ELECTRICAL EQUIPMENT

SECTION N

INDEX

ELECTRICAL EQUIPMENT

DATA

Battery

	KAH/KAL Models	KAD/KAB Models
Make	Lucas	Lucas
Type	BT11A (Wet) BTZ 11A (Dry)	STXT 19E (Wet) STXTZ 19E (Dry)
Arrangement and location	One 12V battery positioned in a tray immediately behind the headlamp aperture panel on the left hand side of the vehicle	Two 6V batteries connected in series and positioned in battery trays, one on each side immediately behind the headlamp aperture panels on the left and right hand side of the vehicle
Capacity	64 amp.hr. at 10 hr. rate	115 amp.hr. at 10 hr. rate
Voltage	12	12
System	Positive earth	Positive earth

Dynamo

	KAH/KAD/KAL Models	KAB Models
Make	Lucas	Lucas
Type	C.40–1 ventilated type, rotating clockwise viewed from driving end, with a "window-less" yoke	C.45 PV–6 ventilated type, rotating clockwise viewed from driving end, with a "window-less" yoke
Mounting	Bracket mounted to cylinder block, with adjustable strap at front to effect fan belt tensioning	Bracket mounted to cylinder block, with adjustable strap at front to effect fan belt tensioning
Drive	"V" belt from crankshaft pulley	"V" belt from crankshaft pulley
Control of output	Current—voltage control	Current—voltage control
Commutator		
Moulded type		
Minimum diameter	1·450 in. (36·830 mm.)	Not applicable
Insulator undercut		
Width	0·040 in. (1·016 mm.) max.	Not applicable
Depth	0·020/0·035 in. (0·508/0·889 mm.)	Not applicable
Fabricated type		
Insulator undercut		
Width	Full width of insulator	Full width of insulator
Depth	·031 in. (0·80 mm.)	·031 in. (0·80 mm.)
Brush spring tension		
New brush	30 oz. (0·84 kg.) max.	33 oz. (0·92 kg.) max.
Worn brush (see text)	13 oz. (0·36 kg.) min.	25 oz. (0·70 kg.) min.
Performance data		
Cut-in speed	1,450 r.p.m. at 13·0 dynamo volts	1,300 r.p.m. at 13·0 dynamo volts
Maximum output	22 amp. at 2,250 r.p.m. at 13·5 dynamo volts with a resistance load of 0·61 ohm.	25 amp. at 2,050 r.p.m. at 13·5 dynamo volts with a resistance load of 0·54 ohm.
Field resistance	6 ohm.	6 ohm.

Control Box

	KAH/KAD/KAL Models	KAB Models
Make	Lucas	Lucas
Type	RB.340 Combined current—voltage regulator and cut-out relay	RB.340 Combined current—voltage regulator and cut-out relay
Maker's despatch number	37344	37342
Location	Mounted on a raised support plate secured to cab scuttle on left hand side, beneath bonnet	Mounted on a raised support plate secured to cab scuttle on left hand side, beneath bonnet

	KAH/KAD/KAL Models	KAB Models
Setting data		
Voltage regulator		
Open circuit—voltage setting		
Ambient Temperature	Voltage Setting (3,000 d.r.p.m.)	Voltage Setting (3,000 d.r.p.m.)
50°F. (10°C.) ..	14·9–15·5	14·9–15·5
68°F. (20°C.) ..	14·7–15·3	14·7–15·3
86°F. (30°C.) ..	14·5–15·1	14·5–15·1
104°F. (40°C.) ..	14·3–14·9	14·3–14·9
Current regulator		
On-load setting	22±1 amp.	25±1 amp.
Cut-out relay ..		
Cut-in voltage ..	12·7–13·3	12·7–13·3
Drop-off voltage ..	9·5–11·0	9·5–11·0
Resistor values		
Contact (field) resistor—nominal	60 ohm. (colour coded red)	60 ohm. (colour coded red)
Swamp resistor (measured between centre tag and base)—nominal ..	13·75 ohm.	13·75 ohm.
Resistance of shunt windings at 68°F. (20°C.)		
Voltage regulator ..	11·4±0·6 ohm.	11·4±0·6 ohm.
Cut-out relay ..	9·2±0·4 ohm.	9·2±0·4 ohm.

Fuse Unit

	KAH/KAL Models	KAD/KAB Models
Make	Lucas	Lucas
Type	4 FJ Twin fuse	4 FJ Twin fuse
Location	Mounted on a raised support plate secured to cab scuttle on left hand side, beneath bonnet	Mounted on a raised support plate secured to cab scuttle on left hand side, beneath bonnet
Fuse capacity	35 amp.	35 amp.

Starter Motor

	KAH/KAL Models	KAD/KAB Models
Make	Lucas	Lucas
Type	M418G Rotation anti-clockwise viewed from front, commutator end, with an inertia type drive for inboard operation	M45G Rotation anti-clockwise viewed from front, commutator end, with pre-engaged type self-indexing drive
Control type	By hand cable to separate starter switch	By solenoid unit integral with starter motor, which is key actuated from starter and heater switch
Drive type	Inertia "S" type drive for inboard operation	Pre-engaged by "S.7" solenoid unit and self-indexing pinion
Brush spring tension ..	38–40 oz. (1·06–1·12 kg.)	30–40 oz. (0·84–1·12 kg.)
Performance data		
Starter motor		
Lock torque	17 lb. ft. (2·35 kg.m.) with 440–460 amp. at 7·4–7·0 terminal volts	*32·5 lb. ft. (4·49 kg.m.) with 900 amp. at 6·4 terminal volts
Torque at 1,000 r.p.m.	8 lb.ft. (1·10 kg.m.) with 250–270 amp. at 9·4–9·0 terminal volts	*15·5 lb.ft. (2·14 kg.m.) with 570 amp. at 8·8 terminal volts
Light running current	45 amp. at 7,400–8,500 r.p.m.	*90 amp. (including hold-on coil current of 16 amp.) at 8,000–9,000 r.p.m.
		*These figures are based on the use of a fully charged 12 volt battery having a capacity of 128 amp.hr. at 10 hr. rate

	KAH/KAL Models	KAD/KAB Models
Solenoid unit		
Closing coil		
Current (see text) ..	Not applicable	24–28 amp.
Resistance (see text)	Not applicable	0·144–0·166 ohm.
Hold-on coil		
Current (see text) ..	Not applicable	5·1–5·8 amp.
Resistance (see text)	Not applicable	0·688–0·792 ohm.

Ignition Coil

	KAH/KAL Models
Make	Lucas
Type	HA

Distributor.

	KAH Models	KAL Models
Make	Lucas	Lucas
Type	DM2	DM6
Drive	Taken from a gear formed on the camshaft centre journal	Taken from a gear towards the front end of camshaft
Direction of rotation ..	Clockwise viewed from the top, i.e., rotor end	Anti-clockwise viewed from above, i.e., rotor end
Firing angles	0°, 90°, 180°, 270° ±1°	0°, 60°, 120°, 180°, 240°, 300° ±1°
Closed period	60° ± 3°	35° ± 3°
Open period	30° ± 3°	25° ± 3°
Contact breaker gap setting	0·015 in. (0·381 mm.)	0·015 in. (0·381 mm.)
Contact breaker spring tension (measured at contacts)	18 to 24 oz. (510 to 680 grm.)	18 to 24 oz. (510 to 680 grm.)
Capacitor	0·2 microfarad	0·18 to 0·24 microfarad
Test data	Using an Auto Advance Test Rig, check for the following:—	
Setting distributor ..	Run the distributor at less than 100 r.p.m. and set scale to zero degrees	Run the distributor at less than 100 r.p.m. and set scale to zero degrees
Centrifugal advance		
Maximum	Increase speed to 1,800 r.p.m. when maximum recorded centrifugal advance should be 23°	Increase speed to 1,500 r.p.m. when maximum recorded centrifugal advance should be 13°
At decelerating speeds	Reduce speed and check the centrifugal advance at the following decelerating speeds At 1,250 r.p.m. advance to be 20°–23° At 1,050 r.p.m. advance to be 17°–19° At 600 r.p.m. advance to be 9°–11° At 450 r.p.m. advance to be 5°–8° At 300 r.p.m. advance to be 0°–3° At 200 r.p.m. no advance to occur below this speed	Reduce speed and check the centrifugal advance at the following decelerating speeds At 950 r.p.m. advance to be 11°–13° At 800 r.p.m. advance to be 8°–11° At 370 r.p.m. advance to be 0°–3° At 200 r.p.m. no advance to occur below this speed
Vacuum advance		
Maximum	Vacuum advance characteristics should be such as to record 25 in. Hg. against a maximum advance of 6°–8°	Vacuum advance characteristics should be such as to record 17–20 in. Hg. against a maximum advance of 6°
At rising vacuum ..	With a rising vacuum the following test figures should be obtained: At 6 in. Hg. advance to be 0°–0·5° At 10 in. Hg. advance to be 1°–4·5° At 14 in. Hg. advance to be 4·5°–7·5°	With a rising vacuum the following test figures should be obtained: At 9·25–11·25 in. Hg. advance to be 1° At 13–16 in. Hg. advance to be 4°

ELECTRICAL EQUIPMENT

	KAH Models	KAL Models
Ignition Timing—		
Static		
Regular grade fuels	1°–3° (1·2 mm.–3·6 mm.*) B.T.D.C.	5°–7° (8·2 mm.–11·5 mm.*) B.T.D.C.

*The mm. dimension is measured on the rim of the crankshaft pulley (KAH Models), or on the rim of the damper (KAL Models), before the groove on the rim reaches the pointer on the timing cover, on rotation of the crankshaft in a clockwise direction viewed from the front of the engine, and gives the correct crankshaft location for static ignition setting when so positioned. Thus this dimension is used for locating the rim groove the required distance before the pointer on the timing cover, prior to chalk marking, when setting the ignition timing using Method 2, as detailed on page N.40.

Sparking Plug.	KAH Models	KAL Models
Make and type	Champion N.8	Champion N.5
Gap	14 mm. long reach 0·025 in. (0·63 mm.)	14 mm. long reach 0·025 in. (0·63 mm.)

ALL Models

Windscreen Wiper	
Model	Lucas DR.2
Voltage of supply	12
Type of motor	Shunt wound
Armature end play	Adjusting screw in gearbox to be set and locked to give 0·008/0·012 in. (·203/·304 mm.) end play of armature.
Current consumption of motor (less cable rack) measured after 60 seconds	2·7–3·4 amperes
Light running speed measured after 60 seconds	44–50 r.p.m. of the final gear or cycles per minute of the wiper blades.
Maximum permissible force required to move cable rack in outer casing tubes (with blades away from windscreens and rack disconnected at gearbox)	6·0 pounds (2·7 kg.)

ELECTRICAL EQUIPMENT

BATTERY DATA

			BT 11A (Uncharged) BTZ 11A (Dry-charged)		STXT 19E (Uncharged) STXTZ 19E (Dry-charged)	
			Uncharged	Dry-charged	Uncharged	Dry-charged
Voltage			12	12	6	6
Ampere-hour capacity at 10 hr. rate			64	64	115	115
No. of plates per cell			11	11	19	19
Specific gravity of electrolyte Corrected to 60°F. (15·5°C.)	With battery fully charged	Climate ordinarily below 80°F. (26°C.)	1·270–1·290		1·270–1·290	
		Climate ordinarily above 80°F. (26°C.)	1·210–1·230		1·210–1·230	
	Re-charge if below	Climate ordinarily below 80°F. (26°C.)	1·150		1·150	
		Climate ordinarily above 80°F. (26°C.)	1·270		1·270	
*Specific gravity of filling acid			1·210		1·210	
Quantity of electrolyte to **half** fill one 2v. cell			½ pint (·28 litre)	½ pint (·28 litre)	1 pint (·56 litre)	1 pint (·56 litre)
Maximum permissible temperature of electrolyte during external charging		Climate ordinarily below 80°F. (26°C.)	100°F. (37·7°C.)		100°F. (37·7°C.)	
		Climate ordinarily above 80°F. (26°C.)	120°F. (48·8°C.)		120°F. (48·8°C.)	
Initial charge current			4·5 amps.	Not applicable	8·0 amps.	Not applicable
Re-charge current			7·0 amps.	7·0 amps.	13·0 amps.	13·0 amps.

* To produce an electrolyte of these specific gravities, add I part by volume of I·835 S.G. concentrated sulphuric acid to distilled water by volume as shown.

S.G.	
1·270	2·8 parts.
1·210	4·0 parts.

Indications of specific gravity readings. Corrected to 60°F. (15·5°C.)		
State of Charge	Temperature	
	Below 80°F. (26°C.)	Above 80°F. (26°C.)
Fully charged	1·270–1·290	1·210–1·230
Half charged	1·190–1·210	1·130–1·150
Fully discharged	1·110–1·130	1·050–1·070

Note When Taking Specific Gravity Readings.

The specific gravity of electrolyte varies with temperature. The specific gravity readings quoted in these tables are given for an electrolyte temperature of 60°F. (15·5°C.), which is adopted for ease of comparison as the reference temperature. Readings taken when the electrolyte temperature is other than 60°F. (15·5°C.) can be corrected to the reference temperature as follows:—

(*a*) For every 5°F. **below** 60°F. **deduct** 0·002 from the observed reading in the hydrometer to obtain true specific gravity at 60°F.

(*b*) For every 5°F. **above** 60°F. **add** 0·002 to the observed reading in the hydrometer to obtain true specific gravity at 60°F.

The temperature must be that actually indicated by a thermometer immersed in the electrolyte and not the ambient temperature.

ELECTRICAL EQUIPMENT

BATTERY

To Remove.

The two 6 volt batteries fitted to diesel models are mounted separately on trays behind the front grille panel immediately at the rear of each headlamp. Access is obtained by raising the bonnet which will permit battery removal after releasing the cables and unscrewing the wing nuts securing the clamping plate on each battery.

The single 12 volt battery fitted to petrol models is mounted in the same position as the nearside 6 volt battery on diesel models. Access and removal is identical.

Inspection and Overhaul.

1. Remove the vent plugs from the cells and examine the level of the electrolyte. The correct level is to the top of the separator guard (on a 12 volt battery) or the splash guard (on a 6 volt battery). When necessary, add distilled water until this level is reached.

Distilled water must always be used for topping up whenever possible. In an emergency, however, drinking water, clean rain water or melted snow may be used.

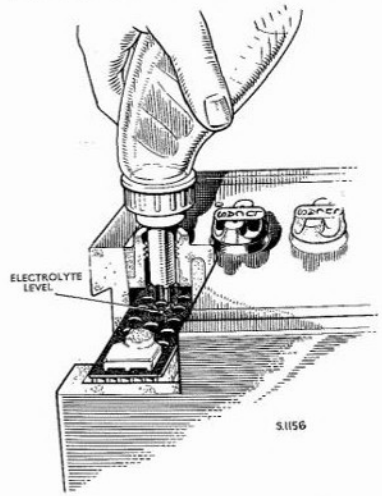


Fig. N.1. Topping-up using the Lucas battery filler

Waters which must **not** be used include, sea or salt water, chlorinated water, chemically softened water or impure water.

If the battery is found to need an excessive amount of topping up, the regulator setting should be checked to ensure that the charge rate is not too high (see "Control Box" sub-section). If one cell in particular requires frequent topping up, the container should be examined for cracks. The use of a Lucas Battery Filler will be found helpful in topping up as it ensures that the correct electrolyte level is obtained automatically and also avoids over-spill (see Fig. N.1).

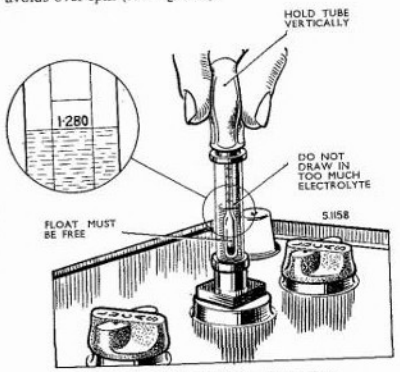


Fig. N.2. Taking the hydrometer readings

Note: (*a*) **Caution.** Never use a naked light when examining a battery, as the mixture of oxygen and hydrogen given off by the battery when on charge, and to a lesser extent when standing idle, can be dangerously explosive.

(*b*) Use a funnel when adding the distilled water to minimise the risk of spilling it on to the top of the battery.

2. Ensure that the air passages in the vent plugs are clear of obstruction.

3. Check the specific gravity of each cell with the aid of a hydrometer. The specific gravity readings and their indications are given under "Battery Data" in this section.

The readings for each cell should be approximately the same. If one cell gives a reading very different from the rest, it may be that the electrolyte has been spilled, or has leaked from one of the cells or there may be an internal fault. **Never transfer the electrolyte from one cell to another.** Examine the condition of the electrolyte in the hydrometer and if the electrolyte is very dirty or contains small particles in suspension, the plates are in a bad condition.

4. Never leave the battery in a discharged condition for any length of time. To re-charge from an external source, charge at the appropriate re-charge current given under "Battery Data" in this section. The charge must be continued until voltage and specific gravity show no increase for three successive hourly readings. During the charge period, the electrolyte level must be kept fully topped up with distilled water.

5. Clean the top of the battery.

6. Examine the battery generally for cracks.

7. Examine the battery support for weakness, especially if the electrolyte has been leaking.

8. Inspect the battery cable terminal posts. If corroded, clean and smear both the posts and the terminals with petroleum jelly.

9. Examine the earth connection to ensure that it is clean and free from rust or corrosion.

Note: If the vehicle is out of use for any length of time, the battery should not be allowed to run down or to remain in a discharged condition. It should be re-charged about every two weeks from an independent supply.

Preparing a New Battery.

Batteries are normally supplied dry and uncharged to the home market and dry-charged to overseas markets. The difference lies in the fact that the latter are dry-charged and sealed before leaving the factory, and when required for service, it is only necessary to fill each cell with electrolyte of the correct specific gravity.

1. To Prepare the Electrolyte. The specific gravity of the electrolyte necessary to fill a new battery is given under "Battery Data". The electrolyte is prepared by mixing distilled water and concentrated sulphuric acid of 1·835 S.G. in the proportions given under "Battery Data". The mixing must be carried out in a lead lined tank or a glass or earthenware vessel. The acid must be added slowly to the water, while the mixture is stirred with a glass rod. **Never add the water to the acid** as the resulting chemical reaction may cause violent and dangerous spurting of the concentrated acid. Heat is produced by the mixture of acid and water. Allow the mixture to cool therefore, before pouring into the battery.

2. Uncharged Batteries. The temperature of the filling-in acid, battery and charging room should be above 32°F. (0°C.). Remove the vent plugs and **half** fill each cell in the battery with electrolyte. The quantity of electrolyte to **half** fill each cell is given under "Battery Data".

Chemical reaction will take place between the dilute acid and the plate, causing heat to be generated. The battery must therefore be allowed to stand for at least six hours before further electrolyte is added, to allow the heat generated by the first filling to be dissipated, thereby avoiding an excessive temperature rise, which would cause damage to the plates and container. After this period, add enough electrolyte to fill each cell to the top surface of the separator guard (on a 12 volt battery) or the splash guard (on a 6 volt battery). Allow to stand for a further two hours and then proceed with the initial charge. The initial charge current is given under "Battery Data". Charge at this constant current until the voltage and temperature-corrected specific gravity readings show no increase over five successive hourly readings, noting the following:

(*a*) Throughout the charge, the electrolyte must be kept level with the top of the separator guard (on a 12 volt battery) or the splash guard (on a 6 volt battery), in each cell by the addition of acid solution of the same specific gravity as the original filling-in acid.

(*b*) If, during the charge, the temperature of the acid in any cell of the battery reaches the maximum permissible temperature (see "Battery Data") the charge must be interrupted and the battery temperature allowed to fall at least 10°F. (6°C.) below the maximum permissible temperature before charging is resumed.

(*c*) At the end of the first charge, carefully check the specific gravity in each cell to ensure that it lies within the limits specified (see "Battery Data"). If any cell requires adjustment, some electrolyte must be syphoned off, and replaced with either acid of the strength used for the original filling-in, or distilled water, according to whether the specific gravity is too low or too high respectively. After such adjustment, the gassing charge should be continued for one or two hours to ensure adequate mixing of the electrolyte. Re-check, if necessary, repeating the procedure until the desired result is obtained. Finally, allow the battery to cool and syphon off any electrolyte above the top of the separator guard (on a 12 volt battery) or the splash guard (on a 6 volt battery).

3. New Dry-charged Batteries. The temperature of the filling room, battery and electrolyte should be maintained between 60°F. (15·5°C.) and 100°F. (37·7°C.). If the battery has been stored in a cool place, it should be allowed to warm up to room temperature before filling.

Carefully break the seals in the cell filling holes and fill each cell with the correct specific gravity acid to the top of the separator guard (on a 12 volt battery) or the splash guard (on a 6 volt battery), in one operation. Batteries filled in this way are up to 90 per cent charged and capable of giving a starting discharge **one hour after filling.** When time permits, however, a short freshening charge will ensure that the battery is fully charged. Such a freshening charge should last for no more than four hours at the normal re-charge rate of the battery as given under "Battery Data". During the charge, the electrolyte must be kept level with the top of the separator guard (on a 12 volt battery) or the splash

guard (on a 6 volt battery) by the addition of distilled water. Check the specific gravity of the electrolyte at the end of the charge, to ensure that the reading is between the limits given in "Battery Data".

To Refit.

Refit in the reverse procedure to that used for removal, smearing the battery posts and the cable terminals with petroleum jelly.

DYNAMO

DESCRIPTION

The dynamo is a ventilated, shunt wound, two pole, two brush unit and is arranged to work in conjunction with the current-voltage control unit. It consists of an armature with a commutator, a field magnet system housed in a yoke (or cylindrical frame) and brush gear. The brush holders are riveted to the commutator end bracket, which also houses the bush for the armature shaft, the other end of the shaft being supported by a ball journal bearing located in the drive end bracket. The two end brackets, which are clamped to the yoke by two through bolts, have ventilation holes, and air is forced through the dynamo by the action of the fan blades on the ventilator situated immediately to the rear of the dynamo pulley. The dynamo is driven, via the pulley by a "V" section belt from the crankshaft pulley.

The dynamo is situated at the front of the cylinder block, on the right hand side on KAH, KAD and KAB Models, and on the left hand side on KAL Models, adjacent to the water pump and is supported by lugs integral with the commutator and drive end brackets. The lugs are bolted to a bracket positioned on the cylinder block, whilst an additional lug at the top of the drive end bracket is secured to a slotted arm, by means of a setscrew, to facilitate fan belt adjustment.

OPERATION

Rotation of the armature in the magnetic field produced by the field magnets induces alternating voltages in the armature windings, which are converted into direct current by the action of the brushes and the commutator. The output of the dynamo is controlled by the current-voltage regulators (see page N.17) and is dependent on the state of charge of the battery, also the loading of the electrical equipment in use. When the battery is in a low state of charge the dynamo gives a high output controlled by the current regulator, whereas if the battery is fully charged, the dynamo controlled then by the voltage regulator, gives only sufficient output to keep the battery in good condition without any possibility of overcharging.

LUBRICATION

Every 6,000 mile (9,000 km.), a few drops of engine oil should be injected into the hole marked "OIL" at the commutator end of the dynamo. The oil is absorbed by a felt ring, which acts as a reservoir and an aluminium ring retainer located behind the felt prevents the entry of dirt on to the bronze bush, which supports one end of the armature (see Fig. N.3).

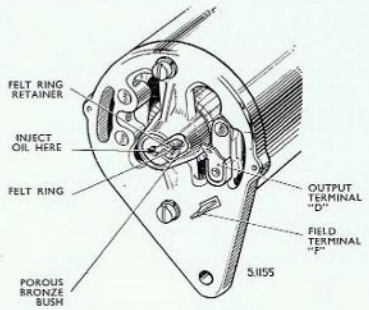


Fig. N.3. Dynamo lubrication

TO TEST THE DYNAMO IN POSITION ON THE VEHICLE

1. Check for correct fan belt tension as detailed in the "Cooling System" section.

2. Check that the dynamo and control box are connected correctly. The large dynamo terminal blade should be connected to the control box terminal blade marked "D" by a yellow cable. The smaller dynamo terminal blade should be connected to the control box terminal blade "F" by a yellow and green cable.

3. Ensure that all the lights and accessories are switched off, then disconnect the yellow and the yellow and green cables from the dynamo terminal blades. Connect these blades with a short length of wire. Start the engine and set it to run at normal idling speed.

4. Clip the negative lead of a moving-coil type voltmeter, calibrated 0–20 volts, to one dynamo terminal and the positive lead to a good earthing point on the dynamo yoke.

5. Gradually increase the engine speed, when the voltmeter reading should rise rapidly without fluctuation. Do not allow the voltmeter reading to reach 20 volts, or race the engine in an attempt to increase the voltage. It is sufficient to run the dynamo up to a speed of 1,000 r.p.m.

(*a*) If the voltage does not rise rapidly and without fluctuation, the dynamo must be dismantled for internal examination.

(*b*) Excessive sparking at the commutator in the above test indicates a defective armature, which should be renewed.

Note: If a radio suppression capacitor is fitted between the output terminal "D" and earth, disconnect this capacitor and re-test the dynamo before dismantling. If the correct voltage response is now given, the capacitor is defective and must be renewed.

6. If the dynamo is in good order, remove the link wire, and restore the original connections to the dynamo. If the reading is correct but the fault still persists, inspect the wiring of the charging circuit, carrying out continuity tests between the dynamo and control box, and if necessary test the control box as detailed on pages N.19 to N.21.

To Remove.

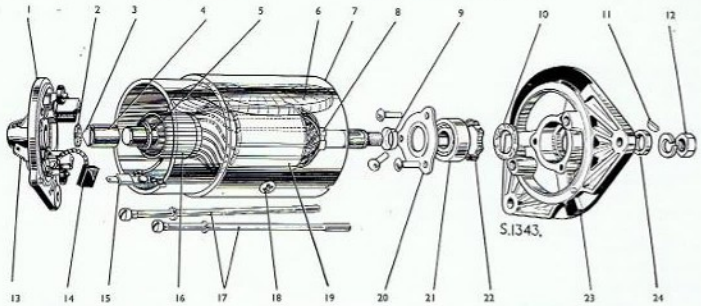
1. Disconnect the battery.

2. Disconnect both dynamo leads at the "Lucar" connectors.

3. Slacken the two securing bolts at the support bracket lugs and also the adjusting strap securings.

4. Pivot the dynamo about the bracket and release the fan belt from the dynamo pulley.

5. Withdraw the securing bolts and adjusting strap setscrew and lift away the dynamo unit.



1 COMMUTATOR END BRACKET
2 FELT RING
3 FELT RING RETAINER
4 POROUS BRONZE BUSH
5 FIBRE 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 BRUSH SET
15 FIELD TERMINAL "F"
16 COMMUTATOR
17 THROUGH BOLTS
18 POLE SHOE SECURING SCREW
19 ARMATURE
20 BEARING RETAINING PLATE
21 BALL BEARING
22 CORRUGATED WASHER
23 DRIVE END BRACKET
24 PULLEY SPACER

Fig. N.4. Details of the C.40–1 dynamo

To Dismantle.

1. Remove the pulley retaining nut, then withdraw the pulley with a suitable tool, followed by the ventilator. On the C45PV–6 type dynamo the ventilator is integral with the pulley.

2. Remove the key from the armature shaft, followed by the spacing collar.

3. Unscrew and remove the two through bolts, which secure both the commutator end bracket and the drive end bracket to the yoke.

4. Remove the commutator end bracket. If a tight fit, lever off carefully with a screwdriver, taking care not to lose the fibre thrust washer(s).

5. The drive end bracket, together with the armature can now be lifted out of the yoke.

6. The drive end bracket need not be separated from the armature shaft unless the bearing is suspect and requires examination, or the armature is to be renewed. In this case the armature should be removed from the drive end bracket by means of a press, supporting the bearing retaining plate firmly whilst the armature shaft is pressed from the drive end journal bearing.

Inspection and Overhaul.

The procedure given in respect of the brush gear and commutator should be carried out every 24,000 mile (36,000 km.) after removing the unit, and dismantling as detailed in paras. 3 to 5 above.

Brush Gear.

1. Raise the brushes up into the brush boxes and retain in that position by positioning the brush springs at the sides of the brushes.

2. Fit the commutator end bracket over the commutator and release the brushes.

3. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is erratic, remove the brush from its holder and clean the sides with a clean, petrol moistened, lintless cloth. If necessary ease the brush sides by lightly

polishing with a smooth file. Always refit brushes in their original positions. If the brushes are badly worn, new brushes must be fitted and bedded to the commutator. The minimum permissible length of brush is pattern (see Figs. N.6 and N.7). Moulded commutators can be recognized by the exposed end being quite smooth, unlike that of fabricated commutators, from which a metal rolled lip and an insulating cone protrude.

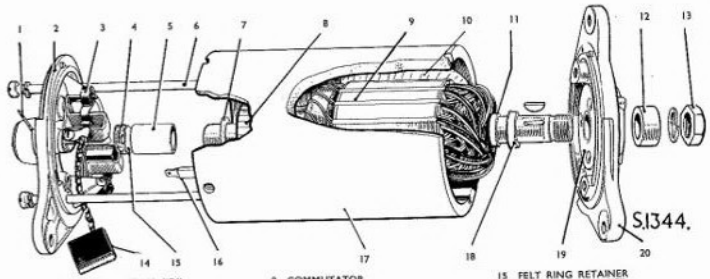


Fig. N.5. Details of the C.45 PV–6 dynamo

$\frac{5}{32}$ in. (7·14 mm.) for the C40–1 type dynamo and $\frac{11}{32}$ in. (8·73 mm.) for the C45 PV–6 type dynamo.

4. Test the brush spring pressures on the C40–1 type dynamo using a spring balance held radially to the commutator. With a commutator diameter of 1·485/1·490 in. (37·719/37·846 mm.), these pressures should be 30 oz. (0·84 kg.) maximum, when exerted on a new brush, and 13 oz. (0·36 kg.) minimum, on a brush worn to $\frac{5}{32}$ in. (7·14 mm.) minimum length. Both pressures should be measured. Fit new springs if the tension is low.

5. Test the brush spring tension on the C45 PV–6 type dynamo using a spring balance held radially to the commutator. The pressure of a new spring on a new brush is 33 oz. (0·92 kg.) maximum and the pressure of a new spring on a brush worn to $\frac{11}{32}$ in. (8·73 mm.) minimum length, is 25 oz. (0·70 kg.) minimum. Both pressures should be measured. Fit new springs if the tension is low.

Commutator.

1. A commutator in good condition will be smooth and free from pits or burned spots. If the commutator condition does not warrant machining, clean the commutator with a clean, petrol moistened, lintless cloth, or fine glass paper according to the degree of commutator deterioration.

2. The commutator on the C40–1 type dynamo may be either of moulded construction or of the fabricated

3. A moulded commutator can be re-skimmed during service, but care must be exercised to ensure that the finished diameter is not less than 1·450 in. (36·830 mm.).

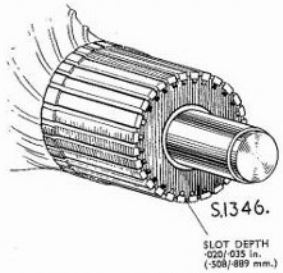


Fig. N.6. Moulded commutator fitted to the C.40–1 dynamo

The process of re-skimming consists of rough turning, undercutting and diamond turning, in that order. Whether or not rough turning is carried out depends upon the severity and unevenness of wear which has taken place. If a moulded commutator cannot be completely cleaned up without going below the specified diameter, the armature should be renewed. The width of undercut slots must not exceed 0·040 in. (1·016 mm.) with a depth of 0·020 in. (0·508 mm.) to 0·035 in. (0·889 mm.). It is important to see that the insulating material is cleared from the sides of each slot to a minimum depth of 0·015 in. (0·381 mm.).

