AEI

ASSOCIATED ELECTRICAL INDUSTRIES LTD.
AIRCRAFT EQUIPMENT GROUP,
COVENTRY, ENGLAND

MAGNETOS
BTH types AG4-6, AG4-10, AG4-10/1, AG4-12, AG4-12/1 and AG4-13

AEI Instruction Book
IB. 4508-62, Part 1
(Maintenance Manual)

This manual complies with British Civil Airworthiness Requirements, Chapter A6-2. The technical accuracy of this manual has been verified and is certified as correct.

Signed. A.G. Coombes

Date 18th May 1965

A. R. B. Design Approval No. AD/1120/47

AEI

MAINTENANCE MANUAL

Record of Revisions

Rev. No.	Insertion Date	By	Rev. No.	Insertion Date	By	Rev. No.	Insertion Date	By

Retain this record in the front of manual or chapter.

On receipt of revisions, insert revised pages in the manual, and enter revision number, date inserted, and initials.

The introduction of any amendment or revision not certified in accordance with British Civil Airworthiness Requirements, Chapter A6-2, will invalidate the statement of Certification on the title page. Amendments or revisions embodied in this manual, which have been certified under an approval authorisation other than that applicable to the initial certification must be recorded on separate record sheets.

IB. 4508-62, Pt. 1
May, 1965

MAINTENANCE MANUAL

MODIFICATION STATUS OF MANUAL

NOTE: These modification numbers are prefixed either CV or CM, designating a civil or a military modification, respectively.

agneto type AG4-6

Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.	
419	*										
1083	*										

agneto type AG4-10

Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.	
419	*										
1	*										

agneto type AG4-10/1

Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.	
419	*	451	*								
443	*	1083	*								

agneto type AG4-12

Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.	
419	*										
1083	*										

agneto type AG4-12/1

Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.	
419	*	451	*								
443	*	1083	*								

agneto type AG4-13

Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.		Mod. No.	
419	*										
1083	*										

Fully covered in manual.
No cover required in manual.

CONTENTS

	Page
Description	4
Operation	6
Data	7
Unpacking	8
Acceptance checks	8
Storage conditions	8
Storage limiting period	8
Checks/Tests before installation	8
Installation	9
Checks/Tests after installation	9
Maintenance	9
Trouble shooting	13
Removal	15
Bench checks	15
Overhaul period	16
Return to manufacturer or base	16
Appendix 1	17

ILLUSTRATIONS

	Figure
External view of magneto type AG4-12/1	1
Isometric sectional view of magneto type AG4-12/1	2
Contact-breaker and cover arrangement with and without safety cut-out	3

DESCRIPTION.

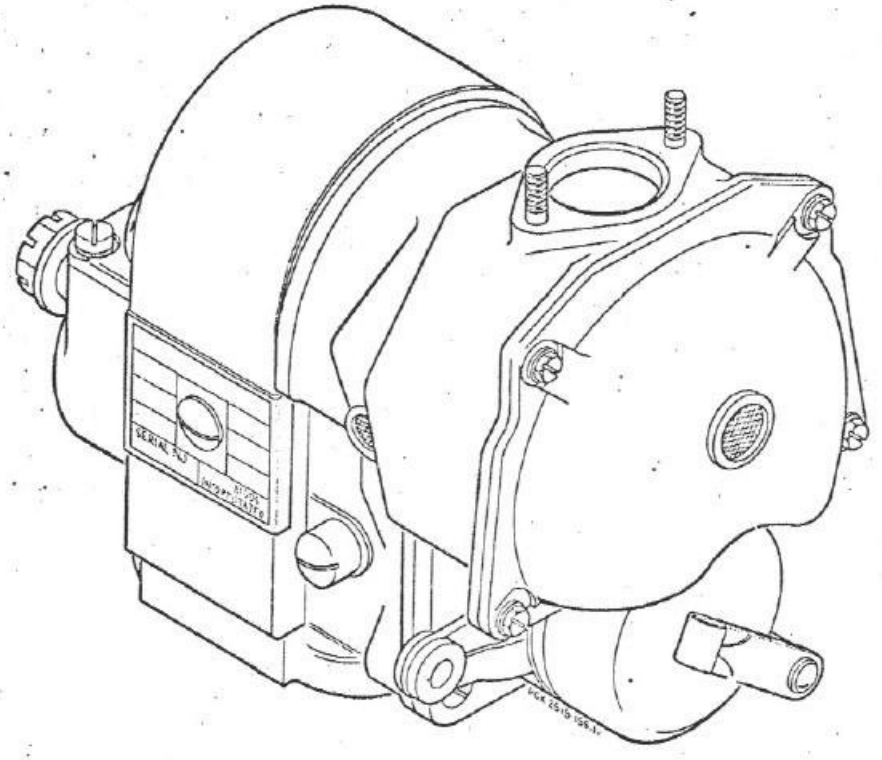
General.

