

Means of suppressing radio inductive interference

The obvious and only satisfactory method of suppressing radio inductive interference which is caused by electrical apparatus which is defective is to put this apparatus in good condition. The owners of such electrical apparatus are always very pleased to have their attention drawn to the fact that their apparatus is in need of repair, in having been found many times that this radio interference is the first indication of a fault, which is not attended to, may cause serious damage.

In cases where the electrical apparatus appears to be good mechanical and electrical condition is very often possible to supply some means of preventing electrical surges, originating in the apparatus from getting out to the power line where they would radiate and caused radio interference.

These electrical surges have the property of passing through condensers more readily than through inductances. The method employed therefore, is preventing electrical surges from travelling along the power lines and thus causing radio interference, is to provide a path to ground in the form of a condenser to filter or drain off this surge. In order to make this filter more effective it is often advisable to introduce between the lines and the source of the disturbance a trap, which will make the passage of the surge more difficult. This trap preferably takes the form of choke coil, which consists of a number of turns of wire of sufficient size to carry the required current without overheating and sufficient insulation to withstand the voltage on the line. These installations should be approved by the local electrical inspector to ensure that there are no fire or accident hazards introduced by the installation.

It is important in the design of those choke coils that they should have low distributed capacity in order to prevent the electrical surge passing through the choke coil by means of this capacity.

CHOKE COIL.

A type of choke coil recommended for cases where the current is less than 3 amperes is constructed as follows. It consists of 100 turns of No. 18 double cotton- covered wire in a single layer wound on a fibre tube 3 inches in diameter, 1/8 inch thick. Leads are soldered to each end and made from No. 14 flexible rubber- insulated braid- covered copper wire, making one turn around the tube then through a hole in the tube and extending through the inside of the tube a length of one foot. The burrs are carefully removed from a hole in the fibre tube so as not to cut the insulation. End rings or filters are mounted at the end of the winding to build up the same diameter as the outside diameter of the winding. These may be made of taps or a suitable size of fibre tube. The whole coil is then covered with five layers of Empire cloth and then taped with black friction tape and painted with insulation varnish. Mounting lugs made of fibre are then attached to each end of the coil.

This coil should be mounted on board covered with asbestos 1/8 inch thick and the leads soldered and thoroughly taped according to standard wiring practices.

Instructions for mounting condensers.

Condensers which will stand a test voltage of 1,000 volts d.c. may be connected across an alternating current or direct current circuit of 250 volts or less. On circuits which are protected by fuses is of no more than 15 amperes capacity, no additional fuses is required for the condenser. On circuits protected by fuses of greater than 15 amperes capacity a separate out cut base and a small fuse (of approved type) not exceeding 15 amperes, must be installed between the condenser and each unground power wire. Where condensers are not installed in metal boxes and are to be placed on wooden surfaces they should be mounted on pads of asbestos at least 1/8 inch thick and these pads should be sufficiently large extent beyond the clamps used for holding the condensor in place.

Where condensers are to be used on 550 volt circuits two condensers of the approved type must be connected in series between the lines and the common point may be grounded. In such installations the condensers are to be protected by 600 volts fuses no greater than 10 amperes in each live line, and both the condensers and fuses are to be enclosed in a grounded metal case where are the condensers are to be connected to two-phase or three-phase circuits no greater than 600 volts, one condenser may be connected from each live line to ground and installed with fuses in boxes as stated above.

As these condensers contain wax. they should not be placed where they may be subject to excessive heat.

Condensers when connected to a circuit as stated above have no objectionable effect on the circuit, all the operation of an electrical apparatus and their power consumption is negligible.

Treatment of typical cases

In most cases it is possible to make a slight changes in the connections of the electrical apparatus causing the surge in order to use some existing apparatus as a choke coil and thus prevent the necessary of adding additional choke calls to the system.

A series of commutator motor causing a surge by sparking at the brushes may have its leads reversed to reduce the radio interference when one wire is grounded, radio interference from such a motor is sometimes reduced by reversing the leads supplying the motor, so that one of the brushes is connected to the ground side of the line and the field coil is connected to the live side of the line. In this case the field coil is used as a choke. It may also be necessary to place a condensor of one or two

Microfarads capacity across the brushes. The suggested connections are shown in fig. 1.

In cases where neither side of the line is grounded a choke may be inserted on the line connected directly to one of the bushes while the field coil may act as a choke in the other line. In this case it is recommended to use two 2-microfarad condensers in series and ground the middle point according to the diagram. The suggested connections are shown in fig. 2.