4. To remedy a badly worn **fabricated commutator,** undercut the insulators between the segments to the full width of the insulator and to a depth of ·031 in.

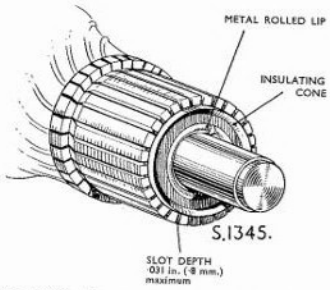


Fig. N.7. Fabricated commutator fitted to the C.40–1 dynamo

(0·80 mm.) then take a light skim with a very sharp (preferably diamond-tipped) tool. If a non-diamond-tipped tool is used for machining, the commutator should afterwards be lightly polished with a very fine glass paper, never emery cloth.

5. Machine the commutator in accordance with the preceding instructions, mounting the armature with or without the drive end bracket fitted, in a lathe. Rotate the lathe mandrel at high speed and take a light cut with the recommended tool.

6. To remedy a badly worn commutator on the C45 PV–6 type dynamo, mount the armature, with or without the drive end bracket, in a lathe, rotate at high speed and take a light cut with a very sharp tool. Do not remove more metal than is necessary. Polish the commutator with a very fine glass paper. Emery cloth must not be used on the commutator. Undercut the insulators between the segments to the full width of the insulators and to a depth of $\frac{1}{32}$ in. (0·80 mm.).

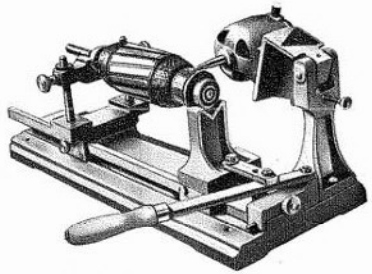


Fig. N.8. Crypton C70 Mica Undercutter

7. The work of undercutting the insulators between the commutator segments is facilitated using preferably the Crypton C.70 Mica Undercutter (see Fig. N.8), observing the remarks made in the proceeding paragraphs relevant to this operation. Proceed to operate the Crypton Mica Undercutter in the following manner:

(*a*) Adjust the "V" supports for height and length by slackening the two knurled headed screws on the rear support to enable the armature to be mounted parallel to the base of the machine.

(*b*) Select the correct width of undercutting saw from the three sizes provided ·010/·015/·025 in. (·254/·381 ·635 mm.) and fit to the motor spindle.

(*c*) By means of the knurled headed screw on the motor stand swivel, set the undercutting saw to the depth required below the surface of the segments.

(*d*) Adjust the correct length of cut required by means of the knurled headed screw, which controls the position of the adjustable stop.

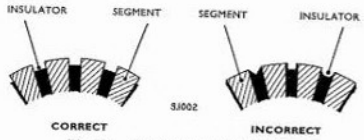


Fig. N.9. Cutting back mica insulators

(*e*) With the saw opposite the first insulator to be undercut, switch on the motor and move the mounted armature along the length of the insulator by operating the handle provided, thus enabling the saw to cut the insulator to the correct depth.

(*f*) When the first insulator is satisfactorily undercut, repeat this operation on the remainder.

(*g*) Alternatively a hacksaw blade, which has been ground to the correct width, relative to the type of commutator construction, may be used.

Armature.

Indication of an open circuit armature winding will be given by burnt commutator segments. The testing of the armature winding requires a volt drop test or the use of a "growler". If this equipment is not available the armature should be checked by substitution. No attempt should be made to machine or true a distorted armature shaft.

Field Coils.

1. Test the field coils without removing them from the dynamo yoke by means of an ohmmeter connected between the field terminal blade and the yoke. The correct reading should be approximately 6 ohms. A high reading indicates a faulty connection or an open circuit in the field winding, whilst a reduced reading indicates an earthed field coil.

2. Alternatively check the field coils by connecting a 12 volt D.C. supply with an ammeter in series between

the field terminal blade and the dynamo yoke. The correct reading on the ammeter should be approximately 2 amperes. No reading on the ammeter indicates an open circuit in the field winding and a higher reading than 2 amperes indicates an earthed field coil.

3. In either case, the field coils should be renewed, or a replacement dynamo fitted. To renew the field coils the following procedure should be carried out using a wheel-operated screwdriver (see Fig. N.10).

(*a*) Remove the rivet securing the field coil terminal blade to the yoke, remove the insulating sleeve from the terminal blade to prevent damage, and unsolder the field coil connections from the terminal blade and the earthing eyelet.

(*b*) Remove the insulation piece, which is provided to prevent the junction of the field coils from contacting the yoke.

(*c*) **Mark the yoke and pole shoes in order that they may be fitted in their original positions.**

(*d*) Unscrew the two pole shoe retaining screws by means of the wheel-operated screwdriver (see Fig. N.10).

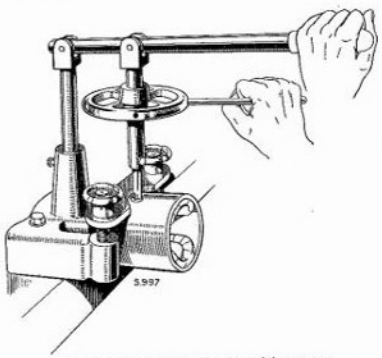


Fig. N.10. Unscrewing the pole retaining screws

(*e*) Draw the pole shoes and coils out of the yoke and lift off the coils.

(*f*) Wipe away all foreign matter from the contacting faces of the pole shoes and yoke, fit the new field coils over the pole shoes and place them in position inside the yoke. Take care to ensure that the tapping of the field coils is not trapped between the pole shoes and the yoke.

(*g*) Locate the pole shoes and field coils by lightly tightening the retaining screws.

(*h*) Fully tighten the pole shoe retaining screws by means of the wheel-operated screwdriver.

(*j*) Refit the insulation piece between the field coil junction and the yoke.

(*k*) Resolder the original terminal blade and earthing eyelet to the appropriate coils ends.

(*l*) Refit the insulating sleeve to the terminal blade and re-rivet the terminal assembly to the yoke.

Bearings.

The dynamo is fitted with a ball journal bearing at the drive end and a porous bronze bearing bush at the commutator end. Bearings that are worn to such an extent that they will allow side movement of the armature shaft must be renewed.

Drive End Ball Journal Bearing.

To renew the journal bearing, adopt the following procedure:

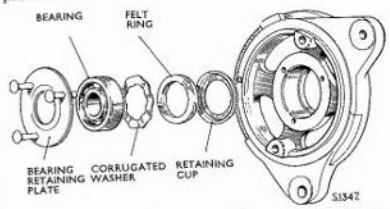


Fig. N.11. Details of the drive end bracket assembly (C.45 PV–6 type dynamo)

1. Drill out the rivets, which secure the bearing retaining plate to the drive end bracket and remove the plate.

2. Press the bearing out of the end bracket, remove and clean the corrugated washer and felt ring. On the C45 PV-6 type dynamo it is also necessary to remove the retaining cup from the end bracket.

3. Before fitting the replacement bearing, see that it is clean and pack with Shell Retinax "A" Grease.

4. Place the retaining cup (C45 PV–6 type dynamo only), felt ring and corrugated washer in the bearing housing on the end bracket.

5. Locate the bearing in the housing and press it into position.

6. Fit the bearing retaining plate. Insert new rivets from the inside of the end bracket and open them, using a punch, to secure the plate rigidly in position.

Commutator End Bearing Bush.

To renew the bearing bush, proceed in the following manner:

1. Remove the old bearing from the commutator end bracket using an extractor. When a suitable extractor is not available use a $\frac{5}{8}$ in. (1·6 cm.) tap for the C40–1 type dynamo, or a $\frac{11}{16}$ in. (1·7 cm.) tap for the C45 PV–6 type dynamo, screwed into the bush for a few turns to provide a purchase for extraction. Screw the tap squarely into the bush to avoid damaging the bracket.

2. Withdraw and clean the felt ring retainer and the felt ring.

3. Insert the felt ring and felt ring retainer into the bearing housing, and then press the new bearing bush

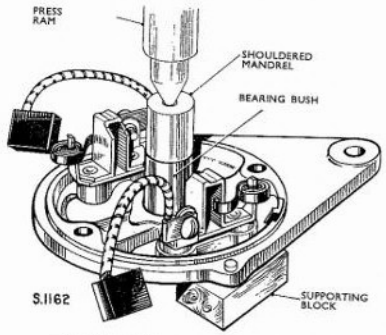


Fig. N.12. Fitting the commutator end bush

into the end bracket using a shouldered, highly polished mandrel of the same diameter as the shaft, which is to fit in the bearing, until the visible end of the bearing is flush with the inner face of the bracket (see Fig. N.12).

Porous bronze bushes must not be reamed after fitting, or the porosity of the bush may be impaired.

Note: Before fitting the new bearing bush it should stand for 24 hours completely immersed in thin oil to allow the pores of the bush to become filled with lubricant. In cases of extreme urgency this period may be shortened to 2 hours if the oil is heated to 212°F. (100°C.) and allowed to cool before removing the bush.

To Re-assemble.

1. Fit the drive end bracket to the armature shaft. The inner journal of the bearing must be supported by a tube, approximately 4 in. (10·16 cm.) long, $\frac{1}{8}$ in. (3·17 mm.) thick, and with a suitable internal diameter, whilst pressing the armature shaft fully home. Do not use the drive end bracket as a support for the bearing while fitting the armature.

2. Fit the yoke to the drive end bracket.

3. Partially withdraw the brushes from their boxes until each brush is trapped in position by the side pressure of its spring (see Fig. N.13).

4. Refit the fibre thrust washer(s) to the commutator end of the armature shaft.

5. Fit the commutator end bracket to the yoke so that the dowel on the bracket locates with the groove in the yoke. Take care not to trap the brush connector leads.

6. Release the brushes on to the commutator with a small screwdriver, or similar tool, inserted through the ventilator apertures positioned adjacent to the brush boxes, when the end bracket is within half an inch of the yoke. Before closing the gap between the end bracket and yoke, see that the springs are in correct contact with the brushes (see Fig. N.13).

7. Refit and tighten the two dynamo through bolts.

8. To complete the dynamo re-assembly, reverse the remaining dismantling procedure.

9. Inject a few drops of engine oil into the hole marked "OIL" at the commutator end of the dynamo (see Fig. N.3).

To Refit.

Refitting is a reversal of the removal procedure. Adjust the dyanmo position to give the correct fan belt tension, as described under the "Cooling System" section.

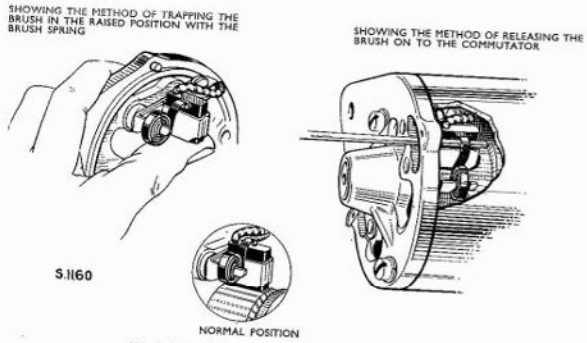


Fig. N.13. Fitting the commutator end bracket

FUSE UNIT AND CONTROL BOX

DESCRIPTION

Fuse Unit.

The fuse unit is mounted adjacent to the control box on a raised support plate, which is in turn attached to the cab scuttle on the left hand side and is accessible upon raising the bonnet (hood). The unit contains two 35 ampere fuses bridging terminals 1 and 2: 3 and 4, the former protects the circuit of the unswitched accessories namely the horn and roof light(s), whilst the latter protects the circuits of all accessories controlled by the ignition switch, e.g. stop lamps, water temperature gauge, fuel gauge, screen wipers, flashing direction-indicators (when fitted) and heater (when fitted). Two spare fuses are provided and a cover prevents the ingress of foreign matter.

Should a short circuit occur in the wiring circuit the fuse will blow. Before renewing the fuse however, the circuit should be examined carefully and the fault rectified.

Control Box.

The control box is mounted adjacent to the fuse unit on the cab scuttle on a raised support plate beneath the bonnet (hood). Control boxes are accurately adjusted during manufacture, after which the cover should not be removed unnecessarily.

The three units comprising the control box, namely, the current regulator, the voltage regulator and the cut-out relay are mounted on an insulator attached to a pressed steel base. The units are enclosed in a moulded cover secured by two screws. A wire wound field resistor is located on the underside of the base and bridged between the current and voltage regulator frames. Five terminal blades are provided on the side of the base and are identified by the letters E, D, WL, F and B marked on the cover. Two terminal blades are provided in the B position, whilst the WL terminal blade is a tapping from the D terminal.

Each unit has a wound core located on a "U" shaped metal frame and operates separate armatures riveted to flat steel springs forming flexible hinges, which are in turn riveted to the rear limb of the metal frames.

Due to the construction of the armatures, the back air gap is fixed and non-adjustable. The contacts are positioned to the rear of the wound cores and lie parallel to the rear limb of each metal frame.

The cut-out relay armature is provided with a back stop, which is secured to the rear limb of the metal frame, behind the wound core.

Riveted to the armatures are tensioning springs, which extend forward to contact the toothed adjustment cams carried on the front limb of each metal frame. Thus with the aid of a setting tool, electrical setting variations are simply made by turning the cams to vary the spring tension acting on the associated armature, except for the cut-out drop-off voltage, which is effected by bending the fixed contact bracket.

The armature-to-bobbin core air gap settings are the only mechanical adjustments to be made on the unit.

The armature tensioning springs maintain the current and voltage regulator contacts in the closed position and the cut-out contact in the open position. The armature hinge on the voltage regulator and the armature tensioning spring on the cut-out relay are reinforced by a bi-metal strip, providing automatic temperature compensation.

Additional protection is given to stabilising the control box settings from the effects of temperature by the inclusion of double swamp resistors in series with the two shunt coils.

The current regulator core incorporates a single low-resistance series coil whilst the voltage regulator core carries a high resistance shunt coil. The cut-out core incorporates a shunt coil and a series coil through which, like that of the current regulator, all charging current flows.

OPERATION

Control Box.

As the voltage regulator is shunt wound and connected across the dynamo terminals, it is responsive only to variation in the dynamo voltage, whilst the current regulator, being connected in series with the load, is affected only by changes in current. The basic function of the cut-out relay is to connect the dynamo to the battery when the dynamo speed is sufficient to provide a voltage higher than that of the battery. It also breaks the circuit when the dynamo voltage falls below that of the battery and in this manner prevents the battery discharging through the dynamo.

Under normal conditions when the battery is not discharged, after the dynamo output reaches the required value and the cut-out contacts close, a further increase in dynamo speed causes a rise in terminal voltage and subsequently the operating voltage setting of the voltage regulator is attained. When this occurs, the magnetic pull of the voltage regulator core attracts the armature and the voltage regulator contacts open, causing the field resistor located underneath the base to be inserted into the dynamo field circuit. The affect of inserting this resistance in the field circuit is to lower the field current and thus reduce the dynamo output. Consequently, the magnetic pull on the armature is reduced and the contacts re-close and short out the field resistor again. This sequence is repeated and starts the regulator armature vibrating, the affect being to limit the dynamo voltage to a predetermined value.

If the battery is discharged or heavy electrical loads are imposed on the system, the dynamo voltage will not rise to the value at which the voltage regulator operates. Therefore another method of controlling the dynamo output to a safe limit is necessary and this is provided by the current regulator. When the current output of the dynamo reaches its maximum rated value, the electro-magnetic effect of the current flowing through the current regulator coil attracts the armature and opens the contacts, thus likewise inserting the field resistor in the field circuit. Consequently the current regulator armature is set into vibration and a safe limit is imposed on the dynamo output.

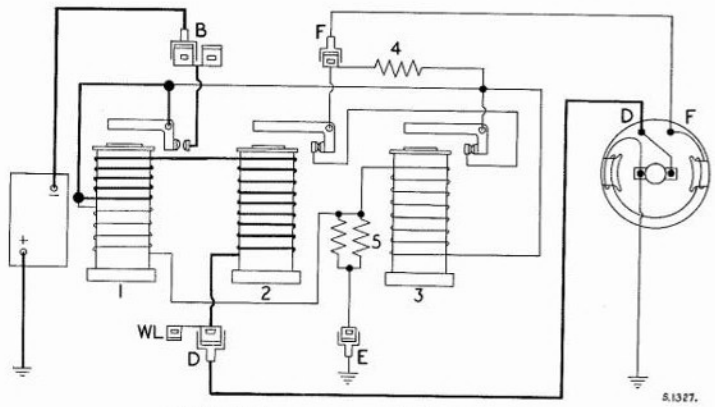


Fig. N.14. Control box circuit

When commencing to charge a flat battery, the current regulator allows the maximum safe dynamo output to pass to the battery and this continues until the battery approaches a charged condition. At this stage, the voltage available is sufficient to bring the voltage regulator into operation, the current value falls and the current regulator ceases to operate. During the change-over period, which exists for approximately thirty seconds, both regulators are in operation.

After the voltage regulator has been brought into operation, the dynamo output diminishes until trickle charge conditions are reached.

To compensate for resistance variations in the shunt coils of the cut-out relay and the voltage regulator, brought about by temperature fluctuations, due in part to ambient temperature conditions and to the normal current passed by the windings, the spring force acting on the armatures of the cut-out relay and voltage regulator is arranged to vary automatically to meet changing conditions. This is effected by the use of a bi-metal strip to fabricate the armature hinge on the voltage regulator, and in the cut-out relay the strip is used to supplement the armature tensioning spring. As the shunt coils of the voltage regulator and cut-out relay warm up during operation, their resistance increases, which reduces the magnetising current flowing through them and weakens the pull on the armature, but this reduction in attraction of the armature is compensated by a reduction in the armature-to-bobbin-core air gap settings due to deflection of the bi-metal strips. The opposite sequence occurs upon cooling and due to the inclusion of the bi-metal strip, compensation for temperature variation is effected.

In addition, the varied requirements of the battery due to temperature changes are provided for by the compensation medium of the bi-metal strips. The tension of the bi-metal strip increases with a fall in temperature and decreases with a rise in temperature. Thus, this arrangement when applied to the voltage regulator, permits a higher charging rate to be maintained during cold weather and a correspondingly lower charge rate during warm weather.

Additionally the effects of temperature change, which can cause fluctuation to the control box settings, is reduced further by the use of double swamp resistors connected in series with the two shunt coils. The resistor has a higher ohmic value than the shunt coils and is made of an alloy material which has electrical resistance properties much less susceptible to changes in temperature than those of copper. The current regulator is not compensated, since the resistance of its operating coil is too low to vary significantly with changes in temperature.

TESTING TO LOCATE A FAULT IN THE CHARGING CIRCUIT

If the procedure given on page N.11 proves that the dynamo and wiring is in order, proceed to check as follows:—

1. Check the battery by substitution or with an hydrometer and a heavy discharge tester.

2. Ensure that the wiring between the battery and control box is correct by disconnecting the two brown wires and connectors from the "B" terminal blades on the control box. Connect the ends to the negative terminal of a voltmeter. The positive terminal of the voltmeter should then be connected to a good earthing point on the chassis. If the voltmeter gives a reading the wiring is in order and the control box must be examined.

3. If there is no reading, examine the wiring between the battery and the "B" terminal on the control box for broken wires or loose connections.

4. Re-connect the wire connectors to the "B" terminals on the control box.

5. Check the earth connections, particularly that of the control box.

6. In the event of reported undercharging, ascertain that this is not due to low mileage.

CHECKING AND ADJUSTING THE CONTROL BOX WHILST IN POSITION

The settings on the voltage regulator, current regulator and cut-out relay should be carried out as a complete sequence. The setting of one unit only is not recommended.

Regulator Adjustment.

The current-voltage regulators are carefully set during manufacture and in general, it should not be necessary to make further adjustments. If however, the battery does not keep in a charged condition, or if the dynamo output does not fall when the battery is fully charged, the setting should be checked and, if necessary, corrected.

It is important before altering the regulator setting to check that the low state of charge of the battery is not due to a battery defect or to slipping of the dynamo drive belt.

Voltage Regulator.

Checking and adjusting should be completed as rapidly as possible to avoid errors due to heating of the shunt coil.

To Check.

1. Disconnect the cables from the control box terminal blades "B". The disconnected cables must be linked together using a short length of cable.

2. Connect a first-grade O–20 moving-coil voltmeter between the control box terminal blade "D" and a good earthing point.

3. Start the engine and run the dynamo at 3,000 dynamo r.p.m.

4. Observe the voltmeter pointer.

5. The voltmeter reading should be steady and lie between the appropriate limits given below according to the ambient temperature. An unsteady reading may be due to unclean contacts.

Ambient Temperature	Open Circuit Voltage Setting
50°F. (10°C.)	14·9 – 15·5
68°F. (20°C.)	14·7 – 15·3
86°F. (30°C.)	14·5 – 15·1
104°F. (40°C.)	14·3 – 14·9

6. If the voltmeter occurs outside the given limits, the voltage regulator must be adjusted.

To Adjust.

To adjust the voltage regulator to the correct open circuit voltage setting continue as follows:—

1. Disconnect the cables from the control box terminal blades "B". The disconnected cables must be linked together using a short length of cable.

2. Connect a first-grade 0–20 moving coil voltmeter between the control box terminal blade "D" and a good earthing point.

3. Remove the control box cover.

4. Start the engine and run the dynamo at 3,000 dynamo r.p.m.

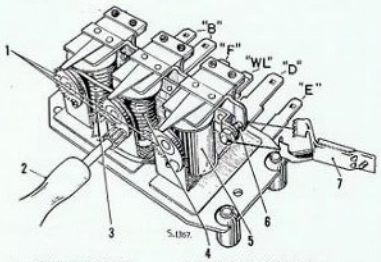
5. Using the setting tool, (Lucas Part No. 54381742) turn the voltage regulator adjustment cam until the correct setting is obtained, turning the tool clockwise to raise the voltage setting, or anti-clockwise to lower the setting.

6. Check the voltage setting by stopping the engine, then re-start and again raise the speed to 3,000 dynamo r.p.m.

7. If the setting is now within the required limit, restore the original connections and refit the cover.

Current Regulator.

The dynamo must be made to develop its maximum rated output, whatever the state of charge of the battery might be at the time of setting. The voltage regulator must therefore be rendered inoperative, and this is the function of the bulldog clip used in keeping the voltage regulator contacts together.



1 ADJUSTMENT CAM
2 SETTING TOOL
3 CUT-OUT RELAY
4 CURRENT REGULATOR
5 VOLTAGE REGULATOR
6 VOLTAGE REGULATOR CONTACTS
7 BULLDOG CLIP

Fig. N.15. Current regulator adjustment

To Check.

1. Remove the control box cover.

2. Using a bulldog clip, short out the voltage regulator contacts (see Fig. N.15).

3. Disconnect the cables from the control box terminal blades "B". Using a suitable "jumper" lead, connect the cables removed to the load side of a first-grade 0–40 moving-coil ammeter and connect the other side of the ammeter to one of the control box terminal blades "B". It is important to ensure that the terminal blade "B" carries only the one connection from the test ammeter, all other load connections must be made to the battery side of the ammeter.

4. Switch on all the lights of the vehicle (the lamp load is necessary to enable the dynamo to develop full rated output).

5. Start the engine and run the dynamo at 4,500 dynamo r.p.m.

6. Observe the ammeter pointer.

7. The ammeter pointer should be steady and indicate a current equal to the on-load setting given below, which is equivalent to within ±1 amp. of the maximum rated output of the dynamo. An unsteady reading may be due to unclean contacts.

On-Load Setting.

The current regulator on-load setting is equal to within ±1 amp. of the maximum rated output of the dynamo, as given in the following:—

Dynamo Type	Control Box No.	On-load Setting
C.40–1	37344	22 ±1 amperes
C.45 PV–6	37342	25 ±1 amperes

8. If the ammeter reading occurs outside the given figure, the current regulator must be adjusted.

9. If the ammeter reading is correct, stop the engine, refit the control box cover and restore the original connection.

To Adjust.

To adjust the current regulator to the correct on-load setting, carry out the operational sequence detailed as follows:—

1. Remove the control box cover.

2. Using a bulldog clip, short out the voltage regulator contacts. (see Fig. N.15).

3. Disconnect the cables from the control box terminal blades "B". Using a suitable "jumper" lead, connect the cables removed to the load side of a first-grade 0–40 moving-coil ammeter and connect the other side of the ammeter to one of the control box terminal blades "B". It is important to ensure that the terminal "B" carries only the one connection from the test ammeter, as all other load connections must be made to the battery side of the ammeter.

4. Switch on all the lights of the vehicle (the lamp load is necessary to enable the dynamo to develop full rated output).

5. Start the engine and run the dynamo at 4,500 dynamo r.p.m.

6. Observe the ammeter pointer.

7. Using the setting tool, (Lucas Part No. 54381742) turn the current regulator adjustment cam until the correct setting is obtained, turning the tool clockwise to raise the amperage setting, or anti-clockwise to lower.

8. Stop the engine and restore the original connections.

9. Refit the cover.

Cleaning Regulator Contacts.

After long periods of service, it may be found necessary to clean the regulator contacts with a fine carborundum stone or fine emery cloth. Carefully wipe away all traces of dirt or foreign matter with methylated spirits.

Cut-out Relay.

Checking and adjusting should be completed as rapidly as possible to avoid heating errors.

Voltage Cut-in Setting.

To Check.

1. Connect a first-grade 0–20 moving-coil voltmeter between the control box terminal blade "D" and a good earthing point.

2. Switch on an electrical load, such as the headlamps.

3. Start the engine and slowly increase the engine speed.

4. Observe the voltmeter pointer.

5. Closure of the contacts, indicated by a slight drop in the voltmeter reading, should occur between the limits given below.

Cut-in Voltage 12·7—13·3

6. If the cut-in occurs outside the given limits, an adjustment must be made.

7. If the voltmeter reading is correct, stop the engine and remake the original connections.

To Adjust.

To adjust the cut-out relay cut-in voltage setting, proceed in the following manner:

1. Remove the control box cover.

2. Connect a first-grade 0–20 moving-coil voltmeter between the control box terminal blade "D" and a good earthing point.

3. Switch on an electrical load, such as the headlamps.

4. Start the engine and slowly increase the engine speed.

5. Observe the voltmeter pointer.

6. Using the setting tool, (Lucas Part No. 54381742) turn the cut-out relay adjustment cam until the correct setting is obtained, turning the tool clockwise to raise the setting, or anti-clockwise to lower the setting and checking after each adjustment by increasing the engine speed and noting the voltmeter reading at which contact closure occurs.

7. Stop the engine, restore the original connections and refit the cover.

Voltage Drop-off Setting.

To Check.

1. Disconnect the battery cable from the control box terminal blade "B" and connect a first-grade 0–20 moving-coil voltmeter between this terminal blade and earth.

2. Start the engine and run up to speed.

3. Slowly decelerate and observe the voltmeter pointer.

4. Opening of the contacts, indicated by the voltmeter pointer dropping to zero, should occur between the limits given below.

Drop-off Voltage 9·5—11·0

5. If the drop-off occurs outside the given limits, an adjustment must be made.

To Adjust.

To adjust the cut-out relay drop-off voltage setting, proceed as follows:—

1. Disconnect the battery cable from the control box terminal blade "B" and connect a first-grade 0–20 moving-coil voltmeter between this terminal blade and earth.

2. Remove the control box cover.

3. Start the engine and run up to speed.

4. Slowly decelerate and observe the voltmeter pointer. Stop the engine.

5. Adjust by carefully bending the fixed contact bracket. Reducing the contact gap will raise the drop-off voltage. Increasing the gap will reduce the drop-off voltage.

6. Repeat the operation as detailed in paras. 3 and 4, and, if necessary, re-adjust until the correct drop-off setting is obtained.

7. Stop the engine, restore the original connections and refit the cover.

Cleaning Cut-out Contacts.

If the contacts appear burnt or dirty, place a strip of fine glass paper between them. Close the contacts by hand and draw the paper through. Repeat this two or three times with the rough side towards each contact. Wipe away all dust or other foreign matter, using a clean lintless cloth, moistened with methylated spirits. **Do not** use emery cloth or a carborundum stone for cleaning cut-out contacts.

Current and Voltage Regulator Core Gaps.

To Adjust.

1. Using the setting tool, turn the adjustment cam to the point giving minimum lift to the armature tensioning spring, i.e., by turning the tool to the fullest extent anti-clockwise.

2. Slacken the adjustable contact locking nut and screw back the adjustable contact.

3. Insert a feeler gauge of ·045 in. (1·14 mm.) thickness between the armature and the copper separation on the core face, taking care not to turn up or damage the copper shim.

4. Retaining the gauge in position and pressing down on the armature, screw in the adjustable contact until it just touches the armature contact.

5. Retighten the locking nut and withdraw the gauge.

6. Carry out the electrical setting, as previously detailed.

Cut-out Relay Contact "Follow-through" and Core Gap.

To Adjust.

1. Press the armature squarely down against the copper separation on the core face.

2. Adjust the fixed contact bracket to give a "follow-through", or blade deflection, of the moving contact of ·010/·020 in. (·254/·508 mm.).

3. Adjust the armature back stop to give a core gap of ·035/·045 in. (·89/1·14 mm.).

STARTER MOTOR

DESCRIPTION

Starter Motor.

The starter motor is a four-pole four-brush unit of similar construction to the dynamo except that heavy copper wire is used in the construction of the armature and field windings. The field coils are series-parallel connected between the field terminal and the insulated pair of brushes.

The motor consists mainly of a cylindrical frame, or yoke, containing the field coils and pole shoes, between which rotates the armature. The field coils seated around the pole shoes are located at right angles to each other in opposing pairs, whilst the armature is carried in two porous bronze bushes, one pressed into each end bracket on the M418G type starter motor, whilst on the M45G type, the armature is additionally supported in an indented bronze bearing in the intermediate bracket. The end brackets are secured to the yoke by through bolts. Brush gear is carried on the commutator end bracket.

Starter Drive Assembly.

Incorporated in the M418G type starter motor is an inertia operated pinion drive designed to crank the engine and automatically disengage when the engine starts, whilst on the M45G type starter motor a solenoid operated pre-engaged, self-indexing drive assembly ensures:—

(*a*) Positive pinion engagement, thus preventing the pinion being thrown out of mesh whilst starting.

(*b*) Dual purpose plate clutch incorporated in the drive assembly giving over-speed and over-load protection.

(*c*) Self-indexing pinion to ensure smooth engagement between the pinion and the flywheel teeth before the starting motor begins to rotate.

(*d*) Armature braking system to ensure rapid return to rest when the starter switch is released.

The inboard type drive of the M418G starter motor is mounted on the splined end of the extended armature shaft. A plain sleeve locating the restraining spring abuts the drive end bush journal. The helical splined sleeve is in contact with the opposite end of the plain sleeve, whilst the end of the restraining spring registers in a collar that abuts the pinion. The helical drive sleeve which carries the pinion, is splined to the armature shaft and retained by means of a washer, main spring and nut, the nut being split pin secured.

The pre-engaged self-indexing drive employed on the M45G type starter motor comprises mainly of a driving sleeve, moving member and clutch plates, all of which are enclosed in a barrel unit. A spring loaded drive pinion is carried on the helical splined sleeve of the barrel unit.