This series of magnetos are of the rotating armature type, they are base mounted and have variable ignition timing. They are for use on four-cylinder, four-stroke, piston engines, the armature being driven at crankshaft speed. They are fitted with a horseshoe permanent magnet and include a safety spark gap. The bearings are lubricated by grease which is included at manufacture.

Differences in the magneto types covered in this manual are as follows.

The AG4-6 magneto is unscreened. The AG4-13 magneto is the same magneto but with the inclusion of a resistor in the brush-holder (distributor rotor).

The AG4-10 magneto is fully screened. Variations of this screened type of magneto are the AG4-10/1 which includes a safety cut-out; the AG4-12 which cludes a brush-holder resistor; and the AG4-12/1 which includes both the resistor and the cut-out.



External view of magneto type AG4-12/1.
Figure 1.

2. Magneto components.

A. Magneto housing.

The magneto housing is an aluminium die-casting with cast-in laminated poles. Cast into the housing base are two screw-threaded brass inserts for the magneto mounting bolts.

B. Armature.

The armature employs an H-type laminated medium resistance iron former on which are wound the primary and secondary windings. Two endcheeks are attached to the former to provide the armature spindles. A capacitor is contained within the base of the endcheek at the contact-breaker end whilst to the spindle is secured the full-speed wheel and the inner race of one of the supporting ball bearings. To the spindle of the endcheek at the driving end is secured a slipring and the inner race of the second supporting ball bearing.

C. Contact-breaker assembly.

The contact-breaker assembly has a brass base on which is mounted an insulated contact block which carries an adjustable contact. The second contact is carried on a pivoting bell-crank lever which is fitted with an insulated bush that forms the bearing of the lever and operates on a hardened and polished pivot pin located in the base. An oil-soaked wick within the pivot pin provides lubrication for the lever. The contact tips are 25% iridium-platinum.

The contact-breaker assembly rotates within a cam ring against which the bonded-fabric heel of the contact-breaker lever bears. Lubrication of the heel is provided by an oil-soaked wick contained in the cam ring. On the types AG4-10/1 and AG4-12/1 magnetos a safety cut-out spring is incorporated which earths the primary circuit when the contact-breaker cover is removed, thereby permitting the engine to be turned without any possibility of electrical ignition.

The cam ring itself is positioned inside a brass tube over which is fitted a brass timing lever and by which means the ignition timing can be varied some 25 degrees measured on the armature shaft.

D. Distributor.

The distributor brush-holder is connected to the secondary winding of the armature by a collector moulding which is located within the driving-end cover adjacent to the slipring. The brush-holder is revolved in the distributor moulding by the half-speed wheel, the assembly being supported by two ball-journal bearings which locate in a bearing housing secured to the magneto housing.

To prevent damage to the armature windings should the external high-tension circuit be interrupted whilst the magneto is in operation, a safety gap is provided. This takes the form of a point gap, one electrode is located on the brush-holder and the second electrode is screwed into a metal boss located in the bonded-fabric half-speed wheel.

