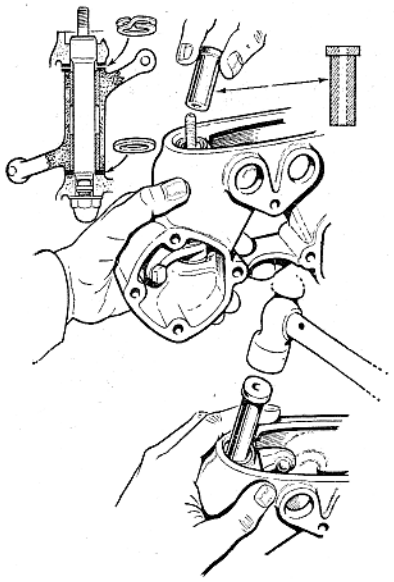
The Single-cylinder o.h.v. MODELS 50, ES2 and 19S

NORTON

Servicing Details for Current Bracebridge Street Push-rod Models in Three Popular Capacities

WHEN, only recently, the long standing "Big Four" and 16H side-valve models were dropped from the Norton catalogue, the single-cylinder range was supplemented by the addition of a long-stroke o.h.v. "single" of 596 c.c. capacity to cater for sidecar requirements, previously the province of the bigger of the side-valvers. Generally, the specification of this model, the 19S, resembles that of the 490 c.c. ES2, for the cylinder head and crankcase arrangements are virtually identical in both cases, the pistons, connecting rod and crank-throw dimensions varying in proportion to the stroke length.

The 348 c.c. Model 50 is structurally similar, but the head is not interchangeable with those of the two bigger-capacity machines. Important, however, is the fact that practical work described for one of the trio applies to the other two: the transmission and suspension assemblies are to a common pattern and the few special tools required by the home workshop enthusiast have equally wide application.



Details of rocker renovation, showing the bush assembly and application of a hollow drift to drive in the spindle.

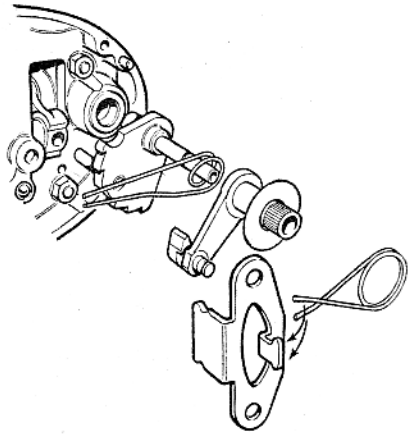
Special Tools

One can get along with the standard tool kit plus a selection of hand tools, some flat tyre levers to act as "persuaders" (for Magdyno sprocket removal), a claw-type puller and Terry valve spring compressor. Nortons recommend a gadget to facilitate the fitting of rebushed rockers and new spindles (an unlikely job) and there is a special base-block support and screw-type extractor device employed to push out tappet guides due for renewal. In all cases the crankpin nuts are tightened at the works with a 3-ft.-long wrench, exerting many ft.-lb. at the pin, and the private owner is not likely to possess any tool capable of producing similar torque. Moreover, as Norton big-end assemblies are selectively assembled it is a good idea to utilize the factory service scheme if at all feasible.

Dismantling Procedure

The engine is roughly 2 ft. tall and it helps the single-handed worker to dismantle as much as possible with the unit still supported in the frame. First, obviously, the primary transmission must come away, including the clutch and oil bath. The clutch body is secured by a centre nut to the splined gearbox mainshaft—there is no engine-shaft shock absorber—and if the sprocket here is pulled free with a claw-type tool, it can be withdrawn as a whole, together with the chain and clutch assembly, and then the back oilbath pressing may be removed.

On the other side, the engine is linked to the Magdyno by endless-chain transmission, the driving sprocket being a taper fit with, and keyed to, the cam-spindle extension. The Magdyno sprocket is a simple taper fit and both sprockets can be removed complete with chain. Nortons suggest the use of a hook-type tool (here the bent tyre-lever "persuaders" come into use) fitting behind the sprocket and bearing in front on the spindle end. Avoid using the back of the housing as a leverage point: it is alloy material and easily damaged.