Helical splines machined on the larger diameter of the driving sleeve register in similar internal splines on the moving member. The action of these components provides for the engagement and release of the clutch plates in accordance with the pinion drive and free-wheel requirements, and gives protection to the starter motor during over-speed and over-load conditions.

The internal ears formed on the clutch inner plates register with parallel splines in the moving member, whilst similarly, the external ears formed on the clutch outer plates mate with parallel splines in the barrel unit. A lock ring retains the engagement bush split halves and the retaining washer to one end spigot of the driving sleeve. The assembly of support plate, clutch plates, shim, backing ring, that locate on the moving member, are secured to the opposite threaded end spigot of the driving sleeve by means of two pressure plates and a nut. A thrust washer is interposed between the driving sleeve and the barrel unit inner face. The complete clutch assembly is retained in the barrel unit by means of a circlip.

A protrusion in the form of a helical splined sleeve cleated to the leading end of the barrel unit, carries the cushion spring and pinion, which are retained by a ring, rivet located. The internal bushed bore of the helical splined sleeve runs on the plain portion of the extended armature shaft, whilst the driving sleeve is internally splined and mates with the splined portion of the armature shaft, thus provision for longitudinal movement of the complete drive assembly along the shaft is made in this way, controlled by the solenoid unit, via the engagement lever.

Thus the drive at the pinion is controlled by the clutch mechanism, whilst the starter drive is engaged by the solenoid unit, which also energises the starter motor once the pinion is in mesh with the starter ring.

The solenoid unit is mounted to the drive end bracket and lies parallel to the yoke and above the motor.

A copper link connects the "STA" terminal on the solenoid to the field terminal on the yoke. Two coils are contained in the solenoid unit, a closing coil which is by-passed when the plunger is drawn fully home, and a hold-on coil that retains the plunger in the full-home position. The plunger return spring ensures the full-return of the plunger when the coils are de-energised. Movement of the plunger is relayed to the moving contact disc by means of a push rod. The contact disc is spring loaded on to the push rod, thus any excess travel of the plunger and push rod is absorbed after closure of the contacts. A slotted spring cup is registered in a groove on the push rod, whilst the washer, spring, contact disc adaptor, moving contact disc and fibre washer are positioned over the rod. The washer and spring locate in the spring cup and a second small spring cup, slot located retains the components on to the push rod. A small plain washer and spring seat in the second spring cup and the free spring end registers in the moulded cover. Terminals are housed in the moulded cover to terminate the leads from the coils, providing also external connection for the starter switch lead, battery negative cable and the copper link to the starter motor field terminal.

OPERATION

M418G Starter Motor fitted with Inertia type Drive.

When the starter switch is operated, a heavy current flows from the battery to the starter motor through the connecting cable. The current then flows around the armature and field windings imparting a strong torque action on to the armature, thus producing rapid acceleration of the helical splined drive sleeve. This sudden axial movement conveyed to the sleeve, results in the latter turning inside the pinion, owing to the inertia of the pinion, causing the pinion to move along the sleeve into engagement with the flywheel starter ring and crank the engine. When the pinion is fully meshed further lateral movement of the pinion is prevented by the spring loaded collar contacting the flange of the plain sleeve. Since the drive sleeve is a sliding fit on the shaft splines, it can move against the resistance of the main spring, thus in this manner initial shock loading of pinion engagement is absorbed.

As soon as the engine fires and commences to run under its own power, the flywheel will be driven faster by the engine than the starter. This will cause the pinion to be screwed back along the sleeve, so drawing

the pinion out of mesh with the starter ring teeth. In this manner the drive safeguards the starter against damage due to being driven at high speeds. The pinion restraining spring prevents the pinion vibrating into mesh whilst the engine is running.

M45G Starter Motor fitted with Pre-engaged, Self-indexing Drive.

When the starter switch is operated the solenoid is energised, the engagement lever is actuated, which moves the drive assembly along the shaft thus engaging the pinion with the flywheel starter ring.

In the event of tooth-to-tooth engagement the forward movement of the pinion is arrested while the helical splined sleeve continues to move forward. This rotates the pinion relative to the flywheel starter ring. When the teeth become aligned, the compressed cushion spring slides the pinion into mesh with the starter ring teeth.

When the pinion is fully engaged with the starter ring teeth, a pair of contacts are closed in the moulded cover of solenoid unit. This causes a heavy current to flow from the battery to the motor when the armature shaft commences to rotate.

When the armature shaft rotates the drive, torque is transmitted from the shaft through the clutch driving sleeve, plate clutch assembly and barrel unit, to the pinion in mesh with the starter ring. The clutch is engaged by pressure from the moving member, which rides up the helical splines on the driving sleeve when the armature shaft rotates. This movement clamps the clutch plates together and torque is transmitted to the pinion, which commences to crank the engine.

When the engine fires and the starter switch is released, the solenoid unit is de-energised and the spring-loaded plunger withdraws the drive assembly to its out-of-mesh position. The armature is brought rapidly to rest by the centrifugal action of a pair of spring loaded brake shoes bearing against a brake drum inside the intermediate bracket.

If, after the engine fires, the torque reverses direction, the moving member releases its pressure on the clutch plates and the clutch automatically disengages and releases the armature shaft therefore only the pinion and barrel unit are driven by the engine. Thus the starting motor armature is protected from over-speeding by the plate clutch assembly. This clutch allows torque to be transmitted from the starting motor to the engine, but not in the reverse direction, which is free-running.

If the clutch is overloaded, it slips at a torque two or three times greater than the maximum developed by the motor. This overload protection feature is effected by shim-setting the engagement pressure on the clutch plates. When the moving member exerts pressure on the clutch plates, the pressure plates are compressed by the backing ring. This compression determines the amount of torque which can be transmitted by the clutch plates, and is pre-set by shims inserted between the backing ring and the clutch plates. Back firing is a typical example of overloading.

Provision is made to ensure that in the case where the pinion is jammed in mesh (this may occur when the engine fails to start), there is sufficient slack in the engagement lever-to-solenoid plunger linkage to permit the solenoid switch contacts to open.

TO TEST IN POSITION

If the starting motor does not operate or fails to crank the engine when the starter switch is actuated, switch on the head lamps (or connect a moving-coil 0–20 voltmeter between the battery terminals) and again use the starter switch and observe for the following symptoms:

M418G Starter Motor.

1. The lamps dim (or the voltmeter reading falls appreciably), but the motor does not crank the engine.

(*a*) This may be caused by the starter drive pinion being jammed in mesh with the flywheel starter ring. The pinion can usually be freed by removing the cap and applying a spanner to the squared extension of the shaft at the commutator end. It is advisable to remove the starter motor from the engine and inspect the starter drive.

(*b*) Uncertain action of the starter motor may be due to a discharged battery. Check by disconnecting the existing cables and reconnecting the motor to a battery known to be fully charged. If the starter motor now gives normal cranking of the engine, the vehicle battery must be examined as detailed on page N.9. Uncertain or slow action may also be traced to a loose terminal connection in the wiring circuit.

(*c*) If the starter motor still does not operate satisfactorily, it must be removed from the engine and the starting motor and starter drive examined

2. The lamps do not dim (or the voltmeter reading remains unaffected) and the motor does not crank the engine.

(*a*) Check by means of a voltmeter or battery-voltage test lamp that the circuit up to the supply terminal on the motor is in order.

(*b*) If no voltage is indicated (or the test lamp does not light), check the circuit from the battery to the starter motor, via the starter switch.

(*c*) Ensure that all connections are clean and tight. If the switch is found to be faulty, a replacement must be fitted.

(*d*) A reading of battery voltage (or the test lamp lighting with full brilliance) at the supply terminal indicates that the starting motor has an internal fault and must be removed from the engine for examination.

(*e*) If the starter motor operates, but does not crank the engine, the starter drive is in need of cleaning or may have developed some other fault. In either event the motor must be removed from the engine for inspection and the necessary attention.

M45G Pre-engaged Starter Motor.

1. The lamps dim (or the voltmeter reading falls appreciably), but the motor does not crank the engine.

(*a*) Check by hand-cranking that the engine is not abnormally stiff.

(*b*) If the motor is not heard to operate, but the symptoms above exist, this indicates that the current is flowing through the motor windings, but the armature is not rotating, possibly due to a seized armature shaft.

(*c*) Uncertain action of the starter motor may be due to a discharged battery. Check by disconnecting the existing cables and reconnecting the motor to a battery known to be fully charged. If the starter motor now gives normal cranking of the engine, the vehicle battery must be examined as detailed on page N.9. Uncertain or slow action may also be traced to a loose terminal connection in the wiring circuit.

2. The lamps do not dim (or the voltmeter reading remains unaffected) and the motor does not crank the engine.

(*a*) Check the starter circuit for continuity, by means of a voltmeter or battery-voltage test lamp, up to the field terminal on the motor. Check the starter switch feed to the solenoid.

(*b*) If the solenoid unit is suspect, check on removal from the starter drive end bracket, as detailed on page N.29.

(*c*) When the motor is heard to operate, but does not crank the engine, damage to the drive assembly is indicated. Remove the starter motor for examination.

To Remove.

1. Disconnect one of the battery cables to prevent short circuits occurring.

2. Release the heavy gauge cable from the starter motor terminal on the M418G type starter motor.

3. On the M45G type starter motor, disconnect the battery cable, the earth cable to the dynamo bracket and the switch lead from the solenoid unit terminal.

4. Remove the starter motor from the vehicle after withdrawing its fixings.

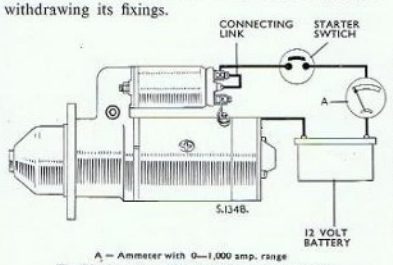


Fig. N.16. Measuring the light running current

TESTING WHEN REMOVED FROM THE VEHICLE

Measuring the Light Running Current.

1. Secure the starter motor in a vice, then connect the motor in series with a starter switch, an ammeter and a 12 volt battery (see Fig. N.16). Do not use small gauge cables as they are liable to burn out. A fixing lug on the drive end bracket is a suitable earthing point on the starter motor.

2. Operate the switch and check the speed of armature rotation, using a tachometer, and observe the reading given by the ammeter. Compare the starter motor performance against the figures given under "Data" at the beginning of the section, relevant to the starter motor under test.

3. Whilst the motor is running at speed check for excessive sparking at the commutator and for undue brush movement. If faulty brush action is observed, check the brush gear as detailed under "Inspection and Overhaul".

Measuring the Lock Torque and Lock Current.

1. With the starter motor still secured in the vice, and connected in series with the starter switch, ammeter and battery, connect a voltmeter between the motor terminals and yoke (see Fig. N.17). Clamp an arm to the driving pinion and to the free end of the arm attach a spring scale (see Fig. N.18).

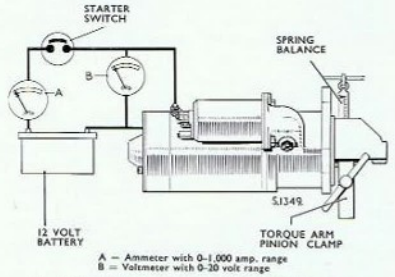


Fig. N.17. Measuring the lock torque and lock current

2. If a constant voltage supply is used, it is important to adjust this to, 7·4 volts in the case of the M418G type starter motor, and 6·4 volts in the case of the M45G type starter motor, at the starter terminal when testing.

3. Operate the switch and note the current consumption, the voltage and the spring scale reading. Compare the starter motor performance against the figures given under "Data" at the beginning of the section, relevant to the starter motor under test.

Note: To calculate the lock torque, multiply the reading on the spring scale in pounds by the length of the arm in feet.

Fault Diagnosis.

An indication of the fault or faults may be deduced from the results of the no-load and torque tests, as follows:—

1. Speed, torque and current consumption correct. Assume motor to be in normal operating condition.

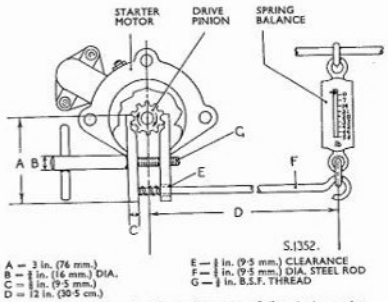


Fig. N.18. Measuring the lock torque of the starter motor

2. Speed, torque and current consumption low. High resistance in brush gear, e.g., faulty connections, dirty or burned commutator causing poor brush contact.

3. Speed and torque low, current consumption high. Tight or worn bearings, bent armature shaft, insufficient end play, armature fouling a pole shoe, or cracked spigot on the drive end bracket.

Short circuit windings in armature, earthed armature or short circuit windings in field coils.

4. Speed and current consumption high, torque low. Short circuit windings in field coils.

5. Armature does not rotate, no current consumption. Open circuit in armature, or field coils. If the commutator is badly burned there may be poor contact between brushes and commutator. On the M45G type starter motor an open circuit in the solenoid windings may exist.

6. Armature does not rotate, high current consumption. Earthed field windings or the armature prevented mechanically from rotating. On M45G type starter motor a short circuit in the solenoid windings may exist.

7. Excessive brush movement. Low brush spring tension, worn or out of round commutator. "Thrown" or high segments on commutator.

8. Excessive arcing at commutator. Defective armature windings, sticking brushes or dirty commutator.

If any fault is indicated during the diagnosis procedure, the starting motor must be dismantled and a further inspection carried out.

To Dismantle (M418G type Starter Motor).

1. Remove the cover band, hold back the brush springs and lift the brushes from their holders.

2. Unscrew the nuts and remove the washers from the terminal post, which protrudes from the commutator end bracket.

3. Unscrew the two through bolts from the commutator end bracket and remove the commutator end bracket from the yoke.

4. Remove the drive end bracket complete with the armature and starter drive from the starter motor yoke.

5. Dismantle the starter drive in the following manner:

(*a*) Extract the split pin and remove the nut from the drive end of the armature shaft.

(*b*) Withdraw the main spring, washer, pinion and sleeve assembly, collar, restraining spring and plain sleeve.

(*c*) Withdraw the drive end bracket.

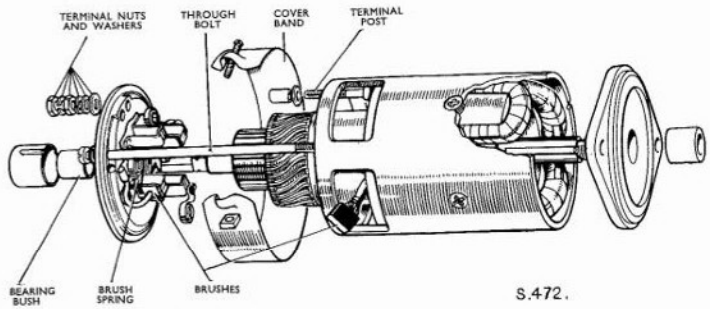


Fig. N.19. Details of the M418G type starter motor

To Dismantle (M45G type Starter Motor).

1. Disconnect the copper link between the lower solenoid terminal and the starter motor field terminal on the yoke.

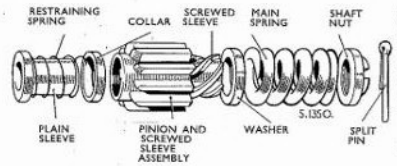


Fig. N.20. Details of the starter drive (M418G type starter motor)

2. Remove the solenoid unit securing bolts. Withdraw the solenoid from the drive end bracket casting, carefully disengaging the solenoid plunger from the starter drive engagement lever.

3. Remove the cover band, hold back the brush springs and lift the brushes from their holders.

4. Unscrew and withdraw the two through bolts from the commutator end bracket. The commutator end bracket and the yoke can now be removed from the intermediate and drive end brackets.

5. Extract the rubber seal from the drive end bracket.

6. Remove the nut securing the eccentric pin, on which the starter drive engagement lever pivots, and unscrew the pin.

7. Separate the drive end bracket from the armature and intermediate bracket assembly.

8. Remove the washer from the end of the armature shaft extension, and slide the drive assembly and engagement lever off the shaft. For information concerning dismantling and overhauling the drive assembly, refer to page N.31.

9. Remove the intermediate bracket retaining ring from the armature shaft extension, and slide the bracket and brake assembly off the shaft.

Inspection and Overhaul.

The procedure given in respect of the brush gear and commutator should be carried out every 24,000 mile (36,000 km.), after removing and dismantling the motor as detailed previously.

During this operation opportunity should be taken on the M45G type starter motor to lubricate the pinion sleeve indented bearings using Shell Retinax "DX" and the indented bronze bearing in the intermediate bracket using Shell Retinax "AM" for this purpose.

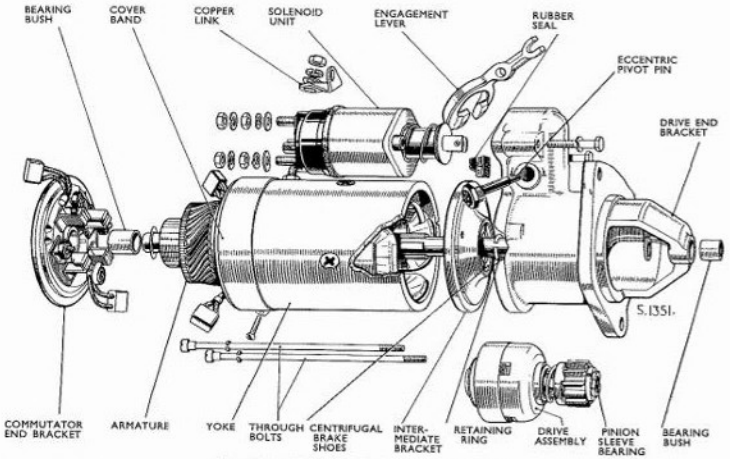


Fig. N.21. Details of the M45G type starter motor

Keep all electrical connections clean and tight. Any terminals which have become dirty must be cleaned and the contacting surfaces lightly smeared with petroleum jelly.

Check for correct operation of the drive assembly.

Brush Gear.

1. Pull back the brush springs and check the brushes for free movement in their boxes. If the brushes tend to

stick remove them from their boxes and clean with a petrol moistened lintless rag. If necessary polish the sides with a smooth file. If the overall length of the

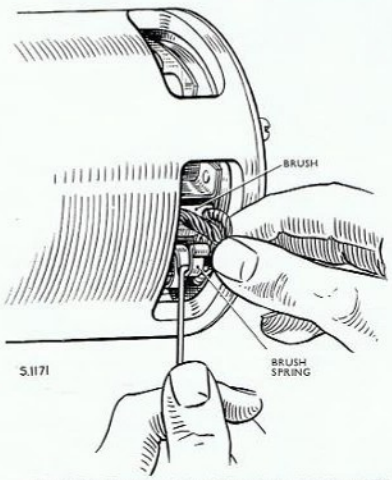


Fig. N.22. Removing the brush from the brush holder

brushes is worn to, or approaching $\frac{3}{16}$ in. (7·9 mm.) in length they must be renewed.

2. Two of the brushes are connected to the terminal tags on the brush boxes and the other two are connected to the free ends of the field coils. Unsolder the flexible

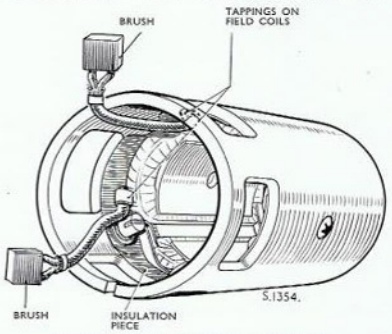


Fig. N.23. Brush connections to the field coils

connectors and solder the connectors of the new brushes in their place. All new brushes are pre-formed so that "bedding" them in to the commutator is unnecessary. Check that the new brushes can move freely in their respective boxes.

3. Test the brush spring tension using a spring balance held radially to the commutator. The correct tension for the M418G type starter motor is 38 oz. to 46 oz. (1·06 kg. to 1·29 kg.) and for the M45G type starter motor is 30 oz. to 40 oz. (0·84 kg. to 1·12 kg.). Renew the springs if the tension is low.

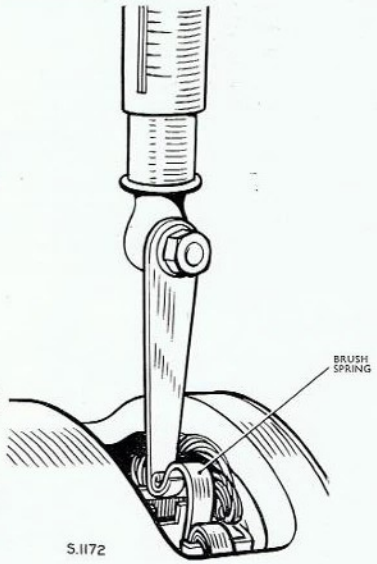


Fig. N.24. Checking brush spring tension

Commutator.

1. A commutator in good condition will be burnished and free from pits or burned spots. Clean the commutator with a petrol-moistened lintless cloth. If this is ineffective, spin the armature and carefully polish the commutator with a strip of fine glass paper. Remove all abrasive dust with dry compressed air.

2. If the commutator is badly worn, mount the armature between centres in a lathe, rotate at high speed and take a light cut with a very sharp tool. Do not remove more metal than is necessary. Finally polish with very fine glass paper. Remove all abrasive dust using dry compressed air. **The insulators between the commutator segments must not be undercut.**

Armature.

1. Check for lifted commutator segments and loose turns in the armature winding. These may be due to the

starting motor having remained engaged while the engine is running, thus causing the armature to be rotated at excessive speed. On the M45G type starter motor check that the clutch assembly is disengaging correctly when engine fires.

2. A damaged armature must always be renewed, no attempt should be made to machine the armature core or to true a distorted armature shaft. An indication of a bent shaft or a loose pole shoe may be given by scored armature laminations.

3. To check the armature insulation, use an ohmmeter, or a 110 volt a.c. test lamp. A high reading should be shown on the meter when connected between the armature shaft and the commutator segments. If a test lamp is used, it must not light when connected as above. Faulty insulation will be indicated by a low ohmic reading, or by lighting of the test lamp.

4. If a short circuit is suspected, check the armature on a "growler". Motor overheating may cause blobs of solder to short circuit the commutator segments.

5. If the cause of an armature fault cannot be located and remedied, a replacement armature must be fitted.

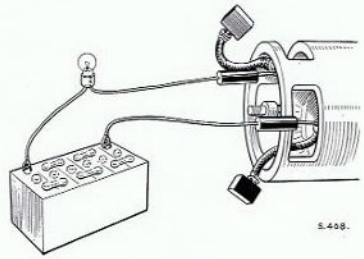


Fig. N.25. Field coil continuity test

Field Coils.

1. **To Check.** Test the field coils for continuity by connecting a 12-volt test lamp and battery in series with two pointed probes, between the brush tappings (with the armature removed from the yoke). Ensure that both brushes and their flexible connectors are clear of the yoke. If the lamp does not light, an open circuit in the field coils is indicated and the defective coils must be renewed.

2. Lighting of the test lamp does not necessarily indicate that the field coils are in order. It is possible that a field coil may be earthed to a pole shoe, or to the yoke. This may be checked by connecting an ohmmeter or a 110 volt a.c. test lamp, between the terminal post and a clean part of the yoke. The test lamp lighting or a low ohmic reading indicates that the field coils are earthed to the yoke and must be renewed.

3. In either case unless a replacement starter motor is available, the field coils must be renewed, as detailed in paras. 5 to 13.

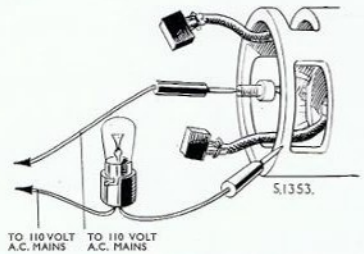


Fig. N.26. Field coil insulation test using low voltage mains

4. When carrying out this test, check also the insulated pair of brush boxes on the commutator end bracket. Clean off all traces of brush deposit before testing. Connect the 110 volt a.c. test lamp between each insulated brush box and the bracket. If the lamp lights this indicates faulty insulation and the end bracket must be renewed.

5. **To Renew.** To do this, carry out the procedure outlined below, using a wheel-operated screwdriver.

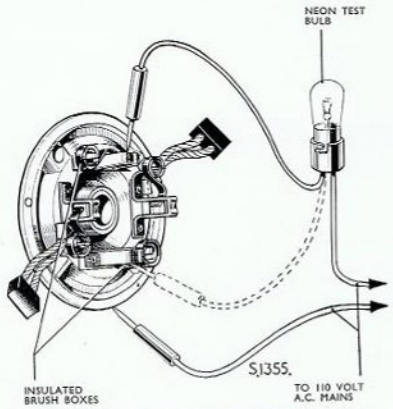


Fig. N.27. Brush box insulation test using low voltage mains

6. **Mark the yoke and pole shoes in order that they can be fitted in their original position.**

7. Unscrew the four pole-shoe retaining screws using a wheel-operated screwdriver.

8. Remove the insulation piece which is fitted to prevent the inter-coil connectors from contacting with the yoke.

9. Draw the pole shoes and coils out of the yoke and lift off the coils.

10. Fit the new field coils over the pole shoes and place them in position inside the yoke. Ensure that the taping of the field coils is not trapped between the pole shoes and the yoke.

11. Locate the pole shoes and field coils by lightly tightening the retaining screws.

12. Refit the insulation piece between the field coil connections and the yoke.

13. Finally, tighten the screws by means of the wheel-operated screwdriver.

Bearings.

The **M418G type starter motor** is fitted with a porous bronze bush in the commutator and drive end brackets. Bushes that are worn to such an extent that they will allow side movement of the armature shaft, must be renewed.

1. Press the bush out of the end bracket.

2. Press the bush into the end bracket using a shouldered highly polished mandrel of the same diameter as the shaft, which is to fit in the bearing. Porous bronze bushes must not be reamered out after fitting, as the porosity of the bush will be impaired.

Note: Completely immerse the new porous bronze bushes in thin engine oil for 24 hours prior to fitting to allow the pores of the bushes to fill with lubricant. In cases of extreme urgency this period may be shortened to 2 hours if the oil is heated to 212°F. (100°C.), and then allowed to cool before removing the bush.

The **M45G type starter motor** is fitted with a porous bronze bush in the commutator and drive end brackets, and an indented bronze bearing in the intermediate bracket. Bushes that are worn to such an extent that they will allow side movement of the armature shaft, must be renewed.

1. The bushes in the intermediate and drive end brackets may be pressed out, whilst that in the commutator end bracket is best removed by inserting a $\frac{11}{16}$ in. (1·7 cm.) tap squarely into the bush for a few turns to provide a purchase for extraction.

2. Press the new bushes into the brackets using a shouldered, highly polished mandrel of the same diameter as the shaft, which is to fit in the bush. Porous bronze bushes must not be reamered out after fitting, as the porosity of the bush will be impaired.

Note: Completely immerse the new porous bronze bushes in thin engine oil for 24 hours prior to fitting to allow the pores of the bushes to fill with lubricant. In cases of extreme urgency this period may be shortened to 2 hours if the oil is heated to 212°F. (100°C.), and then allowed to cool before removing the bush.

3. After fitting a new intermediate bracket bearing, lubricate the bearing surface with Shell Retinax "AM".

Starter Drive (M418G type Starter Motor only).

1. If any difficulty is experienced with the starting motor not meshing correctly with the flywheel starter ring, it may be that the drive requires cleaning.

2. The pinion should move freely on the screwed sleeve; if there is any dirt or other foreign matter on the sleeve it must be washed off with paraffin, and a light film of thin machine oil should be applied to the sleeve.

Solenoid Unit (M45G type Starter Motor only).

1. The solenoid unit contains two coils, a closing coil which is by-passed when the plunger is drawn fully home, and a hold-on coil to retain the plunger in the fully home position.

2. To check the individual coils, remove any existing external connections and using a constant voltage 4 volt d.c. supply with cables of adequate size, proceed as follows:—

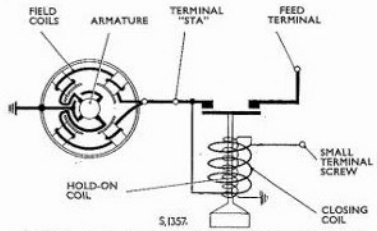


Fig. N.28. Solenoid unit circuit (M45G type starter motor)

(*a*) *Closing coil.* Connect the supply between the solenoid terminal marked "STA" and the small centre terminal. This should cause a current of 24 to 28 amperes to pass.

(*b*) *Hold-on coil.* Connect the supply between the solenoid body and the small centre terminal. This should cause a current of 5·1 to 5·8 amperes to pass.

Note: Do not carry out these tests while the solenoid unit is hot.

3. If a constant voltage supply is not available, check the coil resistance using a Wheatstone Bridge, or some other accurate method of measuring low resistance values. Connect the measuring instrument as for measuring current and compare the resistances with those given below:—

(*a*) Closing coil resistance 0·144 to 0·166 ohms.

(*b*) Hold-on coil resistance 0·688 to 0·792 ohms.

4. Check also the spring pressures and push rod travel with the following:—

(*a*) Spring pressure to close contacts 4 lb. to 7 lb. (1·81 kg. to 3·17 kg.) with plunger return spring removed.

(*b*) Spring pressure to push plunger home 10·5 lb. to 16 lb. (4·76 kg. to 7·26 kg.) with plunger return spring removed.

(*c*) Push rod movement to close contacts 0·116 in. to 0·189 in. (2·946 mm. to 4·800 mm.).

(*d*) Total push rod movement 0·263 in. to 0·273 in. (6·680 mm. to 6·934 mm.).

5. Except for the fitting of replacement solenoid contacts, no attempt should be made to repair a faulty unit.

6. Contact Renewal. Renew the contacts as a complete set. Unscrew the two smaller nuts and washers on the moulded cover, and unsolder the wires attached to the terminal strips. Lift off the cover. Withdraw the push rod from the solenoid unit. Remove the small slotted spring cup from the push rod end, and withdraw the fibre washer and the moving contact disc complete with its adaptor from the push rod. Lift away the worn contact disc from the disc adaptor, and then fit the replacement disc, so that the smoothest side will be the contacting surface. Re-assemble the components to the push rod by reversing the dismantling procedure. Fit the rubber seal and moulded cover, carefully threading the wires through, and refit the two smaller nuts and washers. Finally re-solder the wires as necessary.

Note: When fitted, ensure that the terminal "Lucar" blade is refitted in its former position.

dismantling procedure, observing the following special points:—

1. To facilitate fitting the solenoid unit to the drive end bracket, ease the drive assembly forward along the armature shaft.

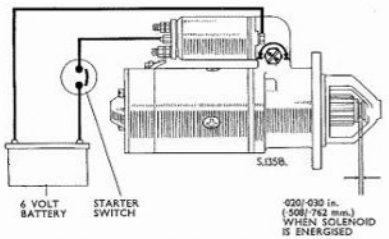


Fig. N.30. Setting the pinion movement limit (M45G type starter motor)

2. Set the pinion movement before tightening the eccentric pivot pin securing nut as detailed in the ensuing paragraphs:—

(*a*) After complete assembly of the starter motor, connect the small centre terminal on the solenoid

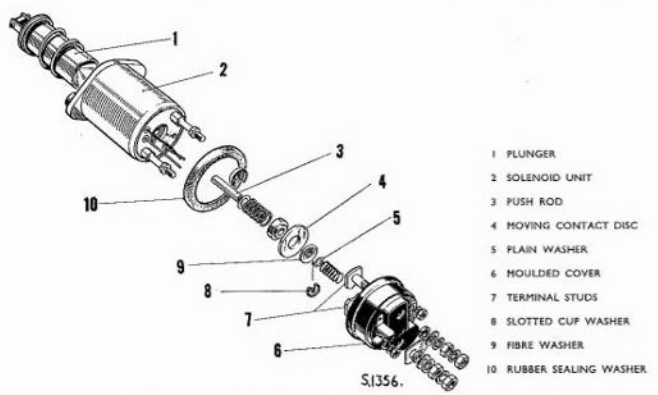


Fig. N.29. Details of the solenoid unit fitted to the M45G starter motor

To Re-assemble (M418G type Starter Motor).