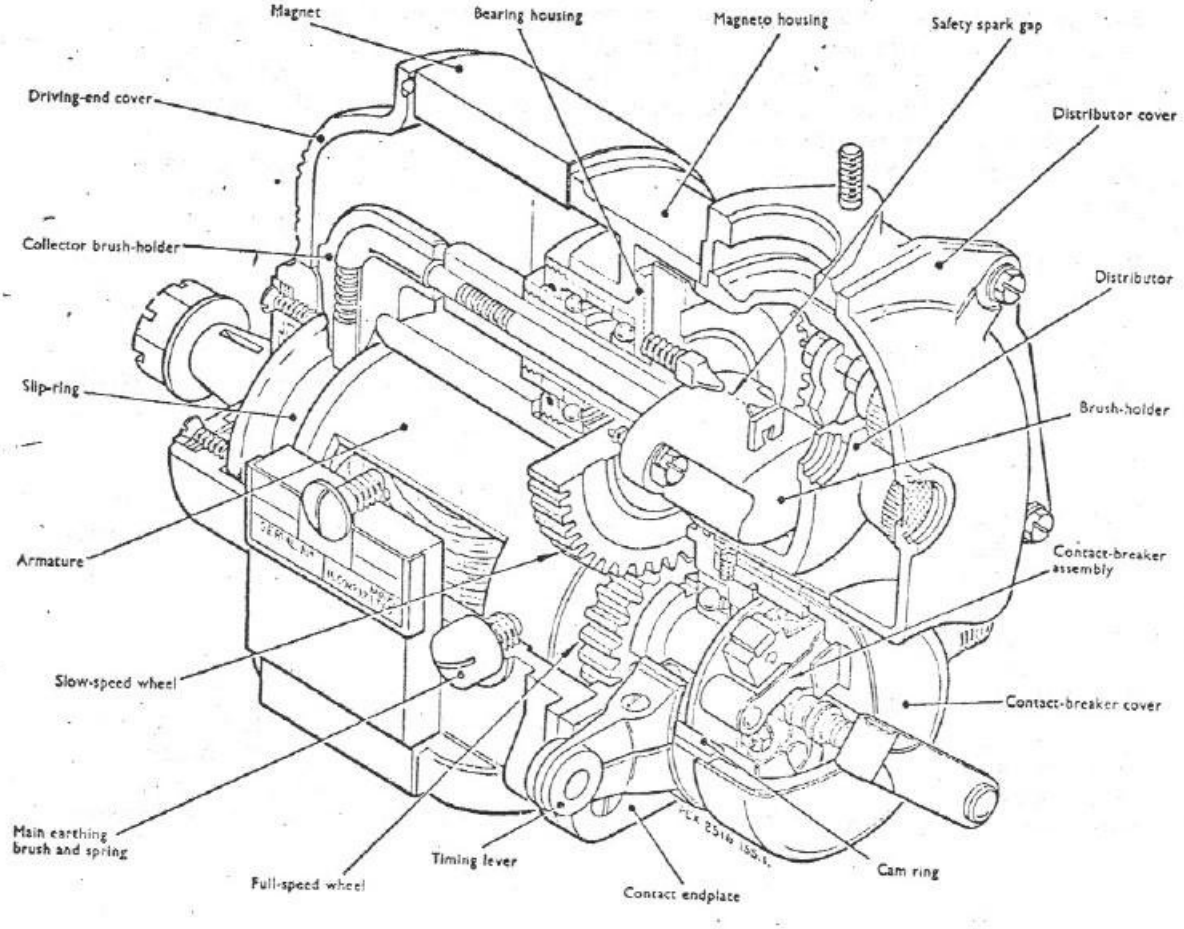
Magneto types AG4-13 and AG4-12 include a resistor in the brush-holder stem.

Rotation.

The magnetos are assembled for one direction of rotation only; the direction of rotation being indicated by an arrow stamped on the driving end.

OPERATION.

The magnetos are of the rotating armature type and employ a permanent horseshoe magnet which has two poles. Thus on rotation of the armature, the flux, passing through the armature core, is reversed twice per revolution of the armature shaft and a current of alternate polarity is built up in the primary circuit.



