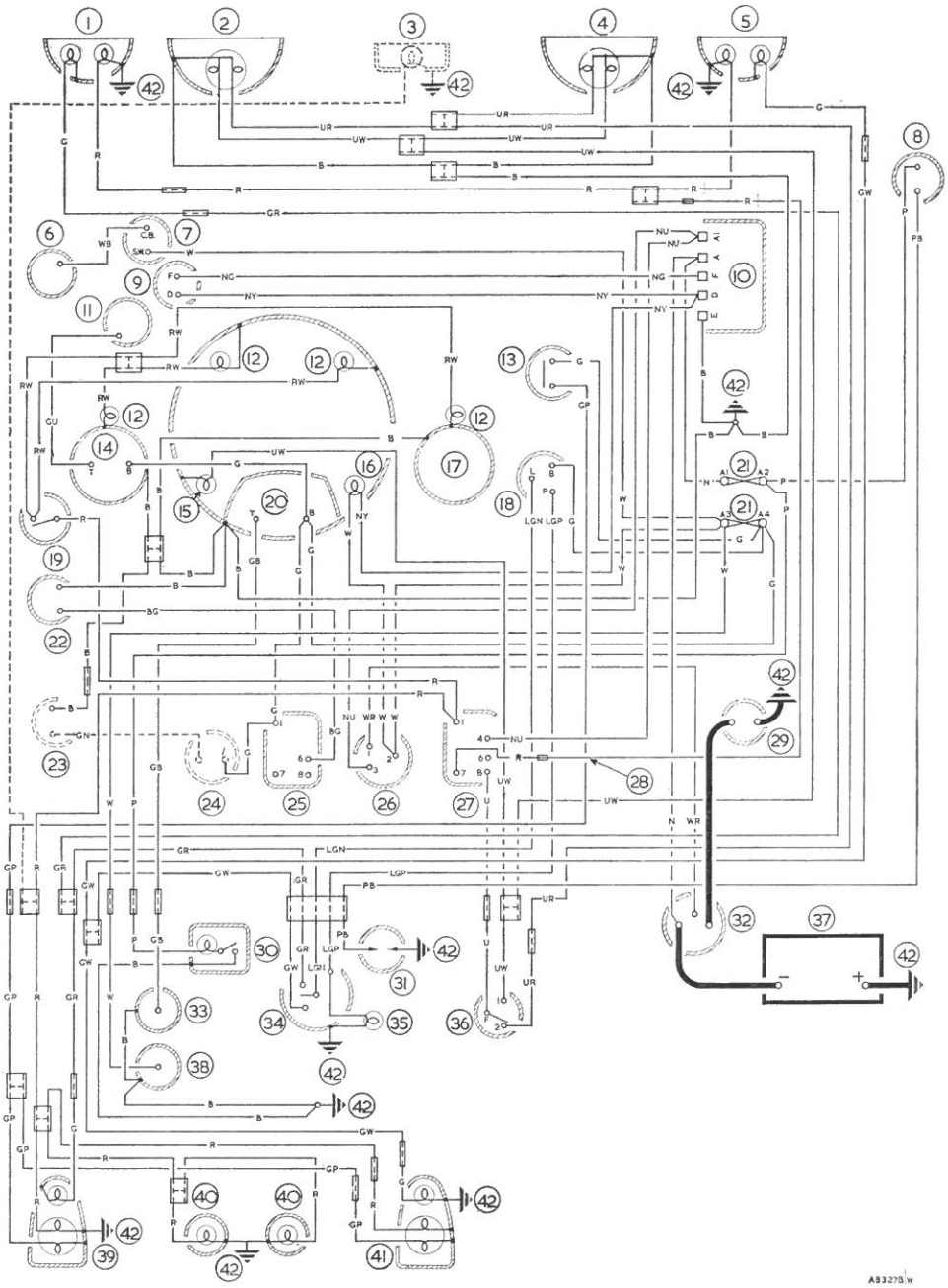
SECTION N

THE ELECTRICAL SYSTEM

WIRING DIAGRAM

1961 to 1964



KEY TO WIRING DIAGRAM

No.	*Description*
1.	L.H. pilot and flashing indicator lamp.
2.	L.H. headlamp.
3.	Bonnet badge lamp (Hornet only).
4.	R.H. headlamp.
5.	R.H. pilot and flashing indicator lamp.
6.	Distributor.
7.	Ignition coil.
8.	Horn.
9.	Dynamo.
10.	Voltage regulator and cut-out.
11.	Thermal element.
12.	Panel illumination lights.
13.	Stop lamp switch.
14.	Temperature gauge.
15.	Main beam warning light.
16.	Ignition warning light.
17.	Oil pressure gauge.
18.	Flasher unit.
19.	Panel lights switch.
20.	Fuel gauge.
21.	Fuse—35-amp.
22.	Windscreen wiper motor.
23.	Heater motor.
24.	Heater motor switch.
25.	Windscreen wiper switch.
26.	Ignition/starter switch.
27.	Headlamp and pilot lamp switch.
28.	Connect to terminal No. 8 for U.S.A.
29.	Starter motor.
30.	Interior lamp.
31.	Horn push.
32.	Starter solenoid switch.
33.	Fuel gauge tank unit.
34.	Flashing indicator switch.
35.	Flashing indicator warning light.
36.	Headlamp dip-switch.
37.	Battery—12-volt.
38.	Fuel pump.
39.	L.H. stop, tail, and flashing indicator lamp.
40.	Number-plate illumination lamp.
41.	R.H. stop, tail, and flashing indicator lamp.
42.	Earth connection.

