The Ericsson Bulletin

No. 18 JANUARY, 1949

Contents

Published by

TELEPHONES Ericsson LIMITED

TELEPHONE WORKS,
BEESTON, NOTTINGHAM
Telephones: Beeston 54225 (6 *Lines*)

Head Office:
22, LINCOLN'S INN FIELDS, LONDON, W.C. 2
Telephones: Holborn 6936 (5 *Lines*)
Telegrams: Ericlond, London

Panclimatization of Telephone Equipment

FOR many years, the Company has maintained a high reputation for the manufacture of telephone equipment designed to give long and efficient service under tropical or adverse climatic conditions. Investigation, development and tests are carried out continually by a section of the process engineering department, a

Fig. 1—Accelerated Weathering of Specimen Panels

specially equipped laboratory providing the apparatus necessary for accelerated and other tests. Fig. 1 is an example of one of the methods used for accelerating the effects of weather on panels having various protective finishes.

New materials, processes, and designs are examined so that their performance and durability can be assessed under various climatic conditions which are simulated by humidity cabinets, refrigeration, salt spray, " Weather-Ometer " etc. Provision is also made so that the effects of dust and chemical corrosion can be investigated. Telephone engineers will appreciate that it is not wise to rely wholly on accelerated tests ; these are therefore supplemented by field trials under actual service conditions in many parts of the world. In this connection, the reports and assistance given by friends overseas and their representatives in this country are of great value and are gratefully acknowledged. Reference should also be made to the close collaboration which exists with the suppliers of raw materials, the joint study of various problems being of great assistance to progress.

In recent years many new materials and processes have been developed in the fields of insulating materials, plastics, ferrous and non-ferrous metals and protective finishes. The Beeston factory has already applied a large number of these innovations, with considerable advantage, while a progressive future for further developments is also assured. It may be considered that the increased provision of air conditioning for telephone exchanges in tropical or humid climates may render this work less vital, but it must be remembered that the period for shipment and installation has also to be considered, while lower maintenance costs, longer life, and reduced fault liability are constant objectives. This point, no doubt, prompts overseas telephone engineers to express the view that the highest practicable standards are the most desirable and economical in the long run. In the case of subscribers' and P.B.X. equipment, it is wise, of course, to provide against the most severe conditions which may be anticipated.

The production of telephone equipment for service in the tropics requires close attention to detail and precise technical control during manufacture. The following are the most important categories for consideration :—

1. The selection of raw materials and components suitable for use under humid conditions, at relatively high temperatures.
2. The selection and application of protective finishes which are adequate not only for the severe service conditions, but which will comply with the fundamental requirements of the apparatus.
3. The provision of features of design which provide for resistance to moisture ingress or for improved insulation.
4. Special processes, e.g., coil and wire impregnation, treatment of insulators, sealing methods.
5. Packing and wrapping methods designed to give protection during shipment and storage.

In addition to the above, consideration must be given to the liability of materials to support mould growth and, if necessary, treatment with fungicides to eliminate this possibility. Considerable attention has been directed to this matter in recent years, as a result of which knowledge of preventative materials and processes has developed rapidly.

The possibility of accelerated corrosion resulting from contact of dissimilar materials is another important consideration. The selection of metals employed, electro-plating or sealing by various organic compounds are the methods used to ensure freedom from faults due to this cause.

Fig. 2—Control and Testing of Electro-plating Solutions and Deposits

Valuable guidance is given in the Inter-Services specifications on the above matters, supplementing the manufacturer's specialized and local knowledge.

It will be seen from the foregoing that the tropicalization of telephone equipment chiefly involves careful attention to detail. Most of this work is not spectacular, taken individually, but the collective results are of great importance.

The scope of this article does not permit a full account of the methods employed for the tropicalization of various classes of equipment at the Beeston factory, however, some examples can be quoted to show the means which have been adopted and which are securing increasingly high standards as follows :—

Fig. 3—Parts being fed on to the Conveyor of the Infra-Red Dryer

PROTECTIVE FINISHES.