Isometric sectional view of magneto type AG4-12/1.
Figure 2.

The arrangement of the primary circuit is such that the winding and contacts are series-connected; one end of the winding being connected to earth and the other end taking an insulated path through the contacts to earth.

At the point of peak stored energy in the primary circuit, the contacts open by action of the heel of the contact-breaker lever striking one of the cam ring lobes, thereby breaking the primary circuit. The rapid drying-away of the primary circuit causes a sudden flux change in the magnetic circuit and an extremely high voltage is induced in the secondary winding, one end of which is connected to earth.

The other end of the secondary winding is brought out to the slipring. The high-voltage oscillation thus passes through the collector moulding to the rotating brush-holder which feeds the distributor electrodes and hence through one of the h.t. cables to the appropriate engine sparking plug.

A capacitor is connected in parallel with the contacts to absorb the current generated by the self-induction of the primary circuit which occurs as a result of the sudden flux change in the magnetic circuit when the contacts open. This limits the voltage across the contacts and prevents excessive arcing and the associated burning and pitting of the contact faces.

DATA.

Rated output (kilovolts)		9
Speed (rev/min)		
Minimum sparking:	fully advanced	350
	fully retarded	500
Maximum		3000
Normal		2500
Ratios		
Magneto (armature) x engine speed		1 : 1
Internal gear reduction (Armature x brush-holder)		2 : 1
Contact-breaker gap (inch)		0.012 ± 0.001
Lubricant		
Pivot pin and cam ring wicks		Engine oil (or oil, D. Eng. RD. 2472 B/O: e.g. Esso Aviation 100; Aeroshell 100; BP Aero 100 etc.)
Spigot for cam ring; ball bearings		Grease, DEF. 2261 (e. g. Esso Aviation General Purpose Grease No. 1 etc.)

UNPACKING.

Unpacking is straightforward.

For transit to temperate areas, the units are generally prepared as described in detail under the section headed RETURN TO MANUFACTURER OR BASE.

For transit to tropical areas, the units are usually enclosed in heat-sealed polythene bags and packed in padded boxes.

ACCEPTANCE CHECKS.

following procedure is only recommended if it is evident or suspected that the unit been damaged or subjected to dampness during transit.

arefully remove the wrappings; retain the wrappings if required and acceptable for re-use.

xamine for external damage.

Slowly rotate the magneto drive shaft for a few revolutions and check for rotational freedom.

If damage is evident or there is undue stiffness or fouling of the rotating assemblies, return to manufacturer or overhaul base.

If moisture is present or suspected, bake the unit in a ventilated oven for several hours at a temperature not exceeding 80 deg. C.

Refit all protectors and, if the unit is to be stored, re-wrap the unit as originally received.

STORAGE CONDITIONS.

Retain the unit in its wrappings and box throughout the storage period.

Store in a dry atmosphere well clear of such apparatus as accumulators which can emit corrosive fumes.

STORAGE LIMITING PERIOD.

Subject to the checks and tests detailed under the section headed BENCH CHECKS being carried out once every 12 months, the recommended period under the given storage conditions is 3 years. After this period the unit is to be subjected to overhaul.

CHECKS/TESTS BEFORE INSTALLATION.

Check that the unit has not exceeded the storage limiting period.

Unpack the unit; examine for damage, corrosion or dampness and, if evident or suspected, subject the unit to the procedure given under the heading BENCH CHECKS.

MAINTENANCE MANUAL

INSTALLATION.

1. Refer to the relevant engine/aircraft manual for detailed instructions and any safety measures for the installation of the magneto and its electrical connections.

CHECKS/TESTS AFTER INSTALLATION.

1. The sequence of checks and tests in the relevant engine/aircraft manual should be followed after installation.

MAINTENANCE.

1. Schedules.

The work (*) involved in the maintenance of these units should be carried out at engine servicing periods approximating every 50 and every 100 hours, as indicated by the following table.