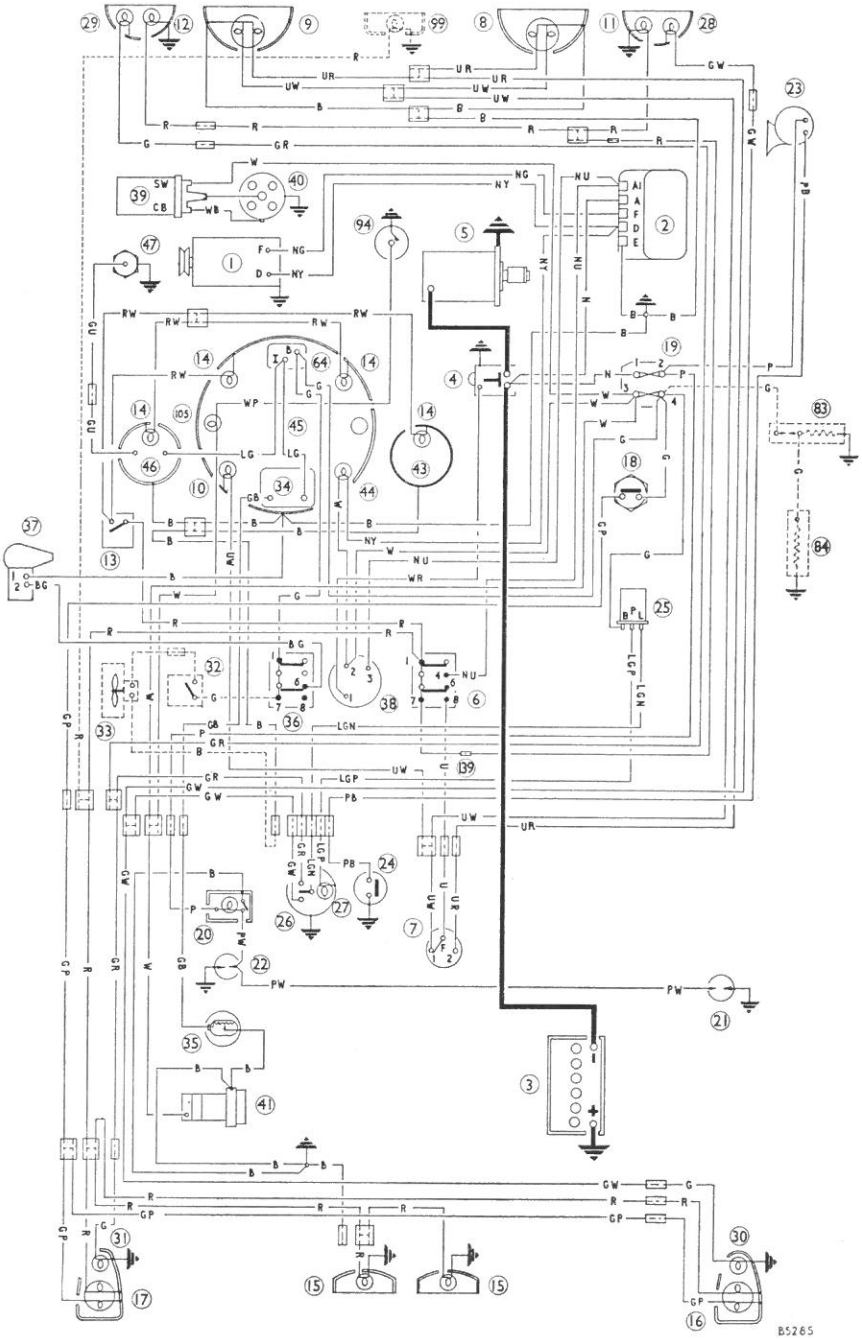
CABLE COLOUR CODE

B. Black.	P. Purple.	Y. Yellow.
U. Blue.	R. Red.	L. Light.
N. Brown.	S. Slate.	D. Dark.
G. Green.	W. White.	M. Medium.

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

WIRING DIAGRAM

1964 to 1967



KEY TO WIRING DIAGRAM

No.	*Description*
1.	Dynamo.
2.	Control box.
3.	Battery—12-volt.
4.	Starter solenoid.
5.	Starter motor.
6.	Lighting switch.
7.	Headlamp dip-switch.
8.	R.H. headlamp.
9.	L.H. headlamp.
10.	Main beam warning lamp.
11.	R.H. sidelamp.
12.	L.H. sidelamp.
13.	Panel lamps switch.
14.	Panel lamps.
15.	Number-plate illumination lamps.
16.	R.H. stop and tail lamp.
17.	L.H. stop and tail lamp.
18.	Stop lamp switch.
19.	Fuse unit—35 amps. 1–2, 35 amps. 3–4.
20.	Interior light.
21.	R.H. door switch.
22.	L.H. door switch.
23.	Horn.
24.	Horn push.
25.	Flasher unit.
26.	Direction indicator switch.
27.	Direction indicator warning lamp.
28.	R.H. front flasher lamp.
29.	L.H. front flasher lamp.
30.	R.H. rear flasher lamp.
31.	L.H. rear flasher lamp.
32.	Heater switch (when fitted).
33.	Heater motor (when fitted).
34.	Fuel gauge.
35.	Fuel gauge tank unit.
36.	Windscreen wiper switch.
37.	Windscreen wiper motor.
38.	Ignition/starter switch.
39.	Ignition coil.
40.	Distributor.
41.	Fuel pump.
43.	Oil pressure gauge.
44.	Ignition warning lamp.
45.	Speedometer.
46.	Water temperature gauge.
47.	Water temperature transmitter.
64.	Bi-metal instrument voltage stabilizer.
83.	Induction heater and thermostat. (When fitted.)
84.	Suction chamber heater. (When fitted.)
94.	Oil filter switch.
99.	Radiator badge illumination lamp.
105.	Oil filter warning lamp.
139.	Connect to No. 6 for U.S.A. (Alternative connection).

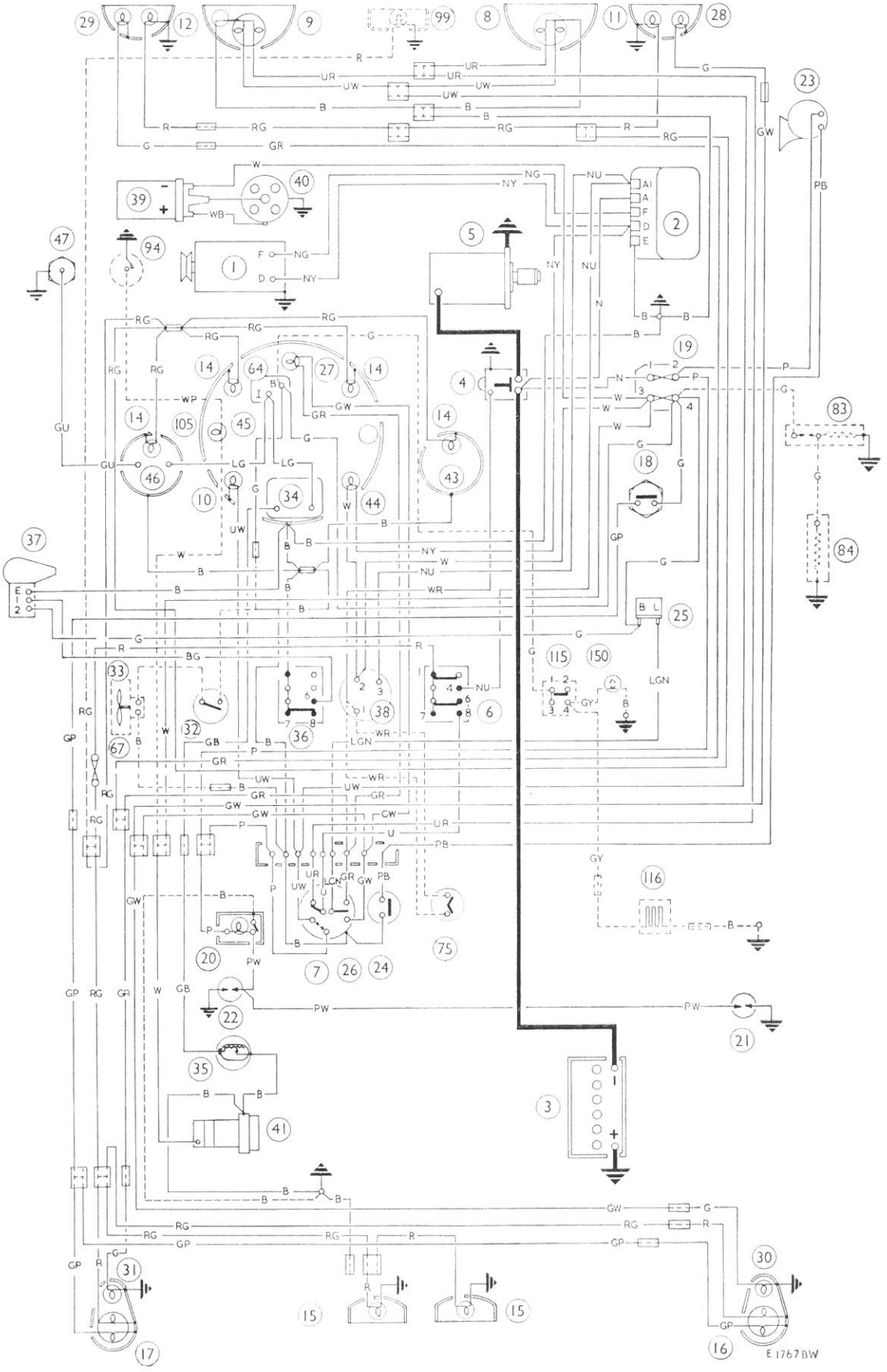
CABLE COLOUR CODE

N. Brown.	P. Purple.	W. White.
U. Blue.	G. Green.	Y. Yellow.
R. Red.	L.G. Light green.	B. Black.

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

WIRING DIAGRAM

1967 Onwards



KEY TO WIRING DIAGRAM

No.	Description
1.	Dynamo.
2.	Control box.
3.	12-volt battery.
4.	Starter solenoid.
5.	Starter motor.
6.	Lighting switch.
7.	Headlamp dip switch.
8.	R.H. headlamp.
9.	L.H. headlamp.
10.	Main-beam warning lamp.
11.	R.H. sidelamp.
12.	L.H. sidelamp.
14.	Panel lamps.
15.	Number-plate lamp.
16.	R.H. stop and tail lamp.
17.	L.H. stop and tail lamp.
18.	Stop lamp switch.
19.	Fuse unit; 1–2, 35 amp.; 3–4, 35 amp.
20.	Interior light.
21.	R.H. door switch.
22.	L.H. door switch.
23.	Horn.
24.	Horn-push.
25.	Flasher unit.
26.	Direction indicator and headlamp flasher switch.
27.	Direction indicator warning lamp.
28.	R.H. front flasher lamp.
29.	L.H. front flasher lamp.
30.	R.H. rear flasher lamp.
31.	L.H. rear flasher lamp.
32.	Heater switch } when fitted
33.	Heater motor } when fitted
34.	Fuel gauge.
35.	Fuel gauge tank unit.
36.	Windscreen wiper switch.
37.	Windscreen wiper motor.
38.	Ignition/starter switch.
39.	Ignition coil.
40.	Distributor.
41.	Fuel pump.
42.	Oil pressure switch.
43.	Oil pressure warning lamp.
44.	Ignition warning lamp.
45.	Speedometer.
46.	Temperature gauge.
47.	Temperature gauge transmitter.
64.	Bi-metal instrument voltage stabilizer.
67.	Line fuse, 35-amp.
75.	Automatic gearbox safety switch (when fitted).
83.	Induction heater and thermostat (when fitted).
84.	Suction chamber heater (when fitted).
99.	Radiator badge illumination lamp (Hornet).
94.	Oil filter switch } not fitted on Automatic.
105.	Oil filter warning lamp } not fitted on Automatic.
115.	Rear window demister switch (when fitted).
116.	Rear window demister unit (when fitted).
150.	Rear window demister warning light (when fitted).

CABLE COLOUR CODE

B. Black.	G. Green.	W. White.
U. Blue.	P. Purple.	Y. Yellow.
N. Brown.	R. Red.	L.G. Light Green.

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

Section N.1

BATTERY

Maintenance

(1) Keep the battery clean and the vent holes in the caps free.

(2) Clean corroded terminals with diluted ammonia and smear them with petroleum jelly.

(3) Maintain the level of the electrolyte just above the tops of the separators.

NOTE.—Disconnect the battery earth cable before boost charging the battery or using arc welding equipment on the body. Considerable damage to the electrical components will result if the ignition is switched on while the battery remains connected to the car electrical system.