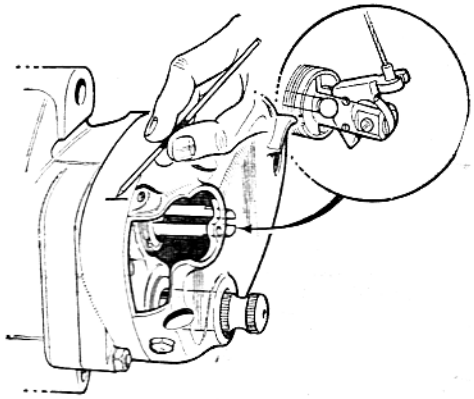
Order of assembly of the gearchange components.

Freed of H.T. and control cables, and with the oil pipes and carburetter removed, the engine presents no further snags. Taking off the rocker box, complete with rockers *in situ*, is straightforward. This work is followed by the removal of the light-alloy cylinder head which, it should be noted, is fitted with Armstrong "Helicoil" inserts for the rocker-box retaining bolts. The push rods can be withdrawn, leaving the tubes and "Neoprene" seals to come away with the head. These seals, located at the top of each tube, seldom need renewing, but the "O"-rings at the base are more readily expendable.

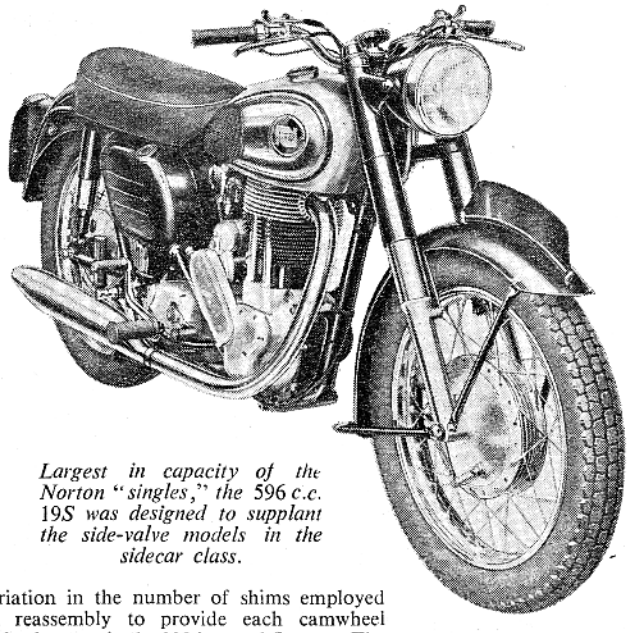
Check these renewable parts; also, when the cylinder has been slipped off, inspect the piston rings, the fit of the gudgeon pin (renewing the wire-type circlips once they have been removed), the tappet guides and the big-end assembly. Note that the piston and ring details set out in the Reference Data are applicable to the B.H.B. wire-wound type now being standardized throughout the Norton single-cylinder range. The B.H.B. piston is designed to control expansion under high-heat working conditions and so avoid distortion.

Cylinders and pistons are graded and marked either "A" or "B," the two gradings representing a .0003-in. tolerance either side of a datum dimension. It is essential that "A" and "B" components are not fitted-up together: if that should happen, the engine will either be noisy, with excess piston clearance, or much too tight. Pistons are marked on the crowns and barrels on the top joint faces.