Servicing Item	Every 50 hours	Every 100 hours	Remarks
A. Lubricate pivot pin wick (contact-breaker)	*		
B. Lubricate cam ring wick (contact-breaker)	*		
C. Lubricate bearing housing spigot (cam ring)	*		
D. Check and adjust contact-breaker gap	*		
E. Check correct retention of contact-breaker lever	*		
F. Clean (1) distributor and brush-holder mouldings			
(2) ventilation gauzes		*	
(3) collector moulding			If magneto removal is necessary, clean whenever practicable
(4) slip ring moulding			
G. Check earthing spring pressure (contact-breaker)		*	Types AG4-10/1 and AG4-12/1 only

Procedure.

A. Lubricating the pivot pin wick.

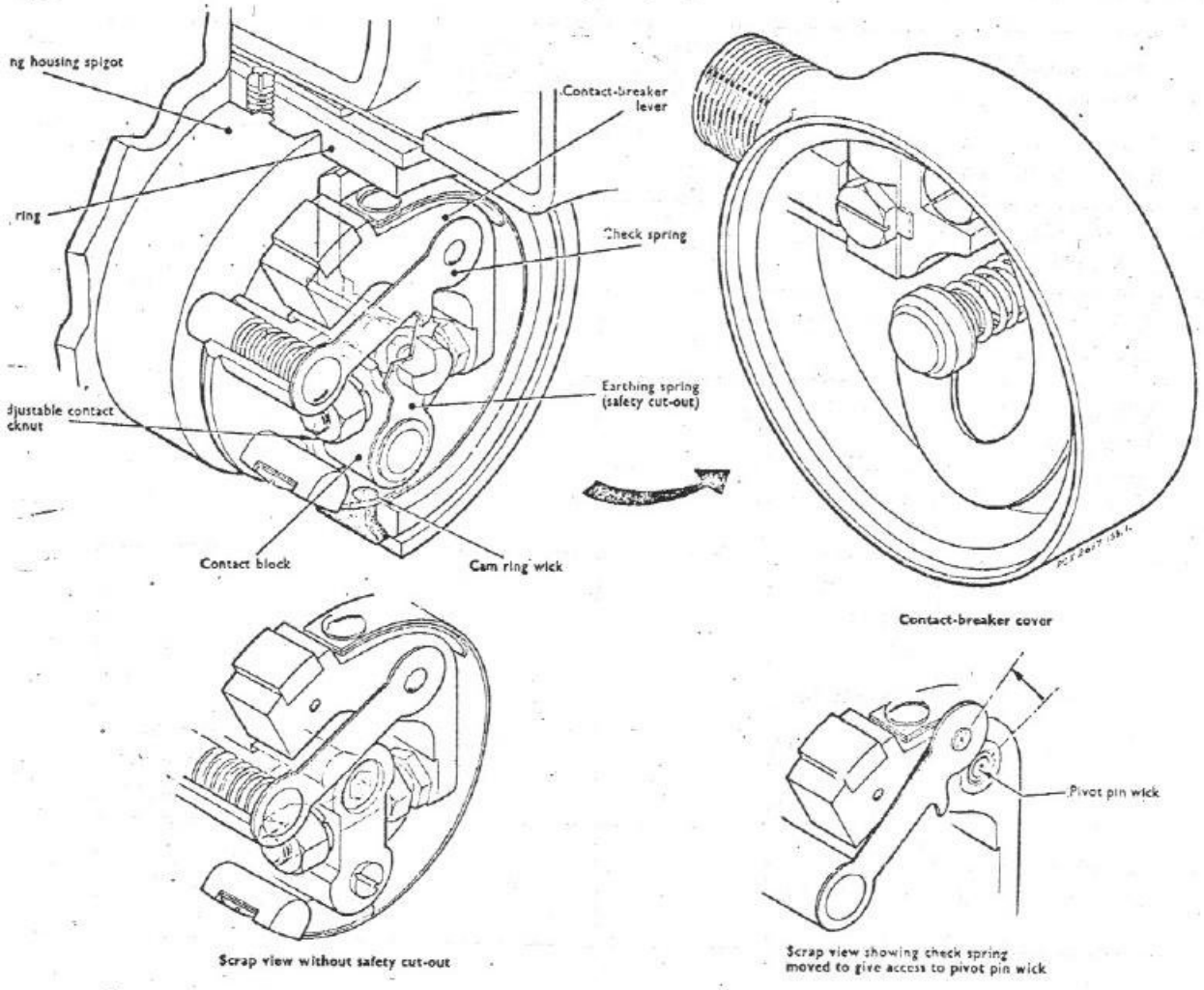
(1) Remove contact-breaker cover.