Checking

(4) The state of charge of the battery is indicated by hydrometer readings as follows:

For climates below 27° *C.* (80° *F.*)	
Cell fully charged	1·270 to 1·290
Cell about half-charged ..	1·190 to 1·210
Cell completely discharged ..	1·110 to 1·130
For climates above 27° *C.* (80° *F.*)	
Cell fully charged	1·210 to 1·230
Cell about half-charged ..	1·130 to 1·150
Cell completely discharged ..	1·050 to 1·070

These figures are given assuming an electrolyte temperature of 16° C. (60° F.). If the temperature of the electrolyte exceeds this ·002 must be added to hydrometer readings for each 3° C. (5° F.) rise to give the true specific gravity. Similarly, ·002 must be subtracted from hydrometer readings for every 3° C. (5° F.) below 16° C. (60° F.).

Charging (used battery)

(5) Charge at 3·0 amps, until all cells are gassing freely and hydrometer readings of each cell have not risen in four hours. Do not allow the temperature of the electrolyte to exceed the following maximum: For climates below 27° C. (80° F.) 30° C. (100° F.). For climates above 27° C. (80° F.) 49° C. (120° F.).

Dry-charged batteries

Dry-charged batteries are supplied without electrolyte but with the plates in a charged condition. No initial charging is required.

(6) Fill with electrolyte obtained as follows:

For climates	*To obtain specific gravity (corrected to* 16° C. [60° *F.*])	*Add* 1 *vol. of acid of* 1·840 *S.G. (corrected of to* 16° *C.* [60° *F.*]) *to*
Below 27° C. (80° F.)	1·260	3·2 volumes of water
Above 27° C. (80° F.)	1·210	4·3 volumes of water

Batteries filled in this way are capable of giving a starting discharge **one hour after filling.** When time permits, however, a short freshening charge at the normal recharge rate (3·0 amps.) will ensure that the battery is fully charged.

During the charge the electrolyte must be kept level with the top edge of the separators by addition of distilled water. Check the specific gravity of the acid at the end of the charge; if 1·260 acid was used to fill the battery, the specific gravity should now be between 1·270 and 1·290. If 1·210 acid was used the specific gravity should now be between 1·210 and 1·230. After filling, a dry-charged battery needs only the attention normally given to a lead-acid battery.

New, unfilled, uncharged battery

(7) Half fill each cell with electrolyte prepared as in item (6) above and allow it to stand for six hours, fill each cell to the correct level and allow a further standing period of two hours.

(8) Charge at 2 amps, until five successive hourly hydrometer checks show no increase in the reading; this will take from 48 to 80 hours, depending on the length of time the battery has been stored before charging. **This charge should not be broken by long rest periods.**

(9) If the temperature of any cell rises above the maximum given in (5), the charge must be interrupted until the temperature has fallen at least 5·5° C. (10° F.) below that figure.

(10) Maintain the level of the electrolyte during the charge.

(11) At the end of the charge carefully check the specific gravity in each cell to ensure that, when corrected to 16° C. (60° F.) it lies between the specified limits. If any cell requires adjustment some of the electrolyte must be siphoned off and replaced either by distilled water or by acid of strength originally used for filling in, depending on whether the specific gravity is too high or too low. Continue the charge for an hour or so to ensure adequate mixing of the electrolyte and again check the specific gravity readings. If necessary, repeat the adjustment process until the desired reading is obtained in each cell.

(12) Finally, allow the battery to cool, and siphon off any surplus electrolyte.

Section N.2

DYNAMO

Removing

(1) Disconnect the leads, slacken the four mounting bolts, remove the fan belt from the pulley, take out the two upper and one lower mounting bolts and lift off the dynamo.

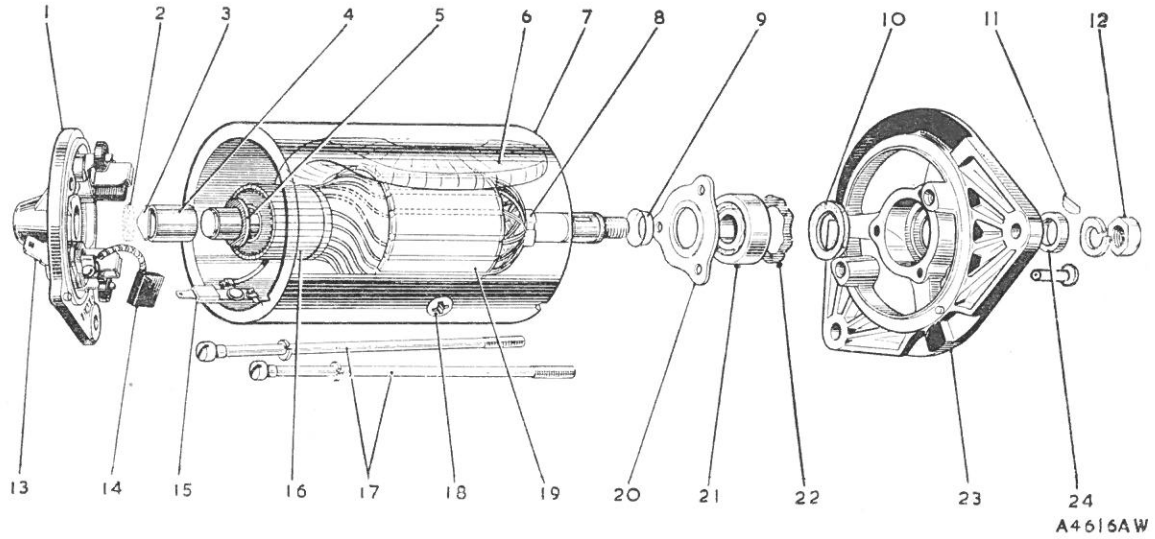


Fig. N.1

The C40/1 type dynamo

1. Commutator end bracket.
2. Felt ring.
3. Felt ring retainer.
4. Bronze bush.
5. Thrust washer.
6. Field coils.
7. Yoke.
8. Shaft collar.
9. Shaft collar retaining cup.
10. Felt ring.
11. Shaft key.
12. Shaft nut
13. Output terminal 'D'.
14. Brushes.
15. Field terminal 'F'.
16. Commutator.
17. Through-bolts.
18. Pole-shoe securing screws.
19. Armature.
20. Bearing retaining plate.
21. Ball bearing.
22. Corrugated washer.
23. Driving end bracket.
24. Pully spacer.

Dismantling

(2) Unscrew the nut and take off the pulley.

(3) Extract the key from the shaft.

(4) Withdraw the two through-bolts and remove the commutator end bracket.

(5) Lift the driving end bracket with the armature and bearing out of the yoke.

(6) To remove the bearing, press off the end bracket.

Servicing

Brushes

(7) Clean the brushes with petrol (fuel) and, if sticking, polish them lightly with a smooth file.

(8) Test the spring tension (**'GENERAL DATA'**).

(9) Fit new brushes if the existing ones are worn to a length of less than $\frac{1}{4}$ in. (6·5 mm.).

Commutator

(10) Clean with petrol (fuel) and cloth or polish with fine glass-paper. If it is in very poor condition it may be skimmed to a minimum diameter of 1·450 in. (37 mm.). The undercut must have the following dimensions:

Width	·040 in. (1·02 mm.)
Depth	·020 to ·035 in. (·51 to ·89 mm.).

Clean the insulating material from the sides of the undercut to a maximum depth of ·015 in. (·38 mm.).

Field coil replacement

(11) Mark the position of the pole-shoes relative to the yoke.

(12) Withdraw the pole-shoe securing screws (Fig. N.1) draw the shoes and coils from the yoke and remove the coils from the shoes.

(13) Fit new coils to the shoes and refit them to the yoke with the shoes in their original positions. Refit the insulating piece at the junction of the coil windings, insert the screws, press the shoes in place with an expander, and tighten the screws (Fig. N.1).

Armature

(14) If special equipment is not available, test the armature by substitution.

Bearings

(15) Screw a $\frac{5}{8}$ in. (15·8 mm.) tap into the bush at the commutator end, pull out the bush and fit a new one, using a shouldered mandrel.

NOTE.—Soak the new bush in thin engine oil for 24 hours before fitting.

(16) Renew the bearing at the driving end as follows:

(17) Knock out the rivets and remove the bearing retaining plate.

(18) Press the bearing out of the bracket and remove the corrugated and felt washers.

(19) Pack the new bearing with grease before pressing it in.

Reassembling and refitting

(20) Reverse the removing and dismantling instructions.

(21) The two upper fixing bolts must be fitted with a flat washer under the head of each bolt to register against the dynamo attachment points.