Re-assemble the starter motor and drive assembly in a reverse manner to the dismantling procedure, after thoroughly cleaning all components.

To Re-assemble (M45G type Starter Motor).

After cleaning all components, re-assemble the starter motor and drive assembly by reversing the unit by way of a switch to a **6 volt battery** (see Fig. N.30). Connect the other terminal of the battery to one of the solenoid fixing bolts and then close the switch (this throws the drive assembly forward into the engaged position). With the drive assembly in this position measure the distance between the pinion and the washer on the armature shaft extension. Make this measurement with the **pinion**

pressed lightly back towards the armature to take up any slack in the engagement linkage. For the setting to be correct this distance should be 0·020 in. to 0·030 in. (0·508 mm. to 0·762 mm.).

(*b*) Ensure that the eccentric pivot pin securing nut is slack and turn the pin until the correct setting is obtained. It will be noted that the arc of adjustment is 180° and the head of the arrow marked on the pivot pin (see Fig. N.30) should be set only between the arrow heads on the drive end bracket casting. After setting, tighten the securing nut to retain the pin in position.

Note: In the event of a replacement motor or drive end bracket being fitted, check the out-of-mesh clearance when assembling the starter motor to the engine. This should be $\frac{1}{8}$ in. (3·175 mm.) between the leading edge of the pinion and the flywheel starter ring with a $\frac{1}{32}$ in. (0·794 mm.) tolerance each way.

To Refit.

Install the starter motor by reversing the removal instructions, ensuring that the cables are connected as shown in the appropriate wiring diagram.

SELF-INDEXING CLUTCH DRIVE ASSEMBLY

(M45G Type Starter Motor Only)

To Dismantle.

It is assumed that the starter motor is dismantled and the drive assembly has been withdrawn from the armature shaft.

1. Remove the lock ring from the driving sleeve.

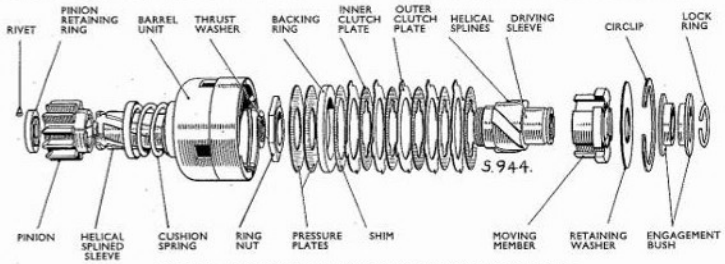


Fig. N.31. Self indexing clutch drive details (M45G type starter motor)

2. Lift the two halves of the engagement bush off the driving sleeve.

3. Using circlip pliers, extract the clutch retaining circlip from the barrel unit and withdraw the driving sleeve and clutch unit.

4. The clutch assembly can now be dismantled by removing all the components from the driving sleeve, with the exception of the two pressure plates which are held in position by the ring nut. To remove the ring nut, slide the driving sleeve on to the splined armature shaft and using soft metal jaw plates, clamp the armature in a vice, file away the peened rim and use a $1\frac{5}{16}$ in. AF spanner to remove the nut.

5. To remove the pinion from the helical splined sleeve, knock out the rivet which secures the pinion retaining ring. The retaining ring, pinion, cushion spring with the cup washers and the sleeve can now be separated.

Inspection.

1. Examine the teeth of the pinion for wear or damage and renew if necessary.

2. The correct spring tension is 11 lb. (4·99 kg.) measured with the spring compressed to $\frac{7}{8}$ in. (22·22 mm.) in length, and 16 lb. (7·25 kg.) when it is compressed to $\frac{1}{2}$ in. (12·70 mm.) in length.

To Re-assemble.

Re-assemble the drive assembly in a reverse manner to that described for dismantling, bearing in mind the following:—

1. Always use a new ring nut and peen the rim over the notch in the driving sleeve to lock the nut in position.

2. Check the slipping torque of the clutch, bearing in mind the points outlined below.

(*a*) Fit the drive assembly on the armature shaft and clamp the armature between soft metal jaw plates in a vice.

(*b*) Apply an anti-clockwise torque to the pinion with a suitable torque wrench secured to the pinion teeth. The clutch should slip between 66·66 and 79·16 lb.ft. (9·21 and 10·94 kg.m.).

(*c*) If the clutch slips at too low a torque figure, dismantle again by withdrawing the circlip and add shims, one at a time, until the correct figure is obtained.

(*d*) If the clutch does not slip between the torque limits given, again dismantle by withdrawing the circlip and remove the shims, one at a time, until the correct figure is obtained.

The correct adjusting shims are:

Lucas Part No.	*Thickness*
291374	0·006 in. (0·152 mm.)
291378	0·005 in. (0·127 mm.)
291379	0·004 in. (0·101 mm.)

3. When assembled to the armature shaft, the drive assembly and lever mechanism must be capable of being pushed to the full extent of the set travel along the armature shaft extension, smoothly and freely, but without slackness.

4. Before fitting the drive assembly to the armature shaft, lightly smear the shaft and pack the space between the indented bearings inside the pinion sleeve, with Shell Retinax "DX".

IGNITION SYSTEM

DESCRIPTION

The ignition system consists basically of two circuits, the primary (low tension) and the secondary (high tension). The primary circuit comprises, the battery, the ignition switch, the primary winding of the coil, the contact breaker incorporated in the distributor, and the capacitor. The secondary circuit includes the secondary winding of the coil, the distributor rotor arm and cover, the high tension leads, and the sparking plugs.

The ignition coil, mounted on the left hand side of the cylinder block on KAH Models and on the lower right hand side on KAL Models, comprises a soft iron core around which is wound the primary and secondary windings. The windings terminate in wire connections, which are located on one end of the coil, the high tension terminal connection being centrally disposed and the terminal blades marked "SW" (switch connection) and "CB" (contact breaker connection) positioned one on either side of the high tension terminal.

The distributor on KAH Models is mounted on the top left hand side of the cylinder head, via an adaptor and is driven by a skew gear wheel formed on the camshaft centre journal, through a skew gear pinion and sleeve assembly at the upper end of the oil pump shaft, which transmits the drive to the distributor by means of a driving shaft. The distributor spindle rotates clockwise viewed from the top, i.e., rotor end.

The distributor on KAL Models is mounted towards the front right hand side of the cylinder block, via an adaptor, and is driven by a skew gear on the camshaft, through a separate driving shaft. The distributor spindle rotates anti-clockwise viewed from the top, i.e., rotor end.

On all models the distributor shaft is attached to the centrifugally operated timing mechanism, comprising a pair of spring loaded governor weights linked by lever action to the contact breaker cam.

Two plates are located immediately above the centrifugal timing control. The lower plate is secured to the distributor body by two screws and the upper plate, which carries the contact breaker and capacitor, is allowed to rotate under the influence of the vacuum operated timing control unit, to which it is connected by a link.

The vacuum operated timing control unit comprises a spring loaded diaphragm contained in a casing. A rod fitted into the casing secures the unit to the distributor body. This rod passes through the body and picks up with a knurled circular nut located in a slot on the opposite side of the body to the vacuum unit. When this knurled nut is rotated the rod draws the vacuum unit in or out of the distributor body and by means of the link, the contact breaker will rotate about the cam. This provides a fine adjustment to the ignition timing to allow for optimum setting on road test.

The cam sleeve is secured to the distributor shaft by a screw, and located in the top of the cam sleeve is a moulded rotor arm with a metal electrode. Over the rotor arm and contact breaker assembly is a cover which is retained in position by spring clips. Assembled into the cover is a spring loaded carbon brush, which is in constant contact with the rotating electrode on the rotor arm and with the high tension cable from the coil. The brush is of composite construction, the centre portion being made of a resistive compound and the ends of softer carbon, the lower end preventing wear taking place on the rotor electrode. The resistive portion of the brush is in circuit between the coil and the distributor and gives a measure of radio interference suppression. Moulded in the cover and equally spaced around the carbon brush are metal segments in contact with the high tension cables to the sparking plugs.

The sparking plugs used are Champion type N.8 on KAH Models and Champion type N.5 on KAL Models, with long reach, 14 mm. diameter thread.

OPERATION

When the ignition is switched on, current flows through the primary, or low tension winding in the coil, and produces a magnetic field around the core. This current is periodically interrupted by the contact breaker points being opened by the cam. The subsequent sudden collapse of the magnetic field across the secondary winding of the coil, induces a high voltage into this winding, assisted by the capacitor which is connected across the contact breaker points.

This high voltage is taken from the coil to the carbon brush in the distributor by a high tension cable. The carbon brush, being in constant contact with the rotor arm electrode as it rotates, distributes the high voltage to the segments moulded in the cover. Further high

tension cables lead to the sparking plugs, thus enabling a spark to occur in the cylinder under compression at the exact moment required to produce combustion of the mixture.

The distributor is fitted with automatic timing controls, which obviate the constant adjustment of a hand ignition control. A centrifugal device regulates the ignition advance according to the engine speed, whilst a vacuum control unit causes variation of the ignition timing in relation to the load. The operation of these units is given in the following paragraphs.

Centrifugal Timing Control. At low engine speeds, the spring force maintains the cam in a slightly retarded position. Under the centrifugal force imparted by the higher engine speeds, the governor weights swing out against spring pressure to advance the contact breaker cam and thereby the spark, to suit engine conditions at the greater speed.

Vacuum Timing Control. The inlet manifold of the engine is in direct communication with one side of the spring loaded vacuum unit diaphragm. When the engine is idling with the throttle valve nearly closed there is practically no vacuum since the take-off point is on the atmospheric side of the carburettor throttle valve and the controlling spring tension in the vacuum unit is not overcome. As the carburettor throttle valve is opened from idling speed the tapping is brought on to the engine side of the throttle valve, the resulting depression in the inlet manifold acts on the vacuum unit diaphragm and by means of the link, the contact breaker plate is rotated about the cam, thus advancing the spark for part throttle operating conditions. This occurs up to approximately half throttle, after which greater opening causes a decrease in depression, thus retarding the spark.

The centrifugal and vacuum timing controls ensure maximum possible power under all conditions.

DISTRIBUTOR LUBRICATION

Take care not to allow any oil or grease to come into contact with the contact breaker points.

1. Lightly smear the cam profile and contact breaker pivot with Shell Retinax "A" grease.

2. On the DM6 type distributors, give the lubricator cap on the side of the distributor body one half turn clockwise to lubricate the distributor shaft. If the lubricator cap is towards the inner end of its travel, unscrew and fill the cap with Shell Retinax "A" Grease and refit.

3. Remove the rotor arm by pulling it up vertically and apply a few drops of clean engine oil to the shaft to lubricate the cam bearing. It is unnecessary to remove the exposed screw since sufficient clearance is present to permit the passage of oil. Refit the rotor arm, carefully locating its moulded projection into the cam sleeve keyway and exert sufficient pressure to ensure complete engagement of the components.

4. The centrifugal timing control should be lubricated with a few drops of clean engine oil, which can be applied through the aperture at the edge of the contact breaker plate.

ADJUSTMENTS TO THE DISTRIBUTOR WHILST IN POSITION

To Clean and Adjust the Contact Breaker Points.

1. Release the spring clips that secure the moulded cover and lift the cover clear of the distributor body.

2. Remove the rotor arm from the top of the cam sleeve, carefully levering with a screwdriver, if necessary.

3. Thoroughly clean the moulded distributor cover, inside and out, with a soft dry cloth paying particular attention to the spaces between the metal segments. Ensure that the small carbon brush moves freely in its holder.

4. Examine the contact breaker. The contacts must be quite free from grease or oil. If they are burnt or blackened, clean them with a very fine carborundum stone or emery cloth, then wipe them with a petrol moistened cloth. Cleaning is facilitated by removing

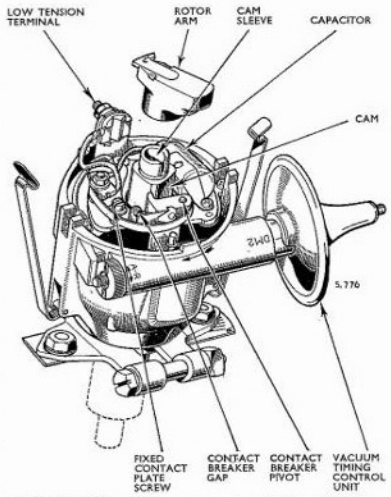


Fig. N.32. Contact breaker adjustment and details (D.M.2 type distributor

the contact breaker moving contact and fixed contact plate. To do this, remove the nut, insulating piece and connections from the spring anchor post. The contact breaker moving contact may now be removed from its pivot. Withdraw the insulating washer from the contact pivot and from the spring anchor post, remove the

securing screw(s) and withdraw from the contact pivot the fixed contact plate.

5. After cleaning and refitting the contact breaker points, set the contact breaker gap, observing that prior to refitting the contact breaker moving contact, the pivot is smeared with Shell Retinax "A" Grease. Turn the engine until the contacts show the maximum opening and adjust to a gap setting of 0·015 in. (0·381 mm.). If this measurement is not attained keep the engine in the position giving the maximum opening, slacken the screw(s) securing the fixed contact plate and adjust its position to give the required gap. Tighten the screw(s). Re-check the setting for other positions of the cam giving maximum opening of the points.

6. Refit the rotor arm, carefully locating its moulded projection into the cam sleeve keyway and exert sufficient pressure to ensure complete engagement of the components.

7. Refit the moulded cover and secure with the spring clips.

TO TEST THE IGNITION SYSTEM

Before carrying out the following tests of the ignition high and low tension circuits, make sure that the battery is not fully discharged, as this will often produce the same symptoms as a fault in the ignition circuit.

Uneven Firing.

1. Start the engine and set to run at a fairly fast idling speed.

2. On KAH Models, short circuit each plug in turn with the blade of an insulated screwdriver placed across the terminal to contact the cylinder head, or in the case of KAL Models, due to the moulded cable casings, remove each plug connector in turn, noting that the cable and moulded casing should be withdrawn simultaneously by exerting withdrawing force on the moulded casing only. No noticeable change in the running note will be apparent when short circuiting, or removing the plug connector from the plug in a defective cylinder. Short circuiting the plugs in the other cylinders will produce a pronounced increase in roughness of running.

3. Having thus located the defective cylinder, stop the engine and remove the cable from the sparking plug terminal.

4. Rotate the engine and hold the cable end about $\frac{3}{16}$ in. (5 mm.) from the cylinder head. If sparking is strong and regular, the fault lies in the sparking plug, and it should be removed, cleaned and the gap adjusted to the correct setting (see page N.7), or a replacement fitted.

5. If, however, there is no spark, or only weak irregular sparking, examine the cable from the plug to the distributor for deterioration of the insulation, renewing the cable, using 7 mm. p.v.c., or neoprene covered rubber-insulated ignition cable, or in the case of KAL Models suppressed ignition cable, if the insulation is cracked or perished, which may be the case after the cable has been in service for a long period.

6. If, on KAH Models, the cable is fitted with a radio, or television suppressor, this should also be checked for damage, or open circuit.

7. Finally examine the distributor cover, wiping the inside with a clean cloth and ensuring that the carbon brush moves freely in its holder, also examine the cover for cracks. After long service, tracking may have occurred, i.e., a conductive path may have formed between two or more segments, or between one of the segments and some adjacent metal part of the distributor body, which is in contact with the cover. Evidence that tracking has taken place on the cover is usually indicated by the presence of a thin black line in the position previously indicated. A replacement distributor cover must be fitted if this fault is found to be apparent.

Note: If a new carbon brush is required, ensure that the correct type is used for under no circumstances must a short non-resistive brush be used as a replacement for the longer resistive brush.

Ignition Failure.

1. Release the spring clips that secure the distributor cover and lift the cover clear of the distributor body. Remove the rotor arm from the top of the cam sleeve, carefully levering with a screwdriver if necessary.

2. Check the contacts for cleanliness and correct gap setting as described on page N.43.

3. Connect an ammeter in series with the battery supply cable, feeding the low tension circuit, switch on the ignition and turn the engine. Observe the ammeter reading, which should rise with the closing and fall to zero with the opening of the contacts if the low tension wiring is in order. When the reading does not fluctuate, a short circuit, or contacts remaining closed, is indicated. No reading indicates a broken or loose connection in the low tension wiring, badly adjusted or dirty contacts.

4. An alternative method of testing is to connect a test lamp containing a 12 volt bulb (or 0–20 voltmeter), between the "CB" terminal of the coil and a good earth. If the bulb lights (voltage reading of approximately 12 volts is obtained) when the contacts are open, it should automatically fail to light (no voltage reading recorded) when the contacts are closed, thus indicating that the low tension circuit is in good order.

Low Tension Circuit.

If it is determined that the fault lies in the low tension circuit, by the eliminating check above, switch on the ignition and turn the engine until the contact breaker points are fully open.

Refer to the wiring diagram and check the circuit with a 0–20 voltmeter between the following points **and a good earth.**

If the circuit is in order, the voltage reading should be approximately 12 volts. No reading indicates a damaged cable, or loose connections, or a breakdown in the section under test.

1. Battery to Control Box. Connect the voltmeter between the control box blade connection "B" and a good earth. This section of the circuit is made via the starter switch. No reading on the voltmeter indicates a faulty lead or loose connection.

2. Control Box to Ignition Switch. Connect the voltmeter between the switch terminal "A", to which the lead from the control box is connected, and a good earth. No reading on the voltmeter indicates a faulty lead, or loose connections.

3. Ignition Switch. Check the voltage between the switch terminal "IGN" and a good earth. No reading on the voltmeter indicates a fault in the switch.

4. Ignition Switch to Ignition Coil. Remove the lead from the ignition coil "SW" terminal blade, and connect the voltmeter between the free end of the cable and a good earth.

This portion of the circuit is made by way of the auxiliary fuse unit, terminal blade "3", and a voltage check should also be made at this point. Re-make the connection to the coil.

5. Ignition Coil. Disconnect the lead from the "CB" terminal blade of the coil and connect the voltmeter between this terminal and a good earth. No reading indicates a fault in the primary winding of the coil, necessitating coil renewal. If, however, the correct reading on the voltmeter is obtained, re-make the cable connection to the coil terminal blade.

6. Ignition Coil to Distributor. Disconnect the low tension cable at the distributor terminal blade and connect the voltmeter between the end of the cable removed and a good earth. No reading on the voltmeter indicates a faulty lead, or loose connection. Reconnect the cable to the distributor terminal blade.

7. Contact Breaker and Capacitor. Connect the voltmeter across the contact points. If no reading is obtained, re-check with the capacitor disconnected. If a reading is now given, the capacitor is faulty and must be renewed.

8. Measure the contact breaker spring tension. This should be 18 to 24 oz. (510 to 680 grm.) measured at the contacts.

High Tension Circuit.

If, after carrying out the tests to the low tension circuit, the fault has not been located, remove the high tension lead from the centre terminal of the distributor cover and proceed as follows:—

1. Switch on the ignition and turn the engine until the contacts close.

2. Flick open the contact breaker moving contact whilst the high tension lead in the coil is held about $\frac{3}{16}$ in. (5 mm.) from the cylinder head.

3. If the ignition equipment is in good order, a strong spark will occur. If no spark is obtained, a fault in the secondary winding of the coil is indicated and the coil must be renewed.

IGNITION COIL

The ignition coil requires no maintenance, apart from ensuring that all terminals are tight and the exterior (particularly between the terminals) is kept clean.

On KAH Models, the coil is mounted on a bracket, which is secured to the left hand side of the cylinder block.

On KAL Models, the coil is mounted to the front camshaft chamber cover plate, on the right hand side of the cylinder block, by means of two securing studs and nuts.

To Remove.

1. Disconnect the high tension cable from the coil centre terminal.

2. Release the two low tension leads from the "SW" and "CB" terminal blades on the coil.

3. Remove the securing nuts attaching the coil to its mounting and lift away the coil.

To Refit.

To refit the coil, reverse the removal procedure, ensuring that the low tension leads are fitted to their correct terminals.

DISTRIBUTOR

To Remove.

In the case where removal of the distributor is required to prevent accidental damage occurring during overhaul, identify the distributor clamp plate to the mounting bracket, so that the original distributor may be refitted without disturbing the ignition timing. However, if the distributor is serviced and new components fitted, the ignition timing must be reset upon refitting the distributor. Proceed to remove the distributor as follows:—

1. Set the engine at T.D.C. with number 1 cylinder firing, proceeding as detailed under "Ignition Timing", on page N.39. This operation is unnecessary in the case where removal of the distributor is an accident precaution measure only.

2. Disconnect the high tension cables from the sparking plugs and from the ignition coil centre terminal, removing the distributor cover complete with the

cables. It should be observed that on KAL Models, the sparking plug cover must be removed to gain access to

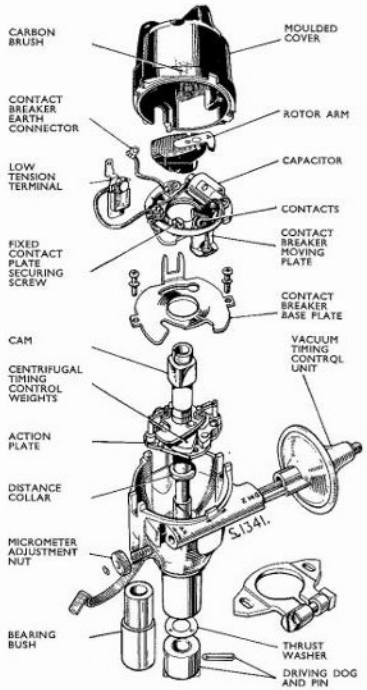


Fig. N.33. Details of the D.M.2 type of distributor

the high tension cables and moulded cable casings. Do not pull on the cables, but exert withdrawing force on the cable casings to effect removal.

3. Release the suction pipe from the distributor vacuum control unit and the low tension lead from the distributor terminal blade.

4. Withdraw the fixings securing the distributor clamp plate to the mounting bracket and lift away the distributor complete.

Note: If it is required to remove the distributor complete with its mounting bracket, then remove the fixings securing the bracket to the cylinder head in the case of KAH Models and to the cylinder block in the case of KAL Models and lift away the complete assembly.

To Dismantle.

In order to ensure that the various components are refitted correctly, a careful note should be made of the positions of the items as they are removed. In particular, note the relationship between the driving dog and the rotor arm and ensure that this relationship is maintained when re-assembling the distributor.

To dismantle the distributor, proceed in the following manner:

1. Lift off the rotor arm from the top of the cam sleeve, carefully levering with a screwdriver if necessary.

2. Disconnect the vacuum unit link from the contact breaker moving plate.

3. Remove the two screws at the edge of the contact breaker base plate.

4. Lift off the contact breaker assembly complete with the low tension terminal block on the DM2 type distributor. On the DM6 type distributor it will be necessary to release the two nuts on the low tension terminal block and raise the contact breaker lead clear.

5. Remove the circlip on the end of the micrometer timing rod and turn the micrometer nut until the rod

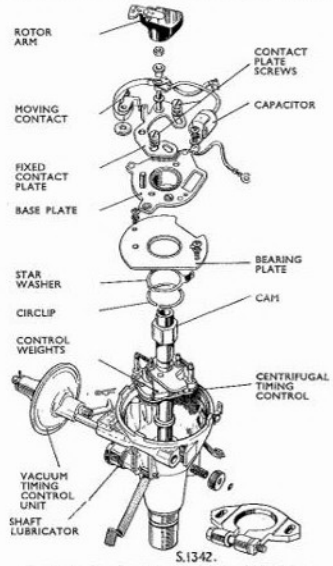


Fig. N.34. Details of the D.M.6 type of distributor

and vacuum unit assembly are free. Take care not to lose the ratchet and coil type springs situated under the nut.

6. Remove the pin securing the driving dog to the distributor shaft, withdraw the driving dog, the thrust washer, and slide the complete shaft assembly with the centrifugal timing control from the distributor body. Observe on the DM6 type distributor that before attempting to remove the shaft assembly, the complete shaft lubricator must first be removed from the distributor body, followed by the spring and the pad, which are situated beneath the lubricator. A distance collar is fitted beneath the action plate, and may be withdrawn at this stage.

Contact Breaker.

1. To dismantle the assembly further, remove the nut, insulating piece and connections from the spring anchor post. This operation frees the low tension terminal block and lead on the DM2 type distributor, and the lead only on the DM6 type distributor.

2. The contact breaker moving contact may now be removed from its pivot, together with the insulating washer positioned beneath it. Withdraw the insulating washer from the spring anchor post.

3. Remove the securing screw(s) and withdraw the fixed contact plate from the contact pivot.

4. Withdraw the single screw securing the capacitor to the base plate. On the DM6 type distributor this operation also frees the contact breaker earthing lead.

5. On the DM2 type distributor, dismantle the contact breaker base assembly by turning the moving plate clockwise and pulling to release it from the contact breaker base plate.

6. On the DM6 type distributor, the contact breaker base assembly can be dismantled by removing the circlip and star washer located under the base plate, when the moving plate and base plate can be separated.

Shaft Action Plate.

To dismantle the centrifugal timing control further, it is important that the following sequence of operations are observed, otherwise damage to the springs may result.

1. Carefully lift off the springs from the posts situated on the action plate and the cam foot.

2. Remove the screw inside the cam sleeve and withdraw the cam sleeve and foot.

3. The centrifugal timing control weights can now be lifted off.

Inspection and Overhaul.
Distributor Cover and High Tension Cables.

1. Wipe the inside of the moulded cover and the metal segments with a petrol moistened cloth, then examine the cover as follows:—

(*a*) If the segments appear blackened, clean with fine emery cloth.

(*b*) Should any segment be worn, the cover must be renewed. Wear on the segments usually indicates that the rotor arm is running out of true. This may be due to bearing wear (see under the appropriate heading).

(*c*) If tracking has occurred on the cover, indicated by a thin black line between two or more segments, or between one of the segments and some adjacent metal part of the distributor, which is in contact with the cover, the cover must be renewed.

(*d*) Ensure the carbon brush in the centre of the cover moves freely.

2. The high tension cables must be carefully examined and renewed if the insulation is cracked or perished, using 7 mm. p.v.c., or neoprene covered rubber-insulated ignition cable, except for the high tension cables on KAL Models which are of the interference suppression type having a special internal construction free from wires. When it becomes necessary to renew the special cables, the correct replacements only should be used. In an emergency the previously mentioned 7 mm. ignition cable can be used, but it should be renewed as soon as possible by the correct suppressed high tension cable. Proceed to renew the high tension cables in the following manner:—

(*a*) On KAH Models to connect new cables to the segments in the distributor cover (see paras. 2(*b*) to 2(*d*) of the following).

(*b*) Slacken the screws on the metal segments, identify the cables to the cover and withdraw the old cables. Cut the new cables to the length required and push them firmly into the side entry holes in the cover, observing cable identification made during removal.

(*c*) Tighten the screw which will pierce the rubber insulation to make contact with the cable core.

(*d*) Secure the cable end to the opposite end of the ignition cable, so that the projection inside the cable end contacts the cable core.

(*e*) To connect the cable to the ignition coil high tension terminal, thread through the moulded terminal, bare about ¼ in. (6 mm.) of the strands at the cable end, thread through the brass washer (removed from the original cable) and bend back the strands (see Fig. N.35).

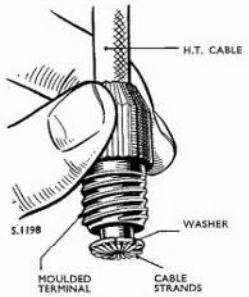


Fig. N.35. Ignition coil high tension cable terminal

(*f*) On KAL Models to connect new cables to the segments in the distributor cover (see paras. 2(*g*) to 2(*l*) of the following).

(*g*) Identify the cables to the distributor cover, unscrew the knurled moulded terminals, remove the cable end and withdraw the old cables.

(*h*) Cut the new suppressed cables to length and pass the end of each cable through the knurled moulded terminal.

(*j*) Refit the cable ends to the new cables ensuring that the cable end projection penetrates the rubber insulation and contacts the cable core.

(*k*) Refit the cables to the distributor cover by means of the moulded terminals, observing cable identification made during removal.

(*l*) Slide the moulded cable casings on to the opposite end of the cable and secure the cable end, so that the projection inside the cable end contacts the cable core.

(*m*) To connect the cable to the ignition coil high tension terminal, proceed as detailed in paras. 2(*h*) and 2(*j*).

3. Examine the rotor arm and renew if it is cracked, or worn.

Contact Breaker Mechanism.

1. Ensure that the moving contact revolves freely on its pivot. If necessary polish the pivot post first with a strip of fine emery cloth. Lubricate the pivot post with a smear of Shell Retinax "A" Grease, refit the moving contact and observe that the contact now rotates freely.

2. Check the contact breaker spring tension, which should be 18 to 24 oz. (510 to 680 grm.) measured at the contacts.

3. The contacts must be quite free from grease or oil. Inspect the contact surfaces, if they are burnt or blackened, clean with a very fine carborundum stone or emery cloth, then wipe the contact surfaces with a petrol moistened cloth.

Distributor Body Bearing.

1. On the DM6 type distributor, the bearing forms an integral part of the cast iron shank of the distributor body and no appreciable wear should occur during normal service life of the distributor, providing that lubrication is carried out at the specified mileages.

2. On the DM2 type distributor, the bearing takes the form of a sintered copper-iron bush which is stepped on its outer diameter and is a press fit in the distributor body shank. The following procedure should be strictly adhered to when fitting a replacement bearing bush.

(*a*) Using a shouldered mandrel of the appropriate diameter, press out the worn bush, from the upper, or body end.

(*b*) Insert the new bush from the lower or drive end, with the smaller diameter of the bush located foremost. The bush is a push fit until the larger diameter registers with the shank of the distributor body. Using a suitable stepped mandrel complete the fitting operation, by pressing the bush fully home, when the bush should be a tight fit, flush with the shank at the lower, or drive end, and with a slight protrusion evident at the body end.

(*c*) Drill the shaft drain hole, carefully removing any fragments of metal which may be present.

(*d*) Ascertain that no burrs exist on the distributor shaft around the hole through which the driving dog securing pin passes. Insert the shaft and action plate assembly, applying clean engine oil to the shaft prior to fitting. If the shaft is a tight fit in the bush when fitted, tap lightly at the drive end and withdraw the shaft. Again insert the shaft, and repeat the operation as long as any tightness persists. It is important that the shaft is free to rotate without binding.

Note: Under no circumstances may the bush be reamed or overbored by any other means after fitting, since this will impair the porosity and thereby the effective lubricating quality of the bush.

(*e*) Run the shaft and body assembly in a test rig, or lathe for approximately 15 min. and then re-lubricate the shaft.

To Re-assemble.

1. Assemble the centrifugal timing control weights, and the cam sleeve and foot assembly to the shaft. Secure the cam to the shaft by means of the fixing screw. Engage the springs with the pillars on the cam foot and the action plate, ensuring that the springs are not stretched, or otherwise damaged during this operation.