In the case of shunt connected motors, and also in other cases where it may not be convenient to make connections with the brushes of a motor the condenser may be placed across the line as near as possible to the motor and between the motor and the choke coil or choke coils.

The live side of a low voltage lighting circuit may be determined by means of a test lamp connected from ground first to one wire then to the other. The lamp will light when connected from the live line to ground.

Battery charger of the vibrator type may be prevented from causing radio interference by connecting the condenser of $\frac{1}{2}$ microfarad capacity across the vibrating contacts. In the case of battery charger is useless to put condensers across the mains, as it is necessary to make use of the choke consisting of the wire and coil within the battery charger, to prevent this surge from getting out on the line.

Flashing electrical signs may usually be prevented from causing radio interference by connecting condensers of from 1 to 2 microfarads capacity across the contacts of the circuit breaker. It is sometimes necessary, however to add a choke coil at the line side of the circuit breaker and also connect the condenser across the contacts of the circuit breaker. As the radio interference from such sources depends upon the condition of installation it is necessary to make these few experiments are suggested above in each case to reduce the radio interference most effectively.

Sometimes the radio interference from a flashing sign installation is caused by sparking at the commutator of a motor drives the flasher. This may be readily determined by the nature of the sound in the radio receiver and may be remedied by the method described for dealing with interference from commutator motors.

Internal combustion engines ignition systems make calls radio interference, but this is usually of a very local nature. This however may be considerably reduced by making the leads from the magneto or spark coil to the engine as short as possible and running them in a grounded shield such as metal conduit or lead covered cable. The frame of the engine magneto and all shields should be thoroughly grounded.

Small rotary converters such as those used to energise some forms of medical apparatus, sometimes cause radio inductive interference by producing a surge, which travels out both on the alternating and direct current

line. In such cases it may be necessary to introduce choke coils into the alternating current lines and put condensers across the lines between the choke coil and the converter. Before putting these choke coils in the alternating current lines it is recommended to try the effect of the condensers across the brushes as described previously from the case of commutator motors.

Electric ozonators which are used for purifying the air in large buildings and for bleaching purposes in flour mills sometimes cause radio inductive interference by producing a surge which travels along the primary line supplying the ozonator.

This interference may easily be eliminated by connecting two choke coils of the cylindrical type previously described one in each of the low voltage lines placed near as possible to the ozonator.

The suggestions of the circular may be summarised into following general rule:-

- (a) Put condensers across the actual source of disturbance in the case of motors, for the condensers across the brushes; in the case of make and break contacts, put the condensers across the contacts themselves.
- (b) When choke coils are used in conjunction with condensers put the chokes between the apparatus and the main supply and put the condensers between the apparatus and the chokes.
- (c) Where the power supply system has one of its wires grounded at the power station or other supply point, put choke coils in the ungrounded or live wire and put the condensers between that wire and ground.
- (d) Where the supply system is ungrounded, put a choke coil in each supply wire and use two condensers in series across the mains with the centre point between the two condensers connected to ground.
- (e) If the apparatus already contains electro- magnetic windings, endeavour to make those windings serve also as anti- interference choke coils.
- (f) Always insert fuses between the condensers and the mains.

Recent investigations by this department indicate that radio interference is almost a common in those country centres where the local electric supply is a direct- current system. Experiments have shown that most of the trouble is due to one or more of the following causes. The remedies are given for each particular case.

(a) Sparking commutators due to accumulation of carbon dust between the commutator segment, the dust accumulating on account of the mica insulation being below the commutator segments.

Remedy:- Re-insulate the segments.

(b) Low insulation between the commutator and the machine shaft.

Remedy:- Re-insulate with good quality micanite.

© Carbon brush use of unsatisfactory grade.

Remedy:- Use a hard grade carbon brush of good Quality.

(d) If leather belting of a copper-laced type is used then continuous spark discharges may occur between the copper lacing and the machine pulley.

Remedy:- Use camel hair belting or effectively earth the copper- lacing by means of arm brush contact, this brush contact may be improvised for the test by fanning out a piece of 7/20 copper wire and placed in such a position as to give light contact on the copper lacing.

Should any of the means mentioned in this communication fail to overcome the difficulty the Department's officers will be only too glad to give any further information regarding the case that may warrant special investigation.