2,716	12803
6LW	8·4	90	1500	2,240	2,688	2,380	2,884	2,420	2,940	12804

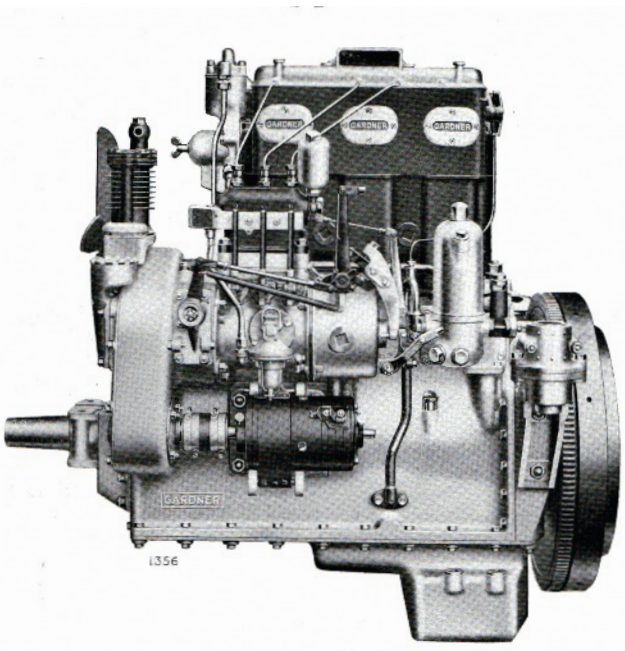
FOR SPECIAL HIGH SPEED CRAFT

Aluminium Construction Engine, Reverse Gear and Reducing Gear

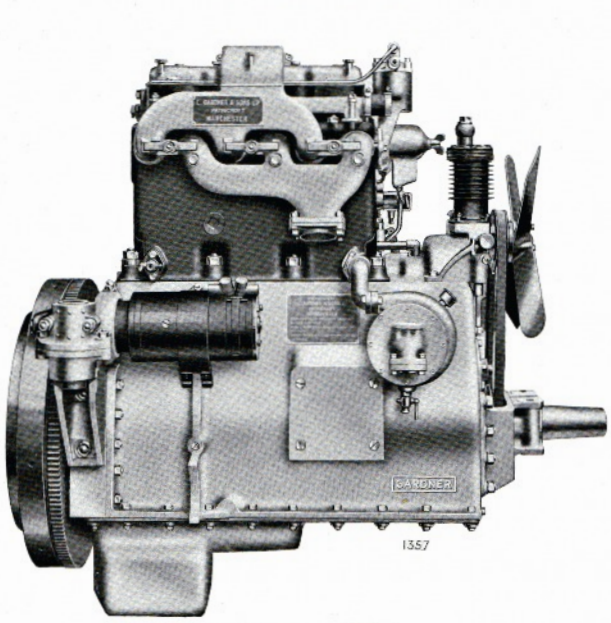
Engine	Swept Volume	B.H.P.	R.P.M.	Approximate Weights (lb.) Direct Drive	2 : 1 Reducing Gear	3 : 1 Reducing Gear	Drawing No.
4LW	5·6	71	1700	1,736	1,876	1,916	12802
5LW	7·0	89	1700	1,932	2,072	2,112	12803
6LW	8·4	107	1700	2,128	2,268	2,308	12804

The above tables give the powers developed at normal atmospheric temperature and pressure, and for adverse climatic conditions we observe de-rating data specified in the Engine Instruction Manual.

All engines revolve anti-clockwise when looking on propeller, but when reducing gear is fitted, propeller revolves clockwise.

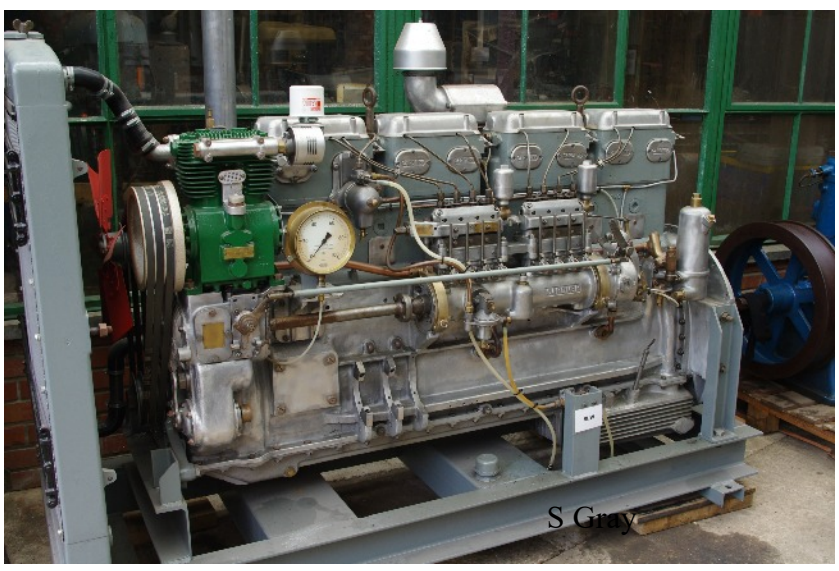


3LW Engine—Near Side



3LW Engine—Off Side

GARDNER



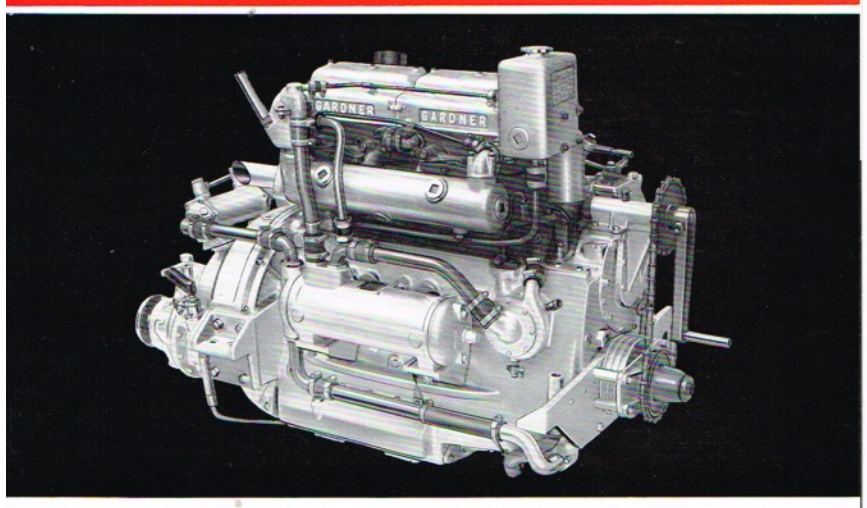
S Gray

8LW on display at the Anson Engine Museum

The “LK” manufactured between 1935 and 1966
Available in Marine and Automotive versions

GARDNER 4LK

Marine Propulsion Diesel Units
with Oil Operated Reversing and Reducing Gears



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The GARDNER 4LK

MARINE PROPULSION DIESEL ENGINE

INTRODUCTION

In response to requirements for a small marine engine possessing characteristics offered by the larger and more powerful Gardner Units, the well known 4LK 3·8 litre Diesel engine has been fully developed for marine propulsion duties.

This engine at one time powered the British Navy Midget Submarine and embodies certain design features developed for that period of historic service. It achieves a high power-to-weight and power-to-space ratio at moderate revolutions per minute together with all traditional Gardner standards of efficiency, durability and refinement.

The minimum specific fuel consumption rate of the engine when directly coupled to the dynamometer, is less than the low value of ·360 lb./BHP/hr. which represents an overall thermal efficiency of 36·4%.

Engine cooling is effected by a fresh water closed circuit system with integrally mounted heat exchanger and header tank or alternatively a keel cooler. Coolant is circulated at high rate by centrifugal pump and temperature is automatically controlled at all loads and speeds from idle to maximum output. Controlled temperature is approximately 142°F.

Standard lubricating oil cooling arrangements provide adequate control in high ambient temperature.

The engine is constructed as a unit with a compact oil operated reversing gear and reversing-reducing gear, manufactured by The Self-Changing Gear Co. Ltd. Control of Ahead and Astern Clutches and engine speed may be effected by a Single Lever or by separate speed and gear levers.

It is available with direct drive or with reducing gear having either hand of rotation. A propeller thrust bearing is incorporated in the unit.

This unit has been accepted by Lloyds and is entered on the Register in the 100A1 Classification.

DESCRIPTION

The four cylinder 4LK engine is of direct injection 4 cycle type, having one inlet and one exhaust valve per cylinder located vertically in the cylinder heads, one each side of the fuel sprayer. The cylinder heads are mounted in pairs and the valves are operated by levers, push rods and tappets from a camshaft located in the crankcase.

The camshaft and auxiliaries are driven by a triplex roller chain running in a constant stream of oil which, together with carefully spaced sprockets, ensures a smooth drive, perfect reliability, long life and silent operation.

The combined fuel injection pump and governor unit is rigidly mounted in permanent alignment on the side of the crankcase and is driven by helical gears from the valve camshaft. Precise optimum injection timing control for all loads and speeds is secured automatically by this combination of helical gears, one of which is moved axially on its helically splined shaft by interconnection with the governor.

The engine is under governor control at all speeds.

on the opposite side are mounted the fuel pump and governor assembly, dynamo and electric starter motor. The inlet manifold is neatly incorporated in the cylinder head design by the simple addition of two cast aluminium covers.

The construction of the engine embodies a rigid, deep section, magnesium alloy crankcase to which is bolted a one-piece cast iron cylinder block by means of high tensile "through" bolts which also form the studs for the main bearing caps.

This method of construction secures great strength and relieves the crankcase of much load and consequent distortion due to cylinder gas pressure, etc.

The extreme rigidity created, gives adequate support to the main bearings and avoids crankshaft deflection, ensuring smooth and quiet engine operation at all speeds and loads together with long bearing life.

A gear type pump delivers oil under pressure directly to all main bearings, big and small end bear-

Cooling of the engine lubricating oil is effected by a cast aluminium water-jacketed oil sump through which sea water is circulated by a separately mounted engine driven centrifugal pump.

A 12 volt or 24 volt electric starter motor may be fitted on all engines in addition to the single handle provided for hand starting and for general servicing and maintenance adjustments.

The Self Change epicyclic reverse gear, Type MRF 11/2B, is bolted directly to the end plate in unit with the engine, ensuring true and permanent alignment of engine and gear.

Ahead and Astern clutch engagement is controlled entirely by oil pressure through the medium of a lever-operated selector valve, fed by the combined lubricating and oil pressure systems contained within the gear box.

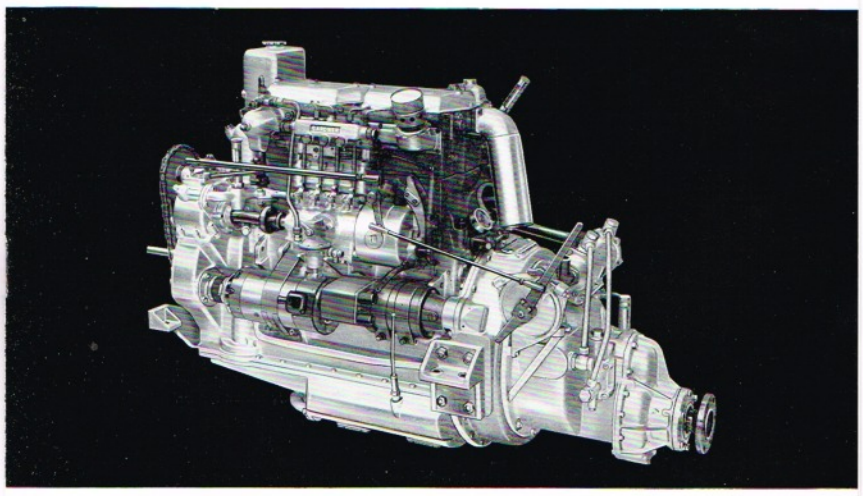
In addition, the selector valve may be made to control engine speed by inter-communication with a Sequent Control directly coupled to the engine speed control lever.

This system of Single Lever Control ensures that engine speed is reduced to idling during the period of clutch engagement and disengagement, thus safe-guarding engine and transmission against sudden loading and stress.

The reducing gear is available as a two-gear reduction unit for driving a right hand propeller or as a three-gear reduction unit for left hand propeller and is lubricated from the reverse gear lubrication system.

Cooling of the reverse gear lubricating oil is effected by a separate water cooled oil cooler mounted on the reverse gear casing.

Every engine complete with reverse gear and, if specified, its reducing gear, is fully tested when coupled to a dynamometer, and no unit is passed off test until all aspects of its performance complies meticulously with requirements in respect of power and fuel consumption, etc., indicated in the published performance curves.



The 4LK, four cylinder engine with oil operated reverse gear and 2:1 ratio reducing gear

GENERAL DATA AND POWER OUTPUT

These units comprising engine reverse gear and reducing gear are of LIGHT ALLOY construction for ALL purposes.

They are suitably protected from corrosion to specification accepted by the Royal National Life-boat Institution.