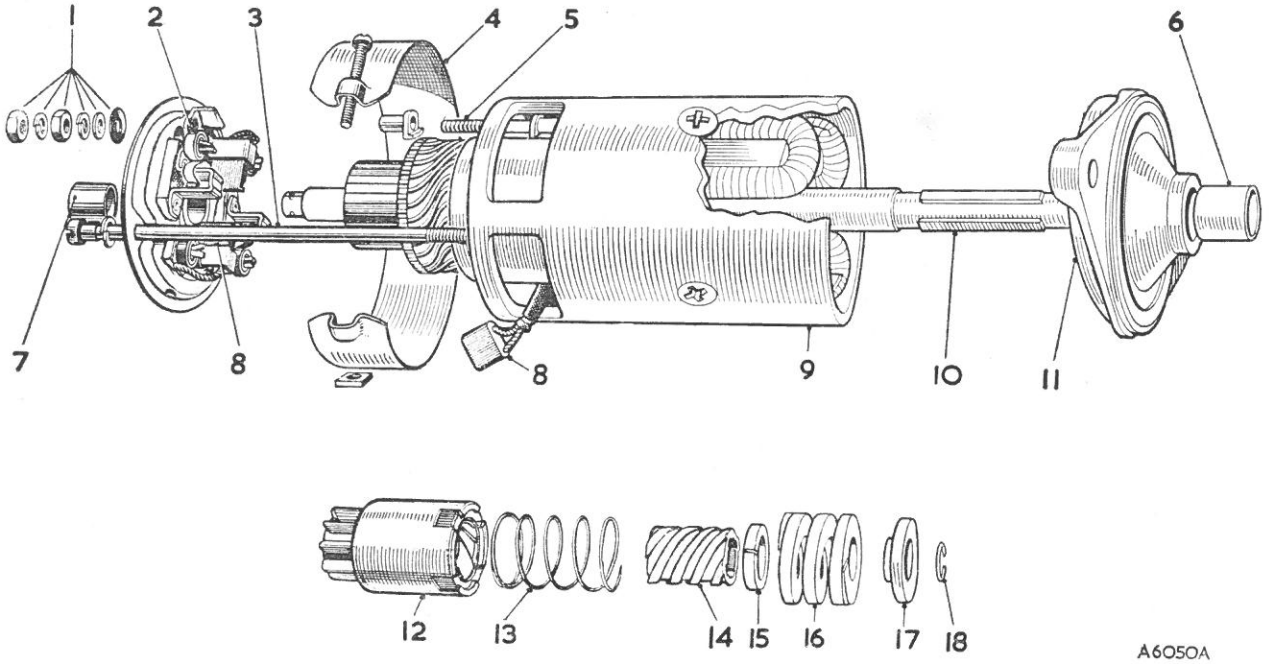


Fig. N.2

An exploded view of the starter motor and drive

1. Terminal nuts and washers.
2. Brush spring.
3. Through-bolt.
4. Band cover.
5. Terminal post.
6. Bearing bush.
7. Bearing.
8. Brushes.
9. Yoke.
10. Armature shaft.
11. Driving-end bracket.
12. Pinion assembly.
13. Restraining spring.
14. Sleeve.
15. Impact washer.
16. Main spring.
17. Locating washer.
18. Circlip.

Section N.3

STARTER

Removing

(1) Disconnect the cable, unscrew the three bolts and lift away.

Dismantling

(2) Remove the cover band, withdraw the brushes, unscrew the through-bolts and take out the armature complete with drive.

Servicing

Brushes

See Section N.2, items (7) to (9).

Drive

(3) If the pinion is tight on the sleeve, wash it in kerosene.

(4) To dismantle, remove the shaft nut and withdraw the main spring and collar. On later types, compress the spring and remove the circlip.

(5) Rotate the barrel, push out the sleeve and remove the barrel and pinion.

(6) The barrel and pinion are supplied as an assembly.

Commutator

(7) If cleaning is not effective, skim lightly removing the absolute minimum amount of metal. Do not undercut the mica.

Field coils

See Section N.2, items (11), (12), and (13).

Bearing

See Section N.2, item (15).

Armature

See Section N.2, item (14).

Reassembling and refitting

Reverse the removal and dismantling instructions.

Section N.4

VOLTAGE REGULATOR

Adjusting (cold unit)

Electrical

(1) Disconnect the cables from the control box terminals 'A' and 'A1' and join them together.

(2) Connect the negative lead from a voltmeter (0–20 volts) to control box terminal 'D' and the positive lead to terminal 'E'.

(3) Slowly increase engine speed until the voltmeter needle flicks and then steadies. This should occur between 15·8 and 16·7 volts, depending on the ambient temperature.

(4) If adjustment is required, switch off the engine and remove the control box cover.

(5) Turn the voltage adjustment screw (1) (Fig. N.3), in a clockwise direction to raise the voltage and anti-clockwise to lower it. Turn only a fraction of a turn at a time. This adjustment should be completed within 30 seconds or the settings will be affected by heat. Do not run the dynamo at a higher speed than is necessary for the adjustment to be made.

Mechanical

(6) Slacken the fixed contact and voltage adjusting screws until they are clear of the moving contact and the tension spring respectively. Slacken the two armature assembly securing screws.

(7) Insert a ·021 in. (·53 mm.) feeler gauge between the armature and the core shim. Press the armature squarely down against the gauge and tighten the armature assembly securing screws.

(8) With the gauge still in position, screw the adjustable contact down until it just touches the armature contact. Tighten the locking nut.

(9) Reset the voltage adjusting screw as in item (5).

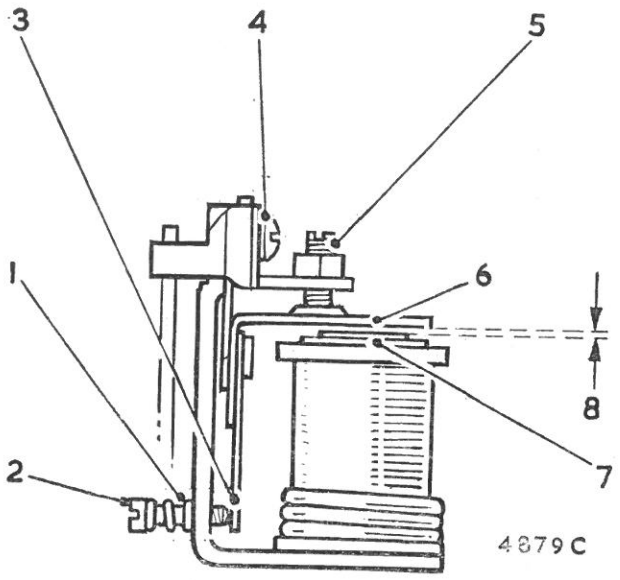


Fig. N. 4

Mechanical setting of the regulator

1. Locknut.
2. Voltage adjusting screw.
3. Armature tension spring.
4. Armature securing screws.
5. Fixed contact adjustment screw.
6. Armature.
7. Core face and shim.
8. ·021 in. (·533 mm.).

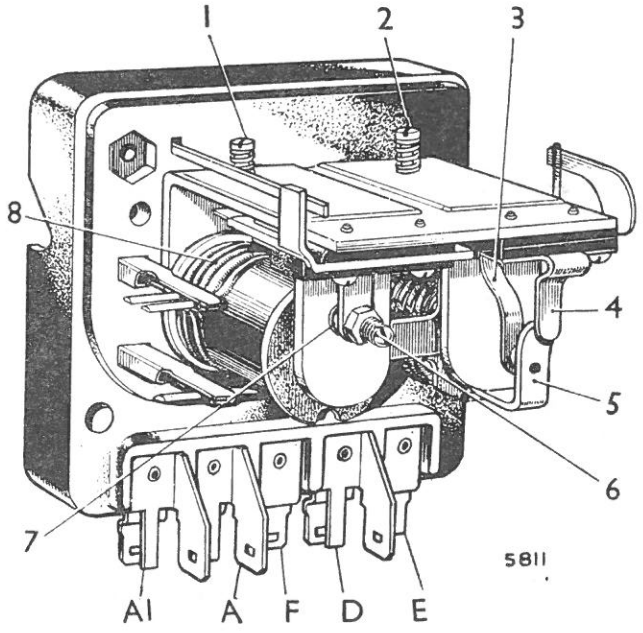


Fig. N.3

The control box

1. Regulator adjusting screw.
2. Cut-out adjusting screw.
3. Fixed contact blade.
4. Stop arm.
5. Armature tongue and moving contact
6. Regulator fixed contact screw.
7. Regulator moving contact.
8. Regulator series windings.

Section N.5

CUT-OUT

Adjustment

Electrical

(1) To check, connect the voltmeter between terminals 'D' and 'E'. Start the engine and slowly increase the speed until the contacts close; this should occur at 12·7 to 13·3 volts.

(2) To adjust, turn the adjusting screw clockwise to raise the voltage and anti-clockwise to reduce it. Turn only a fraction at a time. Make the adjustments as quickly as possible to avoid temperature effects.

Mechanical

(3) Unscrew the cut-out adjusting screw until it is clear of the armature tension spring. Slacken the armature securing screws.

(4) Press the armature down against the copper-sprayed core and tighten the securing screws.

(5) Bend the armature stop arm until the gap between it and the tongue is ·030 in. (·76 mm.) when the armature is pressed squarely against the core face (8) (Fig. N.6).

(6) Bend the fixed contact blade so that there is a gap of ·010 to ·020 in. (·25 to ·50 mm.) between the contact points when the armature is free.

(7) Reset the cut-out adjusting screw.

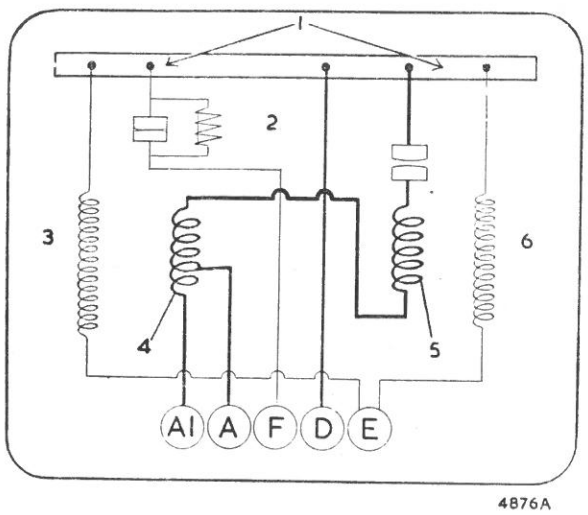


Fig. N.5

The control box (regulator and cut-out) internal connections

1. Regulator and cut-out frame.
2. Field resistance.
3. Shunt coil.
4. Tapped series coil.
5. Series coil.
6. Shunt coil.