2. Place the distance collar over the shaft, smear the shaft with clean engine oil and fit into its bearing.

3. Position the thrust washer over the shaft and then fit the driving dog using a new pin, observing that the marks identifying the dog to the shaft made during dismantling are coincident. If a replacement driving dog, or shaft has been fitted, observe the relationship of the offset tongue of the driving dog with the rotor arm on the old components, and locate the new parts in the same manner.

4. Fit the vacuum unit into its housing followed by the springs and the micrometer nut. Finally secure the nut using the circlip applied to the groove towards the end of the micrometer timing rod.

5. On the DM6 type distributor refit the pad, spring and shaft lubricator.

6. Remake the connection on the DM6 type distributor to the low tension terminal block on the inner side of the distributor body and tighten the nuts on the terminal post to secure the lead.

7. Lightly smear the contact breaker base plate with clean engine oil and fit the moving plate, by reversing the removal procedure.

8. Refit the contact breaker base plate to the distributor body engaging, at this stage, the link from the vacuum unit with the fixing on the contact breaker moving plate. On the DM6 type distributor, secure the link to the moving plate by means of the split pin. Insert the two base plate securing screws, one of which also secures one end of the earthing cable.

9. Fit the capacitor to the contact breaker moving plate and secure with the screw. On the DM6 type distributor, the capacitor fixing screw also secures the free end of the contact breaker earthing cable.

10. Place the fixed contact plate into position over the pivot post and lightly secure with the screw(s). One plain and one spring washer must be fitted under the securing screw(s).

11. Position the insulating washer on the contact breaker pivot post and on the anchor post, on which the end of the contact breaker spring locates.

12. Smear the pivot post with Shell Retinax "A" Grease. Refit the contact breaker moving contact to the pivot post and to the spring anchor post, ensuring that the contact arm moves freely about the pivot post.

13. On the DM2 type distributor, slide the terminal block into the slot on the base plate.

14. Thread the eyelets of the low tension cable and capacitor cable on to the insulating piece. Slide the insulating piece on to the anchor post and engage in the moving contact spring loop, so that the eyelets contact the spring. Refit the washer and nut to secure.

15. Turn the distributor shaft until the contacts show a maximum opening, set the contact breaker gap to ·015 in. (·381 mm.) and then tighten the fixed contact plate securing screw(s). Re-check the setting for other positions of the cam giving maximum opening of the points.

16. Refit the rotor arm, carefully locating its moulded projection into the cam sleeve keyway and exert sufficient pressure to ensure complete engagement of the components.

To Refit.

1. If the original distributor was removed as a precautionary measure only and not serviced, refit observing that the marks made on the distributor clamp plate and mounting bracket during removal operations are coincident.

2. In the case of a replacement distributor or serviced unit, the following refitting procedure as detailed in paras. 3 to 7 must be observed.

3. Ensure the engine is maintained in the position determined during removal operations, i.e., at T.D.C. with number 1 cylinder firing, as detailed under "Ignition Timing", on this page.

4. Refit the distributor mounting bracket at this stage noting that on KAL Models, the operations detailed under "Camshaft—To Refit, para 6" in the "Engine Section", should be observed.

5. On KAH Models, position the timing plate on top of the distributor mounting bracket, with the graduated scale located at the rear of the bracket, so that the arrow marked adjacent to the scale is pointing in a clockwise direction viewed from above.

6. Fit the distributor to the mounting bracket, at the same time turning the rotor arm so that the tongue of the driving dog engages the slot machined in the top of the driving shaft. Secure the clamp plate, positioned mid-way in the slots, to the mounting bracket.

7. To set the distributor to the correct static ignition setting, refer under "Ignition Timing".

8. To complete the distributor refitting, reverse the remaining removal operations, connecting the high tension leads to the sparking plugs in the correct firing order sequence.

IGNITION TIMING

Three means of adjusting the timing are provided:—

(*a*) A clamp bolt mounted horizontally at the base of the distributor. This is the main adjustment, and when it is slackened, the body of the distributor can be turned relative to the clamp plate.

(*b*) Slotted holes in the clamp plate allow the complete distributor to be turned through a small angle, when the two fixings have been slackened. On KAH Models the clamp plate reads against the graduated scale on the timing plate which is situated beneath the clamp plate.

(*c*) The vernier adjustment allows small variations to the ignition setting to be made during road test to determine the optimum ignition setting and also permits setting to the static ignition figure from the T.D.C. position. The knurled nut should be turned anti-clockwise to advance, i.e., in the direction indicated by the letter "A", and clockwise to retard, i.e., in the direction indicated by the letter "R", one complete turn of the nut being equivalent to three crankshaft degrees. A graduated scale on the sleeve of the vacuum unit is provided and each scale division is equivalent to four crankshaft degrees.

On KAH Models, the distributor shaft rotates clockwise when viewed from the top, i.e., rotor end, whilst on KAL Models, the direction of rotation is anti-clockwise when viewed from the top.

To carry out ignition timing proceed using either Method 1 or Method 2 of the following:—

Method 1.

To set the ignition timing to the correct static setting, proceed in the following manner:—

1. Set the engine to T.D.C. with number 1 cylinder firing, by aligning exactly the groove on the crankshaft pulley rear rim (KAH Models) and damper rim (KAL Models) with the timing cover pointer, ensuring that

both the valves on number 1 cylinder are fully closed, if this is not the case, rotate the crankshaft one complete revolution to attain this condition.

2. On KAH Models, the engine may also be set to T.D.C., number 1 cylinder firing, by unscrewing the timing plug and reversing it so that the plain end passes through the hole in the clutch housing, when upon rotating the crankshaft slowly, the plug may be fully registered in the locating hole provided in the flywheel. Ascertain that both valves on number 1 cylinder are fully closed, if this is not the case, rotate the crankshaft one complete revolution to attain this condition.

3. Release the spring clips securing the distributor cover and lift the cover clear of the distributor body.

4. Release the suction pipe from the vacuum unit to avoid strain on the pipe during the ensuing operations.

5. Set the vacuum unit until only one division is visible on the vernier scale, using the knurled micrometer unit.

6. Check that the contact breaker points are adjusted to ·015 in. (·381 mm.) on maximum opening, and ensure that both automatic advance controls are free and in their retarded position.

7. The engine is set at T.D.C., with number 1 cylinder firing, therefore ensure that when the distributor cover is fitted, the rotor arm will be pointing towards the segment for number 1 cylinder high tension cable. Turn the distributor body if necessary to attain this condition.

8. In order to determine the exact separation point of the contact breaker contacts, connect a 12 volt bulb between the distributor low tension terminal and a good earth.

9. On KAH Models rotate the distributor body through an angle of 30° in a clockwise direction, then switch on the ignition, apply light finger pressure to the rotor in an anti-clockwise direction, and turn the distributor body anti-clockwise until the bulb just lights.

10. On KAL Models rotate the distributor body through an angle of 30° in an anti-clockwise direction, then switch on the ignition, apply light finger pressure to the rotor in a clockwise direction and turn the distributor body clockwise until the bulb just lights.

11. Tighten the clamp bolt with the distributor body maintained in the position attained in para. 9 or 10 as applicable.

12. Check this setting by turning the crankshaft two revolutions clockwise when the bulb should again light with the timing pointers in exact alignment.

13. If the timing is now correct, switch off the ignition, remove the test bulb and refit all components.

14. The engine is now timed to fire at T.D.C. and should be advanced for the required number of degrees (refer under "Ignition Timing—Static", on page N.41), by means of the vernier adjustment, rotating the knurled micrometer nut in the direction indicated by the letter "A" cast on the distributor body, for the amount of advance required. One division on the vernier scale corresponds to 4° of crankshaft rotation and one complete turn of the knurled micrometer nut is equivalent to 3° of crankshaft rotation.

Note: On KAH Models an alternative method of advancing the distributor from the T.D.C. setting, is by using the timing plate graduated scale in conjunction with the distributor clamp plate, observing that each division on the scale is equal to three crankshaft degrees.

15. Therefore if 3° B.T.D.C. is the setting required, the distributor will have to be advanced by one complete turn of the knurled micrometer nut, in the direction indicated by the letter "A".

16. Road test the vehicle and establish the final setting for the distributor so that the best possible engine performance is obtained, together with smooth running. Variation to the distributor setting is made using the vernier adjustment, but if the ignition system is functioning correctly only small deviations from the correct static ignition timing should be necessary to obtain the optimum ignition setting.

Method 2 (using the Stroboscopic Timing Light).

The use of a high intensity timing light is recommended for the rapid visual checking of the centrifugal and vacuum advance mechanism incorporated in the ignition distributor. This also provides the best method of setting the ignition timing to the recommended static figure.

The advantages of an electronic timing light are:—

(*a*) It is simple to use, and it is portable.

(*b*) It is the quickest method of setting and checking ignition timing.

(*c*) It enables ignition timing and action of the automatic advance mechanism to be checked under normal operating conditions without removing the distributor or any other items from the engine.

(*d*) It is possible to set or check ignition timing disregarding any backlash, which may exist in the driving gears or slackness of camshaft driving chain.

Preparing to use the Churchill Timing Light, Model 645.

1. The pointer on the timing cover should be cleaned and marked with white chalk.

2. Clean the crankshaft pulley rear rim on KAH Models and the damper rim on KAL Models for approximately 1 in. (25 mm.) before the T.D.C. groove, observing that the crankshaft revolves in a clockwise direction viewed from the front of the engine.

3. Rotate the crankshaft in a clockwise direction viewed from the engine front, until the groove on the rim of the pulley, or damper, dependent on the vehicle, is the required distance before the pointer on the timing cover. Then mark a thin line (hereafter referred

to as the "timing mark"), using white chalk, on to the rim in exact alignment with the timing cover pointer. Refer under the heading "Ignition Timing—Static" for the relevant mm. dimension B.T.D.C. applicable to the vehicle concerned.

4. Connect the electrical leads from the timing light according to the maker's instructions and run the engine at an idling speed of 400 to 500 r.p.m. This is below the speed at which the centrifugal and vacuum advance action begins.

How the Timing Light Operates.

Correctly connected and with the engine running the timing light gives a high intensity flash every time the contact breaker points open for number 1 cylinder. When the light is directed on to the marked rim, the chalked timing mark will appear to be stationary. The distance between the timing mark on the rim and the chalked pointer on the timing cover, indicates the amount of ignition advance at varying speeds above idling.

Setting the Ignition Timing.

1. With the engine idling at 400 to 500 r.p.m., the relative positions of the rim timing mark and the pointer on the timing cover should be observed in the light emitted by the timing lamp.

2. For the static ignition timing to be correct, the timing mark on the rim must align exactly with the chalked pointer on the timing cover.

3. If necessary, the distributor can be adjusted to obtain this alignment, while the engine is still idling, by making the necessary variations to the vernier adjustment.

Checking the Centrifugal Advance Action.

To check the centrifugal advance only, the suction pipe to the vacuum unit should be disconnected. Still observing the "stationary" rim timing mark, gradually increase the engine speed. The distance between the timing mark and the pointer will increase, i.e., the timing mark will move in an anti-clockwise direction away from the pointer, showing that the centrifugal advance mechanism has begun to operate over its speed range. Erratic movement of the timing mark on the rim whilst accelerating, or decelerating indicates a partially seized centrifugal advance mechanism, probably caused by lack of lubrication.

Checking the Vacuum Advance Action.

The throttle should be opened to give an engine speed of 1,200 to 1,500 r.p.m., or until the vacuum connection drilling in the carburettor has been uncovered by the throttle valve. With the engine running under these conditions, the suction pipe connection on the vacuum unit should be alternately disconnected and reconnected whilst observing the timing mark on the pulley rim (KAH Models), or on the damper rim (KAL Models). This mark should retard and advance as the suction pipe is removed and refitted.

IGNITION TIMING—STATIC SETTING

KAH Models.

Regular Grade Fuel 1°–3° (1·2 mm.–3·6 mm.*) B.T.D.C.

KAL Models.

Regular Grade Fuel 5°–7° (8·2 mm.–11·5 mm.*) B.T.D.C.

*The mm. dimension is measured on the rim of the crankshaft pulley (KAH Models), or on the rim of the damper (KAL Models), before the groove on the rim reaches the pointer on the timing cover, on rotation of the crankshaft in a clockwise direction viewed from the front of the engine, and gives the correct crankshaft location for static ignition setting when so positioned. Thus this dimension is used for locating the rim groove the required distance before the pointer on the timing cover, prior to chalk marking, when setting the ignition timing using Method 2.

SPARKING PLUGS

The sparking plugs are of great importance in maintaining satisfactory engine performance and every care should be taken to fit the correct type when replacements are necessary.

There is little to be gained by experimenting with different plugs, as the make and type fitted to the engine when new is best suited to the requirements of the engine.

Plugs should be cleaned on a "Compound Blast" cleaner, the gaps checked and adjusted if necessary and then tested under pressure to enable the true performance of the plug to be ascertained.

To Remove.

1. Raise the bonnet (hood) and secure in the open position, also release the internal engine cowl from its mountings.

2. On KAH Models, complete the plug removal proceeding in the following manner:—

(*a*) Withdraw the high tension cables from the sparking plug terminal post.

(*b*) Unscrew each sparking plug using a well fitting box spanner, taking care to clean the plug recesses in the cylinder head before the last thread is unscrewed. This will prevent any accumulated foreign matter entering the combustion chambers.

Note: The box spanner should be held square with the plug to eliminate any possibility of cracking the plug insulator.

3. On KAL Models, complete the sparking plug removal as follows:—

(*a*) Remove the sparking plug cover, which is a spring fit in between the sides of the rocker cover.

(*b*) Disconnect the high tension cables from the sparking plug terminal post by exerting withdrawing force on the moulded cable casing.

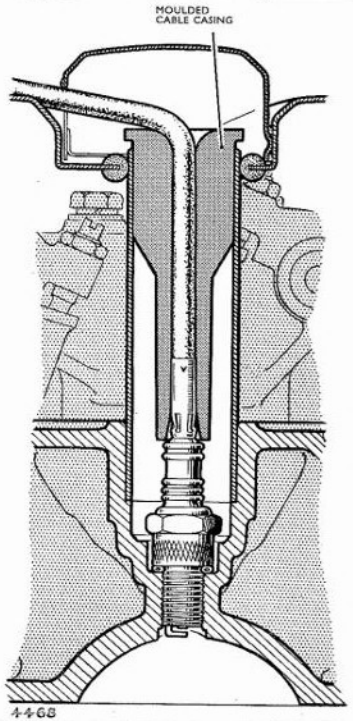


Fig. N.36. Sparking plug H.T. lead connection (KAL models)

Note: Do not pull on the cable itself for as it is secured in the moulded casing, the cable will be disconnected from the sparking plug as the casing is removed.

(*c*) Check the sparking plug wells to ensure that no foreign matter is present, prior to removing the sparking plugs. This precaution should not be omitted and is very quickly carried out by means of a lead lamp and mirror.

(*d*) Remove the sparking plug using the special box spanner provided in the tool kit and withdraw the plug complete with its sealing washer.

Inspection and Overhaul.

1. Examine the plugs, referring to Fig. N.37 which illustrates the various conditions of plugs on removal from the engine after service, and to the following remarks on plug condition:

Normal Condition. Examine the sparking plugs for powdery deposits, ranging from brown to greyish tan. Electrodes may be slightly worn. These are signs of sparking plugs used under normal conditions of mixed high speed and low speed driving. Cleaning and gap re-setting on these sparking plugs is all that is required (see Fig. N.39). White to yellowish powdery deposits usually indicate long periods of constant speed service. These deposits have no effect on performance if the sparking plugs are cleaned thoroughly at 3,000 mile (4,500 km.) intervals.

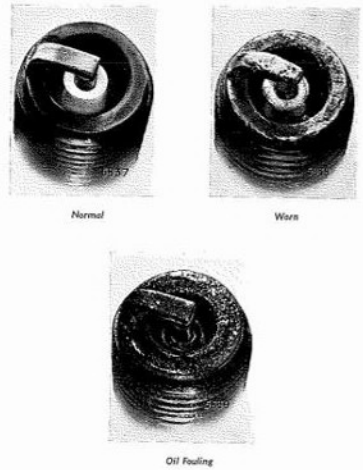


Fig. N.37. Conditions of sparking plugs

Worn Condition. Any sparking plug found in this condition should be renewed by the correct type as given under "Data" at the front of this section. A complete set should be fitted.

Oil Fouling. This condition is usually identified by wet sludge deposits (see Fig. N.37) traceable to excessive oil entering the combustion chambers through worn rings and pistons, excessive clearances between inlet valve guides and stems, or worn bearings, etc. "Hotter" running sparking plugs may alleviate oil fouling temporarily but to cure oil fouling, engine overhaul is called for.

Petrol Fouling. This condition is usually identified by dry black fluffy deposits which result from incomplete combustion (see Fig. N.37). Too rich an air-fuel mixture, excessive use of hand choke or faulty choke action can cause incomplete burning. In addition, defective contact breaker points or high tension cables can reduce voltage supplied to the sparking plug and cause misfiring. If fouling is evident in only a few cylinders, sticking valves may be the cause. Excessive idling, slow speeds or stop-and-start driving can also keep plug temperatures so low that normal combustion deposits are not burned off.

Burnt or Overheated sparking plugs are usually identified by a white, burnt or blistered insulator nose and badly eroded electrodes (see Fig. N.37). Inefficient engine cooling and incorrect ignition timing can cause general overheating. If only some of the sparking plugs have suffered overheating, the cause may be uneven distribution of the coolant. Severe service, such as sustained high speed and heavy loads, can also produce abnormally high temperatures in the combustion chamber, which necessitates use of "cooler" running sparking plugs.

2. Examine the plugs and any that appear dirty or oily should be washed thoroughly in petrol, blowing dry using compressed air, or allow to dry in the atmosphere.

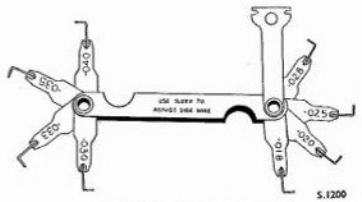


Fig. N.38. Plug gap gauge

3. Clean each serviceable plug on a "Compound Blast" type cleaner, making sure that all traces of carbon deposit are removed. If necessary lightly brush the points and plug face with a small wire brush.

4. Examine the upper and lower end of the insulator for cracks and ensure that the upper end is kept perfectly clean and free from grime and dust. A plug with a cracked insulator must be renewed.

5. If the electrodes are badly burnt, renew the plug.

6. The gap between the plug electrodes should be 0·025 in. (0·63 mm.). Check this with a gap gauge and adjust if necessary by bending the side electrode, until the correct setting is obtained (see Fig. N.39). **On no account must the adjustment be carried out by bending the centre electrode** as this may split the lower part of the insulator.

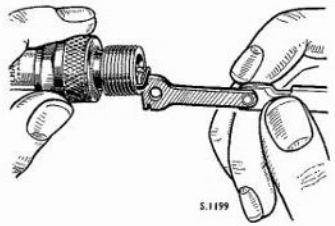


Fig. N.39. Setting the sparking plug gap

7. Test the sparking plugs under pressure using a Spark Plug Comparitor, enabling the true performance of the plug to be ascertained.

8. Renew the sparking plug sealing washer and screw up the plug threads until it abuts the shoulder.

To Refit.

When refitting the sparking plugs observe the following procedure:—

1. On KAH Models, screw down the plugs as far as possible by hand before finally tightening with a box spanner. Ensure that the box spanner is held square with the plug to eliminate any possibility of cracking the plug insulator. Reconnect the high tension cables to the plugs in the correct firing order sequence.

2. On KAL Models, check to ensure that no plug sealing washers have been left in the sparking plug wells, as it is important that only one washer is used under each plug. Insert the plug into the special box spanner, screw down the plugs by hand before finally tightening using a tommy bar.

Reconnect the high tension cables in their correct positions by pressing down on the cable casings. Plug cable lengths are such that incorrect replacement is almost impossible.

Refit the sparking plug cover, making sure that it has sprung correctly into position.

3. Complete the operation by securing the bonnet and internal engine cowl.

LAMPS

DESCRIPTION

The lighting system includes two headlamps, two sidelamps, two stop/tail lamps, two interior roof lamps and a number plate illumination lamp.

The headlamps, which are flush fitting, have a combined reflector and front lens, known as a "light unit". This is secured in a mounting flange by a rim and the complete assembly is mounted to the body under spring tension. The "prefocus" double filament bulb eliminates the need for any focusing device in the lamp. The bulb cap is carried on a flange accurately positioned in relation to the filament during manufacture. A slot in the flange engages with a projection on the inside of the bulb holder at the back of the reflector, thus ensuring the correct positioning of the filaments. A bayonet-fitting cap with spring-loaded contacts secures the bulb firmly in position, and also carries the supply to the bulb contacts. Identical bulbs are fitted to both lamps.

Note: A separate in-line 35 amp. fuse is fitted in the headlamp circuit between the switch and the lamps and is located in the headlamp lead immediately below the instrument panel surround.

The sidelamps are also flush fitting. The flanged bulb holder complete with a 6 watt bulb is carried in a moulded rubber body, both being secured by the same screws. The metal rim and domed glass are retained by shaped lips formed in the rubber body.

Note: A separate in-line 35 amp. fuse is fitted in the sidelamp circuit between the switch and the lamps and is located in the sidelamp lead immediately below the instrument panel surround.

The stop/tail lamps are of the same construction as the sidelamps but these lamps are each fitted with a twin filament bulb, 6 watt for the tail lamp and 21 watt for the stop lamp.

The number plate illumination lamp comprises a moulded rubber body, a metal bulb holder and a metal cover, with a glass window. Two screws retain the cover and glass to the body and two further screws secure the body to the mounting panel.

The glass window seats on a rubber gasket and rubber washers are located below the cover on the cover securing screws. A 6 watt bulb is fitted to this lamp.

The interior lamps each consist of a moulded plastic lens and a metal base. Two slots in the lens locate over protrusions on the lens retaining circlip fitted in the base. The 6 watt bulb and holder is supported on a bakelite plate which also carries the feed terminal and pivot type switch. The cable lead to the feed terminal enters through a grommet fitted in the side of the lamp base.

BULB RENEWAL

It is advisable to renew the bulbs after long service before they actually burn out, as the filaments may sag and cause a reduction in the performance of the lamp.

To assist in identification, Lucas bulbs are stamped with a number on the metal caps. **Ensure that the replacement bulb is the same number as the original.**

Headlamps.

1. Release the screw securing the front rim and lift off the rim. Next remove the dust excluding rubber, when three spring loaded beam adjustment screws will be visible. Do not turn or disturb the setting of these screws, as this would alter the beam setting of the light unit.

2. Press the light unit in against the tension of the adjustment screw springs and turn it in an anti-clockwise direction until the heads of the screws can be disengaged through the slotted holes in the light unit rim.

3. Press the adaptor in towards the reflector and turn in an anti-clockwise direction to withdraw the adaptor when the bulb can be removed.

4. Re-assemble the lamp by reversing the dismantling procedure, ensuring that the thick inner edge of the dust excluding rubber rests in the recess around the light unit rim.

5. Check the beam setting on completion.

Sidelamps and Stop/Tail Lamps.

To gain access for bulb renewal, prise the rim out of the rubber retaining lip and ease the domed glass away from the rubber body. Remove the bulb. When refitting the metal securing rim, ensure that full seating in the rubber lip is evident.

Number Plate Illumination Lamp.

Access to the bulb is obtained by removing the two securing screws and lifting off the cover.

Vacuum Warning Light (KAB Models).

Bulb replacement is carried out after disconnecting the negative terminal on the battery, unscrewing the four screws securing the instrument panel and lifting away the panel sufficiently to give access to the rear of the warning lamp body.

Oil Pressure, Dynamo and Headlamp Main Beam Warning Lights.

Bulb replacement is carried out after disconnecting the negative terminal on the battery, unscrewing the four screws securing the instrument panel and lifting away the panel sufficiently to give access to the rear of the panel. Pull the required bulb holder away from the rear of the speedometer body.

Interior Roof Lamp.

To gain access to the bulb, turn the plastic lens in either direction until the slots in the lens disengage from the retaining circlip protrusions and remove the lens.

HEADLAMPS

To Set the Beams.

The lamps should be set so that the main driving beams are directed straight ahead, parallel with the road surface and with each other. If adjustment is necessary proceed as follows.

1. Slacken the screw securing the front rim and lift off the rim, followed by the dust excluding rubber, thereby exposing three spring loaded adjusting screws.

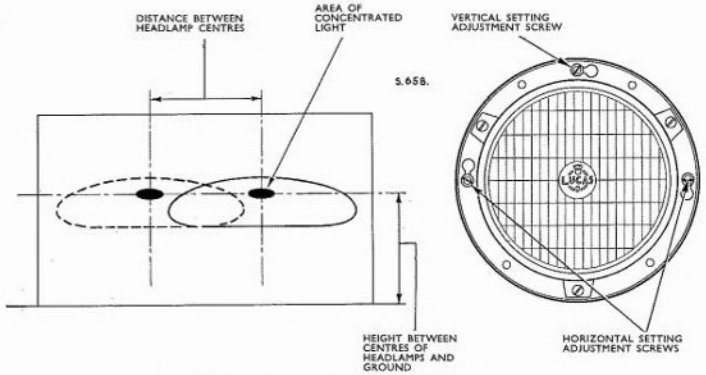


Fig. N.40. Setting the headlamp beams

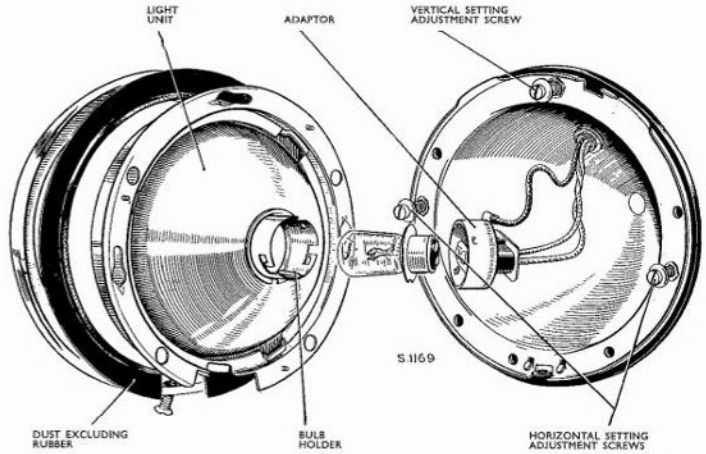


Fig. N.41. Headlamp details

2. The screw at the top of the lamp controls the vertical setting and the screws on each side of the lamp control the horizontal setting.

3. When setting the lamps place the vehicle on a level surface squarely in front of a blank wall or screen at a distance of at least 25 ft. (7·5 m.) (See Fig. N.40).

To Remove.

1. Slacken the screw securing the front rim, then lift off the rim, followed by the dust excluding rubber.

2. Press the light unit in against the tension of the adjustment screw springs and turn in an anti-clockwise direction until the heads of the screws can be disengaged through the slotted holes in the light unit seating rim. Lift the light unit clear after releasing the bulb holder and remove the bulb from the light unit.

3. Withdraw the three screws from the light unit rim and remove the seating rim and the unit rim from the light unit.

Note: The glass and reflector assembly comprising the light unit is a sealed unit and no attempt should be made to separate them.

4. Disconnect the head lamp leads from the main cable harness at the adjacent snap connectors.

5. Remove the three screws securing the headlamp body to the front grille panel, then withdraw the body, followed by the rubber gasket.

Inspection and Overhaul.

1. Examine the body gasket and the dust excluding rubber. If damaged, or deteriorated, renew.

2. If the lens is cracked or broken, renew the light unit.

3. Test the bulb filaments and renew as necessary.

4. Check the lamp leads for damage and ensure that the snap connectors are in good condition. Renew the bulb holder if the contact spring pressure is weak or if the insulator bridge is broken.

To Refit.

To refit the lamp, reverse the removal procedure, making certain that the projections on the edge of the light unit fit into the slots in the light unit rim and that the leads are correctly connected to the main cable harness as shown in the wiring diagram. Before fitting the front rim and dust excluding rubber, set the headlamp beams as previously detailed in this sub-section.

SIDELAMPS

To Remove.

Prise the rim and glass out of the rubber lip to obtain access to the screws which pass through the rubber body and bulb holder to retain the lamp in position. Remove the screws and disconnect the sidelamp leads from the cable harness at the adjacent snap connectors provided, when the sidelamp can be lifted clear.

Inspection and Overhaul.

1. If the glass is cracked or damaged it should be renewed. Clean the glass with a soft cloth before refitting.

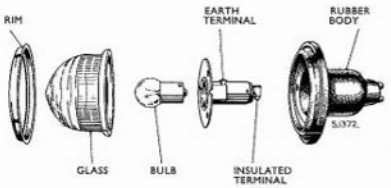


Fig. N.42. Sidelamp details

2. Test the bulb filament, renewing as necessary.

3. Check the leads for damage and ensure the snap connectors are in good condition.

4. Examine the contact spring for weakness.

To Refit.

To refit the lamp, reverse the procedure given for removal ensuring that the leads are correctly connected to the main cable harness as shown in the wiring diagram.

STOP/TAIL LAMPS

To Remove.

Prise the rim and glass out of the rubber lip to obtain access to the screws which pass through the rubber body and bulb holder to retain the lamp in position. Remove the screws and disconnect the stop/tail lamp leads from the cable harness at the adjacent snap connectors provided, when the stop/tail lamp can be lifted clear.

Inspection and Overhaul.

1. If the glass is cracked or damaged it should be renewed. Clean the glass with a soft cloth before refitting.

2. Test the bulb filaments, renewing as necessary.

3. Check the leads for damage and ensure that the snap connectors are in good condition.

4. Examine the contact spring for weakness.

To Refit.

Carry out this operation by reversing the removal procedure, ensuring the leads are connected correctly in accordance with the wiring diagram.

NUMBER PLATE ILLUMINATION LAMP

To Remove.

1. Remove the two screws and withdraw the metal cover and glass noting that a rubber seating gasket is fitted under the glass. Rubber washers are fitted to the securing screws under the cover.

2. Remove the bulb.

3. Disconnect the electrical leads at the snap connectors, unscrew the two screws retaining the bulb holder and rubber body to the mounting panel and withdraw the bulb holder and the body.

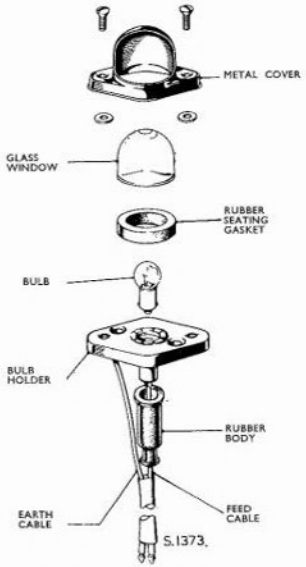


Fig. N.43. Number plate lamp details

Inspection and Overhaul.

1. Renew the glass window if damaged.
2. Test the bulb filament.
3. If the contact spring pressure is weak, renew the bulb holder.
4. Examine the rubber body for deterioration.

To Refit.

To refit reverse the removal procedure.

INTERIOR ROOF LAMP

To Remove.

1. Turn the plastic lens in either direction until the slots in the lens disengage from the retaining circlip protrusions and remove the lens.
2. Remove the bulb.
3. Slacken the feed terminal screw and release the feed cable. Withdraw the cable through the grommet in the side of the base.
4. To remove the front lamp base unit, it is necessary to remove the centre trim panel in order to remove the two screws, nuts and washers retaining the unit to the panel.

The rear interior lamp base unit is removed after releasing two screws, nuts and washers as the nuts are accessible without panel removal.

Inspection and Overhaul.