BORE		STROKE		No. of Cylinders	SWEPT VOLUME	
Inches	m.m.	Inches	m.m.		Cu. In.	Litres
3½	95·250	5½	133·350	4	232	3·80

FOR HEAVY DUTY COMMERCIAL CRAFT

B.H.P.	R.P.M.	Approximate Weight (lb.) and lb. per B.H.P.			Drawing No.
		Direct Drive	With Two-Gear Reduction Unit (1·5 : 1, 2 : 1 and 3 : 1 ratios)	With Three-Gear Reduction Unit (1·5 : 1, 2 : 1 and 3 : 1 ratios)	
42	1,500	1,239 29·5	1,270 30·2	1,287 30·6	14494

FOR YACHTS, CRUISERS, AUXILIARY VESSELS and other MARINE use as distinct from commercial craft which may operate at maximum hours per annum

B.H.P.	R.P.M.	Approximate Weight (lb.) and lb. per B.H.P.			Drawing No.
		Direct Drive	With Two-Gear Reduction Unit (1·5 : 1, 2 : 1 and 3 : 1 ratios)	With Three-Gear Reduction Unit (1·5 : 1, 2 : 1 and 3 : 1 ratios)	
51	1,800	1,239 24·3	1,270 24·9	1,287 25·2	14494

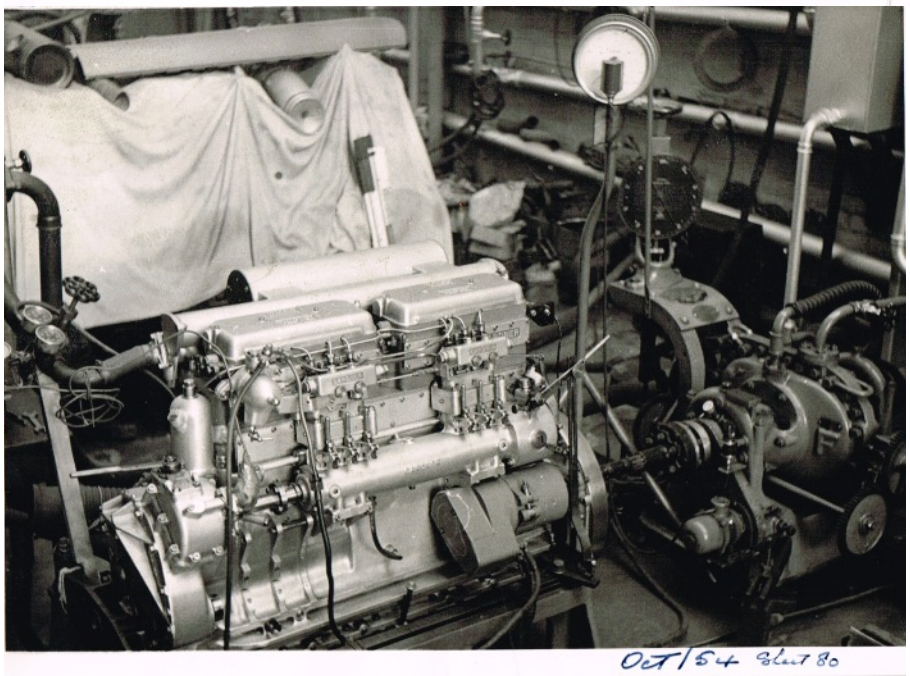
HIGH SPEED CRAFT

B.H.P.	R.P.M	Approximate Weight (lb.) and lb. per B.H.P.			Drawing No.
		Direct Drive	With Two-Gear Reduction Unit (1·5 : 1, 2 : 1 and 3 : 1 ratios)	With Three-Gear Reduction Unit (1·5 : 1, 2 : 1 and 3 : 1 ratios)	
60	2,100	1,176 19·6	1,207 20·1	1,224 20·4	14494

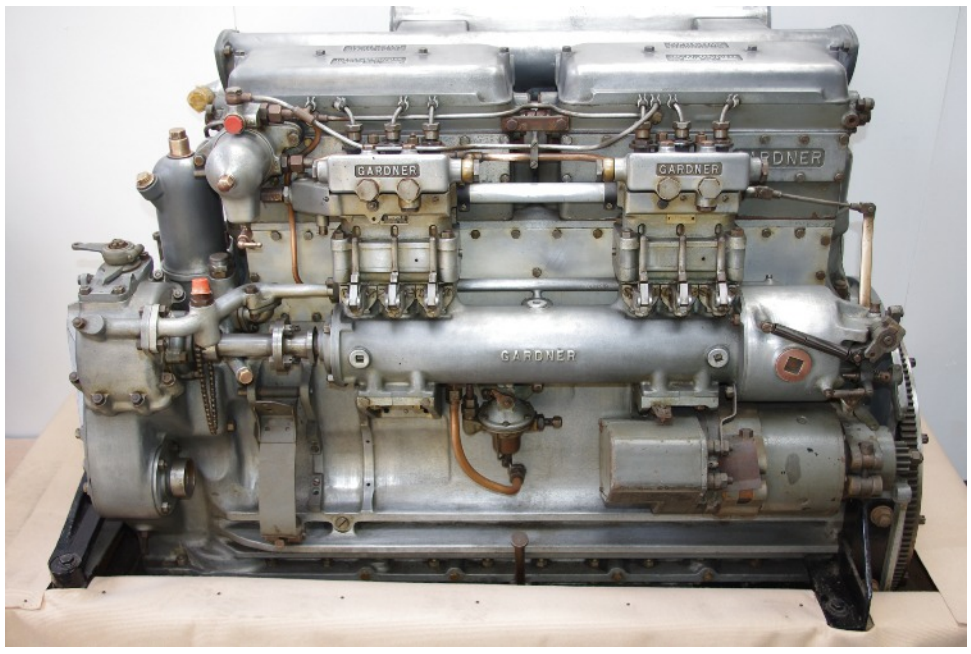
The above tables give the powers developed at **normal atmospheric temperature and pressure.** They are net values and represent installed performance except for deductions on account of transmission gear loss, any auxiliaries, or inadequate induction or exhaust systems.

For adverse climatic conditions engines are de-rated in accordance with Engine Instruction Manual.

The weights quoted include :—
1,500 and 1,800 r.p.m. units : Hand Starting equipment only and heavy design flywheel.
2,100 r.p.m. units : Electric Starting equipment only and light design flywheel.



The LK prototype was this 6 cyl version, in later years it was used for testing modified parts and is seen here on the test bed in 1954.
Photo courtesy of the Anson Engine Museum



The 6LK on display at the Anson Engine Museum
Gardner 150th Exhibition 2018

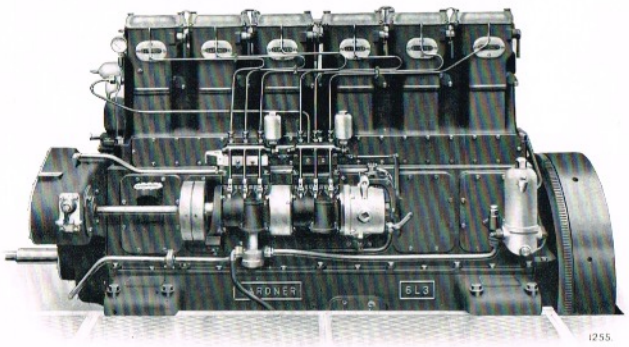
The “L3” manufactured between 1932 and 1961
The “L3B” manufactured between 1960 and 1984

GARDNER
COLD START

HIGH-SPEED OIL ENGINES

(commonly known as Diesel Engines)

L3 TYPE



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GARDNER
L3
TYPE

HIGH-SPEED OIL ENGINES

L3 Type

The Gardner L3 engine is simply a larger model of the well-known L2 engine which has proved so successful during the past five years (1930-1935). It is built on the same lines as the L2 engine except that the cylinders are fitted with loose wet liners and these liners, in turn are fitted with specially hard dry liners. See page 9.

In the following table, L3 denotes the mark of the engine, the prefixed numeral denotes the number (quantity) of cylinders. For example, 4L3 denotes an L3 engine of four cylinders.

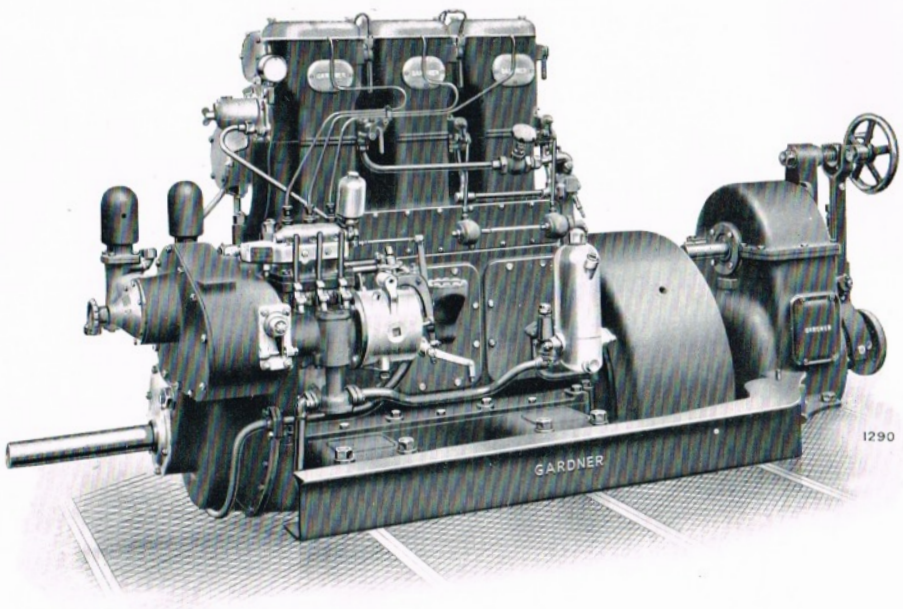
Bore, $5\frac{1}{2}$″ : Stroke, $7\frac{1}{4}$″	MARK	3L3	4L3	5L3	6L3	8L3
Basic Code-Word (see below)		KALIF	KERSH	KILAT	KORAN	KYBER
Swept Volume	Litres	9.05	12.08	15.09	18.10	24.15
Power at 800 r.p.m. Continuous duty	BHP	51	68	85	102	136
Power at 1000 r.p.m. Intermittent duty	BHP		85	106	127.5	170
Power at 1200 r.p.m. Intermittent duty	BHP		102	127.5	153	204

The engines may be used at the higher speeds and powers for the intermittent duties of Rail-Cars and such-like installations. For continuous duties of marine engines, dynamo sets, etc., the engines are offered only at the lower speed of 800 r.p.m.

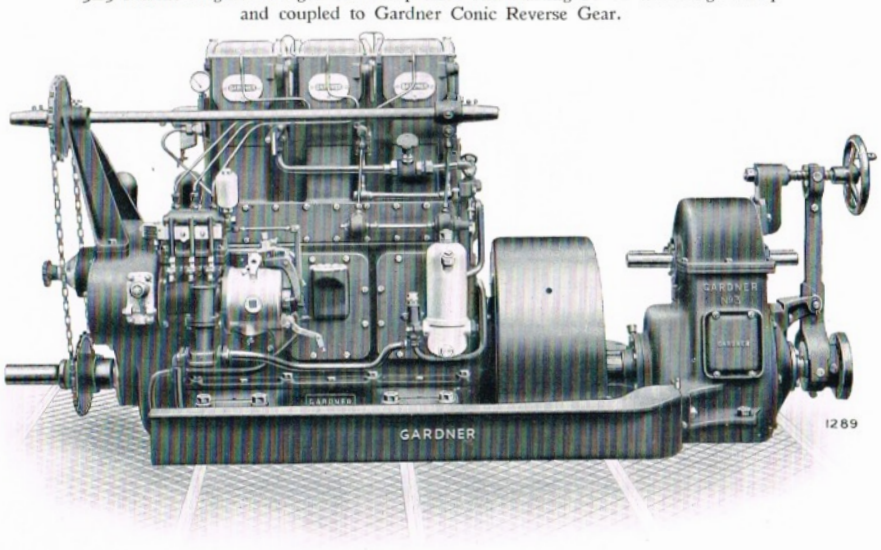
Telegraphic Codes

Marine Engines without reversing gears. Use the basic code-word as in the table above.
Marine Engines with reversing gears. Prefix “ RO ” to the basic code.
Marine Engines with reversing and reduction gears. Prefix “ RERO ” to the basic code.
Rail-Car Engines. Prefix “ CAR ” to the basic code.
Stationary Engines. Prefix “ EL ” to the basic code.
Stationary Engine with dynamo and bedplate. Prefix “ COM ” to the basic code.

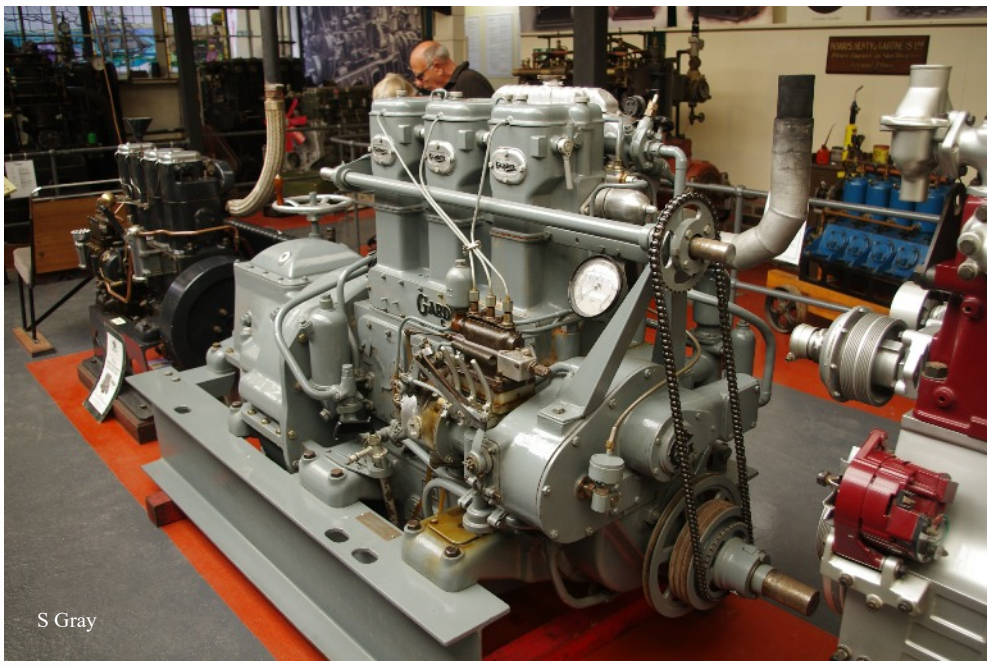
GARDNER
L3
TYPE



3L3 Marine Engine arranged for Compressed Air Starting Fitted with Bilge Pump and coupled to Gardner Conic Reverse Gear.