Section N.6

LAMPS

Full details of the lamps, bulbs, warning-lights, etc., are given in the Driver's Handbook.

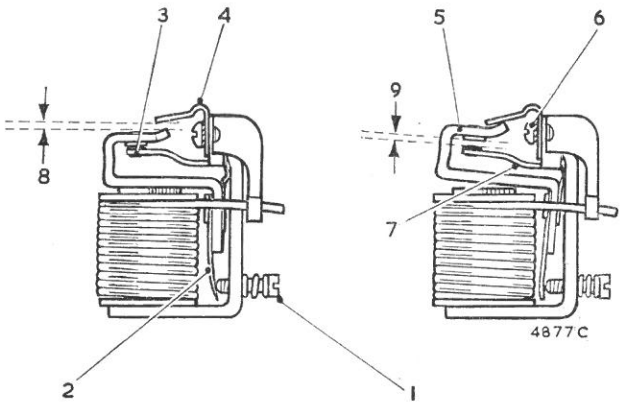


Fig. N.6

Mechanical setting of the cut-out

1. Cut-out adjusting screw.
2. Armature tension spring.
3. 'Follow through'—·010 to ·020 in. (·25 to ·51 mm.).
4. Stop arm.
5. Armature tongue and moveing contact.
6. Armature securing screws.
7. Fixed contact blade.
8. ·030 in. (·76 mm.).
9. ·010 to ·020 in. (·25 to ·51 mm.).

Section N.7

BI-METAL RESISTANCE INSTRUMENTATION

General description

The bi-metal resistance equipment for fuel and temperature gauges consists of an indicator head and transmitter unit connected to a common voltage stabilizer. In both applications the indicator head operates on a thermal principle, using a bi-metal strip surrounded by a heated winding, and the transmitter unit is of a resistance type. The system by which the equipment functions is voltage-sensitive and the voltage stabilizer, which serves one or more gauges, is necessary to ensure a constant supply of a pre-determined voltage to the equipment.

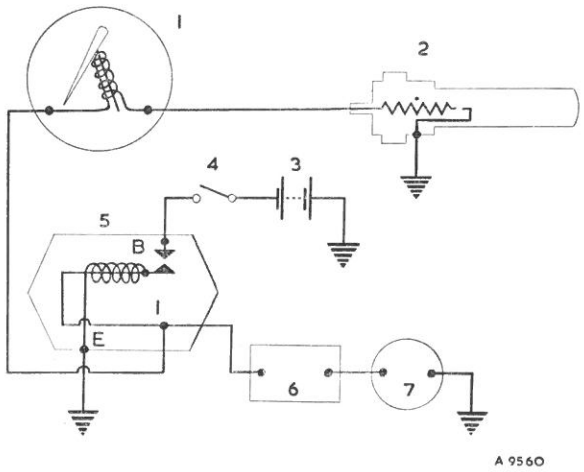


Fig. N.7

The bi-metal resistance instrumentation circuit

1. Temperature gauge.
2. Temperature gauge transmitter.
3. Battery.
4. Ignition switch.
5. Voltage stabilizer.
6. Fuel gauge.
7. Fuel gauge transmitter.

Fault analysis

Voltage stabilizer

Check the mean voltage between the output terminal 'I' and earth, which should be 10 volts.

Substitute voltage stabilizer if faulty.

Gauges

Check for continuity between the terminals with the wiring disconnected. The gauges must not be checked by short circuiting to earth.

Substitute the gauge if faulty.

Transmitter

Check for continuity between terminal and case with lead disconnected.

Substitute transmitter if faulty.

Wiring

Check for continuity between each unit. Check for leak to earth. Check for circuits to earth on wiring to each transmitter. Check terminal wiring for security, earth connections, and wiring continuity. Check that the voltage stabilizer and relating transmitters are earthed.

NOTE.—If the voltage stabilizer is removed it is essential to ensure that, when replacing, B and E are uppermost and not exceeding 20 degrees from the vertical.

Section N.8

WINDSCREEN WIPER MOTOR

Removing

(1) Remove the four nuts securing the rack to the wheelboxes.

(2) Disconnect the electrical connections from the motor.

(3) Remove the three screws securing the motor to the bracket and remove the assembly.

(4) Remove the gearbox cover and withdraw the retaining circlip from the cross-head connecting link pin and lift off the connecting link and rack cable assembly.

Dismantling the motor

(5) Remove the through-bolts and the commutator housing.

(6) Lift the brush unit clear of the commutator and withdraw it. Note the position occupied by each brush so that it may be refitted in its original setting on the commutator.

(7) Access to the armature and field coils is obtained by withdrawing the yoke.

(8) Clean the commutator and brushes, replacing any that are worn. Ensure that the commutator segments are clean; short-circuiting of adjacent segments will cause excessive current consumption. The resistance between segments should be ·29 to ·35 ohms.

Dismantling the gearbox

(9) Carry out instruction (4).

(10) Remove the circlip and washer from the final drive gear shaft located underneath the gearbox casing, and lift out the final drive gear.

(11) The armature can now be withdrawn for cleaning or replacement.

(12) Examine the worm drive of the armature and the teeth of the final drive gear and fit replacements if either are damaged or excessively worn.

Reassembling

(13) Reverse the dismantling procedures, using the following lubricants:

Use Ragosine Listate grease liberally on the cross-head, guide channel, connecting rod assembly worm drive, and on the rack cable and wheelbox assemblies.

Use S.A.E. 20 oil sparingly on the armature and final drive gear bearings.

(14) Ensure that the plain steel washer is placed beneath the connecting rod when assembling the final drive gear crankpin.

(15) The armature end-float adjusting screw should be set to allow an end-float of ·008 to ·012 in. (·2 to ·3 mm.); this is approximately a quarter of a turn clear of the armature thrust pad.

Refitting

(16) Reverse the removing procedure, but before switching on the motor remove the wiper arms from the spindles. Switch on the motor and stop it at the end of the stroke; refit the arms so that they are in the correct parking position.

Section N.9

WINDSCREEN WIPER WHEELBOXES

Removing

(1) Withdraw the wiper arms from the wheelbox spindles, and remove the external securing nuts.

(2) From under the bonnet, slacken the nut securing the rack to the motor. Swivel the wheelboxes through into the engine compartment sufficiently to enable the securing nuts to be removed and release the wheelbox from the rack and cable. Note the location of the flared ends of the Bundy tubing with each wheelbox.

Refitting

(3) Reverse the removing procedure and fit new external sealing grommets if required. Tighten the rack securing nut on the motor.

