

Chapter 3

SUPPRESSION OF ELECTRICAL INTERFERENCE ON MOTOR VEHICLES

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Introduction

1. Radio interference caused by motor vehicles and their associated equipment is wholly undesirable and this chapter describes the accepted methods of reducing this interference to a minimum.

2. The methods described in this chapter do not necessarily give the extent to which service personnel should suppress motor vehicle equipment but, rather, to enable the tradesman concerned to recognize the components which may be employed.

MAIN CAUSES OF INTERFERENCE

Ignition systems

3. The principal source of the radio fields produced by installations embodying spark ignited internal combustion engines is the ignition circuit. This is due to the rapid growth and decay of current which occurs at each spark.

4. The magnitude of the radio interference caused by ignition systems is very considerably influenced by the layout of the system. In general the longer the exposed ignition leads the greater is the interference, and the reduction of the length of these leads may reduce it considerably. A further reduction of radio noise may often be obtained if advantage is taken of the screening effect of proximity to the metal mass of the engine.

5. The existence of additional spark gaps in the ignition circuit normally increases the interference and, therefore, loose connections in the high tension circuit and large gaps between the rotor and the stator of a distributor are to be avoided.

6. In general the maximum interference from the ignition system is to be expected under the following conditions:—

- (1) Rapid acceleration from low speed.
- (2) Wide throttle opening under heavy load.

Ancillary items

7. Radio fields from ancillary items such as vibratory regulators, windscreen wipers, motors, etc., are caused by the R.F. currents circulating in the wiring connected to these items. Such wiring should, therefore, be as short as possible and the practice of looping into circuits which may be carrying R.F. currents should be avoided.

Regulators

8. The surges produced by the operation of the regulator contacts contain radio frequency components which, unless restricted by suitable methods of suppression, are fed into the wiring circuits associated with the regulator system.

Generators and small electric motors

9. Interference from these items is usually associated with sparking at the brushes. Such interference can be materially reduced by ensuring that the commutator is in good condition and that the brushes are not worn or fitting badly.

METHOD OF SUPPRESSION

General

10. In order that the components listed in table 1 may be as effective as possible the following points should be noted:—

- (1) All earth connections must be electrically sound and therefore all contact sur-

TABLE 1
Components

Stores Ref.	Part No.	Nomenclature	Purpose
16E/4284	21384	1·0 μ F capacitor	Generator, wipers, ignition, coils, etc.
16E/4283	21385	0·02 μ F capacitor	Voltage regulators
16E/4320	21387	5,000 ohm resistor	H.T. leads
16E/4285	21388	15,000 ohm resistor	Sparking plugs (British vehicles)
16E/7364	21390	10,000 ohm resistor	Sparking plugs (American vehicles)

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faces must be clean and free from paint and rust. Securing bolts, terminal and earthing clips must be tight. A thin film of Vaseline can be applied with advantage to earth connections and terminal eyelets must be used.

- (2) Capacitor connections should be as close as possible to the source of interference and the capacitor lead(s) cut as short as possible. The clip or bracket securing the capacitor should always make a good connection to earth.
- (3) The ends of H.T. cables should be cut squarely, and the cable should be of sufficient diameter to fit snugly in the end of the resistor. A suitable varnish should be applied to the joint of the cable and resistor to exclude moisture.

Ignition system (coil ignition) (Fig. 1.)

Coil

11. The suppression of the low-tension side of the coil is effected by a capacitor of $1\mu\text{F}$, connected between the battery terminal of the coil and earth, the connecting leads being as short as possible.

Distributor

12. Later types of distributor have a built-in suppression resistor, e.g., resistor brush of nominal value 12,500 ohms. Where these distributors are not fitted, a suppression resistor of 5,000 ohms is connected in the H.T. lead from the coil to the distributor, as close to the distributor as possible.