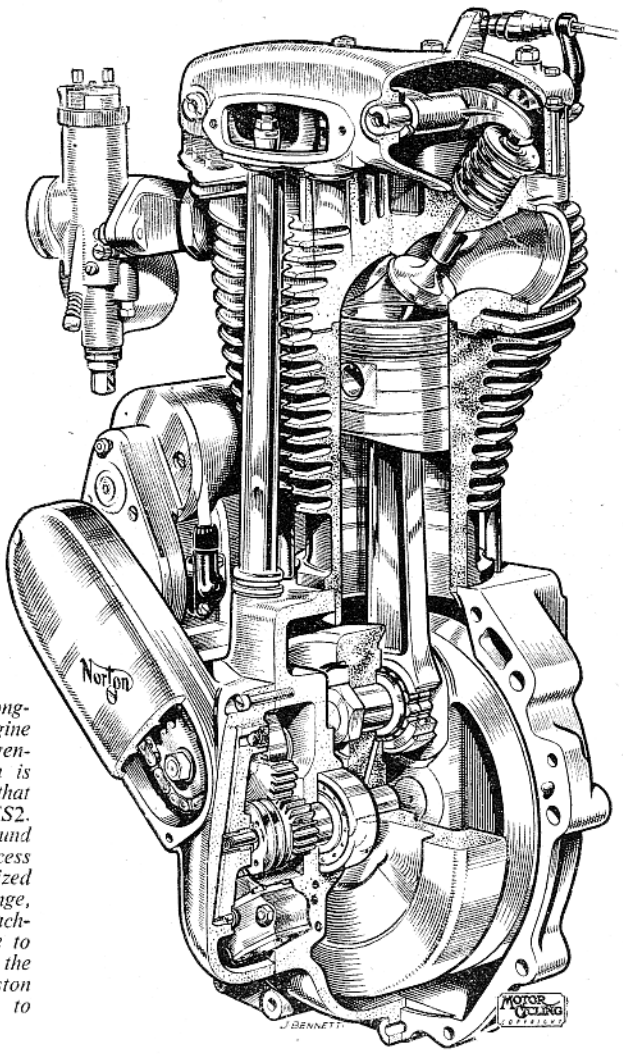
Splitting the crankcase involves, first, the removal of the timing chest cover, revealing the oil pump (driven by a worm, which also acts as a retaining nut—left-hand thread) and camwheels. Both wheels run in bushes which, if renewed, must be line-reamed—and that is usually regarded as a factory job. The fitting of new bushes may mean a



How a mark scribed on the outer surface of the gearbox end cover facilitates re-assembly of the clutch push-rod mechanism.



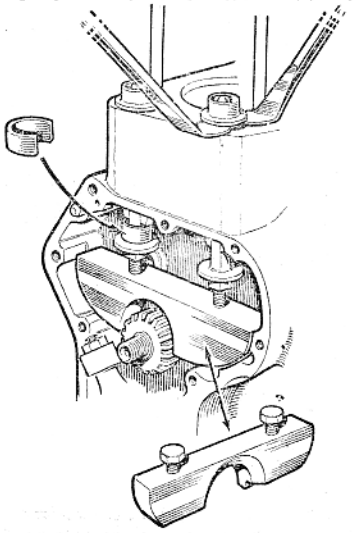
Largest in capacity of the Norton "singles," the 596 c.c. 19S was designed to supplant the side-valve models in the sidecar class.



The sturdy long-stroke o.h.v. engine of the 19S. Its general specification is very similar to that of the 490 c.c. ES2. B.H.B. wire-wound pistons are in process of being standardized throughout the range, although some machines will continue to be produced with the existing type of piston for some months to come.

variation in the number of shims employed on reassembly to provide each camwheel with the required .005-in. end-float. The hole found in the crankcase behind the driving sprocket is the outlet for a timed breather.

Within the casting of the timing cover, or panel, is the oil distribution system comprising, first, the main feed, which is a press-fit union between the pump outlet and the cover, where the ball and spring in the non-return valve can easily fall out and become lost (" C " in sketch overleaf). The feed jet " B " to the orifice of the hollow mainshaft is also spring loaded. At the top of the panel is the pressure-release valve " A "; another spring-loaded ball assembly, the function of which is chiefly to blow off and so relieve the pump under starting conditions with cold oil, rather than to build up a high pressure for normal working. If, for curiosity or any other reason, this mechanism is dismantled, note that the order of reassembly should be: (1) ball, properly seated, (2) spring, and (3) adjuster



The base-block with screw-type extractors used for removing the tappet guides.

nut. Check the position of shims, if any, on the mainshaft when the crankcase is split.

The three bearings (two on the drive side) may be driven out if the surrounding metal is preheated. If the tappet guides are removed, heat must be applied in the manner illustrated.

Although it is of the crowded, loose-assembled type, the big-end bearing is supplied to Nortons, complete with crankpin, as a proprietary unit by a number of bearing manufacturers. The rollers are nominally ¼ in. by ¼ in., but tolerances vary according to the standard to which each supplier works. Assuming the big-end renovation *is* being tackled at home, it is not practicable, therefore, simply to order a new crankpin and fit it up with rollers, old or new, and an outer race from some other source. A complete assembly should be obtained and fitted with the existing connecting rod.