1. Examine the plastic lens for damage particularly at the slots.
2. Check the pivot action of the switch and ensure that contact with the bulb holder is effective.
3. Check the bulb filament.

To Refit.

Reverse the removal procedure.

VACUUM WARNING LIGHT

To Remove.

1. Disconnect the negative lead from the battery post terminal.
2. Unscrew the four screws securing the instrument panel to the panel surround and withdraw the panel sufficiently to gain access to the rear of the panel.
3. Pull away the bulb holder from the rear of the warning light body and remove the bulb.
4. To remove the light body, unscrew the escutcheon on the front of the panel whilst holding the knurled section of the body at the rear of the panel.

To Refit.

Reverse the removal procedure.

SWITCHES

DESCRIPTION

A main lighting switch, a dipper switch and a stop lamp switch are fitted in the respective circuits for controlling the lamps.

Additionally, an oil pressure switch, a vacuum warning light switch (KAB models only), a windscreen wiper switch and an ignition or starter/heater switch are fitted, the latter switch, according to engine type.

The main lighting switch is mounted on the instrument panel to the right of the centrally positioned speedometer. Rotating the main switch in a clockwise direction to the first position completes the circuit to the side lamps, the tail lamps and the number plate illumination lamp. Rotating the main switch, still in a clockwise direction, to the second position completes the headlamp circuit, in addition to those mentioned previously.

The dipper switch is a lever type switch mounted on the steering outer column below the steering wheel. The headlamp bulbs have dual filaments and when the dipper switch is brought into operation the circuit is switched from the lower to the upper filaments to give a dipped beam.

The stop lamp switch is fitted to the hydraulic brake pipe four-way connector located on the chassis frame sidemember adjacent to the handbrake operating rod relay bracket. The switch is operated automatically when the footbrake is applied being controlled by brake fluid pressure.

The oil pressure switch is located in the main oil gallery in the cylinder block of each of the four engine units. The switch operates the warning light on the instrument panel when the engine oil pressure in the gallery reaches a pre-determined figure.

The vacuum switch (KAB models only) is connected in circuit with the vacuum warning light and is fitted in the top of the vacuum tank pipe banjo connection. The switch operates the warning light when vacuum in the system falls below 10 to 16 hg.

The windscreen wiper switch is positioned in the upper half of the instrument panel and is connected in the wiper motor circuit.

The ignition switch is fitted to petrol engined models and located in the centre of the main lighting switch. The switch is key operated and controls the ignition circuit of the vehicle.

The starter switch also fitted to petrol engined models only, is secured to the nearside front end underframe longitudinal member and is cable operated from the starter knob on the instrument panel.

The starter/heater switch, fitted to diesel engined models, is positioned in the upper half of the instrument panel and is key operated. There are five positions on the switch, namely,

"A" which indicates "auxiliaries"
"S" which indicates "starter energised"
"OFF" which indicates "cut-off of electric circuit"
"H" which indicates "heater energised"
"HS" which indicates "starter and heater energised"

The "A" and "S" positions are operated by clockwise rotation and the "H" and "HS" positions are engaged by anti-clockwise rotation. When using the heater switch positions, it is necessary to manually turn the switch to the "A" position, once the engine is running, in order to energise the circuits of the auxiliary equipment. Normal starting without the use of the heater, automatically engages the "A" position by means of the spring loading in the switch.

The panel light switch, located in the lower half of the instrument panel, is operative only when the main lighting switch is turned to the "S" position.

MAIN LIGHTING SWITCH

To Remove and Refit.

1. Disconnect the negative lead at the battery post terminal.
2. Unscrew the four screws securing the instrument panel and withdraw the panel sufficiently to give access to the rear of the panel.
3. Detach the cable leads at the switch terminals.
4. Unscrew the clamping screw and nut on the retaining wire located in slots at the rear of the switch and remove the wire. The switch can then be withdrawn from the front of the panel.
5. On petrol engined models, the ignition barrel lock switch is located in the main switch body by means of a spring loaded plunger. To remove the lock, ensure that the switch is set in the "off" position and compress the plunger with a suitable rod inserted in the hole on the underside of the switch knob. Withdraw the switch knob and the barrel lock switch can be removed.
6. Reverse the removal procedure to refit the switch, connecting the leads as shown in the wiring diagram.

DIPPER SWITCH

To Remove and Refit.

1. Disconnect the negative lead at the battery post terminal.
2. Remove the two cable clips on the upper section of the steering column.
3. Unscrew the four screws securing the instrument panel and withdraw the panel sufficiently to give access to the rear of the panel.
4. Disconnect the three dipper switch cable leads at the snap connectors behind the instrument panel and withdraw the lead ends clear of the panel and the cable sleeve on the steering column.
5. Remove the two screws retaining the end cap to the dipper switch housing and remove the end cap.
6. Unscrew the hexagon nut at the base of the switch lever and separate the housing from the combined lever, switch and cable leads.
7. Refit in the reverse order ensuring that the cables are connected in accordance with the wiring diagram.

STOP LAMP SWITCH

To Remove and Refit.

1. Disconnect the leads from the stop lamp switch and unscrew the switch from the four-way connector. Temporarily plug the tapped hole in the connector to prevent the loss of brake fluid and also the entry of dirt etc.
2. After refitting the switch, bleed the hydraulic system as detailed in the "Brakes" section.

Note: Do not operate the footbrake pedal whilst the stop lamp switch is removed and the temporary plug in position.

OIL PRESSURE SWITCH

To Remove and Refit.

1. Disconnect the lead from the switch and unscrew the switch using a spanner on the hexagon portion of the switch. Temporarily plug the tapped hole in the adaptor on the cylinder block to prevent the loss of oil and also the entry of dirt etc.

Note: Do not run the engine with the switch removed and the temporary plug in position.

2. Refit the switch noting that the thread is tapered and ensuring that the small vent in the large flange of the switch is not closed.

VACUUM SWITCH

(KAB Models)

To Remove and Refit.

1. Disconnect the lead from the switch and unscrew the switch from the vacuum tank banjo using a spanner on the hexagon portion of the switch. Temporarily seal the tapped hole in the banjo to prevent the entry of dirt etc.

2. Refit by reversing the removal procedure, noting that the switch has a tapered thread, It is advisable to run the engine for a few minutes on completion to restore the vacuum in the tank, before moving the vehicle.

WINDSCREEN WIPER SWITCH

To Remove and Refit.

1. Disconnect the negative lead on the battery post terminal.

2. Unscrew the four screws securing the instrument panel and withdraw the panel sufficiently to give access to the rear of the panel.

3. Detach the cable leads at the switch terminals.

4. Unscrew the bezel using the two slots provided and remove the switch from the panel noting the position of the wavy washer located between the bezel and the switch body.

5. Reverse the removal procedure for refitting.

IGNITION SWITCH

(KAH and KAL models)

The ignition lock barrel switch is fitted in the centre of the main lighting switch on petrol engined models and removal instructions are detailed under "Main Lighting Switch" in this section.

STARTER SWITCH

(KAH and KAL models)

To Remove and Refit.

1. Remove the negative lead from the battery post terminal.

2. Release the starter control cable from the cable coupling on the switch spindle and also at the bracket clip.

3. Turn back the rubber protectors and disconnect the cable leads at the switch terminals noting that the control box feed lead is connected at the switch on the terminal which carries the battery negative lead.

4. Unscrew the switch central securing nut and withdraw the switch clear of the front end underframe member.

The starter switch is a sealed unit and therefore is renewed as a complete assembly.

5. To refit the switch, reverse the removal operations referring to the wiring diagram when re-connecting the cable leads.

STARTER/HEATER SWITCH

(KAD and KAB models)

To Remove and Refit.

1. Disconnect the negative terminal at the battery post terminal.

2. Unscrew the four screws securing the instrument panel and withdraw the panel sufficiently to give access to the rear of the panel.

3. Detach the four cable leads at the switch connectors.

4. Unscrew the bezel using the two slots provided and detach the switch, noting that the brass nut and washer are located behind the panel. Remove the annotated escutcheon plate.

5. Refit in the reverse order of removal referring to the wiring diagram when re-connecting the cable leads to the switch terminals.

PANEL LIGHT SWITCH

The removal and refitting instructions for this switch are identical to those given for the "Windscreen Wiper Switch" in this section.

INSTRUMENTS AND GAUGES

INSTRUMENT PANEL

To Remove and Refit.

1. Disconnect the negative lead from the battery post terminal.

2. Unscrew the four screws securing the instrument panel and withdraw the panel sufficiently to give access to the rear of the panel.

3. Release the knurled nut securing the speedometer cable to the rear of the speedometer.

4. Detach all cable connectors at the terminals of each switch and withdraw the instrument illumination and warning light bulb holders from the rear of the speedometer. Take special note of the lead locations to the gauge terminals.

5. The panel may then be withdrawn complete with switches and speedometer.

6. Reverse the removal procedure ensuring that the cable leads are re-connected in accordance with the wiring diagram.

SPEEDOMETER, FUEL GAUGE AND TEMPERATURE GAUGE

To Remove and Refit.

1. Disconnect the negative lead from the battery post terminal.

2. Unscrew the four screws securing the instrument panel and withdraw the panel sufficiently to give access to the rear of the panel.

3. Release the knurled nut securing the speedometer cable to the rear of the speedometer.

4. Detach the cable connectors at the fuel and temperature gauge terminals and withdraw the instrument illumination and warning light bulb holders. Take special note of the lead locations to the gauge terminals.

5. Unscrew the knurled nuts retaining the two clamp legs securing the speedometer to the instrument panel, noting that an earth lead is fitted under one of the nuts. Lift off the clamp legs and withdraw the speedometer complete with the fuel and temperature gauges from the front of the panel.

6. To remove the fuel or temperature gauge from the speedometer, it is not necessary to remove the speedometer from the panel. With the gauge leads detached, unscrew the respective two screws securing the appropriate gauge to the speedometer, and withdraw the gauge ensuring that the pointer is not damaged in the process.

7. Refit the units in the reverse order of removal, connecting the cable leads in accordance with the wiring diagram.

FUEL TANK GAUGE UNIT

To Remove and Refit.

1. Disconnect the cable lead at the connector on the fuel tank unit, ensuring that the negative lead is first removed from the battery post terminal.

2. Unscrew the six screws securing the gauge unit to the top of the tank and lift out the unit taking care not to damage the float or arm which would cause a false reading when the unit is refitted. Remove the gauge seating gasket.

3. Refit in the reverse procedure to removal ensuring that the seating gasket is renewed and the remnants of the original gasket are completely cleaned off to effect a fuel tight joint.

WATER TEMPERATURE SWITCH

To Remove and Refit.

1. Disconnect the cable lead at the connector on the switch.

2. Using a suitable spanner on the haxagon portion of the switch, unscrew the switch and remove the seating gasket. Before removing the switch, it will be necessary to part drain the radiator or alternatively, prepare a suitable plug to temporarily seal the tapped hole as soon as the switch is removed.

3. Refit the switch ensuring that the gasket is in good condition, connect the cable lead and check the radiator water level on completion.

ACCESSORIES

HORN

A single miniature wind tone horn, model 9H, is fitted on the right hand side of the front scuttle immediately below the fresh air ventilator and is connected through a fuse to the battery on one side and to the horn push in the steering wheel hub on the other side.

If a horn fails to sound or its performance becomes uncertain, the fault need not necessarily be in the horn. First ensure that the trouble is not due to a loose or broken connection in the wiring of the horn circuit or to a discharged battery. A short circuit in the horn wiring will cause the fuse to blow. In this event, examine the wiring for the fault and rectify accordingly, before renewing the fuse with the spare provided.

Poor performance can also be caused by loosening of the mounting bolts, which should be checked and tightened as necessary.

If examination proves these points to be in order, the horn may need adjustment but this should not become necessary until the horn has been in service for a long period.

Adjustment.

Adjustment does not alter the pitch of the note but merely takes up wear of moving parts. While adjusting, short out the fuse otherwise it may blow. If a horn does not sound after making an adjustment, release the horn push instantly.

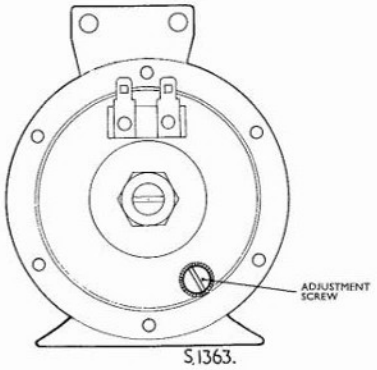


Fig. N.44. Horn adjustment

A small serrated adjustment screw is provided on that side of the horn at which the cables terminate. Turn this screw anti-clockwise until the horn just fails to sound, then turn it back for about one quarter of a turn.

Important: It is essential that the central slotted stem and locking nut are not disturbed.

A 12-volt horn in correct adjustment will pass 3·0–3·5 amperes measured on a first grade moving coil 0-10A. ammeter. If a suitable instrument is available, connect it in series with the horn and turn the adjustment screw clockwise to increase the current, or anti-clockwise to decrease it. When adjusting a horn by the aid of an ammeter, the aim is to obtain the best performance with the least current.

To Remove and Refit.

1. Detach the cable leads at the connectors on the horn and release the horn from the scuttle mounting bracket by unscrewing the two securing bolts.

2. Refitting is a reversal of the removal operation.

HORN PUSH

The horn push comprises a slip ring assembly, a brush contact assembly and a horn push assembly.

The slip ring consists of a brass ring in a rubber moulding, located over the steering column immediately below the steering wheel. A single lead is connected to the terminal on the underside of the moulding.

The brush contact passes through the hub of the steering wheel. This takes the form of a spring loaded plunger which contacts the brass slip ring at one end and the horn push at the other. The horn push is carried in a cap which fits over the centre of the steering wheel.

When the horn push is pressed, the horn circuit is earthed via the steering inner column.

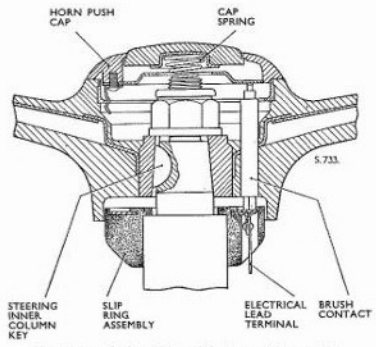


Fig. N.45. Sectional view of the horn push assembly

To Remove and Refit.

1. Prise the horn push cap from the steering wheel.

2. Lift out the brush contact.

3. Remove the dipper switch and steering wheel as detailed in the "Steering" section.

4. Disconnect the lead from the underside of the slip ring and then lift the latter off the steering column.

5. Refit in the reverse order to removal referring to the "Steering" section for details of refitting the steering wheel and the horn push.

WINDSCREEN WIPER ASSEMBLY

Description.

The windscreen wiper model DR2 comprises an electric motor and gearbox which drives a cable rack mechanism transmitting power to the wheelbox spindles and so to the wiper arms and blades. Rotation of the motor armature is converted to a reciprocating motion in the cable rack by means of a single-stage worm and nylon gear, the motor being coupled to the

cable rack via the crank pin in the gear through a connecting rod and crosshead in the gearbox. The cable rack, passing through outer casing tubes, imparts an oscillating motion to the wiper arm spindles by means of the cable rack wire helix meshing with the gear wheel in each wheelbox.

Lubrication.

The gearbox, cable rack and wheelboxes are greased during manufacture and require no periodic lubrication. Efficient wiping is dependent upon having clean windscreens and wiper blades in good condition. The windscreens should be cleaned with methylated spirits (de-natured alcohol) or a good quality silver plate polish, in order to remove oil, tar spots and other contaminations. Silicon or wax based polishes must not be used for this purpose. Worn or perished wiper blades are readily removed for replacement.

To Check for Faults.

In the event of the windscreen wiper failing to operate or giving poor performance, proceed as follows:

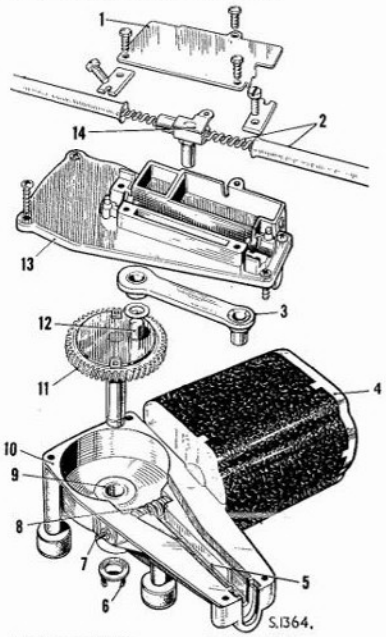
(*a*) Measure Supply Voltage:
Using a first grade moving coil voltmeter, measure the voltage between the motor supply terminal "2" and a good earthing point. When the wiper is working normally this should be at least 11·5 volts with a good battery. If a low or zero reading is given, check the fuse, switch (by substitution), cabling and connections. If these points appear satisfactory, the motor may have developed an internal fault or be subjected to excessive loading due to mechanical defects. Examine and rectify as necessary.

(*b*) Measure Light Running Current:
Disconnect the cable rack at the wiper gearbox as described below and measure the light running current with a first grade moving-coil ammeter connected in the supply cable. To disconnect the cable rack, proceed as follows:
Remove the centre windscreen headboard finisher. Withdraw the three crosshead cover securing screws. Slacken the screws securing the two outer casing tube retaining clips and turn the clips through 90°. Lift out the cable rack assembly from the crosshead guide channel noting that the crosshead driving pin fits into a brass bushed hole in the end of the connecting rod. In this condition the opportunity can be taken to observe the speed of operation by counting the cycles per minute of the connecting rod.
The light running current should be 2·7–3·4 amperes at normal speed (44–50 c.p.m.). If not, fit a replacement motor or remove the motor for further examination.

(*c*) Check Cable Rack Tubing and Wheelboxes.
The maximum permissible force to move the cable rack in the outer casing tube is 6 pounds (2·7 kg.) with the wiper blades away from the windscreen and motor disconnected. The measurement can be made by hooking a spring balance around the crosshead driving pin and withdrawing the cable rack to its full extent in either direction with the balance.
Binding of the cable rack can be due to kinked or flattened tubes or misaligned tubes. Badly kinked or flattened tubes must be renewed. The cable rack should be free of grit, dust etc., and well lubricated with Shell Retinax A grease.
Check the wheelboxes for misalignment or looseness and rectify as required, always renewing seized wheelboxes.

To Remove.

1. Remove the wiper arms and blades.



1 CROSSHEAD COVER
2 CABLE RACK AND TUBES
3 CONNECTING ROD
4 WIPER MOTOR
5 CROSSHEAD GUIDE CHANNEL
6 GEAR WHEEL SHAFT CIRCLIP
7 ARMATURE END PLAY ADJUSTING SCREW
8 WORM GEAR
9 BRONZE BUSH
10 GEARBOX CASING
11 GEAR WHEEL AND SHAFT ASSEMBLY
12 GEAR WHEEL PIN
13 GEARBOX COVER
14 CROSSHEAD

Fig. N.46. Windscreen wiper gearbox details

2. Remove the centre and side windscreen headboard finishers.

3. Unscrew the tapping screws and remove the two wheelbox cover panels. Remove the two slotted screws in each wheelbox cover, detach each cover and outer

casing end tube. Unscrew the securing nut on each wheelbox spindle at the exterior of the windscreen header and remove the front rubber bush on the spindle. Remove the wheelbox, sliding the cable rack out of engagement with the wheelbox gear and remove the rear rubber bush on the wheelbox spindle.

4. Isolate the battery and disconnect the cable leads at the wiper motor terminals. Remove the three bolts and washers at the wiper motor mounting plate and remove the motor assembly complete with the cable rack and outer casing tubes.

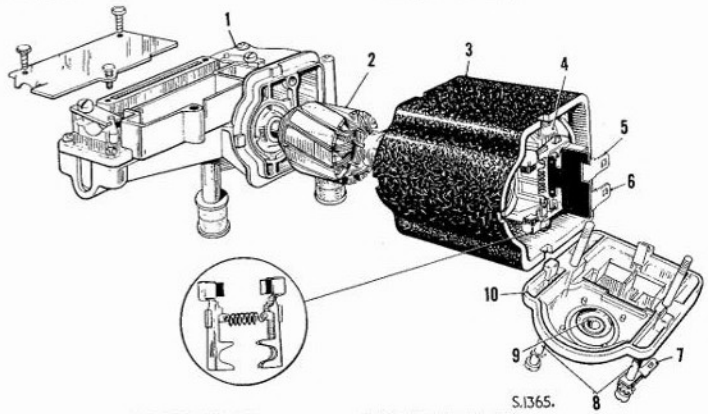
5. Release the outer casing tube retaining clips at the wiper motor and slide each tube off the cable rack.

6. Unscrew the nuts and remove the rubber grommets on the three wiper motor attachments to the mounting plate and remove the plate.

To Dismantle.

1. Remove the hexagon headed screws and lift off the crosshead cover.

2. Ensure that the two clips at each end of the crosshead box are clear and lift out the cable rack assembly from the crosshead guide channel noting that the crosshead driving pin fits into the brass bushed hole of the connecting rod.



1 GEARBOX ASSEMBLY
2 ARMATURE
3 WIPER MOTOR CASING
4 FIELD COIL
5 TERMINAL "2" (SUPPLY)
6 TERMINAL "1" (TO SWITCH)
7 EARTH TERMINAL (NOT USED)
8 THROUGH BOLTS
9 END COVER BUSH
10 END COVER

Fig. N.47. Windscreen wiper motor details

3. Remove the four gearbox cover securing screws and lift off the cover.

4. The connecting rod fitted to the gear wheel pin can then be lifted off.

5. Remove the circlip and plain washer fitted to the gear wheel shaft and lift out the gear wheel assembly. Before withdrawing the assembly, remove any burr from around the circlip groove with a fine file, to obviate scoring of the bearing bore.

6. Unscrew the two through bolts retaining the wiper motor to the gearbox and prise the commutator end cover off the motor casing.

7. Detach the brush holder composite retainer, noting the method of location and unhook the brush holders and spring from the terminal base on the field coil. The brushes are a loose fit in the holders and the spring keepers in the holder slosts are detachable. The motor casing can then be completely withdrawn followed by the armature.

To Re-assemble.

Reverse the dismantling procedure with attention to the following points:

1. Use a new circlip to retain the gearbox shaft in position.

2. Ensure that the end play of the armature is according to the limits given on the data page of this section. Adjust, if necessary, at the screw and locknut provided in the gearbox casing.

3. Lubricate the gearbox using 25 to 35 cubic centimetres of Shell Retinax "A" grease.

4. Re-assemble the brush holder retainer on the underside of the terminal base as noted during dismantling.

5. When re-assembling the cable rack, note that the longer of the two rack lengths is on the left hand side when the assembly is fitted to the vehicle.

To Refit.

Refitting is a reversal of the removal operation noting the following:

1. Before positioning the outer casing tubes, ensure that the cable rack is free of grit, dust, etc., and well lubricated with Shell Retinax "A" grease.

2. A rubber grommet must be positioned on each side of the motor mounting at the three attachment points and a rubber bush is fitted on both sides of the windscreen header panel on the wheelbox spindles.

3. Connect the cable leads in accordance with the wiring diagram.

4. If an earth terminal blade is fitted to one of the motor casing through bolts, it is not necessary to connect the blade to earth.

WIPER ARM AND BLADE ASSEMBLY

To Remove and Refit.

1. Lift the retaining clip on the wiper arm boss and slide the arm from the splined driving drum.

2. When refitting the arm and blade assemblies, first ensure that the wheelbox spindles are in the correct parking position.

3. Fit the arms and blades to the splined driving drums on the wheelbox spindles at the correct parking angle, pressing the headpieces on until the retaining clip is heard to snap over the end of the drum.

4. Wet the windscreen, switch on and note the wiped areas. If necessary, the position of the arms can be adjusted by removing and re-engaging them in the appropriate position, the pitch of the driving drum splines being 5°.

Note: Do not attempt to turn the arms on the spindles, but press back the retaining clip in the headpieces, withdraw the arms from the driving drums and refit in the desired position.

WIPER BLADES

To Remove.

Carefully ease the wiper blade away from the windscreen and grip the wiper arm, swivelling the blade free from its location on the wiper arm. Rest the arm end against the windscreen, interposing rag or thick cardboard to protect the windscreen.

To Dismantle.

When it is required to renew the wiper blade element assembly, consisting of rubber element, blade "backbone" and rubber end caps, proceed as follows:

1. Remove one of the rubber end caps positioned on the blade "backbone" by prising one side of the cap free from its locating recess, when it can be lifted away.

2. Slide the rubber wiper element out of the slot in the blade "backbone".

3. The blade "backbone" is supported in the yokes on four pairs of tags and locked in position by recesses, which engage with one end pair of tags on the yoke. Release the blade "backbone" by squeezing together the sides of the locked end, thus freeing it for withdrawal.

To Re-assemble.

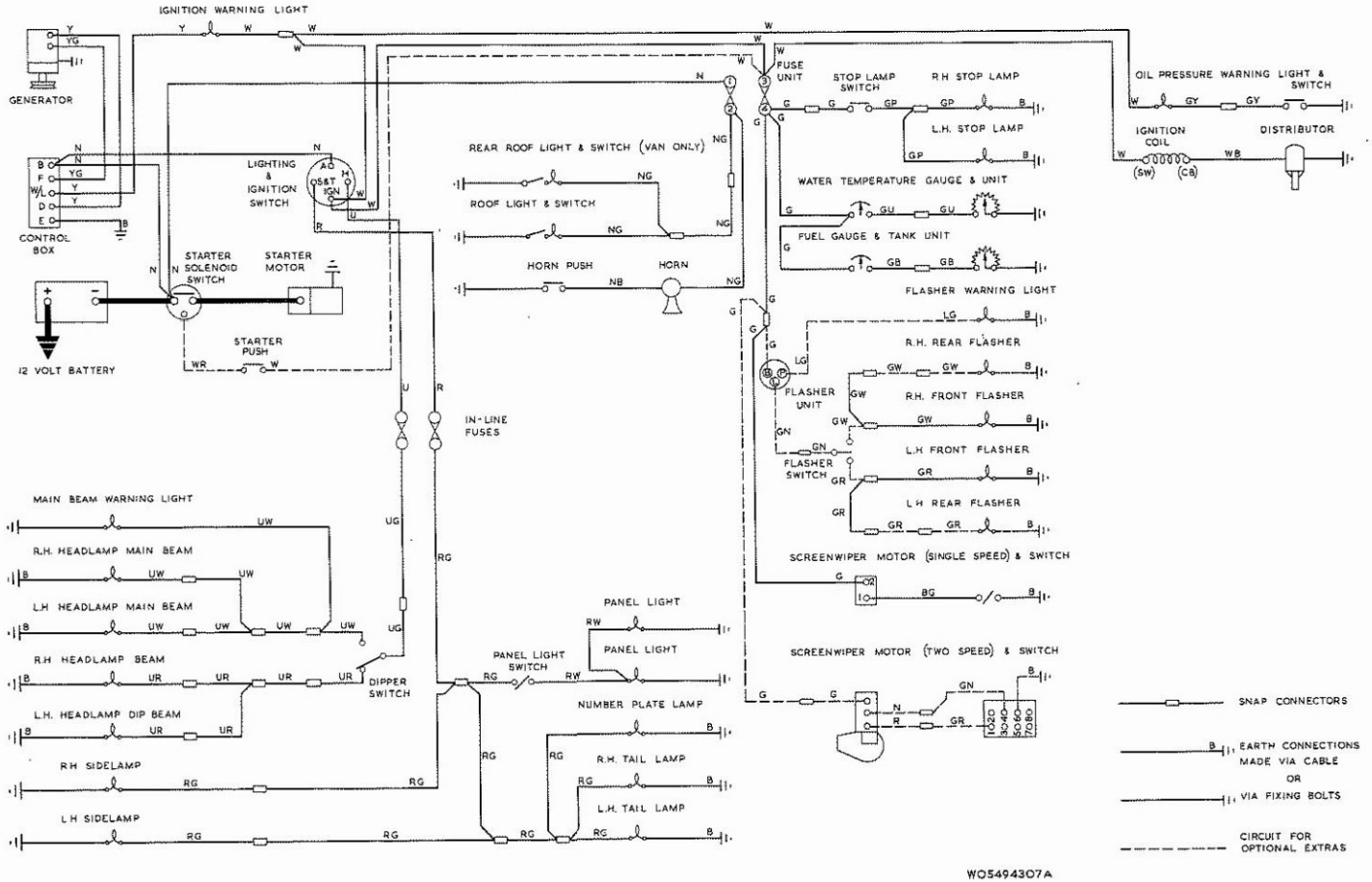
1. New wiper element assemblies should be handled with care. It is particularly important to keep the rubber clean and free from oil and petrol and to avoid distortion of the blade "backbone".

2. Fit the new blade "backbone" to the yokes, ensuring that the end pair of yoke tags seat correctly in the locating recesses provided in the "backbone".

3. Enter the rubber element flange into the slot in the "backbone" and slide the element in until it abuts the assembled end cap. Press on the cap at the opposite end, until it seats correctly in the recesses formed in the "backbone" ensuring the thick section of the cap is positioned to the side carrying the blade elbow.

To Refit.

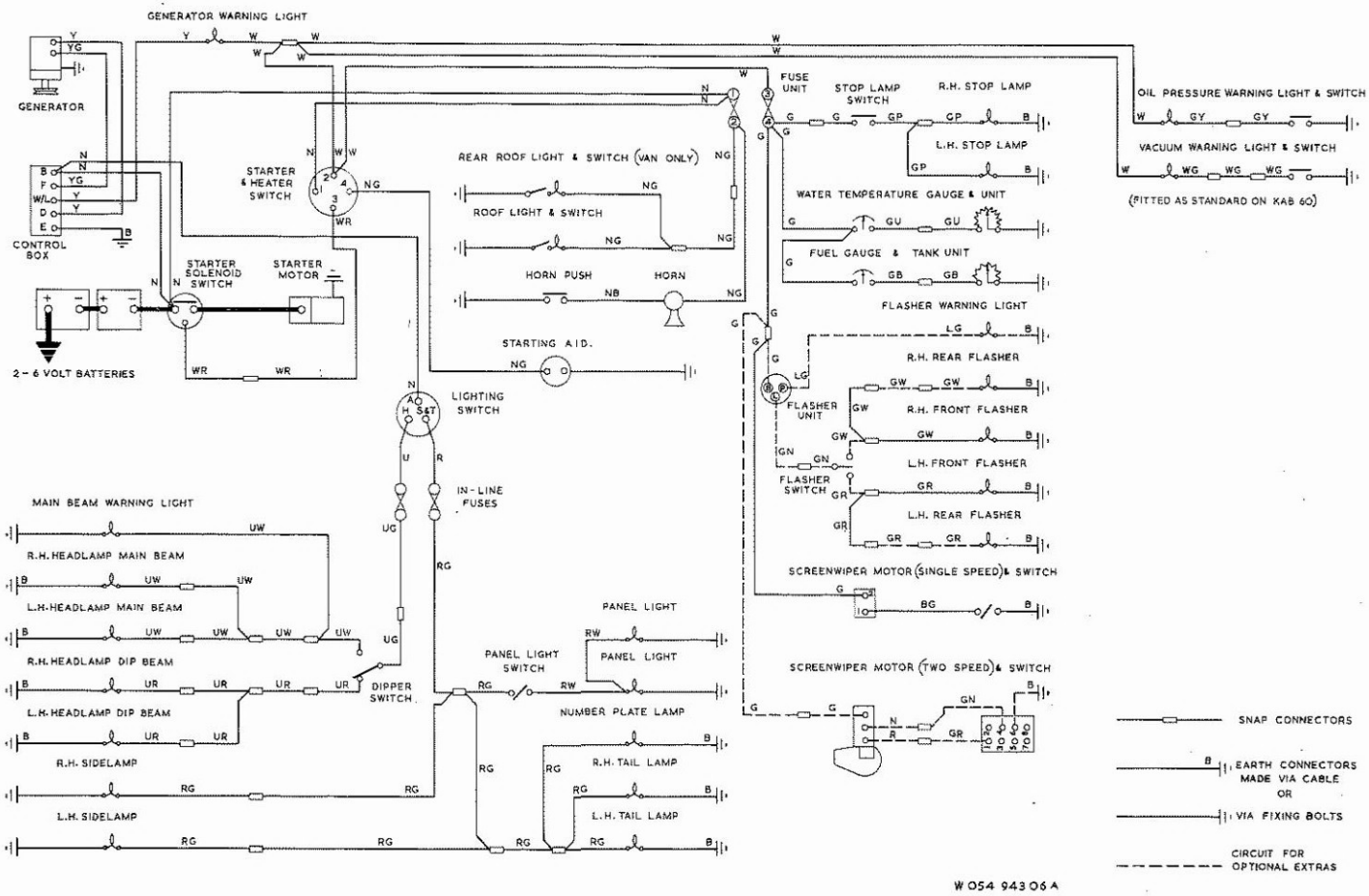
The wiper blades are readily refitted, by locating the end of the wiper arm into the spring loaded pocket provided in the blade elbow, swivelling the two components into engagement, when the pip on the arm will register in the hole situated on the blade elbow.