(2) Disengage check spring from contact-breaker pivot pin.

(3) Add one drop (0.016 cc.) of engine oil (DATA) to the pivot pin wick. This operation may be carried out using a hypodermic syringe fitted with a No. 12 needle.

(4) Re-engage check spring.

CAUTION: Magnetos incorporating safety cut-out - ensure earthing spring is retained beneath check spring lip.



Contact-breaker and cover arrangement with and without safety cut-out.
Figure 3.

B. Lubricating the cam ring wick.

(1) Add one drop (0.016 cc.) of engine oil (DATA) to the cam ring wick. This operation may be carried out using a hypodermic syringe fitted with a No. 12 needle.

C. Lubricating the bearing housing spigot.

(1) Withdraw cam ring.

(2) Smear the spigot on which the cam ring bears with grease (DATA).

(3) Refit cam ring in its original position.

D. Checking and adjusting contact-breaker gap.

NOTE: With the exception of the magneto types AG4-10/1 and AG4-12/1 which incorporate the safety cut-out, the h.t. continuity to the sparking plugs should be interrupted before carrying out this operation.

(1) Turn engine until heel of contact-breaker lever is riding on highest part of cam ring lobe.

(2) Using feeler gauges previously cleaned in carbon tetrachloride, check that contact-breaker gap is within limits given in DATA.

(3) If adjustment is necessary slacken adjustable contact locknut, then turn contact until desired contact-breaker gap (DATA) is obtained. Retighten locknut taking care to keep contact immobile; recheck contact-breaker gap.

(4) Repeat operations (1) and (2), and if necessary (3), for the second cam lobe.

E. Checking correct retention of contact-breaker lever.

(1) Ensure that the check spring is correctly seated on the pivot pin, that the spring tension is satisfactory and that the assembly is generally sound.

(2) Refit contact-breaker cover.

F. Cleaning mouldings and ventilation gauzes.

(1) Distributor cover ventilation gauze.

(a) Remove four screws and nuts securing distributor cover and remove cover.

(b) Brush out ventilation gauze with white spirit (BS. 245).

(2) Cleaning distributor and brush-holder mouldings.

(a) Remove two nuts securing distributor moulding and withdraw moulding.

(b) Clean distributor and brush-holder mouldings with clean cloth moistened in white spirit (BS. 245). Brush out ventilation gauze with white spirit.

(c) Refit distributor moulding and secure with two nuts and lockwashers.

(d) Refit distributor cover and secure with four screws and plain washers and four nuts, plain washers and lockwashers.

(3) Cleaning collector and slipring mouldings.

(a) Remove two screws and lockwashers securing the driving-end cover and remove cover.

(b) Remove two screws securing collector moulding and remove moulding.

(c) Clean collector moulding with a clean cloth moistened in white spirit. Do not unnecessarily remove carbon brush.

CAUTION: Ensure before carrying out the next operation ((d)) that the magneto is switched off i. e. the l. t. circuit is earthed.

(d) Clean slipring moulding by applying a clean cloth moistened in white spirit (BS. 245) to the flanges of the slipring whilst the engine is slowly turned.

(e) Clean the stem of the brush-holder (rotor) moulding with a cloth moistened in white spirit, then refit the collector moulding and secure it with the two screws, lockwashers and new tabwashers.

(f) Refit the driving-end cover and secure it with the two screws and lockwashers.

G. Checking earthing spring pressure - magneto types AG4-10/1 and AG4-12/1 only.

(1) Remove contact-breaker cover.