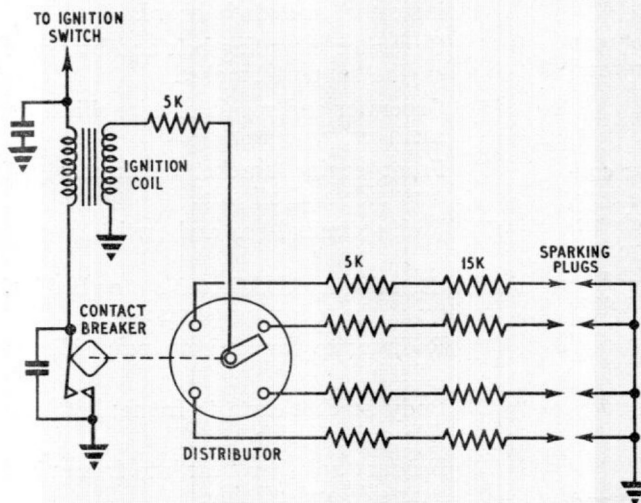


Fig. 1. Ignition system (coil)

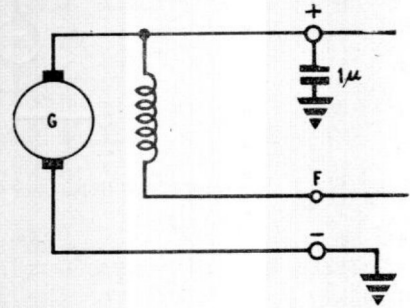


Fig. 2. Generator

13. A 5,000 ohm resistor is connected in each sparking plug lead as close as possible to the distributor. In those cases where the leads run close to each other, the resistors should be placed at equal distances from the distributor and not staggered.

Sparking plugs

14. Sparking plugs with an included suppression resistor of nominal value 12,500 ohms will eventually be a standard fitting. In the absence of these suppressed plugs a 15,000 ohm resistor is fitted in each sparking plug lead as close to the plug as possible.

Ignition system (magneto ignition)

15. Para. 13 and 14 are applicable to magneto ignition systems.

Charging system (double-pole and earth return systems)

Generator

16. Capacitors of $1\mu\text{F}$ are fitted between both of the generator output terminals and earth, the capacitor leads being as short as possible. Where one terminal of the generator is earthed at the machine, the corresponding capacitor is omitted (fig. 2).

Voltage regulators

17. The latest voltage regulators incorporate a simple choke capacitor suppression arrangement; some regulators not incorporating this suppression arrangement have a $0.02\mu\text{F}$ capacitor, connected between the positive and negative terminals of the regulator.

Note . . .

Where the letter X appears as the last letter of the type number on a control board or generator it indi-

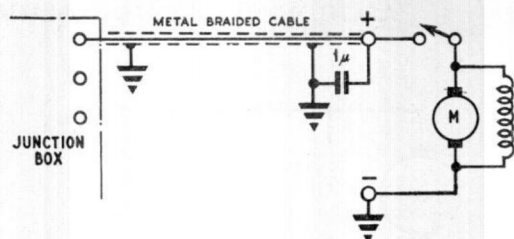


Fig. 3. Windscreen wiper

cates that the unit so marked has been suppressed by the manufacturer.

Ancillary equipment

Windscreen wiper (fig. 3)

18. Metal braided cable is employed between the switch, fuse or junction box and the windscreen wiper; the metal braiding is earthed at each end by means of suitable clips. A capacitor of $1\mu\text{F}$ is connected between the live terminal of the wiper and earth; the polarity of the live terminal must be that of the battery terminal which is not earthed.

Electric fuel tank indicators

19. Certain of these components are suppressed by means of a $1\mu\text{F}$ capacitor fitted between the live terminal and earth.

24-volt, three-wire systems

Charging circuit

20. A $1\mu\text{F}$ capacitor is connected from each terminal of the generator to earth. These are usually fitted inside the generator terminal box. In certain cases due to lack of space capacitors of $0.5\mu\text{F}$ are used.