3L3 Marine Engine arranged for Hand Chain Starting and Compressed Air Starting. Coupled to Gardner Conic Reverse Gear.

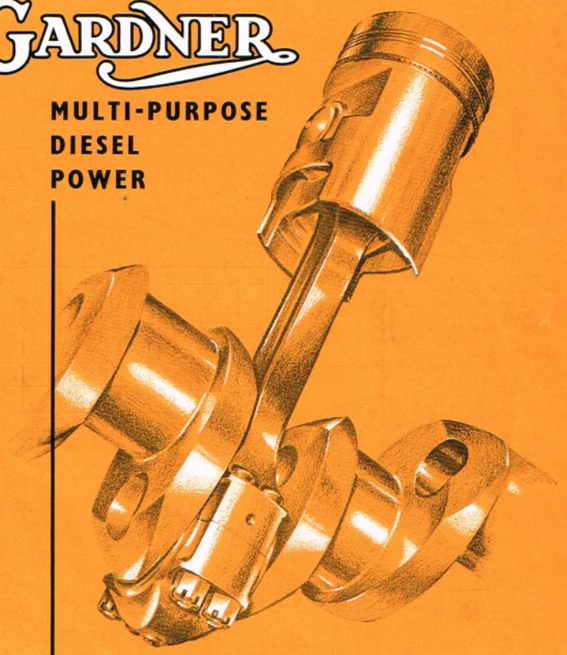


A 3L3 on display at the Anson Engine Museum

Product Leaflet Circa 1964

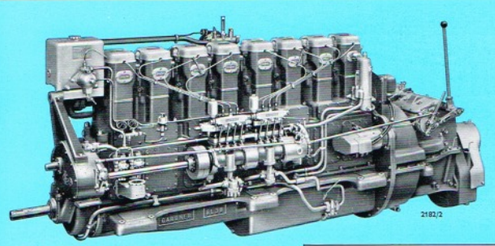
GARDNER

MULTI-PURPOSE DIESEL POWER



FOR EFFICIENCY · DURABILITY · REFINEMENT

MARINE PROPULSION DIESEL ENGINES



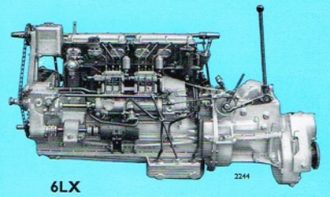
8L3B

The LW, 6LX and L3B Type Marine Propulsion Diesel Engines are built with integrally constructed reversing and reducing gears and are available with direct drive or with 2:1 or 3:1 reduction. These engines are designed for use with a closed circuit fresh water cooling system incorporating an engine mounted header tank with heat exchanger or keel cooler arrangement.

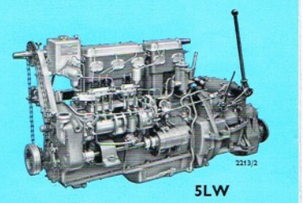
All Units have been accepted by Lloyds and are entered on the Register in the 100A1 classification.

MARINE PROPULSION DIESEL ENGINES

Engine Type	Bore & Stroke in. & mm.	No. of Cyl-inders	Swept Volume		Heavy Duty		Light Duty		High-Speed Craft	
			cu. in.	litres	B.H.P.	R.P.M.	B.H.P.	R.P.M.	B.H.P.	R.P.M.
2LW 3LW 4LW 5LW 6LW	4½" × 6" or 107·95mm. × 152·4mm.	2 3 4 5 6	170 255 340 426 511	2·790 4·184 5·579 6·974 8·369	38 42 56 70 84	1,300 1,300 1,300 1,300 1,300	31 47 62 78 94	1,500 1,500 1,500 1,500 1,500	— 71 89 107	— 1,700 1,700 1,700
6LX	4½" × 6" or 120·65 mm. × 152·4 mm.	6	638	10·450	110	1,300	127	1,500	144	1,700
6L3B 8L3B	5¼" × 7⅜" or 139·7 mm. × 196·85 mm.	6 8	1,105 1,473	18·103 24·138	150 200	1,000 1,000	172 230	1,150 1,150	195 260	1,300 1,300

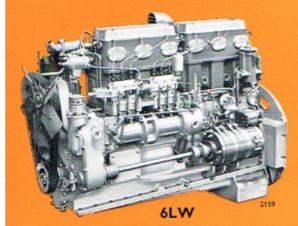


6LX

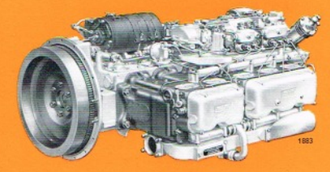


5LW

AUTOMOTIVE DIESEL ENGINES



6LW



5HLW

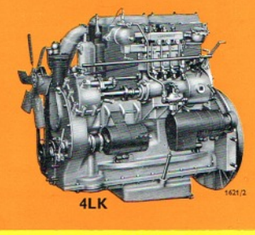
The 4LK, 6LX and LW series Automotive Diesel Engines are suitable for many applications, including Freight and Public Service Passenger Vehicles, Coaches, Off-the-Road Vehicles, Dumpers, Mobile Shovels, Mobile Cranes, Excavators, Trench-cutting machines, and Earth Moving Equipment, etc.

The 6HLX and 4, 5 and 6 cylinder HLW Horizontal Engines are designed for under-floor installation.

ROAD TRANSPORT ENGINE DATA.

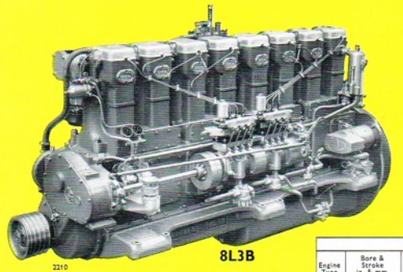
Engine	Swept Volume cu. ins.	Swept Volume litres	B.H.P.	R.P.M.	Maximum Torque lb. ft.	Maximum Torque kg. m.	Maximum Torque r.p.m.	Approximate weight lb.	Approximate weight kg.
4LK	232	3·8	60	2,100	163	22·2	1,100	775	352
4LW	340	5·6	75	1,700	237	32·7	1,300	1,090	495
4HLW	340	5·6	75	1,700	237	32·7	1,300	1,130	513
5LW	426	7·0	94	1,700	300	41·5	1,300	1,250	568
5HLW	426	7·0	94	1,700	300	41·5	1,300	1,295	588
6LW	511	8·4	112	1,700	358	49·5	1,300	1,440	654
6HLW	511	8·4	112	1,700	358	49·5	1,300	1,490	676
6LX	638	10·45	150	1,700	485	67·0	1,000/	1,583	719
6HLX	638	10·45	150	1,700	485	67·0	1,100	1,730	786

6LX



4LK

RAIL TRACTION DIESEL ENGINES



8L3B

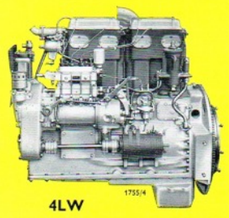
2LW

The 4LK, 6LX, LW and L3B Rail Traction Diesel Engines have many applications in the locomotive field, including light locomotives, small diesel shunters, flameproof mines, locomotives, etc.

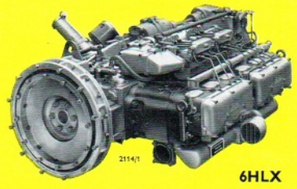
The 6HLX and 4, 5 and 6 cylinder HLW Horizontal Engines are designed for under-floor installation in rail cars, etc.

RAIL TRACTION DIESEL ENGINES.

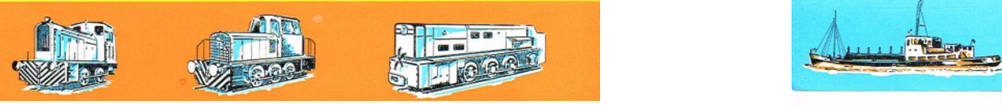
Engine Type	Bore & Stroke in. & mm.	No. of Cyl-inders	Swept Volume cu. in.	Swept Volume litres	Maximum Torque lb. ft.	Maximum Torque kg.m.	Maximum Torque R.P.M.
4LK	3¾" × 5⅛" 95·25 × 133·35 mm.	4	232	3·800	60	2,100	162	22·4	1,100
2LW 3LW 4LW 4HLW 5LW 5HLW 6LW 6HLW	4½" × 6" or 107·95mm. × 152·4mm.	2 3 4 4 5 5 6 6	170 255 340 340 426 426 511 511	2·790 4·184 5·579 5·579 6·974 6·974 8·369 8·369	35·5 53·5 71 71 89 89 107 107	1,700 1,700 1,700 1,700 1,700 1,700 1,700 1,700	113 170 226 226 285 285 342 342	15·7 23·4 31·2 31·2 39·4 39·4 47·2 47·2	1,300 1,300 1,300 1,300 1,300 1,300 1,300 1,300
6LX 6HLX	4½" × 6" or 120·65 mm. × 152·4 mm.	6 6	638 638	10·450 10·450	150 150	1,700 1,700	485 485	67·0 67·0	1,000/ 1,100
6L3B 8L3B	5¼" × 7⅜" or 139·7 mm. × 196·85 mm.	6 8	1,105 1,473	18·103 24·138	195 260	1,300 1,300	823 1,097	113·8 151·8	850 850



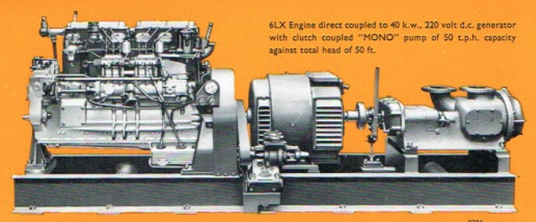
4LW



6HLX



MARINE AUXILIARY UNITS



6LX Engine direct coupled to 40 k.w., 220 volt d.c. generator with clutch coupled "MONO" pump of 50 t.p.h. capacity against total head of 50 ft.

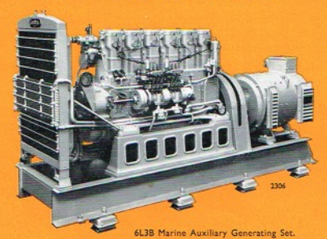
These marine auxiliary diesel sets are Custom built to suit the particular duty or duties they have to perform and can be supplied with any combination of auxiliary machinery, to provide electricity, water, refrigeration or compressed air.

SPECIAL NOTE—DIESEL ENGINE DRIVEN ALTERNATORS

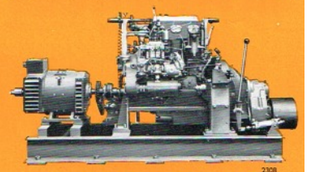
As these must run at the appropriate synchronous speed, the figures given in the b.h.p., r.p.m., k.w. columns will be subject to modification to suit the particular requirements.

MARINE AUXILIARY DIESEL ENGINES

Engine Type	No of Cyls.	Bore	Stroke	Swept Volume cu. ins.	Swept Volume litres	B.H.P. *	R.P.M. *	Approx. maximum kw. output
1L2	1	4½"	6"	85	1·395	11	1100	5·5
2LW 3LW 4LW 5LW 6LW	2 3 4 5 6	4½" or 107·95 mm.	6" or 152·4 mm.	170 255 340 426 511	2·790 4·184 5·579 6·974 8·369	24 36 48 60 72	1200 1200 1200 1200 1200	15 22·5 30 38 45
6LX	6	4½" or 120·65 mm.	6" or 152·4 mm.	638	10·450	97	1200	60
6L3B 8L3B	6 8	5¼" or 139·7 mm.	7⅜" or 196·85 mm.	1105 1473	18·103 24·138	139 185	1000 1000	93 115

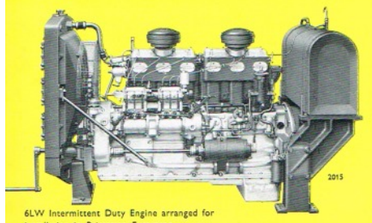


6L3B Marine Auxiliary Generating Set.



3LW Marine Auxiliary Generating Set with power take-off pulley.

INDUSTRIAL & GENERATING SETS



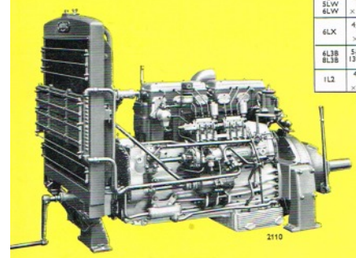
6LW Intermittent Duty Engine arranged for installation in Priestman Excavator.

1L2 Engine direct coupled to 5½ k.w. dynamo.

These single cylinder to eight cylinder diesel engines can be used for a wide range of Industrial duties and applications, including industrial power drives, electric generating sets, portable air compressors, pumping sets, saw mills and all intermittent load duties.

INDUSTRIAL DIESEL ENGINES

Engine Type	Bore & Stroke in Inches and millimeters	No of Cyl-inders	Industrial Duties Electric Generating Sets B.H.P.	Industrial Duties Electric Generating Sets R.P.M.	INTERMITTENT DUTY Air Compressors, Excavators, Sawmills etc. Maximum Torque B.H.P.	Maximum Torque R.P.M.	Maximum Torque lb. ft.	Maximum Torque kg. m.	Maximum Torque R.P.M.
2LW 3LW 4LW 5LW 6LW	All 4½" × 6" or 107·95 mm. × 152·4 mm.	2 3 4 5 6	24 36 48 60 72	1,200 1,200 1,200 1,200 1,200	29 43 58 72 87	1,400 1,400 1,400 1,400 1,400	109 162 218 273 328	15·0 22·4 30·1 37·7 45·3	1,300 1,300 1,300 1,300 1,300
6LX	4½" × 6" or 120·65 mm. × 152·4 mm.	6	97	1,200	119	1,400	455	62·9	1,050
6L3B 8L3B	5¼" × 7⅜" or 139·7 mm. × 196·85 mm.	6 8	139 185	1,000 1,000	158 210	1,100 1,100	783 1,041	108·2 144·0	800 800
1L2	4½" × 6" or 107·95 mm. × 152·4 mm.	1	11	1,100	—	—	—	—	—



6LX Industrial Unit with radiator and clutch-operated power take-off shaft.