The electro-plating department is fully equipped to apply all types of commercial finishes. Modern plant and processes are controlled by the departmental laboratory, part of which can be seen in Fig. 2. Each batch of work is checked for thickness of deposit, a reasonable factor of safety being maintained over specified minimum thicknesses. Throwing power and uniformity are matters which receive particular attention. Electro deposits are improved by additional processes; e.g., by chromate passivating on zinc and cadmium, or where applicable, by subsequent coatings of stoved pigmented or clear lacquer. Anti-corrosion solution treatment is applied where lacquering or enamelling is not permissible.

In the enamelling department, high grade alkyd stoving enamels are used almost exclusively. These materials have a high protective value, combined with permanence of colour and outstanding flexibility and adhesion. Infra-red and conveyor ovens, Fig. 3, ensure precise stoving times and temperatures. A typical treatment for parts made from mild steel may be quoted: Pre-treatment consists of cleaning, followed by surface phosphatizing; a rust-inhibiting iron oxide-zinc chromate stoving enamel is then applied, after which the parts are given coats of stoving enamel in grey or other specified colour. This finish gives prolonged protection under the most adverse conditions of humidity and temperature. Incipient rusting does not develop below

the enamel finish because of the thorough preparation and priming.

As an additional means of promoting development and of checking protective finishes, routine tests are carried out on apparatus after assembly, in a tropical test cabinet, (Fig. 4). These tests are more informative than when applied to the individual piece parts, as the effects of contact potentials and capillary spaces are revealed.

INSULATION.

The maintenance of high electrical insulation under tropical conditions is a subject which demands unremitting attention and embraces a wide field in industrial technology. A considerable number of specialized processes have been developed by the Company, two of the most important being those applied to springsets and coil impregnation. A brief description of these processes will no doubt be of interest.

Fig. 4—Components undergoing Tropical Humidity Tests

For springsets on keys, relays, switches, etc., insulators are manufactured from highest grade S.R.B.P. sheet. These insulators are cleaned and baked after machining to remove traces of moisture or volatile matter; they are then uniformly coated with special phenolic resin-based varnish, so that all cut edges are sealed, and are finally baked at 300°F. After assembly, the springsets are immersed in a low temperature baking synthetic resin insulating varnish, the arrangements during this process ensuring that the soldered connections and contact areas remain clean. Repeated dipping provides a complete seal. These treatments result in a considerable increase in insulation values under damp conditions. Other advantages are, mechanical security after frequent changes in temperature, and elimination of troubles due to dust, these being achieved through the filling of capillary spaces by the dip varnish and the formation of continuous films over the insulators and metal parts. In some cases, e.g., for relay springsets additional varnish sealing is provided by wet assembly methods.

Similar meticulous care is observed with coil impregnation processes. The coil formers are first coated with varnish prior to the application of insulating materials and winding. Double impregnation and baking, followed by a final coat of heavy sealing varnish provides higher resistance to moisture ingress. In the case of double wound coils the first windings are impregnated separately, as an additional process. The impregnating materials are used for enamel and textile covered wires, being

specially suited to both types of coverings, and all materials employed are selected and tested for chemical purity. A section of the laboratory used in the control and investigation of organic finishes is shown in Fig. 5. Long and satisfactory service in tropical countries has fully justified the additional care and effort which have been made.

In the field of plastics, developments have been particularly noteworthy. Earlier types of plastics have been improved and extended in range while completely new products open additional possibilities. Moulding technique provides almost unlimited facilities for the economical production of complex forms and shapes, a very useful feature for the design of tropical components. An example of this is the production of moulded bobbins for transformers, iron cored relays, indicators, ringers, buzzers, etc., illustrated in Figs. 6 and 7. End cheeks and core insulation are continuously formed by plastic moulding in phenolic resin material. Improved insulation results under humid conditions, and capillary spaces, which exist with built up coil formers, are avoided. The precise and uniform diameters also ensure superior windings. Arrangements are being made for full scale production of these formers.

Fig. 5—Part of the Organic Finishes Laboratory

MATERIALS.

Progress in engineering design and performance goes hand in hand with developments in raw materials. Ferrous and non-ferrous metals, timbers, insulating materials, plastics, and textiles are continually offering technical advancement, many new properties being particularly valuable for tropical equipment. Developments with raw materials are therefore closely followed and investigated at the Beeston factory and are applied whenever there is advantage to be gained.