(2) Check that the pressure required to press the earthing leaf spring flat onto contact block is within the limits of 1 lb. 6 oz. and 1 lb. 2 oz.

(3) Refit contact-breaker cover.

TROUBLE SHOOTING.

1. Table 1. General ignition defects.

Fault	Possible cause	Remedy
1. Magneto fails to spark.	A. Earthing switch closed or defect in associated wiring.	Open switch or rectify wiring defect.
	B. Contact-breaker lever seized on pivot pin.	Remove magneto for overhaul.
	C. Contact-breaker lever spring broken.	
	D. Capacitor short-circuited.	
	E. Primary winding open-circuited or earthed.	
	F. Secondary winding open-circuited or earthed.	
	G. Distributor or brush-holder short-circuited.	
2. Faulty sparking (excessive mag drop).	A. Faulty earthing switch or associated wiring.	Examine and rectify.
	B. Contact-breaker defect.	See Table 2.
	C. Moisture in magneto.	Remove magneto and dry out as detailed in ACCEPTANCE CHECKS 5.
	D. Dirty distributor, brush-holder, collector or slipring mouldings.	Clean moulding as detailed in MAINTENANCE 2. F. If 'tracking' is in evidence remove magneto for overhaul.
	E. Defective armature giving reduced output.	Remove magneto for overhaul.
	F. Capacitor partially short-circuited.	
	G. Loose or corroded connections in magneto.	

Table 2. Contact-breaker defects.

Symptom	Fault	Possible cause	Remedy
Poor slow-speed performance.	A. Small contact gap.	(1) Incorrect initial adjustment.	Reset contact gap.
		(2) Pitting of contact faces.	Stone-dress contacts; reset gap. If pitting is persistent, remove magneto for overhaul.
		(3) Wear of contact-breaker lever heel and/or cam lobes, due to lack of lubrication.	Remove magneto for overhaul.
Poor high-speed performance.	A. Large contact gap.	(1) Incorrect initial adjustment.	Reset contact gap.
		(2) Excessive elapsed period since last inspection.	
Poor slow-speed performance possibly accompanied by misfiring at high speed.	A. Dirty contacts.	(1) Non-observation of cleanliness during servicing.	Clean contact faces with clean cloth moistened in carbon tetrachloride.
	B. Contact bounce.	(1) Weak contact-breaker lever spring.	Renew contacts.
	C. Pitted or blackened contacts.	(1) Lubricant or foreign matter on contact faces.	Stone-dress contacts, reset gap. Check contact-breaker assembly for over-lubrication.
		(2) Contact-breaker lever movement sluggish.	Check lubrication; re-lubricate pivot pin. If sluggishness persists remove magneto for overhaul.

Symptom	Fault	Possible cause	Remedy
3. Poor slow-speed performance possibly accompanied by misfiring at high speed (continued).	C. Pitted or blackened contacts (continued).	(3) Weak contact-breaker lever spring. (4) Incorrect fit of lever on pivot pin. (5) Contact loose in contact-breaker lever. (6) Contacts badly out of line or not parallel. (7) Defective capacitor.	Remove magneto for overhaul.

REMOVAL.

1. Refer to the relevant engine/aircraft manual for the detailed instructions and any safety measures for the disconnection and removal of the magneto.

BENCH CHECKS.

1. When the serviceability of the magneto is suspect, or when called for under STORAGE LIMITING PERIOD, and the required facilities are available, carry out the following tests. If the facilities are not available the magneto must be returned for overhaul.

   A. Connect the magneto by $3\frac{1}{2}$-feet lengths of metal-braided cable of between 135 and 145 pico-farads capacity to ball gaps (A.M. EL. 12947, or similar) set to discharge at 9 kV.

   B. Run the magneto at 2500 rev/min for 15 minutes with the timing fully advanced.

   C. Slowly increase the magneto speed to 3000 rev/min and maintain this speed for 1 minute.

   D. Slowly decrease the magneto speed to the lowest rev/min consistent with regular sparking, with the timing still fully advanced, and maintain this speed for 1 minute.