It is improbable that the oil pump of a 1956-7 machine will require servicing. Wear, when it occurs, is manifest by play in the driving spindle, indicating that the end-faces of the gears are reduced—a condition that permits oil to by-pass the gears, resulting in a lowered pump output. The cure is to reduce the housing to the gear-face level by rubbing that side of the assembly on a surface plate covered with fine emery cloth. Wash the parts meticulously after this operation and also check the abutting pump/crankcase faces before the refitting stage is reached.

Assembly

Mainshaft end-float in excess of .005/.008 in. is taken up by the use of pen-steel washers, the fitting of which should leave the flywheels in a central position in the crankcase. When that setting is established, draw off the crankcase halves, lubricate thoroughly all bearing assemblies and gold-size the abutting edges of the crankcases. Join the halves up and recheck shaft float. Then fit the timing wheels, pump-drive worm and lock up the unit.

Set the valve timing by the pinion markings. See that the oil distribution system is correctly assembled and that, when offering-up the timing cover, the fibre washer between the pump output feed and the panel prevents the parts meeting by at least 1/32 in. This ensures that when the panel pins are finally tightened the resultant compressing of the washer provides a thoroughly oil-tight union. Replace the piston and cylinder. Link up

(*Continued overleaf*)

"DO-IT-YOURSELF"

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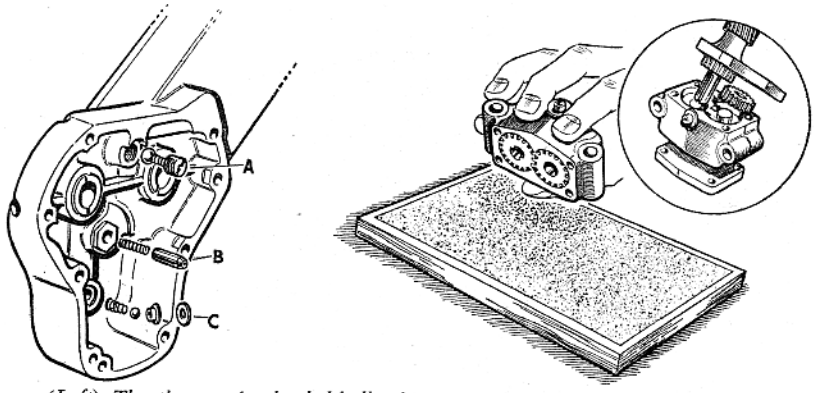


(Left) The three spring-loaded ball valves inside the timing cover (see text on preceding page). (Right) Facing-up the oil pump gears.

the Magdyno drive and tighten the cam-wheel sprocket nut only, so that the sprocket at the other end is left floating; this facilitates ignition timing—$\frac{11}{16}$ in. before T.D.C. ($\frac{3}{8}$ in. ES2)—which should be carried out now while the travel of the piston is easy to measure. The replacing of the cylinder head and rocker box is a reversal of dismantling procedure.

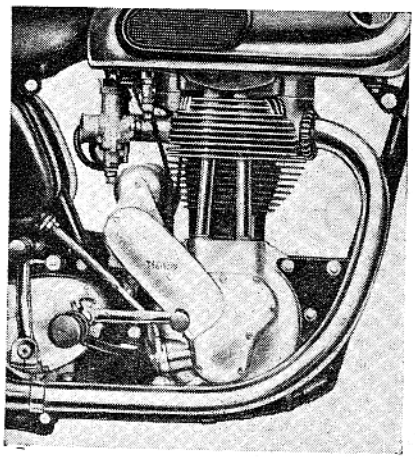
Transmission

The simplicity which characterizes the engine is also a feature of the gearbox. This is conventional in layout and operated by camplate-controlled selector arms sliding on a spindle, which is screwed into the drive-side end of the shell. An end cover on the kick-starter side supports the mainshaft in a ball-journal bearing, the layshaft running in the counter-bored K.S. spindle, which is bushed for the purpose.

A toggle-link with the operating-cam assembly extends through an aperture in the end cover forming a knuckle engagement with the striker plate, part of the foot-change mechanism housed in the outer cover. Removal of the K.S. crank (not the gear lever), gear indicator, oil filler and inspection plates and the five securing screws, suffices to bring away the cover complete with foot-change mechanism-pawls, hairpin springs and striker plate. Before separating the two parts, however, mark on the outer surface of the end cover the line-up of the clutch-operating lever with the slotted thrust member (see sketch) to facilitate later reassembly.