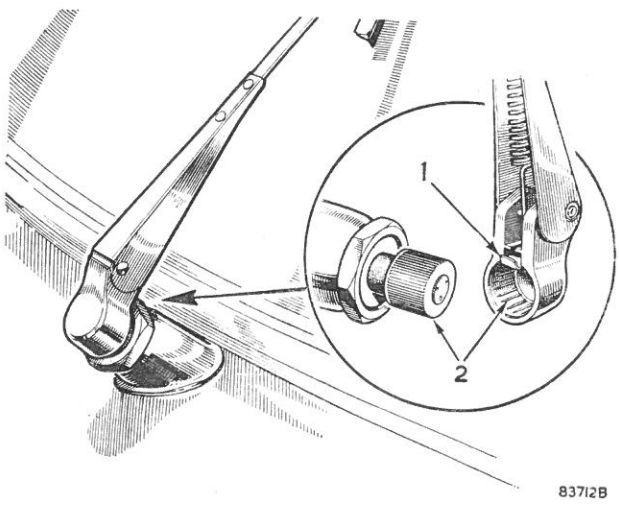
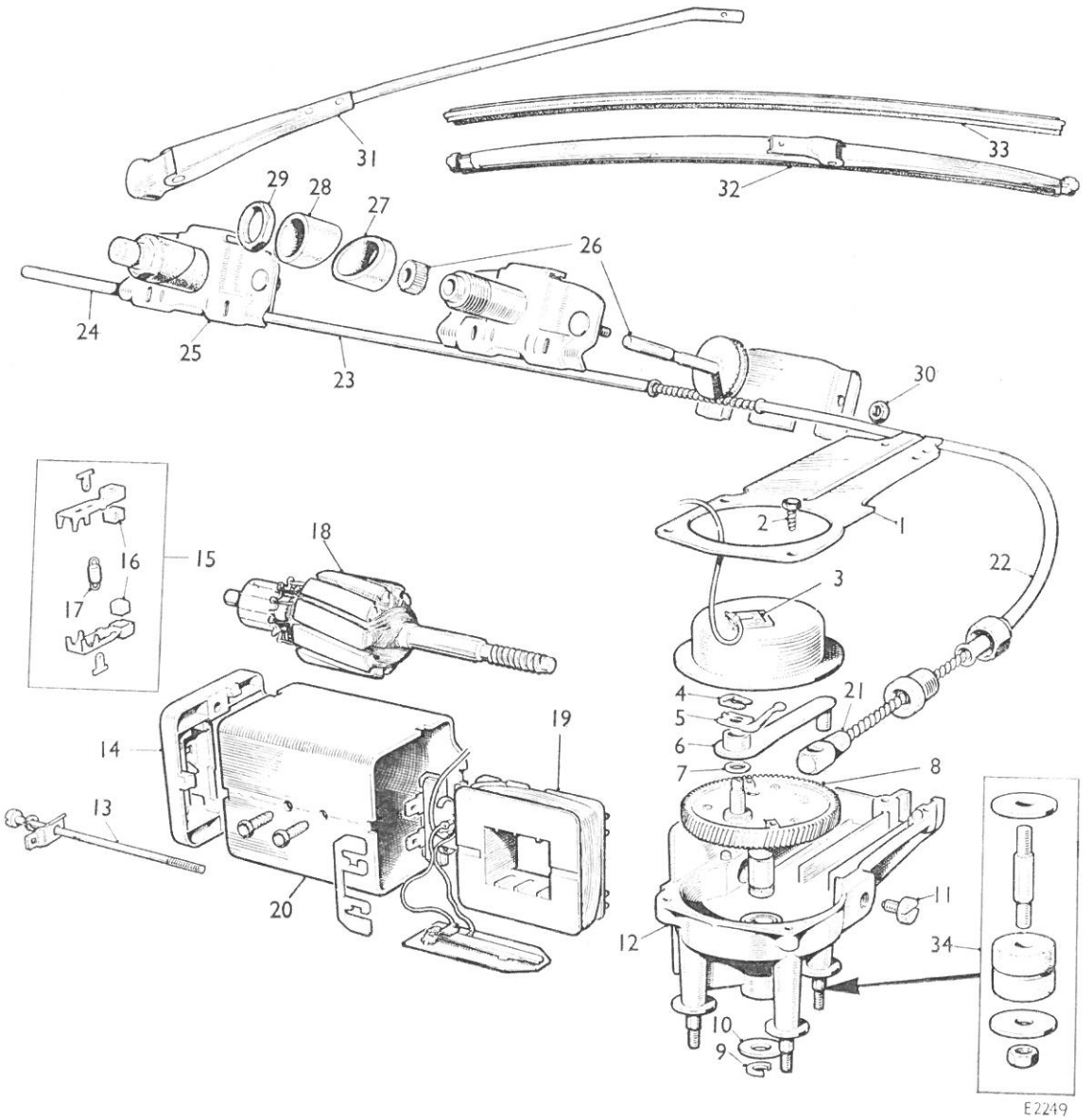


Fig. N.8

Removal and replacement of the windscreen wiper arm

1. Retaining clip. 2. Splined drive.

THE WINDSCREEN WIPER COMPONENTS



No.	*Description*
1.	Gearbox cover.
2.	Gearbox cover securing screw.
3.	Parking switch.
4.	Circlip.
5.	Earth connector.
6.	Cross-head connecting link.
7.	Plain washer.
8.	Final gear.
9.	Circlip.
10.	Plain washer.
11.	Armature end-play screw.
12.	Gearbox.
13.	Bolts.
14.	Commutator end bracket.
15.	Brush assembly.
16.	Brushes.
17.	Brush spring.
18.	Armature.
19.	Field coil.
20.	Yoke.
21.	Cross-head and rack.
22.	Motor to wheelbox—outer casing.
23.	Wheelbox to wheelbox—outer casing.
24.	Wheelbox end—outer casing.
25.	Wheelbox assembly.
26.	Spindle and gear.
27.	Rear bush.
28.	Front bush.
29.	Nut for wheelbox to scuttle.
30.	Nut for wheelbox cover.
31.	Wiper arm.
32.	Wiper arm blade.
33.	Wiper blade rubber.
34.	Motor securing stud assembly.

(4) Switch on the motor and stop it at the end of the stroke. Ensure that the arms are correctly positioned to give maximum wipe area and park at the end of the stroke.

Section N.10

ALTERNATOR SERVICE PRECAUTIONS

The following precautions must be observed when dealing with vehicles fitted with an alternator.

(1) When fitting a replacement alternator ensure that it is of the same polarity as the original. Terminal polarity is clearly marked.

(2) Do not reverse the battery connections. This will damage the alternator rectifiers. Connect up the earth terminal of the battery first.

(3) If a high-rate battery charger is used to charge the battery in position in the vehicle, damage will occur to the regulator if the ignition/starter switch is switched on to the auxiliary position. Detach the connectors from the regulator as a safety measure before boost-charging. Re-connect after charging.

(4) When starting an engine with the aid of a high-rate charger, detach the connectors from the regulator prior to using the charger. Do not re-connect the regulator until the charger is disconnected, and the engine is running at idling speed.

(5) The battery must never be disconnected while the engine is running, nor must the alternator be run with the main output cable disconnected either at the alternator end or the battery end.

(6) The cable connecting the battery and alternator is 'live' even when the engine is not running. Take care not to earth the alternator terminal or the cable end if removed from the terminal.

Do not make or break any connections in the alternator circuit while the engine is running.

(7) Disconnect the alternator and regulator as a safety precaution when arc-welding on the vehicle.

Section N.11

TESTING THE ALTERNATOR CHARGING CIRCUIT IN POSITION

Before commencing the charging circuit tests given below carry out the **'Maintenance'** instructions.

Maintenance

The driving belt must be tensioned so that a deflection of $\frac{1}{2}$ in. (13 mm.) can be obtained under finger pressure at the mid-point of the longest run of the belt.

DO NOT apply leverage to any point if the alternator other than the drive end bracket, or run the engine with the battery or alternator disconnected.

Keep the ventilating holes in the slip-ring end cover clean.

Alternator charging circuit

The following procedure should be adopted to locate a fault in the charging circuit using the test equipment recommended below.

Test equipment required

(*a*) Moving-coil D.C. ammeter, accurate up to at least 60 amps.

(*b*) Moving-coil D.C. voltmeter, scale 0–30 volts (plus one of low range if possible).

(*c*) Ohmmeter—battery powered. Hand-driven generator type must never be used for testing diodes.

Testing

(1) Check the driving belt for wear and tension (see **'Maintenance'**).

(2) Check that the battery voltage is reaching the brush gear by disconnecting the two cables from the alternator field terminals, connect a voltmeter between the two cables and run the engine. The voltmeter should register battery voltage. If no reading is obtained, check the field circuit wiring.

(3) Check alternator output.

Stop the engine and disconnect the battery earth cable (+). If an ammeter is not fitted, disconnect both connectors from the alternator main output terminal 'B' and connect up a moving-coil ammeter between the terminal and the connectors.

Withdraw the cables from the alternator field terminals and connect a pair of auxiliary cables direct between these terminals and the battery (Fig. N.9).

Re-connect the battery earth lead (+). Start the engine and gradually increase speed until the alternator is rotating at 4,000 r.p.m. At this speed the ammeter reading should be approximately 40 amps.

(*a*) Zero reading: Stop the engine. Remove and inspect the brush gear (see **'Inspection'**). Fit new brush gear if necessary and retest. If zero reading persists, remove and dismantle the alternator for detailed inspection.

(*b*) Low reading: Indicates either a faulty alternator or poor wiring circuit connections.

Stop the engine and check the wiring connections. Connect a voltmeter (low range) between the alternator output terminal 'B' and the battery negative (−) terminal, restart the engine and note the reading. Transfer the voltmeter connections to the alternator frame and the battery earth (+) terminal and note the reading.

If either reading exceeds ·5 volt there is high resistance in the charging circuit which must be traced and remedied. Should the test show no undue resistance (although output is low) proceed to dismantle and inspect the alternator.

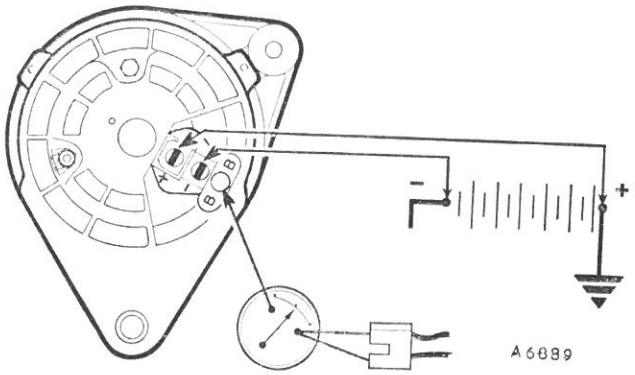


Fig. N.9

Alternator output test connections

Section N.12

DISMANTLING AND OVERHAULING THE 11AC ALTERNATOR

Removing

(1) Disconnect the battery and detach the electrical leads from the alternator.

(2) Slacken the alternator securing bolts, push the alternator towards the engine and detach the driving belt from the alternator pulley. Remove the securing bolts and detach the alternator from the engine.

Dismantling

(3) Remove the securing nut and detach the drive pulley, fan, and key from the armature shaft.

(4) Mark the relative positions of the drive end bracket, the stator lamination pack, and the slip-ring end bracket for correct reassembly.

(5) Remove the through-bolts and detach the drive end bracket and rotor.

The drive end bracket and rotor need not be separated unless the drive end bearing requires examination or the rotor is to be replaced. Remove the rotor from the drive end bracket by means of a hand press having first removed the shaft key and bearing collar.