SPECIAL NOTE

The engine powers quoted for specific duties in all tables in this leaflet are as set at the Works for normal conditions of atmospheric temperature and pressures. Adverse climatic conditions or special duties may demand some amendment to the ratings quoted. Full information in regard to these matters is readily available from the Works upon receipt of the relevant details.

Full information and literature for all engines from :—

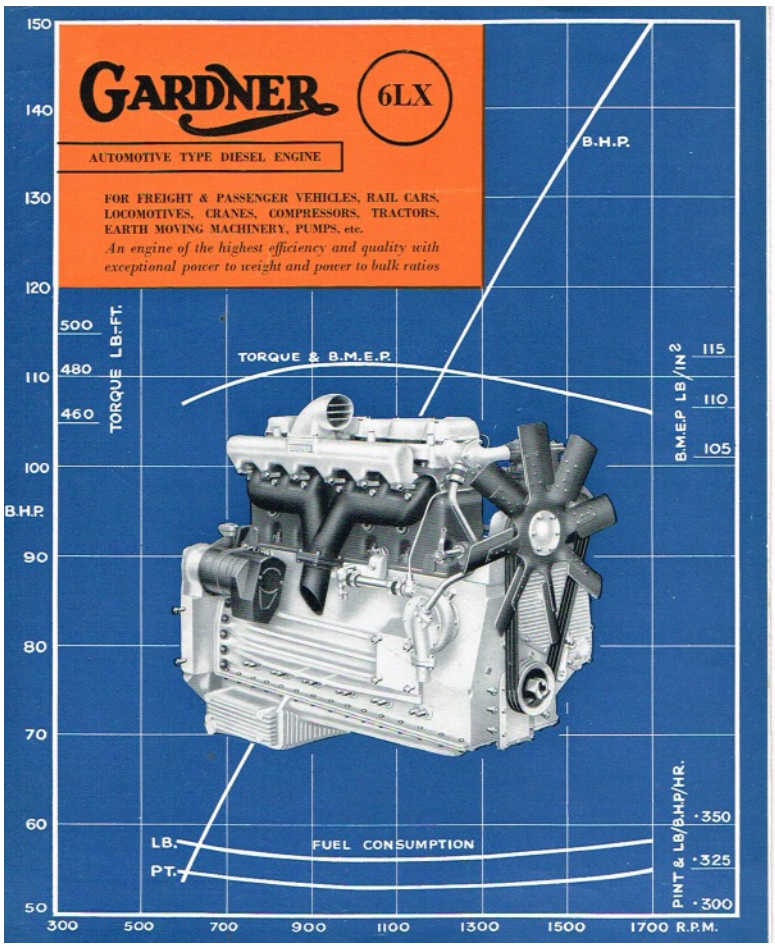
GARDNER ENGINES (SALES) LIMITED
Barton Hall Engine Works,
Patricroft, Eccles, Manchester

Telephones: ECCLES 2201 (8 lines)
Telegrams: "GARDWORKS, ECCLES, MANCHESTER"

LONDON: Abford House, Wilton Road, S.W.1
GLASGOW: 124 St. Vincent Street, C.2

Publication No. 747·3

The “LX” manufactured between 1958 and 1966 The “LXB” manufactured between 1966 and 1978
The “LXC” was introduced in1978. The “LXCT” was introduced in 1981



THE GARDNER 6LX ENGINE

INTRODUCTION

This six-cylinder 150 H.P. engine has been produced to meet the growing requirements of higher power for a wide variety of purposes in all parts of the world. Whilst of course more fuel is required to produce more power, reference to the accompanying performance curve clearly illustrates that the minimum specific fuel consumption rate of this engine is the remarkably low value of ·330 lb./B.H.P./hr. which represents an overall thermal efficiency of no less than 39·75%. The maximum rate does not rise above ·340 lb./B.H.P./hr. and indeed, if the engine is operated at slightly below maximum torque at 900 - 1,100 r.p.m., it does attain over 40% thermal efficiency.

This engine occupies the same space as the well-known 6LW engine and is, in fact, interchangeable with respect to engine mountings, flywheel housing, etc., and it will thus be appreciated that the 6LX engine has very modest overall dimensions for its power output.

The 6LX engine weighs approximately 1,600 lb. so that its weight to power ratio is less than 10·7 lb./H.P., which, for a heavy duty commercial unit, is an exceptionally low value.

The knowledge and experience gained from thirty years' successful production of this type of engine ensures that this latest addition to our range is fully worthy of its heritage.

DESCRIPTION

The 6LX engine is a direct-injection four-stroke type, with one inlet and one exhaust valve per cylinder. The fuel injectors, of Gardner design and manufacture, are centrally positioned between the valves. The valves are operated by levers, push rods, and tappets from the crankcase mounted camshaft which is driven from the forward end of the crankshaft by a triplex bush roller chain. Cylinder heads comprise two three-cylinder units.

The cylinder block is a one-piece casting bolted to the crankcase by high tensile through bolts which also form the main bearing cap studs. This construction relieves the crankcase of load and distortion, also adding to the longitudinal rigidity of the crankcase of aluminium alloy, extensively ribbed and of deep section. Main bearing caps are clamped laterally in deep locating channels by means of two transverse bolts passing through caps and crankcase. The lower side of crankcase is fitted with the oil sump, available in different designs, with surge baffles and gauze strainer to protect the lubricating oil pump. This general design together with other features ensures smooth and quiet engine operation at all speeds and loads. All engines are completely dust-proofed.

Thin wall steel shells, prefinished and lined with specially surfaced copper lead are fitted to the seven crankshaft main bearings and to the big ends of the four bolt connecting rods.

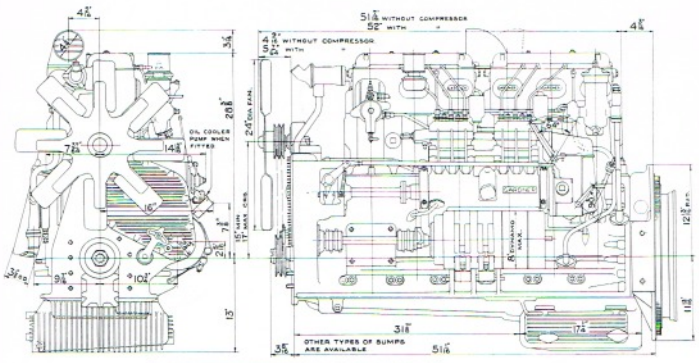
The crankshaft is machined all over from a high tensile steel die forging and is not hardened. At the forward end it is supported by a roller bearing and carries a friction type torsional vibration damper enclosed within the crankcase.

The aluminium alloy pistons are of patented Gardner design, produced in our own foundries. Two pressure rings and one oil control ring are fitted while the 1 11/16 in. diameter gudgeon pin is a floating fit in the piston being located in an endwise direction by suitable aluminium pads.

The CAV B.P.F. fuel injection pump and governor assembly are truanion mounted, gear driven from the valve camshaft. The governor and its linkage to the fuel pump are totally enclosed. Operation of the pump is effected by Gardner camshaft and tappets.

When required, the vacuum brake exhauster is of Gardner reciprocating piston type, mounted at forward end of the engine. Proprietary makes of air compressors are also available, being fitted at the forward end and belt driven from crankshaft. Hydraulic pumps for power steering, etc., can be incorporated in the dynamo drive as shown in illustration at top of page 5.

Every engine is carefully tested when coupled to a dynamometer, no engine being passed off test until all aspects of performance comply with the published Performance Curves. The published Performance Curves are Net Values and the "installed" performance is in accordance with these curves except for deductions on account of Radiator Fan, Air Compressor, Dynamo, or inadequate induction or exhaust systems.



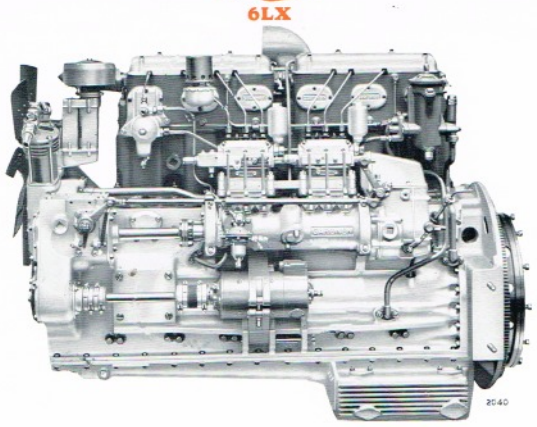
FULLY DIMENSIONED SCALE DRAWINGS MUST BE OBTAINED FOR USE WHEN DESIGNING INSTALLATION LAYOUT

TYPE 6LX AUTOMOTIVE ENGINE DATA

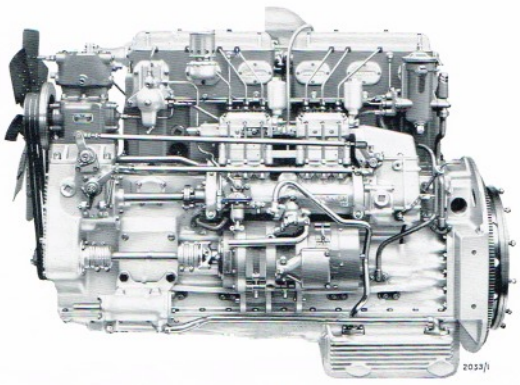
Bore		Stroke		No. of Cyls.	Swept Volume		B.H.P.	R.P.M.	Max. Torque			Approximate weight with flywheel	
in.	mm.	in.	mm.		Cu. in.	Litres			lb. ft.	Kg.m.	r.p.m.	lb.	Kg.
4¼	120·65	6	152·40	6	638	10·45	150	1,700	485	67·0	1,000 to 1,100	1,583	718

The weight does not include electrical equipment and is approximate only. It is not necessarily the lightest specification which can be compiled on application to the Works. The Power quoted is that developed at normal atmospheric temperature and pressure, and for adverse climatic conditions we observe de-rating data specified in Engine Instruction Manual.

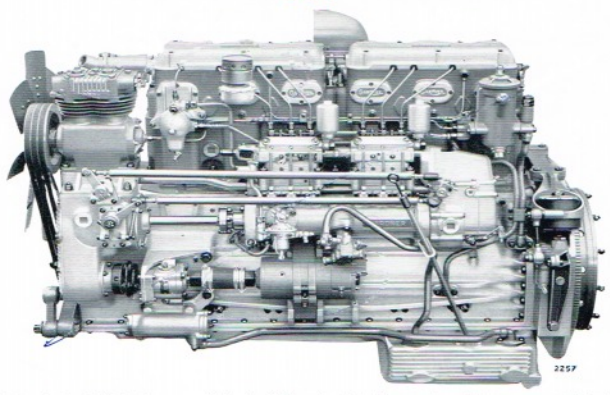
GARDNER ENGINES (SALES) LTD.
PATRICROFT ECCLES MANCHESTER
Telephone: ECCles 2201 (8 lines) Telegrams: GARDWORKS, ECCLES, MANCHESTER
LONDON: ABFORD HOUSE, WILTON ROAD, S.W.1 GLASGOW: 124 ST. VINCENT STREET, C.2



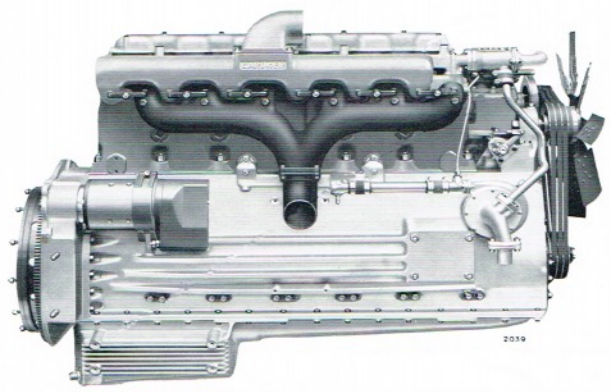
Near side view of engine fitted with twin cylinder exhauster and 5" diameter dynamo



Near side view of engine with lubricating oil cooler pump and filter and 8" diameter dynamo



Near side view showing fuel injection pumps, lubricating oil filter, Amal fuel lift pump, air cooled compressor and hydraulic pump for power assisted steering



Inlet and exhaust manifold side of engine illustrating water coolant pump, thermostat unit, air inlet connection and starter

STANDARD ENGINE EQUIPMENT

Engine with standard equipment comprises steel flywheel suitable for machining to receive clutches, etc. Non-unit construction type crankcase endplate with engine mounting faces only, engine mounted fuel filter, additional fuel filter for mounting between engine and fuel tank, automatic coolant temperature control unit with by-pass to pump, lubricating oil pressure gauge for remote mounting, complete with 5 ft. length steel coiled pipe and 1 ft. length flexible pipe. Twin Vee groove fan driving pulley mounted on forward end of crankshaft, two starting handle shaft claws, one fitted to crankshaft and one for fitting to starting shaft, box containing tools, spare parts, Instruction Books and Spare Parts Catalogue, companion flanges for coolant inlet and outlet and exhaust manifold, accelerator lever, stopping lever, decompression levers and engine lifting eyebolts.