Likely points of wear are, of course, the bearings. The ball-journal bearing in the end cover can be examined if the external nut is slackened to permit the cover to be removed. Applying a spanner to the squared end of the selector-arm spindle will effectively unscrew the spindle and, if the clutch has been taken off, the mainshaft and gears (except the sleeve gear, or higher gear axle, as Nortons term it) can now be pulled out, followed by the layshaft assembly.

The K.S. and control springs in the gear-change mechanism are parts which may call for attention after a fair period of use. A fiddling job, needing good luck at the first attempt or patience thereafter, is the engaging of the striker arm with the knuckle joint. A sketch of the order of assembly of the gearchange bits and pieces provides a guide. Do not forget to inspect the K.S. escapement ratchet and pawl—it is a wearing part, particularly if accidentally misused—and to assemble the gearchange mechanism into the outer cover; this must be offered up to the inner cover as a complete sub-assembly.



A close-up of the 348 c.c. Model 50 power unit.

Suspension

In each leg, the main staunchion of the "Roadholder" forks is a taper fit at the fork crown, where it is secured by a big hexagon-headed nut, and clipped in the lower lug by a pinch-bolt and nut. When adjusting the head bearings, it is essential to slacken the pinch-bolt nut to permit extension or contraction of the steering-column assembly. Failure to do this may result in distortion and impaired steering.

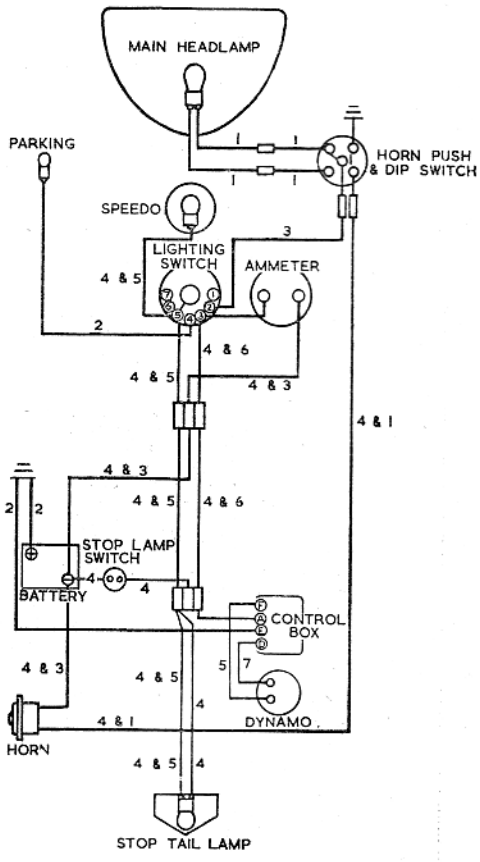
In dismantling either of the legs, the first operations are to slacken the pinch bolt, slightly unscrew the hexagon nut at the head of each fork and then gently tap the nut to break the taper fit of the staunchion in the crown. The hexagon nut may then be removed and the staunchion, complete with slider assembly and spring, withdrawn. The nut at the head of the slider is unscrewed by means of a peg spanner and beneath it will be found the main oil seal, which is expendable and should be renewed from time to time. The top bush, a flanged component, is now accessible and can be removed if necessary. At the lower extremity of the staunchion, the bottom bush is retained by a terminal nut. It operates under ideal conditions and very seldom needs replacing. Fork dismantling work is facilitated by first draining out the damping fluid.

When the job is completed and the forks reassembled, the spindle clamp in the fork end lug should not be tightened until after the forks have been moved sharply up and down several times in order that the spindle and wheel become properly centred. Clamping-up the spindle prematurely results, usually, in a fork assembly which is not completely parallel and, therefore, sure to be inefficient.

The Girling type SB4 suspension units controlling rear swinging-fork movement, are non-adjustable. Sealed at the works, they should not be tampered with.

Lubrication

Salient points about the oiling system have been dealt with earlier because the distribution arrangements from the pump to the big-end become obvious as the timing case is removed. The pressure-release valve is set at the works and, normally, should not be touched. There is no other form of adjustment. It should be noted that the plug and ball located in the timing side crankcase are there to seal off a drillway made during manufacture and have nothing to do with the lubrication system.



