

## CHAPTER IX

### ELECTRICAL INSTALLATIONS

#### Electrical Equipment

Electricity is as important to a modern warship as the main machinery, and the correct functioning of the electrical equipment is essential for the fighting efficiency of the ship, her safety and the comfort of her company.

The maintenance of the electrical equipment is the responsibility of the electrical branch and in no circumstances should it be interfered with by unauthorised persons. Any defects should be reported at once to the electrical office where the necessary steps will be taken for their repair. All electrical machinery is marked with tallies; these are for the information of the electricians and must never be removed or painted over.

#### Distribution of Electric Power

In most ships electricity is produced at 220 volts D.C. and is conducted round the ship by main electric cables, running as far as possible below the waterline or behind armour, from which it is tapped by leads to feed the various electrical appliances and machines. In small ships the supply of power is distributed from one or more centralised switchboards, but in larger ships it is distributed from a "ring-main" system. This consists of heavy armoured cables led round the ship, inside the armour, in the form of a ring, which is fed through suitable switch gear from all dynamos. By means of various types of switches, electrically, mechanically, or hand operated, electrical power can be distributed to or withheld from any part of the ship. This degree of control of the electrical power system is most useful in the event of failure or damage to the dynamos or cables, because it enables the repair parties to repair or replace damaged circuits with speed and in safety from the dangers of electric shock.

## Emergency Lanterns

These are small battery-operated lights fitted throughout the ship, and their main function is to illuminate gangways and ladders in the event of a failure of the main lighting.

## Internal Communications

Internal communications refer to the telephone and broadcasting systems in a ship. Radio, lamp and flag signalling come under the heading of external communications.

### TELEPHONE SYSTEMS

In a ship telephone systems may be divided under three broad headings:—

- direct telephones,
- exchange systems,
- grouped telephones.

*DIRECT TELEPHONES* are two telephones connected together so that a call may be made from one to the other, but to no others. They are the normal means of communication in small ships.

*EXCHANGE SYSTEMS* consist of a number of outlying telephones connected to an exchange, where, by means of plugs on flexible leads, any telephone in the system can be connected to any other.

Most cruisers and larger ships have three telephone exchanges:—

- Main Exchange,
- Engine-Room Exchange,
- Fire Control Exchange.

*Main exchange.* Telephones connected to the Main Exchange are used for the normal routine of the ship. The Main Exchange is kept manned continuously and can be connected to a shore exchange when the ship is lying in harbour at a berth to which leads from the shore system have been run.

The *engine-room exchange* is a small exchange used in the communication system between the engine rooms and boiler rooms.

*Fire control exchange.* Telephones connected to the Fire Control Exchange are used for "action" communications.

This exchange is wired to allow the operator to pass orders to a number of outlying stations simultaneously.

*GROUPED TELEPHONES.* In many cases a number of telephones are connected in groups, whereby a controlling telephone can pass orders simultaneously to a number of outlying ones.

*Types of Telephones.* Several types of telephones will be found in ships. These include:—

(i) telephones with hand sets, similar to those found on shore but more robust; lifting the hand set automatically calls the other end.

(ii) head sets, carrying earphones, usually fitted with transmitters; they are generally used for action purposes.

(iii) telephones with hand sets, but having a call up worked by turning a handle.

## BROADCAST SYSTEMS

Examples of broadcast systems are:—

- (i) the Warning Telephone System; and
- (ii) the Armament Broadcast System.

In these systems microphones situated in selected positions are connected, through amplifiers, to loud speakers throughout the ship.

In the case of the Warning Telephone System the loud speakers are fitted in living and working spaces. In the Armament Broadcast System they are fitted in various "action" positions.

How to use a telephone and care in its handling are described in Chapter 13 under "Voice Communications".

## Radio

The modern warship carries a large number of radio equipments of many kinds including wireless telegraphy, radio telephony and radar sets. As far as possible they are placed in offices where they are protected from the weather, dirt and shock, but certain parts have to be in exposed positions. Unless care is used these parts can very easily be damaged, with the most serious results. Such items of radio equipment, for which ratings must keep a look-out are:—

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- (i) aerials and their " feeders " (or " leads ");
- (ii) radar indicator units (on the bridge, in gun directors, target indicating rooms, gunnery calculating positions, action information spaces, etc.);
- (iii) radio telephone microphones and small transmitters (in spaces like the aircraft direction room).