Additional equipment supplied when specified

1. Flywheel housing for unit construction of engine and transmission gearbox.
2. Flanged type crankcase endplate to receive flywheel housing.
3. Intermediate type crankcase endplate to carry an outboard clutch bearing.
4. GARDNER twin cylinder reciprocating exhauster and drive for vacuum brakes.
5. Twin cylinder reciprocating air compressor and drive for pressure brakes including special arrangement of radiator fan and drive.
6. Vacuum tank with non-return valve.
7. 24 volt electric starter motor.
8. Mounting and driving parts for starter motor.
9. Dynamo and voltage regulator.
10. Mounting and driving parts for dynamo.
11. Engine mounted oil bath type air filter (not available on 6LX).
12. Air inlet silencer pipe (not available on 6LX).
13. GARDNER universal oil bath type air filter.
14. Precleaner and flexible pipe for air inlet.
15. Radiator cooling fan and drive.
16. Combined forward engine support and engine starting handle.
17. GARDNER flexible engine mounting arrangement.
18. Engine driven diaphragm type fuel lift pump and feed arrangement.
19. Special shapes of lubricating oil sumps.
20. Lubricating oil transfer pump for extreme gradients.
21. Oil Circulating pump and relief valve for oil cooler.
22. Radiators and oil coolers for temperate or tropical conditions, etc.
23. Oil pressure and water temperature sensitive electric warning light switches and safety stopping devices.
24. Ball bearing mounted accelerator control cross shaft.
25. Cable operated engine stopping control.
26. Mechanical or electrical type tachometer with necessary drive.
27. Remote location water and oil temperature thermometers with tubing.
28. Straight through absorption type exhaust silencer.
29. Running Hours meter.
30. Dust proofing seals (standard with engine).
31. Machine engine flywheel to accept customer's clutch, also fitting renewable plate if required.
32. Packing engine for export and delivery F.O.B. Liverpool or Birkenhead.

This leaflet is a condensed version of a more comprehensive catalogue, copies of which are available upon request.

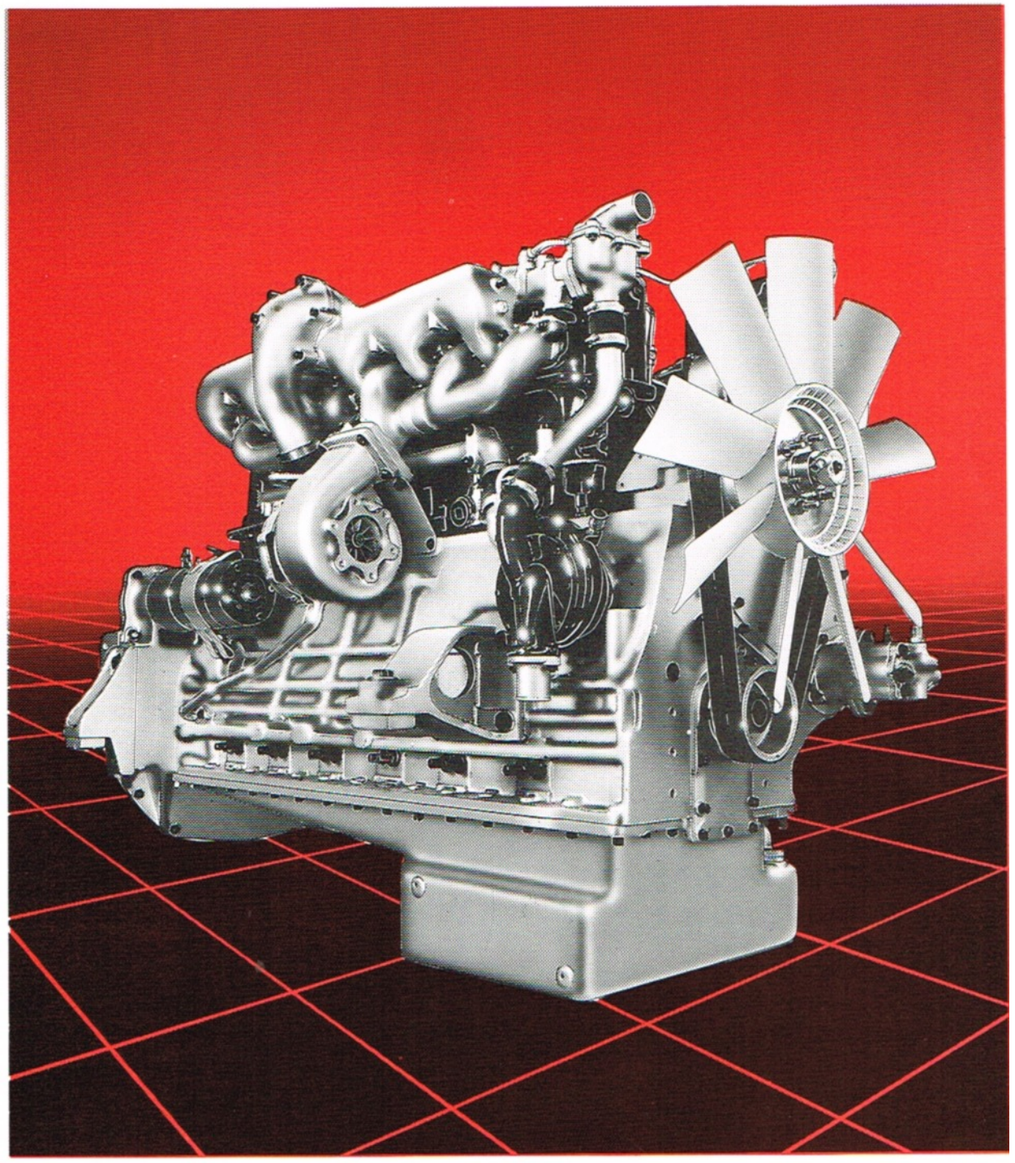
(6LX-Auto.)
Publication No. 746.1

The “LXDT” introduced in 1984

GARDNER

DIESEL ENGINES

6LXDT
Automotive



Performance Data

Maximum Power Output – 201.3 kW (270 bhp) at 1900 rpm in accordance with 80/1269 EEC. (N.B. Lower power outputs of 260 bhp, 250 bhp, 240 bhp and 230 bhp are also available)

Maximum Torque – 1160 Nm (855 lb ft) at 1300 rpm in accordance with 80/1269 EEC

General Specification

Engine Type – Turbocharged, 6 cylinder, vertical, in line, direct injection diesel

Displacement – 12.7 litres (775 cu in)

Bore – 130.17 mm (5.125 in)

Stroke – 158.75 mm (6.25 in)

Dry Weight – 858 kg (1890 lbs)

Specific Fuel Consumption – minimum 191 gm/kW/hr (0.314 lb/bhp/hr)

Lube System Oil Capacity – 27 litres (6 gallons)

Coolant System Capacity – 16 litres (3.5 gallons)

Compression Ratio – 15:1

GARDNER

DIESEL ENGINES

6LXDT
Automotive

Performance Data

Maximum Power Output –
201.3 kW (270 bhp) at 1900 rpm in accordance with 80/1269 EEC. (N.B. Lower power outputs of 260 bhp, 250 bhp, 240 bhp and 230 bhp are also available)

Maximum Torque –
1160 Nm (855 lb ft) at 1300 rpm in accordance with 80/1269 EEC

Design Features

Connecting Rods
Machined chromium molybdenum steel. Rifle drilled from end to end. Special copper alloy small end bearings. Can be withdrawn through cylinder bore, facilitating engine dismantling and assembly in-situ

Cooling System
Gear driven pump circulates coolant to base of cylinders and through cylinder heads via synthetic rubber joint rings, independent of main gasket

Crankcase
Aluminium construction. Pre-loaded vertically and transversely. Extends 5in (126mm) below crankshaft centre line

Crankshaft
8 bearing, dynamically balanced chromium molybdenum steel, with hollow bored crank pins and main journals

Cylinder Block
Detachable, one piece cast iron. Dry liners avoiding cylinder liner erosion and leakage

Cylinder Heads
Two detachable cast iron units

Filters
30,000 mile oil filter and long life fuel filter fitted as standard

Fuel System
Direct injection fuel system with injection pumps. Injector pipes run through cylinder head

Oil Cooler Pump
Crankcase mounted

Pistons
Medium silicon aluminium alloy construction with cast iron insert. Chromium plated pressure rings and U section cast iron oil scraper ring, hardened and tempered

Thermostat
Dual, wax capsule type

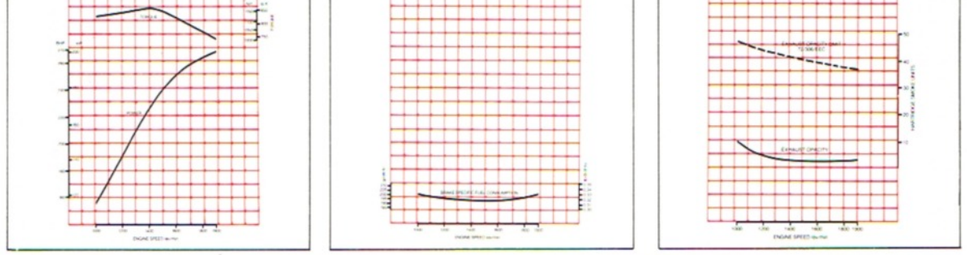
Turbocharger
May be positioned in differing locations to suit application

Valves
One inlet and one exhaust valve per cylinder. Both valves and valve seat inserts are faced with Stellite. Valve stems chrome plated to minimise wear

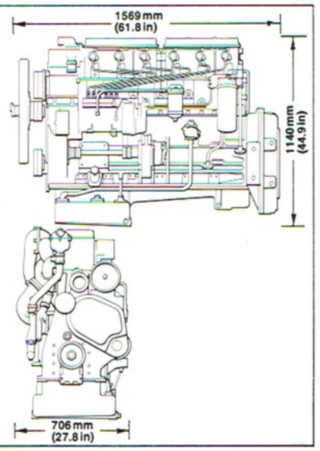
Water Pump
Gardner centrifugal impeller type, having gunmetal impeller and phenolic resin balanced pressure seal bearing on ceramic face

Engine Equipment
Flywheel – *Steel and cast iron types, suitable for machining to receive clutches etc.*
Unit construction type crankcase endplate with engine mounting faces
Fuel filter – *Engine mounted*
Additional fuel filter for mounting between engine and fuel tank
Automatic coolant temperature control unit with by-pass to pump
Twin vee groove fan driving pulley, mounted on forward end of crankshaft

Optional Equipment
1. Flywheel housing for gear box
2. Fan and drive for radiator with mounting and driving parts for air compressor
3. Starter motor – *24 volt*
4. Mounting and drive parts for starter motor
5. 24 volt alternators and regulators as required
6. Mounting and driving parts for CAV and Butec alternators
7. Air filter – *Dry type, as approved list*
8. Alternative air filter arrangement for severe dust conditions
9. Electric oil pressure gauge – *Remote mounting*
10. Thermostatically operated radiator fan clutch
11. Special shapes of lubricating oil sumps
12. Oil pressure switch
13. Water temperature switch
14. Electrical tachometer generator
15. Electrical water temperature gauge – *Remote reading*
16. Electrical oil temperature gauge – *Remote reading*
17. Flywheel – *Machined and fitted with renewable clutch plate*
18. Packing for shipment and delivery FOB Liverpool



GENERAL SPECIFICATION	
Engine Type	Turbocharged, 6 cylinder, vertical, in line direct injection diesel
Displacement	12.7 litres (775 cu in)
Bore	130.17mm (5.125in)
Stroke	158.75mm (6.25in)
Specific Fuel Consumption minimum	191gm/kW/hr (0.314lb/bhp/hr)
Dry Weight	858kg (1890lbs)
Compression Ratio	15:1
Lube System Oil Capacity	27 litres (6 gallons)
Coolant System Capacity	16 litres (3.5 gallons)



L. Gardner and Sons Limited
Barton Hall Engine Works, Patricroft
Eccles, Manchester M30 7WA
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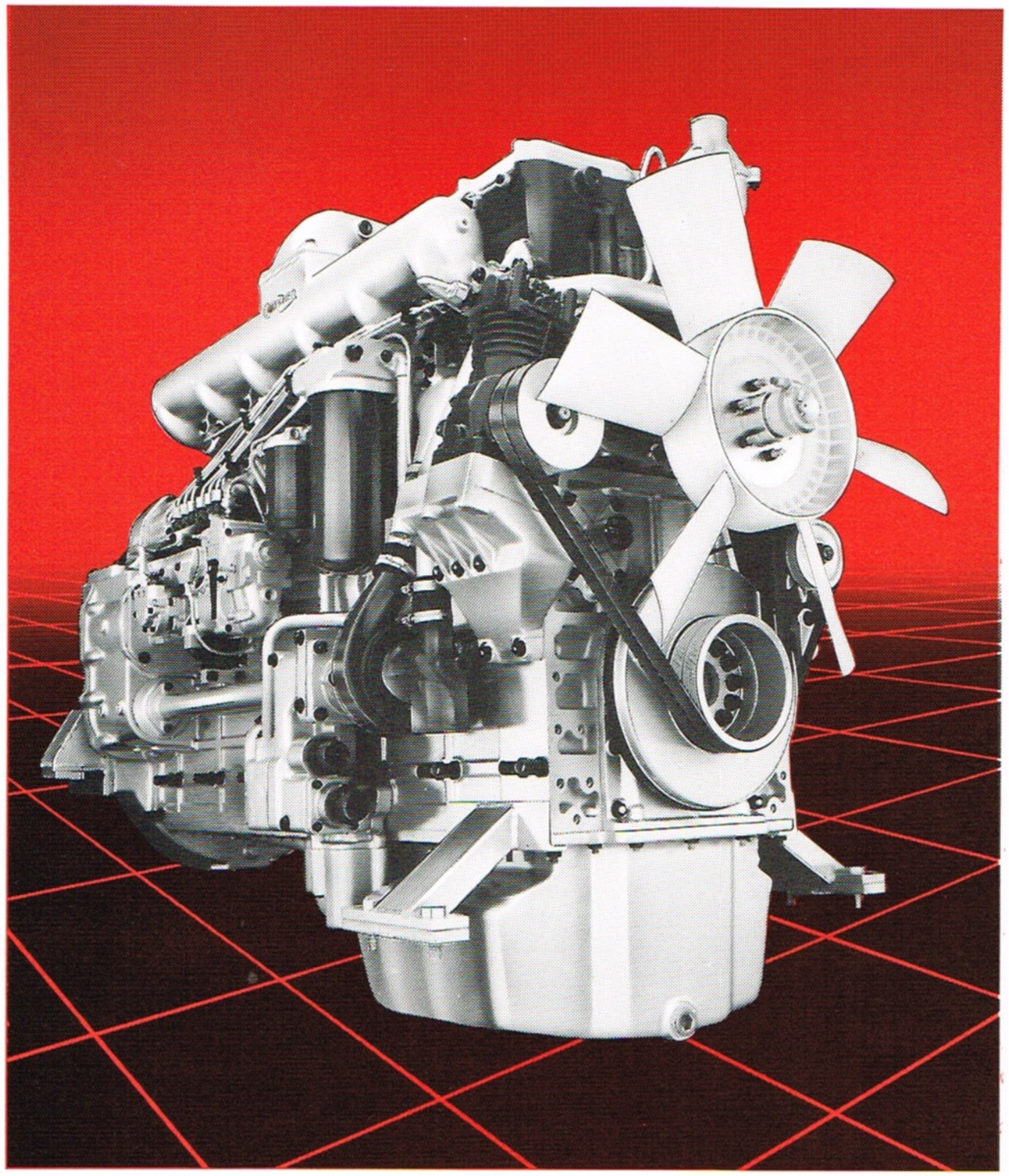
Publication No. 139/9/86