Wiring diagram of the three Norton "singles". Key to colour code: 1, black; 2, red; 3, blue; 4, brown; 5, green; 6, white; 7, yellow.

REFERENCE DATA

Norton Models 19S, ES2 and 50

CYLINDER-PISTON GROUP

	ES2	19S	50
Bore:	79 mm.	82 mm.	71 mm.
Stroke:	100 mm.	113 mm.	88 mm.
Swept volume:	490 c.c.	596 c.c.	348 c.c.
Compression ratio:	7.1	6.4	7.3

Rebore to .010 in. O.S. when maximum wear exceeds .006 in.

Piston diameters:

At top land:
3.077/3.079 in. 3.194/3.196 in. 2.760/2.762 in.

At bottom land (top):
3.107/3.108 in. 3.224/3.226 in. 2.793/2.794 in.

At skirt (bottom):
+ .0004/.0006 in. + .0004/.0012 in.

Piston ring gap: .012/.019 in.

Piston ring depth: (thickness) .0590/.0600 in.

Permissible vertical play: .0045/.0065 in.

Gudgeon-pin diameter: .8740/.8743 in.

Small-end bush diameter: .8745/.8750 in.

VALVES AND VALVE GEAR

Valve stem diameter: .. .370/.371 in.

Bore of valve guides: .. .3745/.3750 in.

Seat angle: 45°

Free valve-spring length:
Inner 2 in. Outer 2.062 in.

Rocker spindle diameter: .5615/.5620 in.

Rocker bush bore: .5625/.5630 in.

Timing-wheel bush bore: .6248/.6251 in.

Valve timing (with tappets set at .020 in. clearance):

Inlet opens before T.D.C. ..	30°
Inlet closes after B.D.C.	75°
Exhaust opens before B.D.C. ..	78°
Exhaust closes after T.D.C. ..	35°

Normal tappet clearances: Zero (push-rods just free to rotate).

CRANKSHAFT GROUP

Con-rod big-end eye diameter: 1.9980/1.9985 in.

Permissible side play: .020/.026 in.

Type of big-end bearing: Crowded roller (see text).

Main bearings: 1 in. bore by 2¼ in. O/D by ⅝ in.; two roller and one ball journal.

Permissible shaft end-play: .005/.008 in. (adjusted by shims).

Left-hand threads on engine components: Oil-pump worm.

Location of contact breaker: In magdyno

GEARBOX

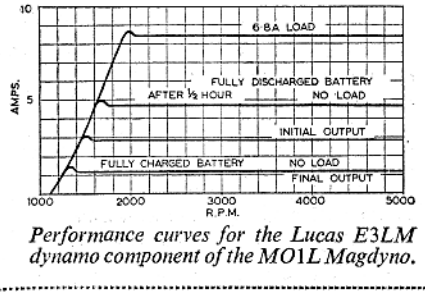
Bearings, type and size: Sleeve gear supported by double-row rigid ball bearing SKF RLS 9Z, 1¼ in. bore by 2½ in. O/D by ⅝ in.

Mainshaft bearing at K.S. end: Single row rigid, ⅝ in. bore by 1 5/16 in. O/D by 7/16 in.

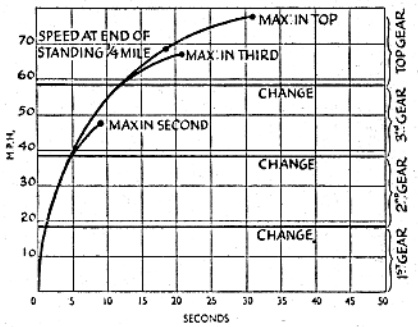
Layshaft supported by: Ball bearing SKF 6203, 17 mm. bore by 40 mm. O/D by 12 mm.

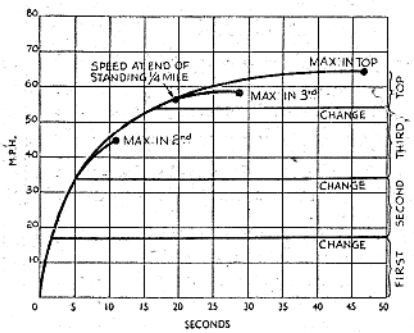
Internal reductions: 1.33 1.77 2.67

Left-hand threads on gearbox: Final drive sprocket nut.