   E. Slowly move the timing lever to the fully retarded position, then adjust the magneto speed to the lowest rev/min consistent with regular sparking and maintain this speed for 1 minute.

F. If the lowest speed consistent with regular sparking does not exceed:

(1) 350 rev/min in full advance (test D)

(2) 500 rev/min in full retard (test E)

and, apart from incidental misfiring in the determination of these speeds, regular sparking has been maintained throughout the tests, the magneto can be considered to be serviceable.

OVERHAUL PERIOD.

Subject the magneto to the full overhaul procedure at engine overhaul periods approximating to between 1000 to 1200 hours.

RETURN TO MANUFACTURER OR BASE.

- rotection.

A. Fit wooden shield for driving taper.

B. Arrange pads of corrugated paper as protection for the magneto protruberances.

Wrapping.

A. Wrap with an enclosing layer of waxed paper and at least two layers of corrugated paper, ensuring pads are held in position.

B. Wrap with a final layer of water-resistant paper and seal with gummed paper strip.

Packing.

Pack magnetos in wooden boxes lined with water-resistant paper. If despatched in quantity, employ wood-wool stuffing between magnetos and layers of magnetos.

Information.

A. Return with each magneto a brief history of its use, including if possible the number of overhauls completed and details of any defects experienced since the last overhaul.

APPENDIX NO. 1

GENERAL ISSUE

STORAGE CONDITIONS, SHELF AND SERVICE LIFE OF RUBBER COMPONENTS AND UNITS INCORPORATING RUBBER COMPONENTS

1. STORAGE CONDITIONS.

A. Storage Conditions - Rubber Components

(1) Spare rubber components should be stored in a suitable store room which provides adequate protection from light and adverse climatic conditions. The ideal store room temperature is 10° to 21°C (50° to 70°F) but if this cannot be maintained the temperature should not exceed 27°C (80°F) and should never be lower than −15°C (5°F).

(2) Contamination of the stored components by fluid of any description must be avoided. Components should preferably be pre-packed in envelopes or in cartons and stored in the dark. If possible, small components should be stored in airtight containers.

(3) All components should be laid in a 'relaxed' position and should not be subjected to compression and distortion by excessive weight or over-tight packing. Undue distortion may result in a permanent set or accelerated cracking of the rubber.

(4) Strict rotation of issue from stores must be observed, by records and/or method of storage, so that the stock remaining in the stores may be of the latest supply quality.

B. Storage Conditions - Assembled Units

(1) General store room conditions should be as detailed in para. 1. A.

2. GENERAL.

Recommendations given in this appendix are based on the storage conditions given in paragraph 1 and due allowance should be made if the conditions fall short of this standard. Except where otherwise stated the life of the stored rubber components should be based on the date quoted on the Advice/Approved Certificate and for assembled units on the assembly date marked on the unit.

3. STORAGE LIFE.

A. Rubber Components (stored in accordance with the conditions detailed in paragraph 1).

(1) These components may be stored for a period not exceeding four years from the Advice/Approved Certificate date for subsequent use as detailed below.

(2) Spare rubber components which have been stored for any period up to four years may be assembled into units for a further five years storage life as detailed in para. B or into units which are to be placed immediately into service.

B. Assembled Units (stored in accordance with the conditions detailed in para. 1).

(1) Except where otherwise stated units may be stored fully assembled for a period not exceeding five years from the assembly date marked on the unit. At the end of this period it is recommended that the unit be disassembled and the complete set of rubber components renewed from stocks not more than four years old.

(2) Units which have been stored for any period up to five years since the rubber components were renewed may be put into service.

4. SERVICE LIFE.

A. If high standards in operation and maintenance are consistently observed, rubber components will give a long period of satisfactory service. Except where otherwise stated, the service life will depend upon the severity and frequency of the work which the component is required to do and to some extent upon local operating conditions, and will be determined by its condition when examined during the overhaul of the unit to which it is fitted. The Operator should vary the unit overhaul period recommended in the Maintenance Manual accordingly.

Printed in England by AFS'R