(6) Remove the terminal nuts, brush box retaining screws, and the heat sink bolt. Withdraw the stator and heat sink from the slip-ring end bracket.

(7) Close the retaining tongues on the brush terminal blades and withdraw the terminals from the brush box.

Inspection

Brush gear

Brushes worn below $\frac{5}{16}$ in. (8 mm). should be replaced.

(*a*) The new brush complete with springs and 'Lucar' terminal blade is pushed into the holder until the tongue registers. To retain the terminal, carefully lever up the retaining tongue with a thin blade.

(*b*) Check that the brushes move freely in their holders. If sluggish, clean brush sides with a petrol-moistened cloth or, if ineffective, lightly polish brush sides with a smooth file. Clean off and re-house.

Slip-rings

Surfaces should be smooth and free of oil or other foreign matter. Clean the surfaces if necessary, using a petrol-moistened cloth or, if there is evidence of burning, very fine glass-paper.

NOTE.—Do not attempt to machine the slip-rings.

Testing

Test equipment required:

(*a*) Moving-coil D.C. ammeter, accurate up to 60 amps.

(*b*) Moving-coil D.C. voltmeter, scale 0–30 volts.

(*c*) Ohmmeter—battery-powered. Do not use a hand-driven generator type for testing diodes.

(*d*) Mains test lamp, 110-volt A.C. ,15-watt.

Rotor

(*a*) Test the rotor windings by connecting an ohmmeter, or a 12-volt battery supply and ammeter in series, between the slip-rings (Fig. N.10). The resistance or current of the field coils should be as given in **'GENERAL DATA'**.

(*b*) Defective insulation between the slip-rings and one of the rotor poles. Use a mains test lamp (110-volt A.C., 15-watt), connect it between one of the slip-rings and rotor poles; if the lamp lights, the coil is earthing. Replace the rotor assembly.

NOTE.—Do not attempt to machine the rotor poles or true a distorted shaft.

Stator

(*a*) Check for continuity of the stator windings. Unsolder the three stator cables from the heat sink assembly (see **'Replacing diode heat sink'**). Connect any two of the three stator cables in series with a 1·5-watt test lamp and a 12-volt battery. Repeat the test, replacing one of the two cables by the third. Failure of the test lamp to light in either test indicates that the stator windings are open circuit. Replace the stator.

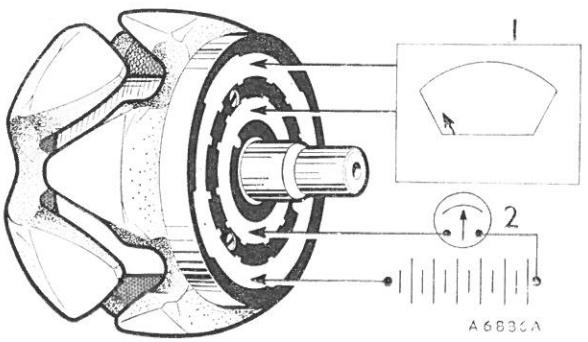


Fig. N.10

Using an ohmmeter (1) *or a battery and ammeter* (2) *to test the resistance or current flow of the field winding*

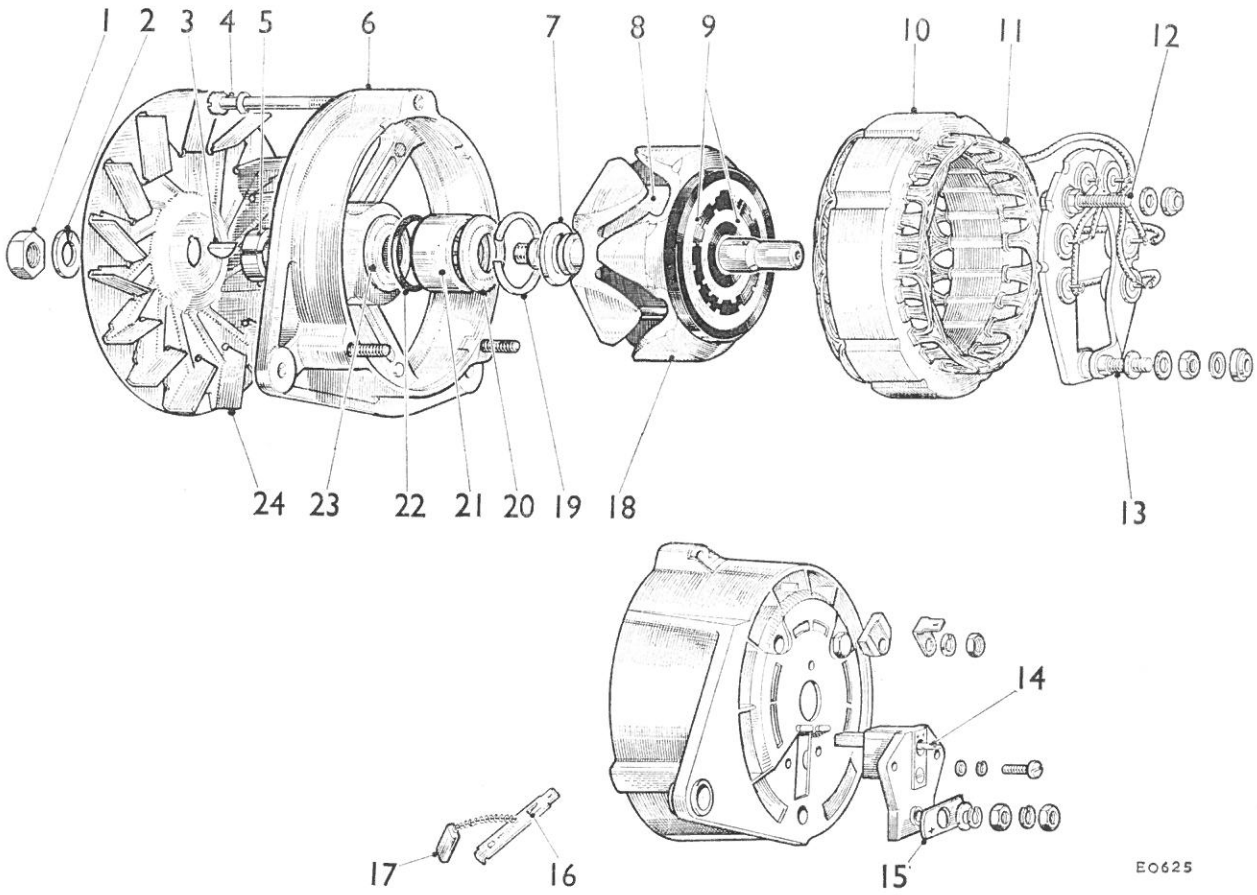


Fig. N.11

Alternator components

1. Shaft nut.
2. Spring washer.
3. Key.
4. Through-bolt.
5. Distance collar.
6. Drive end bracket.
7. Jump ring shroud.
8. Rotor (field) winding.
9. Slip rings.
10. Stator laminations.
11. Stator windings.
12. Warning light terminal.
13. Ball bearing.
14. Field terminal blade.
15. Output terminal plastic strip.
16. Terminal blade retaining tonque.
17. Brush.
18. Rotor.
19. Bearing circlip.
20. Bearing retaining plate.
21. Ball bearing.
22. 'O' ring oil seal.
23. 'O' ring retaining washer.
24. Fan.

(*b*) Test insulation between stator coils and lamination pack with the mains test lamp. Connect the test probes between any of the three cable ends and the lamination pack. If the lamp lights, the stator coils are earthing. Replace the stator.

Carry out the following test before resoldering the stator cables.

Diodes

Test each diode by connecting a 12-volt D.C. supply and a 1·5-watt test lamp in series with each diode in turn as shown in Fig. N.12, and then reversing the connections. Current should flow in one direction only.

Should the bulb light up, or not light at all, in both tests the diode is defective. Replace the appropriate heat sink assembly.

The above procedure is adequate for testing. If, however, a battery-ohmmeter is used, it should be understood that no realistic readings can be obtained. A good diode will yield 'Infinity' in one direction, and a much lower, indefinite reading in the other.

Replacing diode heat sink

The heat sink assembly comprises two mutually insulated portions, one of positive polarity carries cathode-based diodes (marked red), and the other, negative, carries anode-base diodes (marked black).

(*a*) Make the interconnections with 'M' grade 45–55 tin-lead solder.

(*b*) Take great care to avoid overheating the diodes. Lightly grip the diodes pin with a pair of long-nosed pliers, which will act as a thermal shunt, and carry out the soldering as quickly as possible.

(*c*) Arrange the connections neatly around the heat sinks to ensure adequate clearance for the rotor, and secure with a suitable heat-resistant adhesive (Fig. N.13). The three stator connections must pass through the appropriate notches at the edge of the heat sink.