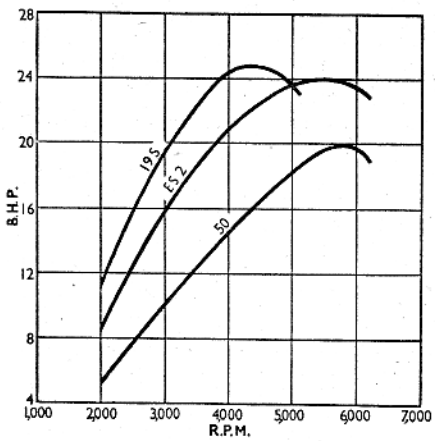


Performance curves for the Lucas E3LM dynamo component of the MO1L Magdyno.





"Motor Cycling" road test graphs for (left) the ES2 (published May 6, 1954) and the 19S with sidecar (August 11, 1955).



Manufacturer's output curves for the three Norton "singles"; figures obtained with premium grade fuel, test-bench exhaust system and engines in standard trim.

TRANSMISSION

	ES2	19S	50
Sprocket sizes:			
Primary drive:			
Engine:	20t	19t (sidecar)	18t
Clutch:	42t	42t	42t
Final drive:			
Gearbox driving sprocket:	19t	19t	19t
Rear wheel:	43t	43t	43t

Gear ratios: E.S2, 4.75, 6.31, 8.41, 12.7; 19S, 5, 6.65, 8.85, 13.35; 50, 5.29, 7.04, 9.36, 14.12.

Primary chain: Renold 110046, ½-in. pitch by .305 in. by .335 in., 76 pitches (model 50, 75 pitches).

Secondary chain: Renold 110054, ⅝ in. pitch by .225 in. by .400 in., 90 pitches.

WHEELS

Front: WM 2-19.

Brake diameter 8 in.

Spokes, brake side: 6³/₃₂ in. long, ⅜ in. at bend (20 off).

Spokes, plain side: 6³/₃₂ in. long, ¹⁷/₃₂ in. at bend (20 off).

Hub bearings: One single row 17 mm. by 12 mm.: one double row ball journal, 17 mm. by 40 mm. by 16 mm.

Rear: WM 2-19.

Brake diameter: 7 in.

Spokes, brake side: 6³/₃₂ in. long, ⅜ in. at bend (20 off).

Spokes, plain side: 6³/₃₂ in. long, ¹⁷/₃₂ in. at bend (20 off).

Hub bearings: One single row and one double row ball journal, as above.

FRONT SUSPENSION

Telescopic forks, carried on thrust type head bearings, comprising ⁵/₁₆-in. diameter balls (17 off) with 1²²/₃₂ in. pitch circle.

Multi-rate compression springs.

Fork angle: 27°

Trail: 3 in.

Damper fluid content, ¼-pint of S.A.E. 20 oil.

Slider bush dimensions:
Main tube bush 1.3595/1.3605 in. bore.
Slider tube bush: 1.4980/1.4990 in. O/D.

REAR SUSPENSION

By swinging arm and Girling SB4 suspension units.

Pivot bush details:
Silentbloc rubber bush. 1 3/16 in. diameter by 3⅛ in. long.

CARBURATION

	ES2	19S	50
Amal Monobloc 376—			
Choke:	1 1/16 in.	1 1/16 in.	1 in.
Main jet:	270	270	210
Throttle slide	4	4	3½
Needle groove No.	3	3	2

LUBRICATION

Oil tank capacity: 4 pints. Circulation by gear-type pump, worm-driven from mainshaft. Rotary type engine breather with outlet behind engine sprocket.

ELECTRICAL EQUIPMENT

Ignition by Lucas type MO1L Magdyno with integral E3LM 6v. 60 watt dynamo charging PUZ7E/11 13 amp. hr. battery through RB/107 c.v.c unit.

Cut-out
Cut-in voltage: 6.3/6.7 volts.
Drop-off voltage: 4.8/5.3 volts.
Reverse current: 3.0/5.0 amp.

Regulator

10° C. (50° F.)	7.7/8.1 volts.
20° C. (68° F.)	7.6/8.0 volts.
30° C. (86° F.)	7.5/7.9 volts.
40° C. (104° F.)	7.4/7.8 volts.

Bulb rating:
Headlamp: 6v. 30/24w.
Pilot: 6v. 3w.
Tail: 6v. 6/18w.