GARDNER
DIESEL ENGINES

6LYT
Automotive



Performance Data

Maximum Power Output –
260.9 kW (350 bhp) at 1800 rpm in accordance with 80/1269 EEC (N.B. Lower power outputs at 340 bhp, 330 bhp, 320 bhp and 300 bhp are also available)

Maximum Torque –
1545 Nm (1140 lb ft) at 1200 rpm in accordance with 80/1269 EEC

General Specification

Engine Type – Turbocharged, 6 cylinder, vertical, in line, diesel

Displacement – 15.5 litres (946 cu in)

Bore – 140 mm (5.51 in)

Stroke – 168 mm (6.61 in)

Dry Weight – 1091 kg (2407 lbs)

Specific Fuel Consumption – minimum 192 gm/kW/hr (0.315 lb/bhp/hr)

Lube System Oil Capacity – 34 litres (7.5 gallons)

Coolant System Capacity – 20.45 litres (4.5 gallons)

Compression Ratio – 15:1

GARDNER
DIESEL ENGINES

6LYT
Automotive

Performance Data

Maximum Power Output –
260.9 kW (350 bhp) at 1800 rpm in accordance with 80/1269 EEC. (N.B. Lower power outputs at 340 bhp, 330 bhp, 320 bhp and 300 bhp are also available)

Maximum Torque –
1545 Nm (1140 lb ft) at 1200 rpm in accordance with 80/1269 EEC

Design Features

Camshaft
Single piece camshaft

Connecting Rods
Machined chromium molybdenum steel. Rifle drilled from end to end. Special copper alloy small end bearings. Can be withdrawn through cylinder bore, facilitating engine dismantling and assembly in-situ

Cooling System
Gear driven pump circulates coolant to base of cylinders and through cylinder heads

Crankcase
Aluminium construction. Pre-loaded vertically and transversely

Crankshaft
8 bearing, dynamically balanced chromium molybdenum steel, with hollow bored crank pins and main journals

Cylinder Block
Detachable, one piece cast iron. Dry liners avoiding cylinder liner erosion and leakage

Cylinder Heads
Two detachable cast iron units. Cross flow

Filters
30,000 mile oil filter and long life fuel filter

Fuel System
Direct injection fuel system. Injector pipes run through cylinder head

Gear Train
Rear mounted gear train for camshaft drives

Pistons
Medium silicon aluminium alloy construction with cast iron insert. Chromium plated pressure rings and U section cast iron oil scraper ring, hardened and tempered. Oil jet piston cooling

Thermostat
Wax capsule type

Turbocharger
May be positioned in differing locations to suit application

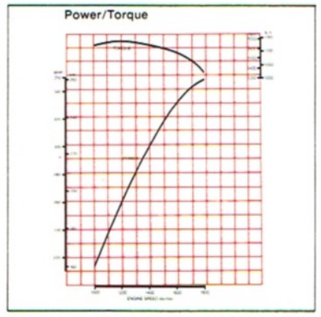
Valves
One inlet and one exhaust valve per cylinder. Both valves and valve seat inserts are faced with Stellite. Valve stems chrome plated to minimise wear

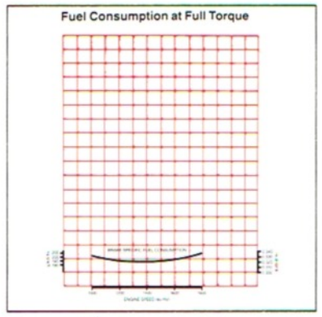
Water Pump
High output centrifugal type, driven in tandem with lube oil pump. Gear driven. Both externally mounted

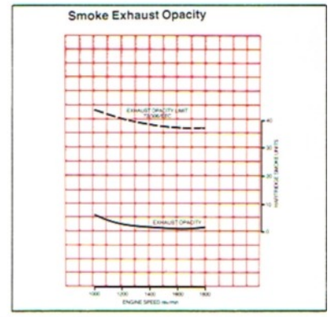
Engine Equipment
Flywheel – *Steel and cast iron types, suitable for machining to receive clutches etc.*
Unit construction type crankcase endplate. Flywheel housing with engine mounting faces
Fuel filter – *Engine mounted*
Automatic coolant temperature control unit with by-pass to pump
Exhaust brake – *Designed to accommodate exhaust brake*
Lift pump – *mounted on crankcase*

Optional Equipment

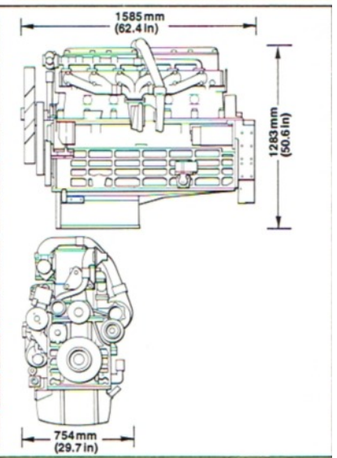
1. Fan and drive for radiator with mounting and driving parts for air compressor
2. Starter motor – *24 volt*
3. Mounting and drive parts for starter motor
4. 24 volt alternators and regulators as required
5. Mounting and driving parts for CAV and Butec alternators
6. Air filter – *Dry type, as approved list*
7. Alternative air filter arrangement for severe dust conditions
8. Electrical oil pressure gauge – *Remote mounting*
9. Thermostatically operated radiator fan clutch
10. Special shapes of lubricating oil sumps
11. Oil pressure switch
12. Water temperature switch
13. Electrical tachometer generator
14. Electrical water temperature gauge – *Remote reading*
15. Electrical oil temperature gauge – *Remote reading*
16. Flywheel – *Machined and fitted with renewable clutch plate*
17. Packing for shipment and delivery FOB Liverpool







GENERAL SPECIFICATION	
Engine Type	Turbocharged, 6 cylinder, vertical, in line diesel
Displacement	15.5 litres (946 cu in)
Bore	140mm (5.51in)
Stroke	168mm (6.61in)
Specific Fuel Consumption minimum	192 gm/kW/hr (0.315 lb/bhp/hr)
Dry Weight	1091kg (2407lbs)
Compression Ratio	15:1
Lube System Oil Capacity	34 litres (7.5 gallons)
Coolant System Capacity	20.45 litres (4.5 gallons)



L. Gardner and Sons Limited
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Eccles, Manchester M30 7WA
Telephone: 061-789 2201
Telex: 668023

GARDNER LG1200

Diesel Engines For Bus and Coach Applications. 210 b.h.p.-275 b.h.p.

The LG1200 engine range, developed from the Gardner 6LXDT engine, gives premium performance across all bus and coach applications, based on unrivalled Gardner expertise at ensuring trouble-free operation in demanding working conditions.

Economy, Reliability and Durability with improved design.

Improved design features include

- New profile pistons
- Polynomial cams
- Additional by-pass oil centrifuge filter (optional)
- Integral oil cooler
- Gear driven fuel pump, valve camshaft & PTO drives
- High output water pump
- Reduced external pipework
- High output lubricating oil pump
- Oil cooled pistons

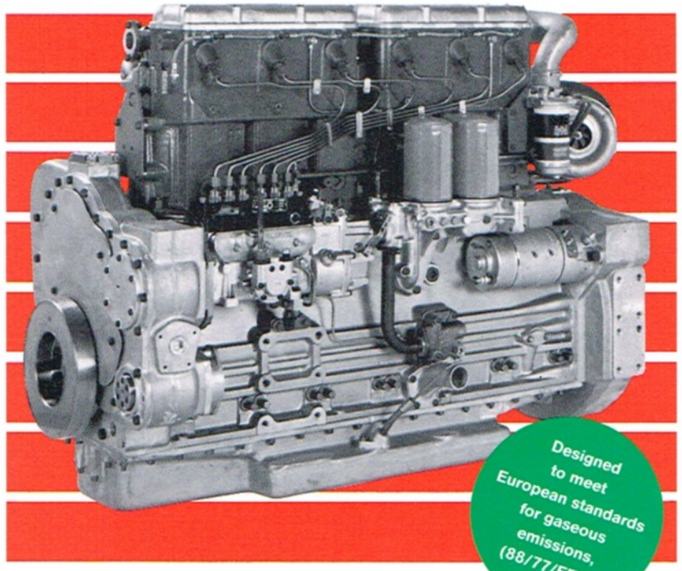
Traditional Gardner economy and reliability, combined with high productivity give proven "on the road" performance in the tough operating world of passenger transport.

LG1200 Series: Features include

- Aluminium crankcase, preloaded vertically and transversely for lightness and strength.
- Aluminium alloy pistons with cast iron insert for light weight and long ring groove life.
- Chromium molybdenum steel crankshaft with massive bearings for low loading and long life.
- Detachable one-piece cast iron cylinder block for simple top end overhaul.
- Direct injection fuel system for top economy.
- Dry cylinder liners to avoid sealing problems.
- Gear driven air compressor.
- Gear driven water pump for reliable circulation.
- Machined and balanced chromium molybdenum steel con rods for vibration-free running.
- Oil filter and fuel filter changes at 30,000 miles.
- Special copper alloy small end bearings for long life.
- Stellite faced valves and valve seat inserts for long life.
- Two detachable cast iron cylinder heads.
- Twin spin-on main lub. oil filters with optional by-pass centrifuge.
- CAV Majormec fuel pump.
- SAE1 Flywheel housing.
- Valve gear to suit exhaust brake.(or similar)
- Externally mounted crankshaft damper.
- Gear train driven at front of engine, providing 40 bhp PTO or full power from front of crankshaft.
- Flange mounted starter.
- Belt drive for alternators up to 250 amps, 24v.

Guaranteed value for money — 3 Year Warranty

A full 3 year warranty is standard with each LG1200 engine, providing comprehensive reassurance for operators of Gardner powered vehicles.



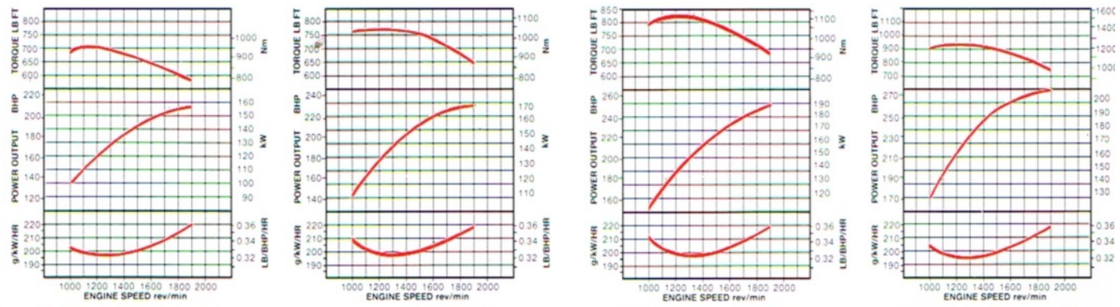
Designed to meet European gaseous emissions, (88/77/EEC).

General Data

Aspiration: Turbocharged	**No. of cylinders:** 6 in-line vertical
Bore/Stroke: 130.17mm (5.125in) x 158.75mm (6.25in)	**Power take-offs:** Gear driven available for pumps, etc
Combustion system: Direct injection	**Rotation:** Clockwise, viewed from front
Compression ratio: 15:1	**Weight*:** 838kg (1848lb)
Cooling: Liquid (16 litre capacity)	**Width:** 732mm (28.8in)
Cycle: 4 stroke	*Dry weight of bare engine, excluding flywheel
Cubic capacity: 12.7 litres (775cu in)	**210 bhp/156.7 kW 700 lb ft/949 Nm**
Electrical: 24 volt system	
Engine speed: 1900 rpm	**230 bhp/171.6 kW 775 lb ft/1050 Nm**
Firing order: 1, 5, 3, 6, 2, 4.	
Governing: Mechanical	**250 bhp/186.5 kW 830 lb ft/1125 Nm**
Height: 1074mm (42.3in)	
Length: 1382mm (54.4in)	**275 bhp/205.1 kW 922 lb ft/1250 Nm**

GARDNER LG1200

Diesel Engines For Bus and Coach Applications. 210 b.h.p.-275 b.h.p.