CABLE COLOUR CODE			
B	BLACK	R	RED
G	GREEN	U	BLUE
N	BROWN	W	WHITE
P	PURPLE	Y	YELLOW

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

Wiring Diagram (Petrol Models)



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Wiring Diagram (Diesel Models)

CAB AND BODY

SECTION O

INDEX

CAB AND BODY

DESCRIPTION

Front End. The front end is of all-steel welded construction with a full width opening bonnet giving immediate access to the engine, batteries, heaters, cooling and other ancillary equipment. Two types of bonnet top and grille are fitted to suit the two smaller engines and the two larger engines respectively. With the larger engines, the grille and grille panel are moved forward and the bonnet modified accordingly to meet the increased frontage. A full width front bumper is standard to all models. Single headlamps and sidelamps are placed either side of the grille in the front panel.

The bonnet is retained in the closed position by two budget locks operated by a square section "T" key.

There is a small engine intrusion into the driver's compartment and a rigid, fully sealed engine cover is fitted, which is easily removable for access to the rear of the engine unit. This cover is retained by a simple yet effective clamping device operated by the action of lowering the "U" shaped handgrip. The handgrip is placed on top of the cover and is hinged at its forward end. Raising the handgrip releases two legs from engagement in brackets mounted on the dash panel and the complete cover can then be removed. To secure the cover in position, the handgrip is lowered, engaging the brackets, and a slight effort is required to assist the mechanism "over-centre" thus firmly holding the cover against the toe plate seal. The top of the cover has a raised edge to form a tray suitable for driver's documents etc.

Fresh air ventilating equipment is standard, the air entering through apertures on each side of the front grille and then ducted to a hinged flap ventilator on each side of the front panel.

A fixed two-piece windscreen is provided, together with large fixed quarter lights and also kerbside windows in the front quarter panels. Driving mirrors are fitted to the offside and nearside of the vehicle as standard fittings.

The front end floor, toe panels and step sills are of swaged steel sheet.

The driver's seat is of the bucket type, upholstered in foam cushioning and leathercloth. The seat has fore and aft adjustment and is hinged to permit forward folding, giving free passage across the van.

Van Body. The factory built 350 cu. ft. capacity all-steel van body is fitted on the 1½ ton and 2 ton 123 in. W.B. models only. This body is of all-steel welded construction and insulated from the chassis frame by hard rubberised canvas mounting blocks. The body incorporates on each side, upper and lower panels which are joined at waist level and braced on the inside with vertical steel "top-hat" section supports, both panels being further protected by rolled-steel longitudinal slats. The underframe consists of flanged steel "top-hat" section cross bearers supported by gussets where necessary.

Flat side panels give a substantially "square" type of construction and a metal faced timber sectioned protection rail is positioned along the full length of the body sides. A turned-under flange is provided around the rear wheel arch aperture.

Rear wings are fitted to the 2 ton van models which have twin rear wheels, whereas no rear wings are fitted to the 1½ ton van models which have single rear wheels.

Roof. The roof is assembled from pressed steel sections which are supported on lateral pressed steel hoops and is finished with water channelling.

Sliding Doors. Each side of the body is fitted with a sliding type door which runs in ball race guides. When fully open, the door is concealed within a recess in the body side and gives an aperture of 30 in. (7·62 cm). Both doors have sliding windows and these doors incorporate a new type of locking mechanism in which the handle is operated in the required direction of travel. The nearside door locks from the interior while the offside door locks from the exterior of the van. When fully opened the doors are automatically locked in that position, thus preventing slamming from the open position.

Rear Doors. Full length double rear doors, with glazed panels are hung on hinges, offset to allow doors to swing round through 260° and are retained against the body sides by self adjusting, self releasing catches. Slam bolts are fitted to both doors and an outside locking handle is provided. The doors are completely sealed with sponge rubber when closed.

Floor. The flooring is constructed of hardwood, supported in steel longitudinal runners, and clamped down with flush fitting steel strips, providing a completely flat loading surface.

Wheelboxes. The flat topped wheelboxes are of square construction and low to facilitate loading.

Sealing. The cab and body are fully sealed against water and dust.

Tool stowage is provided under the bonnet, thus enabling tools to be stowed away under lock and key.

The wheelbrace, tyre lever and jack handle are clipped in position on the bodywork under the bonnet.

The jack and tool roll are loaded on the right hand and left hand sides of the front end above the wheel-arches under the bonnet. Straps with buckles and felt padding are provided for securing the jack and tool roll in position.

A "T" key for unlocking the bonnet is located inside the cab on the right hand kicking panel side quarter.

Complete Cab (when fitted). The all steel cab is constructed from the complete front end assembly as described under the heading "Front End."

The "C" posts, rear frame, roof and rear panels are the additional assemblies welded to form a complete cab unit with the front end assembly.

The rear panel is in two main parts, i.e., upper and lower panels. The upper panel being of double skin

all-metal construction and the lower panel is of single skin metal outer, with a hardboard lining to form the inner skin. The upper panel at the rear of the cab has two rear view lights at the right hand and left hand sides of the cab.

"Jack-knife" type doors are fitted to both nearside and offside of the vehicle. Each door is in two parts hinged at the centre and rear, and moves on ball-race guides, opening through 90° inside the cab. The front panel of the "jack-knife" driver's door is fitted with a vertical sliding window unit whilst the rear panel has a fixed window unit. The passenger door is fitted with two fixed window units.

The cab trim mainly consists of grained bitumen hardboard finished in pearl grey, and is fitted to the lower rear panel, roof and header panels, and the front kicking panels. The doors and the remainder of the front panel are not trimmed.

WINDSCREEN

To Remove.

1. Remove the windscreen wiper arm.

2. Locate the two adjoining ends of the rubber filler strip in the centre channel of the windscreen weatherstrip and lever one of the ends out of the channel. Grip the end by hand and pull away the filler strip from the weatherstrip.

3. The weatherstrip is sealed to the glass with "Seelastik" sealing compound. To break this seal, insert the thin end of a suitable wooden wedge between the weatherstrip and the glass contacting surface, and draw the wedge around the inner periphery of the weatherstrip.

4. Apply hand pressure to the inside of one of the lower corners of the windscreen and push outwards to remove the windscreen. An assistant outside the vehicle can support the windscreen as it is released from the body aperture. Should difficulty be experienced in removing the windscreen because of hardening of the weatherstrip in service, it is advisable to cut away the lip of the weatherstrip protruding over the rim aperture and push out the windscreen with an assistant supporting the opposite side of the glass.

5. Remove the weatherstrip from the glass.

To Refit.

1. Clean the surfaces of the glass around the periphery and the aperture rim of the body.

2. Lay the windscreen flat and assemble a new weatherstrip to the glass. Thread a single length of cord considerably longer than the outer periphery of the weatherstrip, around the outer lip of the weatherstrip so that the loose ends of the cord are positioned at the centre in he lower edge of the outer lip.

3. Position the windscreen assembly into the front end aperture from the exterior of the vehicle after passing the ends of the cord into the interior of the vehicle. With pressure applied to the windscreen from the exterior of the glass, an assistant inside the vehicle can then pull the inner lip over the rim aperture by means of the cord until the weatherstrip is fully seated.

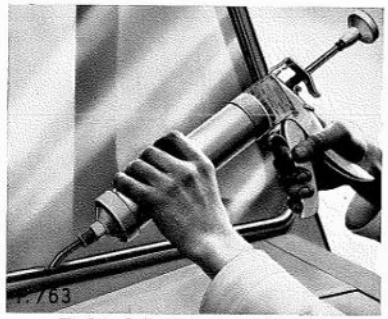


Fig. O.1. Sealing the weatherstrip to the windscreen

4. Seal the weatherstrip to the glass with "Seelastik" compound using a special gun, obtainable from Messrs. Expandite Ltd., Cunard Road Works, London, N.W.10, England, who also supply full operating instructions.

Insert the nozzle of the gun between the inner lip of the weatherstrip and the glass, operate the gun and work around the weatherstrip.

5. Press the inner lip of the weatherstrip firmly against the glass and refit the filler strip in the centre channel of the weatherstrip using a broad-bladed screwdriver or alternatively a glazing tool fitted with an eye-hook adaptor.

6. Clean off all surplus sealing compound and refit the windscreen wiper arm.

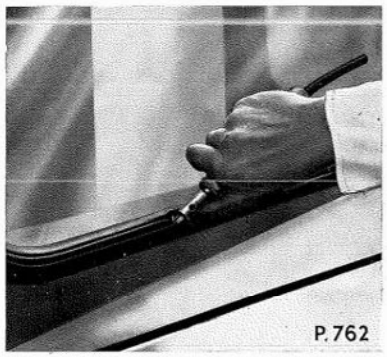


Fig. O.2. Refitting the rubber filler strip using a glazing tool

FRONT QUARTERLIGHTS AND KERBSIDE WINDOWS

The operations necessary for removing and refitting these glasses and weatherstrips are identical to those given for the windscreen.

FRONT SLIDING DOORS

To Remove.

1. Remove the setscrews and washers at the top and side of the main recess panel inside the body. Remove the tapping screws in the bottom flange of the panel and lift away the recess panel.

2. Remove the tapping screws and washers securing the upper door gear valance panel above the door aperture and remove the panel.

3. Ensure that the sliding door is positioned in the door aperture ready for removal. Remove three setscrews and washers in each hanger bracket located on the upper section of the door, and slide the hanger brackets rearwards along the sliding gear, free of the door.

4. Slacken off the four setscrews retaining each roller assembly to the base of the door.

5. Lift the sliding door clear of the bottom roller track and withdraw the door through the door aperture, noting that the bottom rollers and buffer springs may slide out of the roller housing during this operation, unless the roller is retained by temporarily inserting a thin rod through the holes provided on the housing barrel and the roller shank.

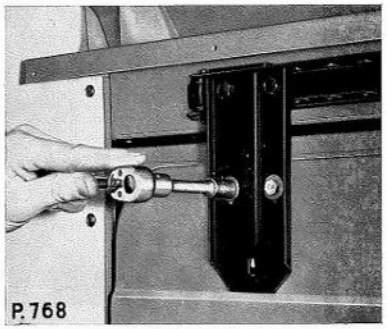


Fig. O.3. Removing the sliding door hanger bracket setscrews

To Dismantle.

1. The door window is removed as a complete unit after drilling out all rivets securing the window unit to the door panel, allowing the unit to be withdrawn from the outer side of the door. If it is necessary to renew the window unit seal in the door aperture, strip out the seal. To renew the fixed or sliding glasses in the unit, drill out the four rivets, remove the bridge plate in the unit surround rim and part the surround sufficiently to extract and refit the respective glass.

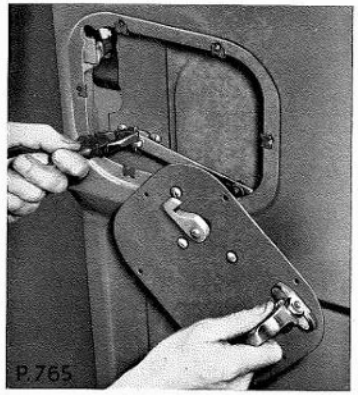


Fig. O.4. Removing the sliding door lock panel

2. To remove the sliding door lock mechanism, proceed as follows.

(*a*) The right hand and left hand door locks are identical except that a remote control finger pull is fitted to the left hand lock, and a key type barrel lock is fitted to the right hand lock assembly. Before removing the left hand lock, it will be necessary to unscrew the finger pull knob before commencing removal.

(*b*) Remove six slotted screws fitted around the periphery of the door lock panel on the inside of the door, and swing the panel downwards sufficiently to expose the lock operating rods (inside the door). Remove the split pins and felt washer retaining the operating rod to the lock outer handle and withdraw the door lock panel and inner handle complete.

To further dismantle the door lock panel, remove the remaining two split pins and felt washer retaining the second operating rod, release the rear striker plate by removing the slotted screw and shakeproof washer, and withdraw the striker mechanism by unscrewing the three slotted screws and washers on the panel face. The inner handle can then be removed after unscrewing four slotted setscrews on the inside of the panel.

(*c*) Remove the door lock barrel (fitted to right hand door) by removing the barrel retaining clip now accessible through the door lock aperture.

(*d*) Unscrew four screws and washers in the leading edge of the door and withdraw the lock body through the lock panel aperture. Note that on the left hand door lock, the remote control finger pull lock rod must also be eased out of the grommet in the door pressing as the lock body is removed.

(*e*) Four screws and washers retain the door outer handle to the door panel and are accessible through the lock aperture on the inside of the door. Remove the screws and washers and lift away the handle.

3. The roller guide assemblies fitted to the bottom inner side of the door were slackened during door removal. Unscrew the four setscrews, remove the spring and plain washers and withdraw each roller guide assembly and backing plate ensuring that each roller, buffer spring and housing are retained together as separate assemblies.

4. The sliding door lower seal is removed from the bottom edge of the door as a complete unit by releasing the two specially shouldered setscrews. The rubber seal in the metal portion of the lower seal unit is released, when necessary, by prising out with a screwdriver.

5. The sliding door upper seal is retained, in the roof rail of the body, over the door aperture, by means of tapping screws. Remove the tapping screws and on releasing the seal unit, prise out the rubber section, if renewal is necessary.

6. The door front striker is secured to the front door pillar by two slotted screws and washers. Remove the screws and release the striker, noting the rubber buffer fitted on the nose of the striker.

To Re-assemble.

Re-assembly is a reversal of the dismantling operations with attention to the following points.

1. To refit the door window unit proceed as follows.

(*a*) Check that the window seal in the door window aperture is in good condition and seating correctly, or if a new seal is being refitted, apply a coating of "Bostik" adhesive to the seal and both sides of the aperture rim flange prior to fitting and seat the seal fully around the aperture.

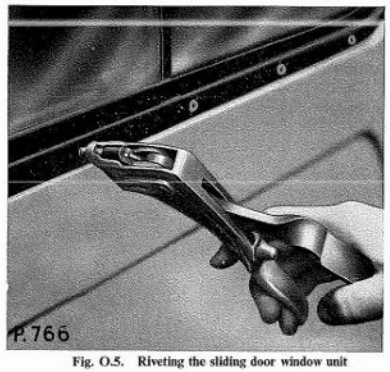


Fig. O.5. Riveting the sliding door window unit

(*b*) Apply a bead of "Seelastik" sealing compound to the flange of the window unit and offer up the unit to the door. Pass a $\frac{1}{8}$ in. (3 mm.) drill through the mating holes in the window unit surround and the door to ensure correct alignment of the holes for riveting. Rivet the unit to the door using $\frac{1}{8}$ in. (3 mm.) diameter rivets.

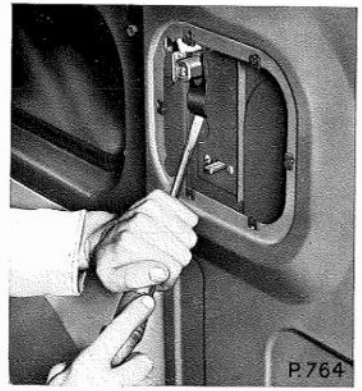


Fig. O.6. Refitting the sliding door barrel lock retaining clip

2. When refitting the two roller guide assemblies to the door, repack the housing with grease, enter the buffer spring and roller and compress the spring until the roller can be retained in its loaded position using a thin rod through the holes provided in the housing barrel and the roller shank. With the roller retained in the loaded position, refit each assembly and backing plate to the door. The rods must be withdrawn after the door is refitted.

3. The upper and lower door seal rubbers must be fitted in their respective retainers using "Bostik" adhesive. Work the seals in their metal channels progressively using a screwdriver, and check the sliding action of the lower seal, renewing the spring as necessary.

To Refit.

Reverse the removal procedure and check that the door slam impact is absorbed by the rubber buffer on the nose of the front striker. Adjust the front striker vertically and/or horizontally to obtain this condition.

Also ensure that the rear striker engages the striker catch at the fully open position.

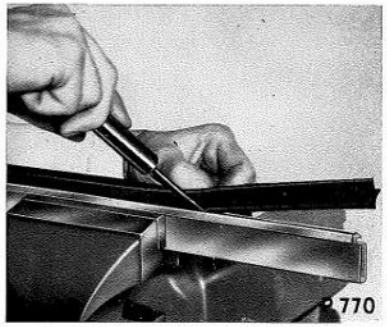


Fig. O.7. Fitting the rubber strip in the sliding door lower seal

SLIDING DOOR BALL GEAR AND ROLLER TRACK

To Remove.

1. Remove the sliding door.

2. To remove the roller track, unscrew the slotted screws, spring washers, plain washers and nuts securing the track to the body floor and lift away the track.

3. To remove the sliding door ball gear, unscrew the slotted screws, plain washers and self locking nuts securing the complete gear to the body and withdraw the gear complete with the two door hanger brackets. The gear is renewed as a complete assembly.

The two setscrews retaining the hanger brackets to the gear slide track are specially tightened during manufacture and it is recommended that these setscrews are only removed when absolutely necessary.

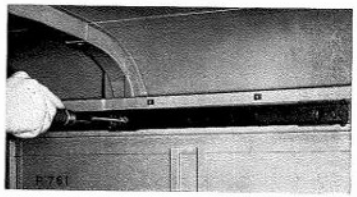


Fig. O.8. Removing the sliding door ball gear

To Refit.

Reverse the removal operations ensuring that the underside face of the roller track is coated with a suitable sealing compound to prevent water seepage.

REAR DOORS

To Remove.

1. Unscrew eight tapping screws and lift away the rear corner finish panels inside the body interior.

2. Remove four nuts and washers on the inside of the body panels to release each rear door hinge, supporting the door as each hinge is released. The door can then be lifted away from the body noting that a composite packing is fitted between the hinge flange and the body panel.

To Dismantle.

1. The rear door hinges are removed from the door after releasing the three bolts, nuts and washers at each hinge, noting the composite packing fitted between the hinge flange and the door panel.

On removing the hinges, the two arms can be separated by tapping back the tabwasher, unscrewing the hinge pin nut and removing the hinge pin, together with the ball and spring.

2. Rear Door Lock Control Mechanism—N.S. Remove the twelve setscrews and washers securing the complete mechanism to the door panel and lift off the locks and linkage. Dismantle the components as follows.

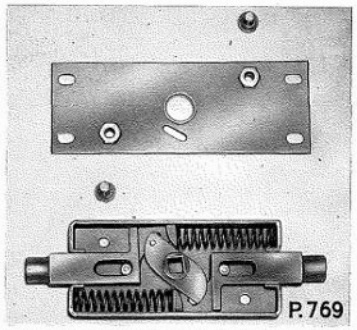


Fig. O.9. Internal details of the rear door lock as fitted to later models

(*a*) Remove the screw and washer at the rear of the centre lock unit and withdraw the inner handle. On later models, the inner handle comprises a separate handle and shank, the handle being secured to the shank by a screw and shakeproof washer. The shank is retained in the lock by a further screw and lockwasher.

(*b*) Slacken the locknuts (L.H. thread) and unscrew the long adjuster nuts (R.H. and L.H. thread) at each end of the linkage to separate the "bolt shoot" units. The two operating rods can then be unscrewed from the centre lock unit, after releasing the locknuts.

(*c*) To dismantle the centre lock unit, unscrew the two slotted screws and lift off the lock back plate. The two springs and internal levers can then be removed.

3. Rear Door Lock Control Mechanism—O.S. Remove the interior handle by tapping out the handle pin using a suitable metal drift. On later models, the interior handle is secured to the shank of the exterior handle by a screw and shakeproof washer. Unscrew two slotted screws and withdraw the exterior handle complete with shank.

The remainder of the offside door control mechanism is dismantled as described in para. 2 for the nearside door.

4. The rear door strikers and wedges are secured to the rear floor, roof rail and door panels respectively and are removed by releasing the slotted screws and washers.

5. The door retaining catch fitted to the body side panel and the striker catch on the exterior of the rear door are removed after releasing the screws and washers noting that nuts are fitted to the striker catch screws and a tapped plate fits at the rear of the retaining catch on the body panel interior.

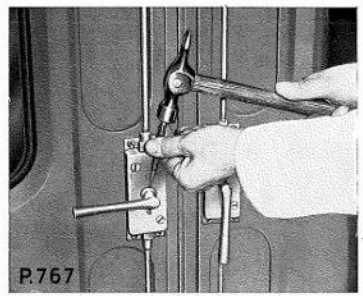


Fig. O.10. Tapping out the handle pin to remove the rear door interior handle as fitted to early models

6. Rear Door Window. To remove the window glass, proceed as follows.

(*a*) To release the "Seelastik" seal on the weatherstrip, insert the point of a wooden wedge between the glass exterior and the weatherstrip lip, drawing the wedge completely round the periphery of the glass. Repeat this operation inserting the point of the wedge between the outer lip of the weatherstrip and the exterior of the rear door panel.

(*b*) Insert the wedge in one of the top corners of the window rim and ease the glass and weatherstrip from the rim aperture.

(*c*) Apply hand pressure to the glass from the interior side and push the glass complete with weatherstrip clear of the door aperture. Remove the weatherstrip from the glass.

7. The rear door seal is removed by detaching the seal lip from the flange rim turn-over on the door edge. The door centre seal is fitted in the channel section of the door leading edge with "Bostik" adhesive and is stripped out for renewal.

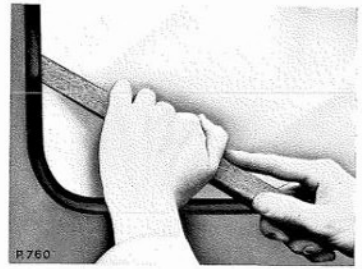


Fig. O.11. Releasing the compound seal between the rear door window glass and the weatherstrip using a wooden wedge

To Re-assemble.

Reverse the dismantling operations noting the following points.

1. When refitting the door hinges to the door panel, ensure that the composite packing is in good condition. Apply sealing compound between the packing and the door panel.

2. Ensure that the door retaining catch and striker catch are bedded on sealing compound when refitting.

3. To refit the rear window, proceed as follows.

(*a*) Mount the weatherstrip on the perimeter of the door glass, run a length of strong thin cord around the securing lip of the weatherstrip and tie the free ends of the cord to form a loop.

(*b*) Position the glass and weatherstrip in the door aperture with the cord loop accessible on the interior side of the door.

(*c*) With an assistant pressing the glass firmly and squarely into the aperture from the exterior side of the door, carefully pull the cord loop which will lift the weatherstrip lip over the edge of the aperture.

(*d*) On fitting the glass and weatherstrip, seal the exterior lips of the weatherstrip to the glass and the door panel with "Seelastik" sealing compound using a special gun obtainable from Messrs. Expandite Ltd., Cunard Road Works, London, N.W.10, England, who also supply full operating instructions.

Insert the nozzle of the gun between the glass and the weatherstrip lip, operate the gun and work around the full length of the weatherstrip. Repeat this operation inserting the nozzle of the gun between the door panel and the weatherstrip lip.

(*e*) Press the weatherstrip firmly to the glass and the panel removing all surplus sealing compound exuding from the joints.

4. Refit the rear door seal by progressively entering the lip of the seal into the lipped flange using a broad bladed screwdriver. The door centre seal is fitted with "Bostik" adhesive after cleaning the remnants of the old adhesive from the channel section.

To Refit.

Reverse the removal procedure ensuring that sealing compound is used between the hinge flange packing and the body panel.

1. To adjust the lock control mechanism on each door, refit the complete unit leaving the locknuts and "bolt shoot" unit screws slack. Firmly close the door and ensure that adequate engagement is present between each "bolt shoot" nose and the strikers on the rear floor and roof rail by adjusting the lengths of the operating rods. Tighten the locknuts and "bolt shoot" unit screws on completing the adjustment.

2. To reset the door wedges fitted on the door, leave the securing screws slack, push each wedge hard down on the corresponding nylon striker with the door fully closed and tighten the screws whilst holding the wedge in this position.

BONNET AND BONNET LOCKS

To Remove.

1. Raise the bonnet and unscrew the two nuts and washers securing each hinge to the cowl top panel. Lift off the bonnet complete with hinges, releasing the hinges from the bonnet by unscrewing the nuts and washers.

2. To remove the bonnet locks, release the two retaining screws and washers and withdraw each lock taking care to retain the two metal plates complete with mounting nuts inside the slot in the bonnet leading edge.

3. The bonnet lock striker pins are removed by releasing the nuts and washers.

To Refit.

Reverse the removal operations.

FRONT GRILLE PANEL

To Remove.

1. Remove the battery(s) and release the headlamp and sidelamp leads at the adjacent main harness connectors.

2. Remove three setscrews at each side of the panel and remove the front grille panel complete with headlamps and sidelamps, taking care not to damage the panel seals. On KAB. and KAL. models, it is necessary to remove the bumper bar and a further six setscrews, nuts and washers to release the front valance panel which is attached to the grille panel. On the remaining models, the valance panel is separate and need not be removed to withdraw the grille panel.

To Refit.

Reverse the removal operations ensuring that the panel seals are correctly fitted, and refer to the wiring diagram in the "Electrical Equipment" section when connecting the electrical leads.

Should a new grille panel be fitted, refer to the "Electrical Equipment" section for the removal and refitting of the headlamps and sidelamps.

FRONT END RAIL AND RADIATOR BAFFLES (KAH. and KAD. Models)

To Remove.

1. Detach the front ends of the fresh air or heater intake hoses, as applicable, from the rear of the radiator guards.

2. Remove the front grille panel.

3. Release the two setscrews and washers retaining the rail to each side of the front end and remove the two bonnet lock striker pins, by unscrewing the nuts and washers.

4. To release the radiator baffles, it is necessary to remove the setscrews securing the radiator, therefore it is advisable to drain and remove the radiator (see "Cooling System") otherwise the weight of the radiator will be supported on the hoses.

Remove the four setscrews, nuts and washers retaining each side of the baffle fronts to the front end and lift out the rail and both baffles as an assembly.

5. The baffles are then released from the rail by unscrewing two setscrews, nuts and washers on each baffle.

To Refit.

Reverse the removal procedure, referring to the "Cooling System" section for refitting the radiator.

FRONT END TIE BAR AND RADIATOR BAFFLES (KAB. and KAL. Models)

To Remove.

1. Remove the two setscrews and washers retaining the tie bar to each side of the front end, remove the two bonnet lock striker pins by unscrewing the nuts and washers and lift away the tie bar.

2. To withdraw the radiator baffles, remove the front grille panel, remove the radiator (see "Cooling System"). which will allow the baffle securing setscrews, nuts and washers to be removed and the baffles can then be withdrawn after detaching the fresh air or heater intake hoses from the rear of the baffles.

To Refit.

Reverse the removal procedure, referring to the "Cooling System" section for refitting the radiator.

SIDE PANEL PROTECTION RAIL

To Remove.

1. Remove the five nuts and washers on the inside of the body and detach the rail. The front two nuts are accessible after closing the sliding door and removing the door recess panel.

2. The metal rail finisher is removed from the rail by releasing the slotted wood screws. Tap out the rail coach bolts.

To Refit.

Reverse the removal procedure.

UPPER SIDE PANEL

To Remove.

1. Remove the rear door retaining catch and the panel protection rail.

2. Using a $\frac{1}{8}$ in. (3 mm.) drill, remove all rivets retaining the upper side panel to the body framework. Note that the finisher rail located below the roof water channel will be released with the side panel.

3. Break the adhesive seal between the panel and the body framework using a metal tapered drift and remove the side panel.

To Fit New Panel.

1. Apply metal adhesive to the contact surfaces of the body framework and offer up the new panel, noting that the upper panel overlaps the top edge of the lower panels, and that the front edge of the panel is located under the door pillar finisher rail.

2. Pass a $\frac{1}{8}$ in. (3 mm.) drill through the panel and framework drilled holes to ensure alignment and rivet the panel into position. Ensure that the top finisher rail is refitted before riveting the top of the panel. Apply sealing compound to the inner corner of the rail before clamping the rail into position ready for riveting and remove the surplus compound on completion.

3. With the panel riveted in position, swing the rear door fully against the body side, offer up the door retaining catch in relation to the striker catch on the door, mark off the hole positions and drill two $\frac{5}{16}$ in. (7 mm.) holes to accept the panel catch setscrews. Re-assemble the catch to the panel with the tapped plate.

4. To refit the protection rail, remove the metal rail finisher, pass a $\frac{5}{32}$ in. (7 mm.) drill through the two locating holes in the new panel and on through the existing framework holes thus ensuring correct alignment.

Secure the protection rail to the panel using the coach bolts, nuts and washers in the two locating holes and drill the three remaining holes, to accept the coachbolts, through the panel and the framework. Refit the three coachbolts, nuts and washers and the metal rail finisher.

REAR LOWER SIDE PANEL

To Remove.

1. Remove the rear wing (when fitted) and the protection rail.

2. Using a $\frac{1}{8}$ in. (3 mm.) drill, remove all rivets securing the rear lower panel noting that it is necessary to drill out certain rivets on the lower edge of the upper side panel where the two panels overlap.

3. Drill out the spotwelds securing the bottom edge of the panel to the skirt rail.

4. Break the metal adhesive seal between the panel and the body framework using a metal tapered drift and ease away the panel.

To Fit New Panel.

1. Apply metal adhesive to the contact surfaces of the body framework and offer up the new panel ensuring that the new panel top edge is fitted under the bottom edge of the upper panel.

2. Pass a $\frac{1}{8}$ in. (3 mm.) drill through the panel and framework drilled holes to ensure alignment and rivet the panel in position.

3. Spotweld the bottom edge of the panel to the skirt rail, or alternatively, drill out $\frac{1}{8}$ in. (3 mm.) holes and rivet to secure the bottom edge to the rail.

4. Using the upper panel protection rail holes for location, drill out $\frac{5}{16}$ in. (7 mm.) holes in the new lower panel and refit the protection rail.

5. When a rear wing is fitted, offer up the wing, mark off the eight wing hole positions, drill out $\frac{3}{8}$ in. (9·5 mm.) holes in the panel and refit the wing and piping, using the special bolts, nuts and plain washers.