### MAINTENANCE OF RADIO EQUIPMENT

The three greatest enemies of all radio equipment are:—*water* (especially salt water), *dirt* and *rough treatment*, for the following reasons:—

*Water*—Most of these sets use high voltages (400 to 20,000 volts). Insulators are used to keep these high voltages in the right channels. Water conducts electricity, especially salt water, and if it reaches radio gear the insulators will be useless and the high voltages will " flash over ", causing burning and serious damage throughout the equipment. Even when salt-water is dried out the troubles are not over because the salt itself remains and gets damp again, starting the trouble all over again. So remember:—

- (i) don't use hoses near radio equipment, or near the ventilation to radio rooms;
- (ii) when scrubbing decks near radio equipment use as little water as possible, don't splash it about, and wipe it as dry as possible with a wrung out cloth;
- (iii) keep ventilation fans running (and radiators switched on when necessary) to keep the air warm and dry.

*Dirt*.—This is harmful for the same reasons and in the same way as water. Dust consists of tiny particles of metal, carbon and other conductors of electricity. So a film of dust over insulators allows the high voltage to discharge through it. So remember:—

- (i) in the vicinity of radio gear put your cigarette ash and ends in a tin (a good seaman never throws them on the deck anyway);
- (ii) use a moist cloth for dusting; a dry duster only scatters the dust into the air—and so into the radio equipment.

*Rough Treatment.* Radio gear is extremely delicate, and will not stand being knocked about. Serious damage can be done to it by inexperienced persons. For this reason no unauthorised person is allowed to interfere with any radio equipment.

Care must be taken not to break, crush, dent, bend or chafe the leads to and from aerials, as they are very delicate.

Never paint any part of any aerial unless expressly ordered to do so. Ordinary paint contains metal and the high voltages of many aerials will cause leakages over painted insulators.

### Electrical Dangers

The operation of all electrical devices depends upon supplies of power which are carried in conductors inside the wires and cables, and these run through every compartment. To prevent leaks of power all conductors have to be insulated from the metal parts of the ship, and this insulation is provided by layers of insulant between the current-carrying conductor and the protective water-tight cover of the cable. Water or damp in any form is harmful to electrical apparatus, and this means that the utmost care must be taken to prevent damage to cables and to replace the caps on plug sockets after use. Rubber-covered cable should not be painted because the oil in the paint will ruin the rubber. Electric cables must never be chipped or scraped, and nothing must be hung from cables or the channel plating overhead.

Just as hoses are more likely to leak than the ship's fire mains, so flexible electric cables on portable apparatus are more likely to leak than the ship's permanent wiring, and a leak of electricity at 220 volts can be lethal. Never attempt to repair electric irons, portable drills, electric chipping hammers, wandering leads, or any other portable apparatus, because such repairs by inexperienced persons may lead to serious injury or loss of life.

*Aerials*—especially radar aerials—often carry very high voltages; it is therefore advisable to keep clear of all aerials. An additional reason for keeping clear of aerials is that many of them are liable to revolve without warning.

Permission should invariably be obtained from the Officer of the Watch before any man goes aloft or works near an aerial. Before permission is granted the necessary precautions are taken to

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ensure that all aerials are safe. In order to prevent a radio set being kept out of action unnecessarily a report should be made to the Officer of the Watch as soon as the man has returned from aloft.

### **Electrical Defects**

The Electrical Department has running machinery throughout the ship, and it is impossible to watch all of it all the time. Any person who notices anything amiss with an electrical device should report it at once to the duty electrician or to the Electrical Office. Prompt reporting of defects may save a lot of work and add to your own comfort.

### **Electrical Fires**

Electrical fires are usually caused by the heat generated by short circuits which occur when bare current-carrying conductors make contact with other conductors or with the metal of the ship. They differ from ordinary fires because, even after any burning material has been dealt with, the source of heat still remains to start another fire immediately if the current is not switched off. If a solid jet branch pipe is used anywhere in the vicinity of live electrical circuits the jet of water will act as a conductor and the holder of the branch pipe may receive a lethal electric shock.

So whenever possible, switch off the current before tackling a fire involving electrical apparatus and remember that rubber gloves give a false sense of security and should not be worn.