Engine Model LG12-210
Max. Power-210 bhp @ 1900rpm (88/195 EEC)
Max. Torque - 700 lb ft @ 1200 rpm

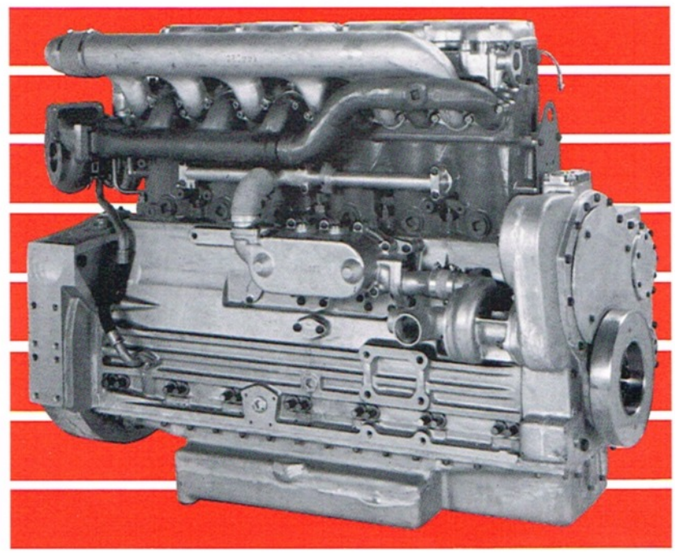
Engine Model LG12-230
Max. Power-230 bhp @ 1900 rpm (88/195 EEC)
Max. Torque - 775 lb ft @ 1200 rpm

Engine Model LG12-250
Max. Power-250 bhp @ 1900 rpm (88/195 EEC)
Max. Torque - 830 lb ft @ 1200 rpm

Engine Model LG12-275
Max. Power-275 bhp @ 1900 rp
(88/195 EEC)
Max. Torque - 922 lb ft @ 1200

LG1200 — All round performance working for you and the environment

LG1200 power gives passenger transport operators a full product line up covering city, urban, intercity and coach applications. Manufactured at the Gardner Engine Plant in Manchester, the LG1200 series of engines will meet current European standards for gaseous emissions (88/77/EEC), making Gardner one of the leading manufacturers of "green" environmentally friendly diesel engines.



Gardner Automotive Power

The Gardner automotive power range covers engines with ratings from 170 bhp up to 350 bhp. All have premium specification, top performance and ease of maintenance, giving maximum productivity with the lowest possible operating costs. In addition, Gardner has an extensive UK distribution capability supported by a long established overseas distributor network worldwide.

Specialist products from the Perkins Group Perkins

Publication No: A/9/90/Q

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Gardner
Patricroft, Eccles,
Manchester, M30 7WA
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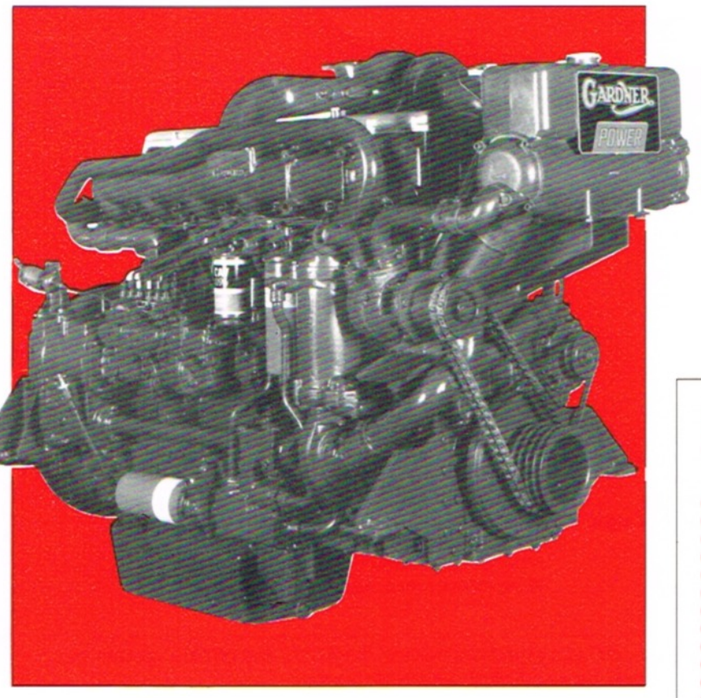
Telex: 668023
Fax: 061 787 7549

GARDNER

YT 300

300 bhp (224kw) @1650 RPM



Marine Heavy Duty Propulsion Engines.

BENEFITS

- RELIABILITY:- An enviable reputation for Reliability earned from many years of hard working experience around the world.
- DURABILITY:- Modern yet robust aluminium construction – proven durability in a wide range of marine applications – long life assured with low output per litre capacity.
- PRODUCT INTEGRITY:- Products designed and tested to meet the most exacting sea conditions.
- LOW COST OF OWNERSHIP:- Reliable, durable and extremely fuel efficient to operate. Fuel savings ensure lowest operational cost.
- SERVICE NETWORK:- Worldwide service network, long established offering full service support.
- SPARE PARTS:- Full range of genuine replacement parts, competitively priced – supplied through UK and overseas distributor networks.
- FULL TECHNICAL SUPPORT:- Efficient, highly qualified Application Engineering facility – worldwide support – expert advice on product installation and performance.
- PRODUCT TRAINING:- Training courses available for boat operators, run by skilled instructors.

STANDARD EQUIPMENT

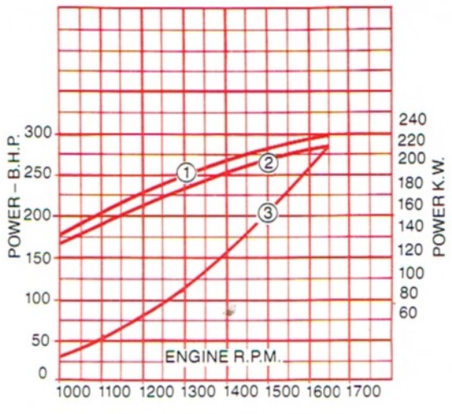
- Fresh water heat exchanger cooling system or, alternatively, adapted for keel cooling.
- SAE 1 flywheel housing.
- High inertia SAE 14 flywheel.
- Fresh water circulating pump.
- 4 groove crankshaft mounted accessory drive.
- Lub. oil cooler and full flow filter.
- Lub. oil sump emptying pump.
- Gearbox lub. oil cooler.
- Engine feet with jacking screws.
- Air intake silencer.
- Fuel lift pump.
- Exhaust elbow and stainless steel bellows.
- Engine mounted instruments for water and oil temperature.
- 24 volt starter.
- 24 volt, 60 amp CAV AC7 alternator with screened regulator and fast fuse.
- Tools, spares, operation and maintenance manual, parts book.
- Duplex fuel filter supplied loose.

OPTIONAL EQUIPMENT

- Marine transmission
  - Twin Disc MG5111 (shallow case) (Ratios – 1.50:1, 2.04:1, 2.54:1, 3.10:1)
  - Twin Disc MG5111 (deep case) (Ratios – 3.92:1, 4.95:1)
  - Twin Disc MG514C (shallow case) (Ratios – 1.51:1, 2.00:1, 2.50:1, 3.00:1, 3.50:1)
  - Twin Disc MG514 (deep case) (Ratios – 4.13:1, 4.50:1, 5.16:1, 6.00:1)
- Bridge instruments supplied loose.
- Overspeed protection switch.
- Protection switch.
- 24v fuel pump solenoid.
- Dry exhaust silencer.
- Engine speed and gearbox remote control.
- Front power take offs as follows:
  - forward end flexible coupling
  - crankshaft extension stub shaft
  - flexible coupling and shaft between 2 bearings
  - close coupled clutched front p.t.o.
- Flexible mountings.
- Second alternator (45A).
- Classification society approval – Lloyds.
- Sterngear.
- Spare fresh water pump.
- Sea water strainer.

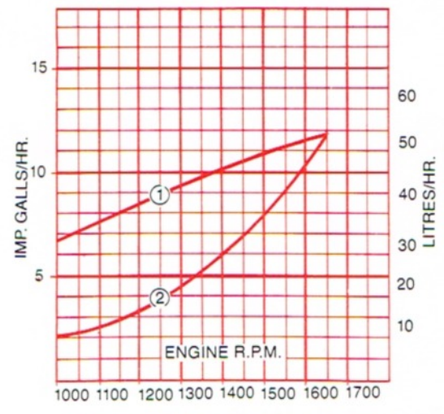
YT 300 300 bhp (224kw)

POWER CURVE



1 Maximum power available from engine.
2 Shaft power
3 Power required by typical propeller

FUEL CONSUMPTION CURVE



1 Fuel consumption – max power absorbed
2 Fuel consumption – prop. power absorbed

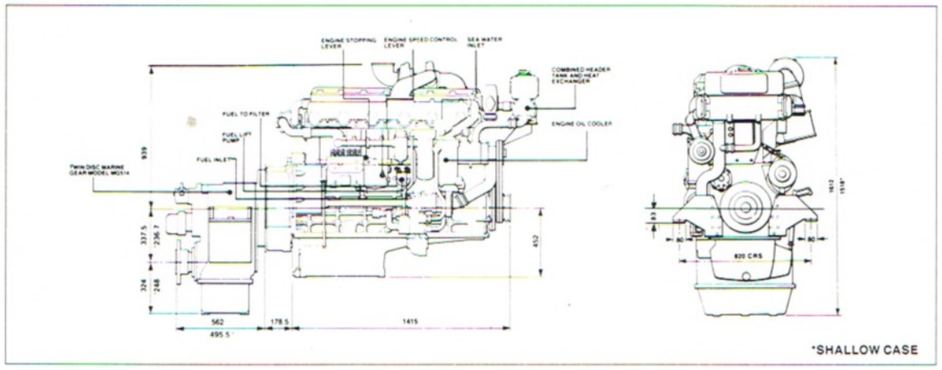
GENERAL DATA

Bore:	140mm (5.51in)	**Compression Ratio:**	15:1
Stroke:	168mm (6.61in)	**Capacity:**	15.5 litres (946 cu in)
Configuration:	6 cylinders in-line	**Rotation:**	Anti-clockwise viewed from rear
Cycle:	4 stroke	**Nett Dry weight:**	1876kg (4127lb) shallow case marine gear – MG514
Aspiration:	Turbocharged		2010kg (4422lb) deep case marine gear – MG514
			1640kg (3610lb) shallow case marine gear – MG5111
			1720kg (3784lb) deep case marine gear – MG5111

TYPICAL APPLICATIONS

Ideally suited for a variety of fishing vessels, including trawlers, netters, longliners and potters, as well as for heavy duty work boats, ferry boats, barges, tugs and off shore supply vessels.

DIMENSIONS



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GARDNER

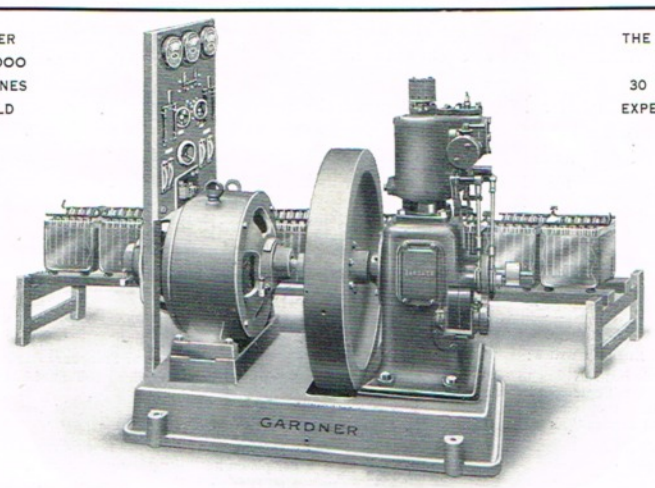
"LONGLIFE"

ELECTRIC HOUSE LIGHTING SETS

THE CONVENIENCE OF ELECTRICITY AT A NOMINAL COST.
MANY SIZES FOR LIGHTING BUNGALOWS, VILLAS, MANSIONS, ETC.

OVER 30,000 ENGINES SOLD

THE RESULT OF 30 YEARS' EXPERIENCE.



3 K.W. PARAFFIN SET WITH DIRECT LIGHTING FLYWHEEL.

NORRIS, HENTY & GARDNERS LTD.,

WORKS:
BARTON HALL ENGINE WORKS.
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LONDON OFFICE:
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ALSO AT

LIVERPOOL, GLASGOW AND NEWCASTLE-ON-TYNE.

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"LONGLIFE" ELECTRIC LIGHTING SETS.

FOR LONG LIFE AND HARD WORK.

SPECIALLY DESIGNED TO PROVIDE LIGHTING SETS OF FIRST-CLASS MATERIAL AND WORKMANSHIP AT COMPETITIVE PRICES.

IN putting these well-known Lighting Sets before the Public in a new form, we wish to point out that the standard sizes now offered can be modified as desired to meet Customers' special requirements. This consideration, together with the comprehensive nature of the equipment offered and the superior workmanship and finish of each article, are such as to make Gardner "Longlife" Lighting Sets the best and most reliable procurable.

SIMPLICITY and the elimination of complicated mechanism have been one of the chief objectives, thus making these Sets such that they can be run by any available person.

The **RELIABILITY** of Gardner Lighting Sets is such that they are used for House Lighting and Towns Lighting all over the world. They are used by the Admiralty, War Office, and most Foreign Governments, while Marconi's Wireless and other Telegraph Companies use them in large numbers. Gardner Lighting Sets are also used on board many of the largest Liners in the World for Lighting and Wireless purposes. Such users include the White Star Line, Cunard Line, P. & O. Line, etc., etc.

The reliability of a Lighting Set depends chiefly upon the engine by which it is driven, and care should be taken to avoid Sets in which the Engine Maker's name is suppressed. The Engine of every Gardner Set is made by Messrs. Gardner, at Barton Hall Engine Works, employing over 1,000 men, and who have for thirty years specialised in the manufacture of these Engines of which

OVER 30,000 HAVE BEEN SOLD.

TESTIMONIALS.

CORK ST. W. 1., 1922.

An Electrical Engineer writes:—

"As Technical Advisers to our clients we always specify Gardner Engines wherever possible, in the knowledge that they cannot be excelled for general reliability and service."

After 14 Years.

Co. Dublin, 1922.

"I have had a Gardner Engine since 1908, and it has always given me the greatest satisfaction."

After 20 Years.

SHROPSHIRE, 1922.

"You will be interested to hear that the little 3½ H.P. has been working steadily for nearly 20 years, and is as good as ever."

CORK, 1922.

"I have one of your Stationary Engines running my Electric Light plant, which could not be better."

After 13 Years. 1922.