FRONT LOWER SIDE PANEL

The procedure for removal and fitting the front lower side panel, is the same as the procedure for the rear lower side panel, except that on the nearside panel, the fuel tank filler neck and the large rubber grommet must be removed prior to removal.

Important: When refitting this panel on the near-side of the body, the bottom edge will require spotwelding unless rivets are used, therefore it is essential to drain the fuel tank, allowing the tank to remain empty for a sufficient period of time in order to allow the fuel vapour to completely evaporate, before commencing the spotwelding operation. Always use an asbestos shield to protect the fuel tank during these operations.

FRONT WING

To Remove and Refit.

1. Remove the tapping screws securing the inner kicking trim panel on the inside of the cab to expose the wing fixing setscrews (Acme thread). The remaining wing setscrews at the front and rear of the wing are

accessible from inside the bonnet and step sill. Release the setscrews and the wing, taking care not to damage the wing piping during removal.

2. Refit the wing with the setscrews and plain washers renewing the spire nuts as necessary. Before fully tightening the setscrews, slide in the wing piping between

Fig. O.12. Releasing the front wing setscrews after removing the inner kicking trim panel

the front end and the wing ensuring that the piping seats correctly. Refit the inner kicking trim panel on completion.

REAR WING
(when fitted)

To Remove and Refit.

1. Remove the eight setscrews (Acme thread) and plain washers then take off the wing taking care not to damage the wing piping.

2. Refit the wing with the setscrews and plain washers renewing the spire nuts as necessary. Before fully tightening the setscrews, slide the wing piping into position.

DRIVER'S SEAT

To Remove and Dismantle.

1. The seat complete with the support assembly is lifted away as an assembly after removing four setscrews with the spring and plain washers, which retain the support assembly to the floor panel.

2. To detach the seat frame from the slides on the seat support, remove the four nuts and washers located in the metal channel section of the slides.

3. Remove two setscrews, nuts and washers at each slide to separate the slides from the seat support.

4. To remove the seat cover and cushioning, prise the plastic edge of the seat valance from the seat base rim, release the clips securing the three cover tags under the rear of the metal seat frame and pull off the seat cover.

The foam pad then exposed is adhered to the metal seat frame and must be pulled off the metal for removal. A rubber platform, fitted below the foam pad, is released by unhooking the attaching clips from the seat base.

5. To remove the squab cover and cushioning, release the clips retaining the cover at the base of the squab. Remove the clips retaining the three cover tags under the rear of the metal seat frame and pull off the squab cover.

The foam pad is adhered to the metal back of the squab and requires pulling off for removal.

To Re-assemble and Refit.

Reverse the removal procedure noting the following points.

1. When fitting new foam pads to the seat or squab, thoroughly clean off the adhesion area prior to commencing the application of fresh adhesive.

2. If the squab cover is being refitted off the vehicle, it is advisable to securely clamp the seat by means of the metal runners, to the bench.

Progressively pull the cover into position, locating the three cover tags in the slots of the metal seat frame base and retain with the six clips.

"JACK-KNIFE" DOORS
(When Cab is fitted)

To Remove.

1. Remove two setscrews and washers to release the door top striker plate.

2. Unscrew three setscrews and washers retaining the hanger bracket to the door top.

3. Slacken the four setscrews securing the roller guide assembly to the door, noting that the roller should be temporarily retained in the housing by inserting a thin rod through the holes provided in the housing barrel and the roller shank.

4. Drill out the rivets securing the "piano-type" hinge to the door aperture "C" post, release the three tapping screws in each hinge flap and remove the door assembly.

To Dismantle.

1. To remove the centre door hinge seal, drill out the rivets securing the seal retainers to each section of the door, allowing the seal and retainers to be removed as an assembly. The seal is adhered to the retainers and requires to be stripped off for separation.

2. The door buffer fitted to the rear section of the door is removed after releasing two slotted screws and washers.

3. To remove the fixed window unit in the rear section of the door, proceed as follows.

(*a*) To release the "Seelastik" seal on the weatherstrip insert the point of a wooden wedge between the glass exterior and the weatherstrip lip, drawing the wedge completely round the periphery of the glass. Repeat this operation inserting the point of the wedge between the outer lip of weatherstrip and the exterior of the door panel.

(*b*) Insert the wedge in one of the top corners of the window rim and ease the glass and weatherstrip from the rim aperture.

(*c*) Apply hand pressure to the glass from the interior side and push the glass complete with weatherstrip clear of the door aperture. Remove the weatherstrip from the glass.

4. The sliding window unit in the front section of the door is removed in the same manner as the sliding door window unit detailed under the sub-heading "Front Sliding Doors" in this section.

To renew the fixed or sliding glasses in the window unit after removal, remove the surround joining plate and part the surround rim sufficiently to extract and refit the respective glass.

5. Door Lock Control Mechanism. The cab door locks are identical except that a remote control finger pull is fitted to the left hand lock and a key type barrel lock is fitted to the right hand lock assembly. To dismantle the lock control mechanism, proceed as follows.

(*a*) Remove the four slotted screws and washers, slip the lock cover panel over the door inner handle and remove the panel.

(*b*) Unscrew the four setscrews at each "bolt-shoot" unit, release the shouldered setscrew, plain washers and self-locking nut securing each operating rod jaw to the lock lever, to enable the "bolt-shoot" units and operating rods to be removed. In order to release the lower operating rod at the bottom "bolt-shoot" unit, unscrew the grub screw in the sliding bolt of the unit to withdraw the bolt, the spring and the casing. The lower operating rod can then be removed. To further dismantle these assemblies, unscrew the locknuts, and the long adjusting nuts to separate the long and short operating rods; the top "bolt-shoot" unit can be dismantled after releasing the grub screw in the sliding bolt which will allow the bolt, spring and casing to be separated.

(*c*) To remove the inner handle, unscrew the setscrew and washer at each end of the handle pivot pin, remove the sleeves located each side of the handle centre boss and withdraw the pivot pin to release the handle.

(*d*) On removing the inner handle, access is obtained for unscrewing the self-locking nut and washers on each lock lever attachment pin. Note the position of the lock lever with the pin and nylon roller relative to the opposing lock lever with the slot, before detaching the levers from the door brackets, in order to facilitate re-assembly.

(*e*) On the left-hand door lock cover panel, the remote control finger pull catch is dismantled by unscrewing the finger pull knob after slackening the knob locknut, remove the locknut and push the threaded end of the plunger down until the plunger can be withdrawn from the panel. Remove the rubber grommet.

6. The door outer handle is removed after unscrewing the nut and washer on the inside of the door panel below the door lock panel. To unscrew the slotted screw retaining the top of the handle, it is necessary to first remove the door lock panel (if the remainder of the lock control mechanism has not been dismantled). Composite seating washers are fitted under the top and bottom faces of the handle.

To remove the barrel lock from the right hand outer handle, release the two small slotted screws securing the retainer plate at the rear of the handle. The plate will not be fully released unless the plunger contact setscrew is removed. Swing the plate clear sufficiently to allow the barrel lock to be pushed out of the handle.

7. The roller guide assembly is removed after releasing the four setscrews and washers retaining the roller guide and back plate to the door.

8. The door upper and lower seals are riveted to the roof rail and bottom door panel respectively and to renew, drill out the rivets, remove the seals complete and fit the new seals with rivets.

9. The door front seal is retained to the "B" post and the door rear seal is attached to the "C" post. To remove each seal, pull away from the door post to break the adhesion. Fit the new seals using "Bostik" adhesive.

To Re-assemble.

Reverse the dismantling instructions noting the following points.

1. To refit the fixed door window in the rear section of the door, proceed as follows.

(*a*) Mount the weatherstrip on the perimeter of the door glass, run a length of strong thin cord around the securing lip of the weatherstrip and tie the free ends of the cord to form a loop.

(*b*) Position the glass and weatherstrip in the door aperture with the cord loop accessible on the interior side of the door.

(*c*) With an assistant pressing the glass firmly and squarely into the aperture from the exterior side of the door, carefully pull the cord loop which will lift the weatherstrip lip over the edge of the aperture.

(*d*) On fitting the glass and weatherstrip, seal the exterior lips of the weatherstrip to the glass and the door panel with "Seelastik" sealing compound using a special gun obtainable from Messrs. Expandite Ltd., Cunard Road Works, London, N.W.10, England, who also supply full operating instructions.

Insert the nozzle of the gun between the glass and the weatherstrip lip, operate the gun and work around the full length of the weatherstrip. Repeat this operation inserting the nozzle of the gun between the door panel and the weatherstrip lip.

(*e*) Press the weatherstrip firmly to the glass and the panel removing all surplus sealing compound exuding from the joints.

2. The re-assembly of the sliding window unit in the front section of the door is as follows.

(*a*) Check that the window seal in the door window aperture is in good condition and seating correctly, or if a new seal is being refitted, apply a coating of "Bostik" adhesive to the seal and both sides of the aperture rim flange prior to fitting and seat the seal fully around the aperture.

(*b*) Apply a bead of "Seelastik" sealing compound to the flange of the window unit and offer up the unit to the door. Pass a $\frac{1}{8}$ in. (3 mm.) drill through the mating holes in the window unit surround and the door to ensure correct alignment of the holes for riveting. Rivet the unit to the door using $\frac{1}{8}$ in. (3 mm.) diameter rivets.

3. To fit a new centre door hinge seal, coat the surfaces contacting the seal retainers with "Bostik" adhesive and place the seal retainers in position on the adhesion area. When the seal is firmly adhered, position the seal and retainer assembly over the centre door hinge and rivet the retainers to the opposing door edges.

To Refit.

Reverse the removal procedure. When riveting the door hinge to the door post, pass a $\frac{1}{8}$ in. (3 mm.) diameter drill through the corresponding holes in the door and post to ensure correct alignment, prior to commencing riveting.

If a new door assembly is to be fitted, assemble the hinge to the door and the cab "C" post using the six tapping screws through the slotted holes in the hinge flaps, but do not tighten the screws. Adjust the door in the aperture to obtain equal parallel clearances between the front and rear door edges and the door frame posts. Fully tighten the tapping screws.

With the door correctly positioned, drill the rivet holes in the new door using a $\frac{1}{8}$ in. (3 mm.) diameter drill through the corresponding hinge flap holes and finally, rivet the hinge to the door and the "C" post with $\frac{1}{8}$ in. (3 mm.) diameter rivets.

To adjust the lock control mechanism on each door refit the complete assembly, noting that the centre lock levers are re-assembled with the nylon roller in the positions identified during dismantling. Firmly close the door and ensure that adequate engagement is present between each "bolt-shoot" nose and the corresponding striker, by adjusting the lengths of the operating rods at the long adjusting nuts, ensuring that the "bolt-shoot" unit setscrews are slack during this operation. Tighten the locknuts and the "bolt-shoot" unit setscrews on completing the adjustment.

Finally, adjust the length of the contact setscrew protruding through the door panel from the outer handle until no free play is evident between the head of the setscrew and the inner handle.

DOOR TRACKS
(When Cab is fitted)

To Remove.

1. Remove the tapping screws retaining the upper door track cover panel.

2. With the door in the open position, unscrew the top setscrew and washers retaining the hanger bracket to the door. Close the door and remove the two remaining setscrews and washers securing the hanger bracket to the door. Retain the hanger bracket by hand and open the door away from the hanger bracket.

3. Remove the four slotted screws securing the upper door track assembly and remove the track complete with the hanger bracket.

The two setscrews retaining the hanger bracket to the door upper track are specially tightened during manufacture and it is recommended that these setscrews are only removed when absolutely necessary.

4. To remove the roller track, release the four setscrews and washers retaining the roller guide assembly and back plate to the door and lift off the roller guide and plate. The roller track can then be removed after releasing the six slotted screws, nuts and washers. It may be necessary to remove the step tread edge in order to expose the front roller track fixing screw.

To Refit.

Reverse the removal procedure with attention to the following points.

1. When refitting the door upper track, leave the securing screws slack in both the hanger bracket attachment to the door and the track retention to the roof rail. Firmly close the door, fully tighten the hanger bracket setscrews and then fully tighten the track securing screws.

2. If the step tread edge has been removed, re-seal the tread edge to the step well panel with sealing compound when refitting.

3. On refitting the roller track, allow the roller guide to run over the track several times before finally tightening the track screws.

REAR WINDOWS
(When Cab is fitted)

The removal and refitting instructions for the cab rear window glass and weatherstrip are identical to those given for the van rear door windows under the sub-heading "Rear Doors" within this section.

VAN BODY

To Remove.

1. Position the vehicle below a suitable overhead hoist capable of lifting the factory made van body which weighs approximately 20 cwts. (1018 kgs.).

2. Disconnect and remove the battery(s).

3. Drain and remove the radiator (see "Cooling System" section).

4. Disconnect the electrical leads at the following points.

(*a*) Starter solenoid.

(*b*) Dynamo.

(*c*) Stop/tail connections at the front scuttle and at the connectors behind the rear number plate. Also disconnect the number plate lamp lead and flasher unit leads (if fitted).

(*d*) Oil pressure switch (on engine).

(*e*) Water temperature gauge (at water pump) and ignition coil (petrol models).

(*f*) Vacuum warning light (at servo reservoir)—KAB. models.

(*g*) Fuel tank gauge (at tank).

(*h*) Earth lead (body crossbearer to rear engine mounting).

(*j*) Starting aid lead (at unit on manifold)—diesel models.

5. Disconnect the control cables according to engine type, i.e., throttle, choke, accelerator or stop cables, etc.

6. Disconnect the speedometer cable (at the gearbox).

7. Disconnect the air cleaner hose to the manifold.

8. Fuel pipe connections at the fuel inlet pipe to fuel lift pump (petrol engine) or the water/dirt trap and the fuel return pipe (diesel engine).

9. Fresh air or heater intake ducts must be removed; remove the hoses at the water pump and the control cable (if heater is fitted).

10. Remove the starting aid reservoir at the scuttle bracket (diesel engine).

11. Remove the dipper switch (and flasher switch if fitted) as detailed in the "Electrical Equipment" section.

12. Remove the steering wheel (see "Steering" section). Release the steering column at the support bracket on the dash panel. If insufficient height for lifting the body clear of the steering column is evident, remove the steering gear.

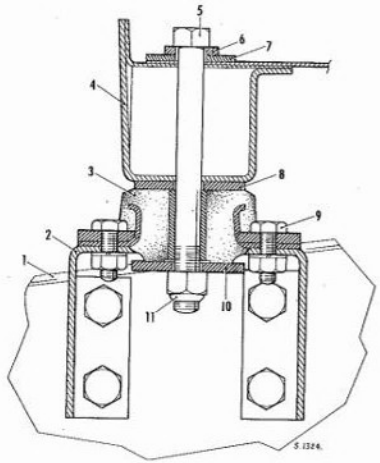
13. Remove the clutch and brake pedal stems and unscrew the accelerator pedal pad.

14. Remove the engine rear cover. The centre and both side toe-panels must also be removed.

15. Raise the rubber gaiter on the change speed lever and release the three setscrews in the gearbox tower top cover to allow the lever to be withdrawn.

16. Remove the fuel tank filler pipe and grommet (see "Fuel System" section).

17. Remove the eight self locking nuts and plain washers, under the top flange of the chassis sidemembers at the body crossbearer positions.



1 CHASSIS FRAME SIDEMEMBER
2 FRONT MOUNTING BRACKET
3 MOUNTING PAD
4 FRONT END UNDERFRAME
5 MOUNTING BOLT
6 SMALL PLAIN WASHER
7 WASHER PLATE
8 LARGE PLAIN WASHER
9 MOUNTING PAD SECURING SETSCREW
10 LARGE PLAIN WASHER
11 SELF LOCKING NUT

Fig. O.13. Sectional view of the front end front mounting

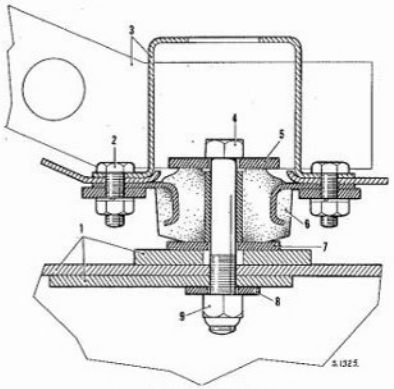
18. The six front end mountings are released as follows.

(*a*) Remove the self locking nut and plain washer below each front mounting bracket located adjacent to the front bearer.

(*b*) Remove the self locking nut and plain washer fitted under the top flange of each chassis sidemember, directly below the base of the toe-panel. A cover plate is located over the floor aperture for each mounting bolt head at this position.

(*c*) The remaining two front end mountings are located below the metal retaining strip at the front end of the body floorboards. Remove the self locking nut and plain washer at each position.

Note: The front and intermediate mountings of the front end are of the bonded rubber type which are detachable after releasing two setscrews, nuts and washers. The rear mountings of the front end are identical to the remaining body mountings and consist of a hard rubberised canvas block at each location.



1 CHASSIS FRAME SIDEMEMBER
2 MOUNTING PAD SECURING SETSCREW
3 FRONT END UNDERFRAME
4 MOUNTING BOLT
5 LARGE PLAIN WASHER
6 MOUNTING PAD
7 LARGE PLAIN WASHER
8 SMALL PLAIN WASHER
9 SELF LOCKING NUT

Fig. O.14. Sectional view of the front end intermediate mounting

19. The van body is then ready for lifting, employing a padded central spreader bar with crossbars to accept four padded lifting hooks located at the front top corners of the sliding door aperture and at the outer top corners of the rear door aperture.

To Refit.

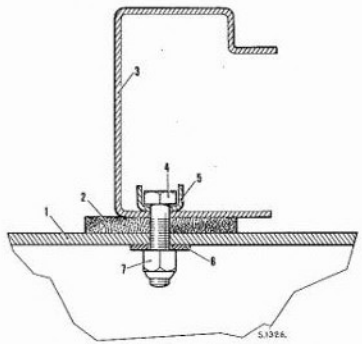
Reverse the removal procedure noting the following points.

1. The body mounting bolt heads are held in the body crossbearers by channel section retainers and to obtain access to the bolt heads it is necessary to remove the metal retaining strips and remove the longitudinal floorboards fitted immediately above the chassis frame sidemembers.

2. Locate a rubberised canvas mounting block at each body mounting point with the exception of the four front end mountings. Note that the fourth body crossbearer from the rear end of the van body has no mounting bolts and the mounting blocks are adhered to the bearer with "Bostik" adhesive.

3. Ensure that plain washers are fitted under the self locking nuts of the body mounting bolts.

The front mountings of the front end have a plain washer and a washer plate under the centre bolt head; a large plain washer is located on both the top and bottom faces of the rubber mounting, the latter being followed by the self locking nut.



1 CHASSIS FRAME SIDEMEMBER
2 RUBBERISED CANVAS MOUNTING BLOCK
3 FRONT END UNDERFRAME
4 MOUNTING BOLT
5 CHANNEL SECTION RETAINER
6 PLAIN WASHER
7 SELF LOCKING NUT

Fig. O.15. Sectional view of the front end rear mounting

The intermediate front end mountings also have a large plain washer located on the top and bottom faces of the rubber mounting; smaller plain washers are fitted under the self locking nuts.

The rear front end mountings are identical to the body mountings.

RECOMMENDED LUBRICANTS

The following list shows the correct grade of lubricant to be used for each chassis unit or lubrication point:

Unit	Lubricant
ENGINE	
4-Cylinder Petrol and 6-Cylinder Petrol	
Where prevailing climatic temperature is:—	
Above 70°F. (21°C.)	Shell X-100 Motor Oil 30, or Shell X-100 Multigrade 20W/40
80°F. (27°C.) to 20°F. (–7°C.)	Shell X-100 Motor Oil 20/20W, or Shell X-100 Multigrade 10W/30
32°F. (0°C.) to 0°F. (–18°C.)	Shell X-100 Motor Oil 10W, or Shell X-100 Multigrade 5W/20
Below 5°F. (–15°C.)	Shell X-100 Multigrade 5W/20
4-Cylinder "Light" Diesel and Perkins Four/203 Diesel.	
Where prevailing climatic temperature is:—	
Above 80°F. (27°C.)	Shell Rotella 30, or Rotella T30, or Shell Rotella Multigrade 20W/40, or Shell Rotella T Multigrade 20W/40
80°F. (27°C.) to 30°F. (–1°C.)	Shell Rotella 20/20W, or Rotella T 20/20W, or Shell Rotella Multigrade 10W/30, or Shell Rotella T Multigrade 10W/30
30°F. (–1°C.) to 0°F. (–18°C.)	Shell Rotella 10W, or Rotella T 10W, or Shell Rotella Multigrade 10W/30, or Shell Rotella T Multigrade 10W/30
GEARBOX (TRANSMISSION)	
Where prevailing climatic temperature is:—	
Above 32°F. (0°C.)	Shell Dentax 90
Between 32°F. (0°C.) and –25°F. (–32°C.)	Shell Dentax 80

RECOMMENDED LUBRICANTS

Unit	Lubricant
STEERING UNIT	
Where prevailing climatic temperature is:—	
Above 10°F. (–12°C.)	Shell Spirax 90 E.P.
Below 10°F. (–12°C.)	Shell Spirax 80 E.P.
REAR AXLE	
Where prevailing climatic temperature is:—	
Above 32°F. (0°C.)	Shell Spirax 140 E.P.
Between 32°F. (0°C.) and –10°F. (–23°C.)	Shell Spirax 90 E.P.
Below –10°F. (–23°C.)	Shell Spirax 80 E.P.
***PROPELLER SHAFT JOINTS AND SPLINES**	Shell Retinax A
***PROPELLER SHAFTS CENTRE BEARING**	Shell Retinax A
***CLUTCH WITHDRAWAL BALL BEARING**	Shell Retinax A
WHEEL HUBS AND BEARINGS	Shell Retinax A
PRIMARY SHAFT PILOT BEARING	Shell Retinax A
CHASSIS GUN LUBRICATION (other than items marked *, above)	Shell Spirax 140 E.P., or Shell Retinax A
DISTRIBUTOR CAM PROFILE	Shell Retinax A
DISTRIBUTOR CONTACT BREAKER PIVOT	Shell Retinax A
DISTRIBUTOR SHAFT LUBRICATOR CAP (when fitted)	Shell Retinax A
DISTRIBUTOR AUTOMATIC TIMING CONTROL, AND CAM BEARING	Engine Oil
OIL BATH AIR CLEANERS (Petrol and Diesel Engines)	Engine Oil
OIL CAN LUBRICATION	Engine Oil
DYNAMO (Commutator End Bush)	Engine Oil
HANDBRAKE CABLE	Girling Graphited Cable Grease, or Shell Retinax A
BRAKE ASSEMBLIES AND MASTER CYLINDER	Refer to the respective component lubricants recommended within the "BRAKES" section.
BRAKE FLUID SUPPLY TANK	Girling Brake Fluid 6293
SHOCK ABSORBERS	Armstrong Shock Absorber Super (thin) Oil No. 624.

SPECIAL TOOLS

The specially designed tools recommended within this Section are manufactured and supplied by:

Messrs. V. L. Churchill and Co. Ltd.,
Great South West Road,
Bedfont,
Feltham,
Middlesex,
England.

	Tool No.	*Tool Description*	
4-Cylinder Petrol Engine			
	430	Cylinder Compression Tester	
	R.G.6513	Valve Spring Compressor	
	R.G.6513–1	Valve Spring Compressor Adaptor Foot	
	R.G.10A	Valve Guide Remover/Replacer (Main Tool)	
	R.G.10A–3A	Adaptor Set for R.G.10A	
	R.G.10A–6	Adaptor Set for R.G.10A	
	316X	Valve Seat Cutter (Main Tool)	
	316–11	Valve Seat Cutter Pilot	
	317–22	Valve Seat Cutter Tool 45°	Exhaust Valves
	317T–22	Valve Seat Cutter Tool 15°	
	317P–22	Valve Seat Cutter Tool 75°	
	317G–22	Valve Seat Glaze-breaker Tool	
	317–30	Valve Seat Cutter Tool 45°	Inlet Valves
	317T–30	Valve Seat Cutter Tool 15°	
	317P–30	Valve Seat Cutter Tool 75°	
	317G–30	Valve Seat Glaze-breaker Tool	
	55	Adjustable Puller (Main Tool)	
	R.G.55–4	Adaptor Set for Tool 55	
	R.G.21	Timing Cover Centraliser	
	6312A	Universal Puller	
	32	Camshaft Bushes Remover/Replacer (Main Tool)	
	R.G.32–3	Adaptor Set for Tool 32	
	R.G.32–4	Adaptor Set for Tool 32	
	7065A	Two-way Circlip Pliers	
	335	Connecting Rod Alignment Jig	
	336	Master Multi-purpose Arbor	
	R.G.336–4	Adaptor for Tool 336	
	6201	Small End Bush Remover/Replacer (Main Tool)	
	R.G.6201–1	Adaptor for Tool 6201	
	R.G.133	Piston and Ring Fitting Tool	
	R.G.11A	Main Bearing Cap Remover (Main Tool)	
	R.G.11A–1	Adaptor for R.G.11A	
	7600	Primary Shaft Pilot Bearing Remover (Main Tool)	
	R.G.7600–1	Adaptor for Tool 7600	
	155	Adjustable Puller (Main Tool)	
	R.G.155–6	Adaptor Set for Tool 155	
6-Cylinder Petrol Engine			
	R.G.274A	Cylinder Head Bolt Wrench	
	430	Cylinder Compression Tester	
	430–1	Adaptor Set for Tool 430	
	R.G.6513	Valve Spring Compressor	
	R.G.6513–2	Valve Spring Compressor Adaptor Foot	
	R.G.10A	Valve Guide Remover/Replacer (Main Tool)	
	R.G.10A–5A	Adaptor Set for R.G.10A	
	R.G.10A–6	Adaptor Set for R.G.10A	
	316X	Valve Seat Cutter (Main Tool)	
	316–11	Valve Seat Cutter Pilot	
	317–25	Valve Seat Cutter Tool 45°	

6-Cylinder Petrol Engine—*continued*

Tool No.	*Tool Description*
317G–25	Valve Seat Glaze-breaker Tool
6057	Valve Seat Insert Replacer
R.G.6057–8	Adaptor Set for Tool 6057
55	Adjustable Puller (Main Tool)
R.G.55–8	Adaptor Set for Tool 55
R.G.221	Timing Cover Centraliser
6312A	Universal Puller
R.G.209	Camshaft Sprocket Remover
32	Camshaft Bushes Remover/Replacer (Main Tool)
R.G.32–5	Adaptor Set for Tool 32
7065A	Two-way Circlip Pliers
335	Connecting Rod Alignment Jig
336	Master Multi-purpose Arbor
R.G.336–3B	Adaptor for Tool 336
6201	Small End Bush Remover/Replacer (Main Tool)
R.G.6201–1	Adaptor for Tool 6201
R.G.203	Piston Ring Compressor
R.G.11A	Main Bearing Cap Remover (Main Tool)
R.G.11A–3	Adaptor for R.G.11A
7600	Primary Shaft Pilot Bearing Remover (Main Tool)
R.G.7600–1	Adaptor for Tool 7600
R.G.186	Sump Drain Plug Socket
155	Adjustable Puller (Main Tool)
R.G.155–2	Adaptor Set for Tool 155

Clutch Unit

99A	Clutch Fixture (includes all adaptors etc.)

Gearbox

55	Adjustable Puller (Main Tool)
R.G.55–8	Legs for Tool 55
R.G.55–10	Adaptor Set for Tool 55
R.G.80	Selector Fork Ball and Spring Compressor
R.G.81	Reverse Selector Fork Assembly Tool
R.G.101B	Reverse Gear Shaft Remover (Main Tool)
R.G.101B–3	Adaptor for R.G.101B
R.G.76	Mainshaft Circlip Replacer (used with R.G.77)
R.G.77	Primary Shaft Circlip Replacer (Main Tool)
R.G.77–1	Extension Adaptor for R.G.77
R.G.78	Dummy Layshaft
R.G.79	Protector Pad

Front Axle

R.G.302	Hub Cap Nut Wrench
550	Universal Handle
R.G.325	Front Hub Outer Bearing Cup Remover
R.G.324	Front Hub Inner Bearing Cup Remover/Replacer (KA.30 models)
R.G.323	Front Hub Inner Bearing Cup Remover/Replacer (KA.40/60 models)
R.G.327	Front Hub Outer Bearing Cup Replacer (KA.30 models)
R.G.326	Front Hub Outer Bearing Cup Replacer (KA.40/60 models)
89A	Front Axle Beam Aligning Rods

Rear Axle
KAH/KAD. 3023 Models

R.G.334	Rear Hub End Float Gauge
R.G.51B	Rear Hub Remover/Replacer (Main Tool)
R.G.51B–9A	Adaptor Set for R.G.51B
R.G.51B–10	Adaptor Set for R.G.51B
R.G.95	Rear Hub Locknut Wrench

Rear Axle—*continued*
KAH/KAD. 3023 Models

Tool No.	*Tool Description*
R.G.322	Rear Hub Inner Bearing Cup Remover/Replacer
550	Universal Handle
R.G.321	Rear Hub Outer Bearing Cup Remover/Replacer
55	Adjustable Puller (Main Tool)
R.G.55–8	Adaptor Set for Tool 55
R.G.55–10	Adaptor Set for Tool 55
R.G.315	Differential Pinion Bearings—Inner and Outer Cup Remover/Replacer
R.G.323	Differential Pinion Outer Bearing Cup Remover/Replacer
R.G.4221B	Differential and Pinion Bearing Hand Press (Main Tool)
R.G.4221B–22	Adaptor Set for R.G.4221B
R.G.77, Code 2	Hollow Drift (Alternative tool to R.G.4221B and R.G.4221B–22 for fitting bearing)
R.G.4221B–18A	Adaptor Set for R.G.4221B
PT.4008	Crown Wheel and Pinion Backlash Gauge
R.G.201	Axle Die Nut

Rear Axle
KAL.30 and KA.40/60 Models

R.G.335	Rear Hub End Float Gauge
R.G.71D	Rear Hub Locknut Wrench
R.G.51B	Rear Hub Remover/Replacer (Main Tool)
R.G.51B–9A	Adaptor Set for R.G.51B
R.G.51B–6 (Code 18)	Thrust Pad for R.G.51B
R.G.314	Rear Hub Inner Bearing Cup Remover/Replacer
550	Universal Handle
R.G.333	Rear Hub Outer Bearing Assembly Remover/Replacer
55	Adjustable Puller (Main Tool)
R.G.55–8	Adaptor Set for Tool 55
R.G.55–10	Adaptor Set for Tool 55
R.G.55–5	Adaptor Set for Tool 55 (KAH/KAD.40 models only)
R.G.4221B	Differential and Pinion Bearing Hand Press (Main Tool)
R.G.4221B–13	Adaptor Set for R.G.4221B
R.G.315	Differential Pinion Bearings—Inner and Outer Cup Remover/Replacer
R.G.106A	Hollow Drift (Alternative tool to R.G.4221B and R.G.4221B–13 for fitting bearing)
R.G.4221B–15	Adaptor Set for R.G.4221B
R.G.179	Differential Bearing Nut Wrench
PT.4008	Crown Wheel and Pinion Backlash Gauge
R.G.72	Axle Die Nut

Suspension

R.G.65A	Shackle Pin Extractor

Steering

121LA	Wheel Alignment Gauge
121U	Wheel Turntable
121W	Wheel Ramp
121PD–B	Pedal Depressor
95B	Tracking (Toe-in) Gauge
R.G.3600	Steering Wheel Remover (Main Tool)
R.G.3600–1	Adaptor Set for R.G.3600
R.G.59A	Drop Arm Remover
R.G.59A–2	Thrust Pad for R.G.59A