Vehicle battery

21. A $1\mu\text{F}$ capacitor is connected between the 12 volt centre tapping of the battery and earth.

Windscreen wipers

22. Where the windscreen wipers are connected to the 12/24 volt half of the battery, a $1\mu\text{F}$ capacitor is connected from each terminal of each wiper to earth. Where the wipers are connected to the negative/12 volt half of the battery a $1\mu\text{F}$ capacitor is connected between the positive terminal of each wiper and earth.

SUPPRESSION METHODS IN AMERICAN VEHICLES

Jeeps $\frac{1}{2}$ ton $\times$ 4, Willys and Ford

Ignition system

23. (1) Relevant remarks in para. 10 and 11 apply.

- (2) A resistor of 10,000 ohms is fitted between the coil and the distributor.
- (3) Resistors of 10,000 ohms are fitted in the H.T. leads to the sparking plugs.
- (4) A capacitor of $0.1\mu\text{F}$ is fitted in the ignition coil primary circuit between the positive terminal and the cylinder block. A $0.1\mu\text{F}$ capacitor is also fitted between the ignition switch terminal (lower) and the instrument panel.

Charging circuits

24. (1) A $0.1\mu\text{F}$ capacitor is fitted between the generator armature terminal and earth.
- (2) Capacitor of $0.1\mu\text{F}$ between the regulator field terminal (F) and earth.
- (3) Capacitor of $0.25\mu\text{F}$ between the regulator field terminal B and earth.

Note . . .

Terminal B is the most forward of the three terminals on the regulator.

Miscellaneous circuits

25. (1) A capacitor of $0.5\mu\text{F}$ is between the radio box terminal and earth.
- (2) The starting switch has a $0.5\mu\text{F}$ capacitor between the battery terminal and earth (floor).

Bonding

26. Bonding strips are installed between the following points:—

- (1) Bonnet top and dash board; both near side and off side.
- (2) Cylinder head stud and dash board.
- (3) Cables (hand brakes, speedometer, heat indicator) and dash board.
- (4) Generator mounting bolt and bracket to engine support bracket.
- (5) Generator and regulator wire shield and earth on generator.
- (6) Front engine bracket on frame; both near side and off side.
- (7) Radio terminal box and earth.

27. Bonding is also effected by toothed lock washers at the following points:—

- (1) Radiator to frame; both near side and off side.
- (2) Body bracket earth to frame; both near side and off side.
- (3) Fender "splasher" earth to frame; both near side and off side.
- (4) Air cleaner mounting.

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- (5) All body holding down bolts.
- (6) Radiator grill to cross members.
- (7) Fender to cowl, both near side and off side.

MOTOR CYCLES

Sparking plugs and H.T. leads

28. In most cases it is current practice to fit a waterproof cover to the sparking plug on motor cycles; this prevents a plug type resistor being fitted.

29. The suppression of motor cycles with magneto ignition is restricted to one 5,000 ohm resistor, Stores Ref. 16E/4320, fitted as near to the sparking plug as possible. In the case of motor cycles with coil ignition, a 1 μ F capacitor is connected between the terminal of the contact breaker and earth.

SERVICING

General

30. All electrical connections should be tight and clean and all metal parts of the vehicle well earthed. In the event of any component being removed from the engine, care must be taken, when replacing, to ensure

that a good electrical connection exists between the body of the component and the engine.

Ignition circuits

31. The distributor spark gaps should be examined for excessive burning and, in the event of the gap being too great, the distributor cover and rotor should be replaced. The contact breaker points should be examined for cleanliness and rectified if necessary.

32. All ignition leads should be closely examined for oil impregnation, burning and cracks and replaced if necessary.

Ancillary equipment

33. Windscreen wipers, generators, electrical petrol pumps and other electrical appliances should be examined for excessive sparking. If necessary worn brushes should be renewed and the commutator cleaned. Contact points in electrical fuel pumps should be kept clean and set at the correct gap.

Bonding

34. All bonding should be examined and, if worn or broken, should be renewed.