"She has never been taken down, as on examination her piston head is perfectly clean and free from carbon after running nearly 13 years."

After 21 Years.

1922.

"It gives me the greatest pleasure to be able to testify to the satisfaction I have obtained from the above Engine, which you will see from your records was built in 1901."

IRELAND, 1922.

"We are writing you as we wish to state that we have taken much interest and pleasure in the performance of your 1½ K.W. Set recently supplied to our order.

"We may state that it is really giving at present 1900 watts at the higher voltage, and we are sure that we can get 2 K.W. from it without undue stress on the engine. Our client is more than pleased, and incidently we may state that a very great interest is being shown by a large number of possible clients."

SPECIFICATION.

THE ENGINE is of the medium speed four stroke type, and uses less fuel than most other makes. **Fuels** used are either Paraffin or Petrol, or Town's Gas. The Paraffin Engines do not require petrol for starting purposes, but petrol starting is fitted unless otherwise desired. **The Flywheel** is of our Battery Charging size, and a sensitive Governor is fitted, thus ensuring steady running. **Lubrication** is fully automatic, there being no lubricators to turn on or off. **Ignition** is by High Tension Bosch Magneto or equal. **Starting** is normally by hand (like a motor car), aud quite independent of the Batteries. If desired, Electric Starting can be fitted at an extra charge of 5%. **Fuel Tank.** Six-hour Fuel Tank (or Gas Bag) with Piping is supplied with each Set. For Petrol Starting a separate Tank is supplied, and for starting on Paraffin a Blow Lamp is substituted. **Cooling** is by Water, thus avoiding the loss of power common to air cooled engines and enabling the Plant to run continuously without overheating. Galvanised Water Tank and a Standard Set of Pipes, Bends, Drain Cock, etc., are supplied with every Set. **Silencer** of efficient type is included with each Set, also Exhaust Piping with Bends, etc., according to our standard. **Accessories** include Starting Handle, a complete Set of Spanners, Oil Can and Tin of Oil, Spare Piston Ring, Set of Spare Springs, Packings, etc., and Book of Fixing and Working Instructions. If desired the Engines can be fitted with a Standard Pulley to drive Pump, Saw Bench, etc., without extra charge.

THE DYNAMO is of high class make. It is of the open protected Shunt Wound Type, and is capable of withstanding heavy overloads. **For direct coupled Sets** it is mounted on a heavy Cast Iron Bedplate, and coupled to the Engine by means of a solid flanged coupling, thus making the Set a single unit of first-class construction. **For Belt Driven Sets** both Engine and Dynamo are mounted on a rigid Bedplate, the drive being by an endless Belt for which a mechanical tightening arrangement is provided. Each Set includes a suitable Front of Board Type Voltage Regulator.

THE SWITCHBOARD is of Enamelled Black Finish for mounting on bedplate or an adjacent wall. Wall mounting is recommended, but we can supply bedplate stands at slight extra. **Every Board is complete** with large size Ampmeters, and Voltmeter with Switch to give charge and discharge readings. Automatic Cut in and Cut Out is fitted, also Battery Regulating Switches, Main Switches and Fuses. The Board is fitted with all interconnections and is ready for coupling up. When **Electric Starting** is fitted a special Starting Switch is supplied, thus enabling the Set to be started without taking excessive current from the Battery. Automatic Battery Regulating Switches can be fitted without extra charge.

THE BATTERY is of the highest grade procurable. Open topped glass cells are provided. **The Plates** are such that they will stand well up to the work and give the utmost satisfaction. Three sizes of Battery are offered with each Set. The largest requiring charging the least frequently, whereas the smallest Battery can be charged in a shorter time. The intermediate size is recommended, but it is a matter of choice which of our standards is selected, and any desired size can be supplied. **The number of cells** is 14, 27, or 54, according to the voltage. Each Battery is complete with acid, Hydrometer, etc., but exclusive of any special stands.

EVERY SET IS GUARANTEED.

See Conditions of Sale, copy of which will be supplied on application.

SIZES AND PRICES.

SEASON 1923-1924.

Size	DYNAMO K.W.	DYNAMO Amps.	DYNAMO Volts	ENGINE R.P.M.	ENGINE B.H.P.	BATTERY Cells	BATTERY Ampere Hours	LIGHTS Normal	LIGHTS Max.	Price without Battery or Switchboard: Direct Coupled	Price without Battery or Switchboard: Belt Driven	Price of Battery and Switchboard
A1							84	10	17			£34 10
A2	¾	20	25/37	770	1¼	14	115	14	24	£78	£72	£40 6
A3							144	18	30			£45 7
B1							84	21	35			£62 5
B2	1½	20	50/75	660	2¾	27	115	29	48	£103	£89	£73 8
B3							144	36	60			£81 5
C1							100	25	40			£70 19
C2	1¾	23½	50/75	660	3	27	126	31	52	£105	£91	£77 3
C3							168	40	70			£87 5
D1							126	31	52			£77 3
D2	2	27	50/75	600	3¾	27	144	36	60	£126	£119	£82 11
D3							198	49	82			£102 9
E1							168	42	70			£92 15
E2	3	40	50/75	500	5¼	27	230	46	96	£161	£142	£98 9
E3							278	70	115			£138 0
F1							126	63	105			£139 4
F2	4¼	30	100/140	400	7¼	54	174	87	145	£199	£175	£171 14
F3							252	126	210			£222 19
G1							168	84	140			£167 9
G2	5¼	37	100/140	1000 2 cyls.	8½	54	216	108	180	£205	—	£199 0
G3							291	145	240			£268 7
H1							183	90	150			£179 2
H2	6½	45	100/140	350	11	54	288	144	240	£255	£204	£265 14
H3							348	170	290			£312 17

Prospective Customers are invited to apply for a special quotation, as we can usually improve upon the above prices.

The above prices are subject to cancellation or alteration without notice. They include delivery F.O.Q. Dublin, Belfast, or equal. The outputs mentioned are subject to slight modification according to the fuel used.

THE CHOICE OF PLANT.—While we recommend non-technical readers to apply for advice to the address given on the cover, the following brief notes may be of assistance:—The column "Lights" is based upon lamps, each consuming 20 watts. The "Normal" is the number the battery will light for 10 hours, and the Maximum ("Max.") the number the battery will light for 5 hours. The Ampere Hour capacity is based on 10 hours' discharge.

For electrical appliances, the following allowances should be made on the basis of lamps of 20 watts each:—For an Electric Iron, Kettle, or Toaster, allow 25/30 lamps; for an Electric Fan, allow 1 to 5 lamps; for Electric Fires, allow 25/50 lamps upwards.

APPROXIMATE OVERALL DIMENSIONS OF ENGINE AND DYNAMO.

SIZE OF PLANT		A	B	C	D	E	F	G	H
DIRECT COUPLED SETS.	Length ...	40¼"	50½"	50½"	54"	65"	85"	61½"	85½"
	Breadth ..	28"	28"	28"	28"	34"	39½"	26¼"	39½"
	Height ...	32½"	39"	39"	44½"	52"	66¼"	38½"	72"
BELT DRIVEN SETS.	Length ...	56½"	61½"	61½"	65½"	71½"	75"	—	78½"
	Breadth ...	24"	31½"	31½"	36½"	43"	47¾"	—	51"
	Height ...	30½"	37"	37"	43"	49"	56"	—	65"

Engine Production Dates & Acknowledgments

		Engine No.
4th January	1927	27140
4th July	1927	27339
3rd January	1928	27538
4th July	1928	27766
3rd January	1929	27912
3rd July	1929	28122
4th January	1930	28356
2nd July	1930	28596
6th January	1931	28872
1st July	1931	29127
4th January	1932	29343
1st July	1932	29670
6th January	1933	30114
3rd July	1933	30526

ENGINES RECEIVED ON TEST ON DATE SHOWN BELOW

		Engine Nos.			Engine Nos.			Engine Nos.			Engine Nos.
2nd January	1934	31041	2nd January	1947	70759	4th January	1960	123169	2nd January	1973	188768
2nd July	1934	31903	1st July	1947	72168	1st July	1960	125545	2nd July	1973	189953
2nd January	1935	32901	2nd January	1948	74024	3rd January	1961	127769	3rd January	1974	191705
2nd July	1935	33909	1st July	1948	75959	1st July	1961	130131	1st July	1974	193116
3rd January	1936	34884	3rd January	1949	77737	2nd January	1962	132400	2nd January	1975	195164
1st July	1936	36211	1st July	1949	79369	2nd July	1962	134800	1st July	1975	197322
4th January	1937	37746	3rd January	1950	81591	2nd January	1963	136908	2nd. January	1976	199052
1st July	1937	39391	1st July	1950	83480	1st July	1963	139167	1st July	1976	201375
4th January	1938	41294	2nd January	1951	85303	2nd January	1964	141620	3rd January	1977	203577
1st July	1938	43211	2nd July	1951	87292	1st July	1964	144110	1st July	1977	206347
3rd January	1939	45229	2nd January	1952	89330	4th January	1965	146344	3rd January	1978	208618
3rd July	1939	47030	1st July	1952	91377	1st July	1965	148733			
2nd January	1940	48789	2nd January	1953	93502	4th January	1966	150849			
1st July	1940	50448	1st July	1953	95719	1st July	1966	152970			
3rd January	1941	51736	4th January	1954	97645	3rd January	1967	155262			
1st July	1941	53187	1st July	1954	100097	3rd July	1967	157796			
2nd January	1942	54477	4th January	1955	102278	2nd January	1968	160303			
1st July	1942	55972	1st July	1955	104577	1st July	1968	163082			
4th January	1943	57444	3rd January	1956	106830	2nd January	1969	165632			
1st July	1943	59060	1st July	1956	109284	1st July	1969	168414			
3rd January	1944	60741	2nd January	1957	111862	2nd January,	1970	171192			
1st July	1944	62555	1st July	1957	114159	1st July,	1970	174016			
3rd January	1945	64182	2nd January	1958	116151	4th January,	1971	176899			
2nd July	1945	65728	1st July	1958	117714	1st July,	1971	179920			
2nd January	1946	67381	2nd January	1959	119376	4th January,	1972	183088			
1st July	1946	69082	1st July	1959	121199	3rd July,	1972	186150			

Data collated from details provided by Spares Office 23rd September, 1970 Amende

SITE & TYPE OF ENGINE	FIRST ENGINE BUILT SERIAL NO.	FIRST ENGINE BUILT DATE TESTED	LAST ENGINE BUILT SERIAL NO.	LAST ENGINE BUILT DATE TESTED
Hot Air Engine No.4.	-	-	-	-
Hot Air Engine No. A4.	-	-	-	-
Hot Air Engine No. 4B.	-	-	-	-
Gas Eng. (Old horizontal)	1/83	5th May,1894	-	-
M Type	2BM/2954	3rd Oct.1902	2FHM/30631	19th Aug.1933
V Type	3V/3231	8th Apl.1903	1AV/34577	11th Nov.1935
F Type	2F/10327	12th Jan.1910	4AF/25398	8th Aug.1931
CR Type	4BCR/10740	2nd Mch.1910	3BCR/36800	22nd Oct.1936
H Type	10H/10910	7th Apl.1910	6H/25419	25th Jly.1928
T & VT Type	4VT/17534	27th Jne.1913	3T4/42248	27th May 1938
HC Type	8HC/13578	27th Aug.1913	6HC/28145	19th Jne.1929
HF Type	8HF/25506	28th Dec.1922	12HF/54751	10th Feb.1942
OVC Type	OVC/25599	30th Apl.1925	OVC/81269	29th Nov.1949
J Type	6J9/27702	11th Jne.1928	4J5/49907	22nd May,1940
L2 Type	4L2/28423	28th Feb.1930	4L2/87122	25th Jne.1951
1L2 Type	1L2/28915	26th Jan.1931	-	-
LW Type	6LW/29240	26th Oct.1931	8LW/132608 4LW/174499(A) 5LW/173897 " 6LW/174512 " 2LW/171573(M) 3LW/175766(M)	24th Jan.1962 20th Jly.1970 8th Jne.1970 8th Spt.1970 12th Jan.1970 25th May 1970
L3 Type	4L3/29791	1st Spt.1932	8L3/132132	6th Dec.1961
LK Type	4LK/34405	10th Oct.1935	4LK/153808	11th Oct.1966
LW Marine Engine uprated		Aug.1957		
LW & L3 Industrial uprated		Oct.1958		
HLW Type	6HLW/115644	6th Feb.1951	6HLW/169748	9th Oct.1969
6LX Type	6LX/117100	16th Apl.1958	-	-
6HLX Type	6HLX/126050	20th Jly.1960	-	-
L3B Type	8L3B/126600 6L3B/127750	30th Nov.1960 8th Mch.1961	-	-
6LXB Type	6LXB/153276	18th Jly.1966	-	-
LW20 Type	5LW20/164958	12th Nov.1968	-	-
8LXB Type	8LXB/174504	2nd Jly.1970	-	-

Note (1) Test reports are available from Gas engine No. 1/83 onwards.
(2) Engine No. 4L2/28203 was built before 4L2/28423 and is now in the Power House at Patricroft. JUNE 1929

Engine date information courtesy of the Anson Engine Museum.

The information in this display is only intended to show the range of engines produced by the Gardner's and a short history.

The Small Horizontal Gas and Paraffin Engines and BCR pages courtesy of the Anson Engine Museum.

All other catalogue or brochure pages from the personal collection held by S Gray.

Bibliography

Gardners of Patricroft 1868-1968. . Written by David Whitehead published by Newman Neame for L Gardner and Sons Ltd 1968

L Gardner and Sons Ltd. Legendary Engineering Excellence
Written by G Edge 2002

Gardner. A product history over 25 years. Written by James J Francis. published by the Anson Engine Museum.

Anson Engine Museum “Gardner 150th Celebration Booklet.

Copies of
L Gardner and Sons Ltd. Legendary Engineering Excellence
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Can be purchased from The Anson Engine Museum. Anson Road

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www.enginemuseum.org