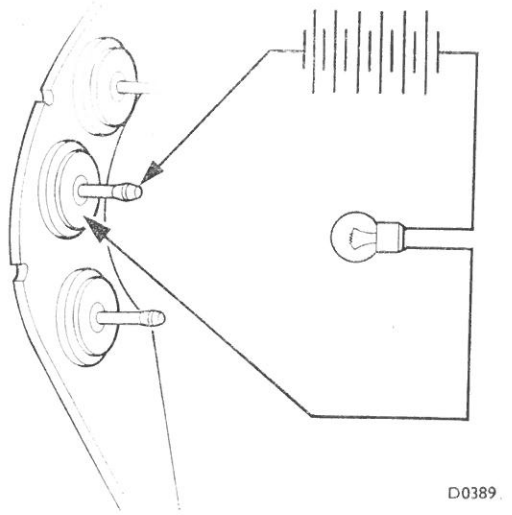


Fig. N.12
Testing the diodes

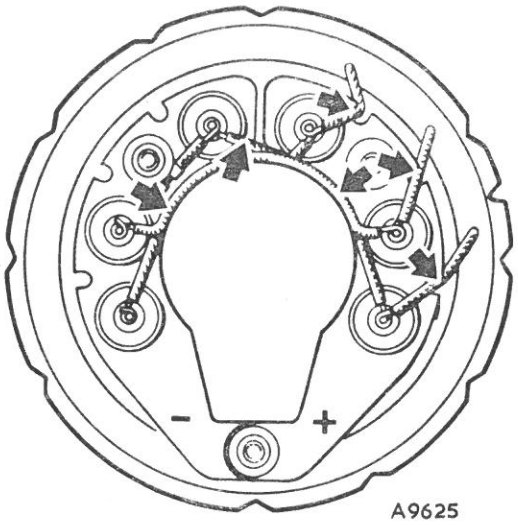


Fig. N.13
The heat sink diode internal connections

Bearings

Renew bearings which allow excessive side play of the rotor shaft.

Bearing—slip-ring end-cover

The needle-roller bearing and slip-ring end cover should be renewed as an assembly; if however a new bearing is to be fitted, follow the procedure below.

(*a*) Check the depth to which the original bearing is pressed into its housing so that the new bearing may be positioned likewise.

(*b*) Support the bearing boss, and press the bearing to the required depth. Pack with high-melting-point grease.

Bearing—drive-end bracket

(*a*) Withdraw the rotor shaft from the drive-end bracket.

(*b*) The bearing retaining plate is secured by either screws, rivets or a circlip.

File away the rivet heads and punch out the rivets; withdraw the screws or extract the circlip.

(*c*) Press the bearing from the bracket.

(*d*) Ensure that the new bearing is clean and pack it with high-melting-point grease. Locate the bearing and press fully into the housing.

(*e*) Refit the bearing retaining plate. When circlip retained, press in enough to allow the circlip to be located.

Re-assembling

(8) Reverse the dismantling procedure, bending the retaining tongues of the field terminal blades out at an angle of 30 degrees before fitting.

(9) Align the marks on the drive-end bracket, stator lamination pack and the slip-ring end-bracket.

(10) Support the inner journal of the drive-end bearing on a suitable tube and press the rotor home. Do not use the drive-end bracket as a support for the bearing while fitting the rotor. Tighten the through-bolts, brushbox fixing screws, and diode heat sink fixings to the correct torque figures (see **'GENERAL DATA'**).

Section N.13

CONTROL UNIT (4TR)

Testing

(1) Check the resistance of the wiring circuits of the alternator, control unit, and battery to control unit, including the relay unit. The resistance should not exceed ·1 ohm.

NOTE.—Do not use an ohmmeter of the type which incorporates a hand-driven generator when checking the rectifiers or transistors.

(2) Check that the battery is fully charged.

(3) Check the voltage output as follows:

(*a*) Connect an accurate voltmeter across the battery terminals and note the reading.

(*b*) Connect an ammeter between the alternator main cable and its terminal 'B' on the alternator.

(*c*) Switch on enough lights to give a load of 2 amps.

(*d*) Start the engine and run for at least eight minutes at an alternator speed of 3,000 r.p.m. until the ammeter reads 10 amps.

(*e*) The voltmeter reading should then be between 13·9 and 14·3 volts. If the reading is unstable or has not risen above the battery voltage renew the control unit. If the reading is stable but outside the correct limits, adjust the control unit.

(4) If adjustment is needed, proceed as follows:

(*a*) Stop the engine, and detach the control unit from its mountings.

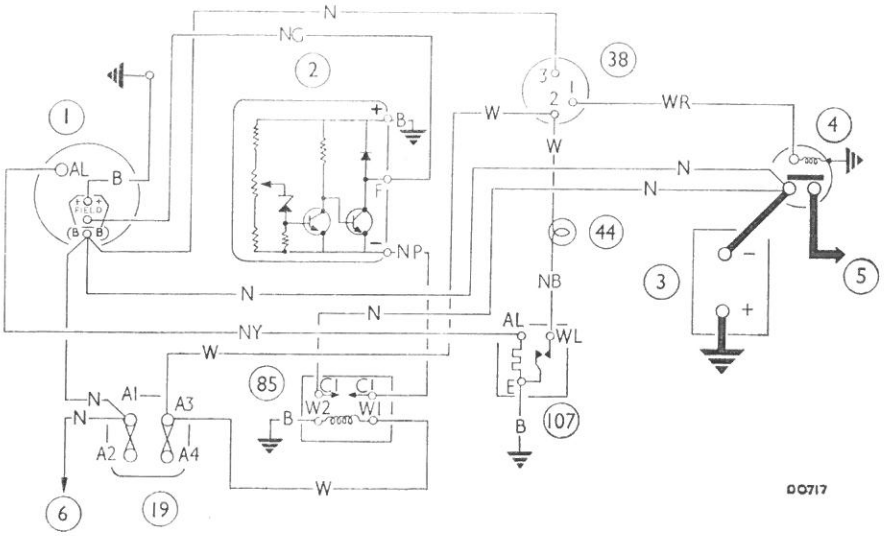


Fig. N.14

The alternator charging circuit

1. Alternator.
2. 4TR control unit.
3. 12-volt battery.
4. Starter solenoid.
5. Starter motor.
6. Lighting switch.
19. Fuse unit; 1–2, 35-amp.; 3–4, 35-amp.
38. Ignition/starter switch.
44. Ignition warning lamp.
85. Alternator field isolating relay.
107. Alternator charge indicator unit 3AW.

(*b*) Scrape out the compound sealing the potentiometer adjustment at the back of the unit.

(*c*) Ensure the connections on the unit are secure and re-start the engine.

(*d*) Run the engine to give an alternator speed of 3,000 r.p.m., with the conditions of test as in (3).

(*e*) Turn the adjuster slot gradually until the voltmeter registers a stable reading within the correct voltage limits (see Fig. N.15). Only a small adjuster movement is needed to effect an appreciable difference in the voltmeter reading.

(*f*) Re-check by stopping the engine, re-starting it and running the alternator at 3,000 r.p.m. Check the voltmeter reading, and when it is correct, refit the control unit and remove the voltmeter and ammeter. Do not attempt to re-seal the adjuster hole. Application of undue heat will damage the control unit.

Section N.14

RELAY

Description

The relay de-energizes the alternator rotor field winding when the engine is stationary by disconnecting the supply from the rotor field immediately the ignition is switched 'off'. This allows contact 'C1' and 'C2' to part and open-circuit the rotor field winding. The alternator will not generate if the contacts fail to close when the ignition is switched 'on'.

Testing

(1) Connect an ammeter as detailed in Section N.11, item (3).

(2) Remove the lead from terminal 'C2' and temporarily join to the 'C1' terminal, ensuring good electrical contact.

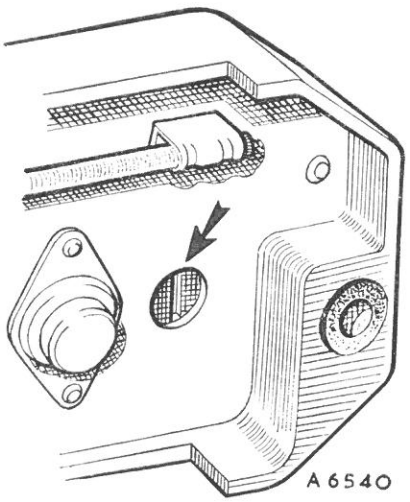


Fig. N.15

The 4TR control unit potentiometer adjuster. Turn clockwise to increase the voltage reading

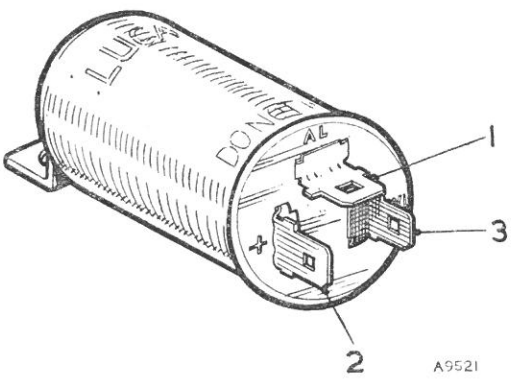


Fig. N.16

Warning light control terminals

1. Alternator 'AL'.
2. Positive '+'.
3. Warning light 'WL'.

(3) If the alternator generates its specified output (with the leads connected as above), the relay is faulty and must be replaced.

Check continuity of relay operating winding, relay circuit wiring, and earth. If the relay and circuit are satisfactory (with cables 'C1' and 'C2' still joined), but no output from the alternator, check the alternator and control unit.

Section N.15

WARNING LIGHT CONTROL

The control is electrically connected to the centre point of one pair of diodes in the alternator and enables a warning light to be used to indicate that the alternator is charging when the engine is running at normal speed.

If proved faulty, replace the unit.