Arrestor blocks are produced from plastic bonded conducting materials. Freedom from dusting and porosity, and chemical purity are some of the advantages which result in these arrestors being specially recommended for tropical service.

In connection with the use of metals, many special applications have been developed ; for example, certain parts of telephone components such as uniselector and two motion switches, switchboard plugs etc., are subject to heavy duty and wear in service. Stainless steels and corrosion resisting metals are frequently applied as the most satisfactory materials to withstand these conditions.

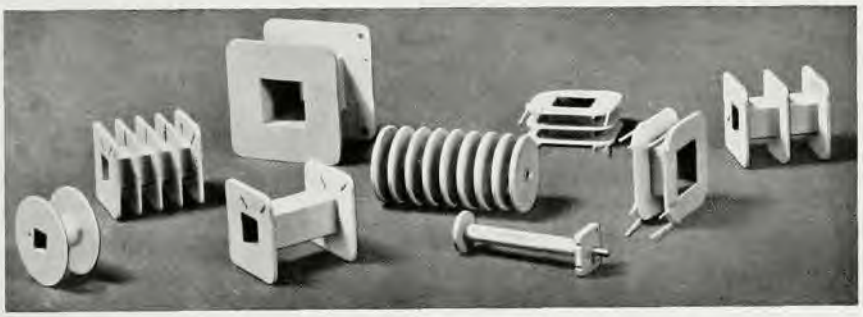

Fig. 6—Typical Completely Moulded Plastics Formers used on Tropical Equipment

SWITCHBOARD WIRES.

Enamel and textile insulated wires have been used widely for tropical equipment for many years but these are now being strongly challenged by plastic (P.V.C.) insulated wires. Still further technical advantage is provided by the plastic-textile insulated wires which are being used by the Company as an alternative for severe service conditions. The full description of this wire is " P.V.C. insulated, rayon lapped and lacquered wire ". Polyvinyl chloride is the main insulant, the properties of which are enhanced by a tight rayon lap with final coats of cellulose acetate lacquer giving a smooth hard finish. Briefly, the advantages of this wire are :—

1. High insulation under very moist conditions.
2. Freedom from electrolytic and chemical corrosion.
3. High breakdown voltage under moist conditions.
4. Bright colours which can be readily identified.
5. Permanent cleanliness owing to the fact that cable forms need not be waxed and therefore do not pick up atmospheric dirt, dust or polution.
6. The lacquer includes a fungicide so that the wire does not support mould growth.
7. The lapping and lacquering eliminates the possibility of cold flow and other forms of ageing.

Developments are continuing with various types of plastic insulated wire.

PACKING.

Warehouse facilities have been increased by the provision of a number of modern processes specially designed for tropical equipment. These include the use of heat

sealed metallic laminated foils, impregnation and dip-immersion sealing, and various dessicants. Much progress has been achieved in the construction of packing cases, which are now largely manufactured from moisture and weatherproof plywood. These cases are strongly reinforced by strips and battens, all joints being secured by synthetic resin adhesives in addition to normal mechanical methods. Internal corners are sealed with bitumen material and lids are also made watertight by means of flexible compounds. The result is that the cases possess great mechanical strength and resistance to handling shocks, and remain watertight even under complete water immersion tests.

Much valuable experience was gained during the recent war in connection with materials, protective finishes and packing, not only in respect of new substances and processes but also with regard to the efficiency of familiar, previously accepted standards under extraordinary conditions such as were experienced, for instance, in the far East where equipment was often floated from ship to shore in heavy seas for lack of proper landing facilities and where it was sometimes used for long periods with very little or no natural protection from the elements.

Knowledge thus gained was pooled by the allied countries and concerted efforts were made to overcome these conditions, with considerable success.

The necessity for changing some of the protective finishes and processes was due to the compulsory use of war-time substitute materials, nevertheless all these developments have greatly assisted the investigations which are being continuously made by the Company to find the best material and the best treatment, consistent with reasonable economy in cost, for every component manufactured.

Fig. 7—Iron-cored Coil Formers with Moulded Insulation

It will be appreciated that the foregoing account of some of our activities in this direction can be only of a general nature as the field of investigation is very wide, but it is hoped that some important projects which are at present in the development stage may be described in detail in future issues of the Bulletin.