Ericsson Celebrates 125 Years in Australia

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Summary: 2015 marks the 125th anniversary of Ericsson supplying telecommunications equipment in Australia. The history of Ericsson in Australia is précised here and the paper entitled "Establishing L M Ericsson Crossbar Production in Australia" is included for historic reference.

Introduction

Ericsson began sales in Australia in 1890 through its agent C A Fahlstedt in Sydney. Initially, sales consisted exclusively of telephones and spare parts for telephones, not telephone exchanges. In the 1890's Ericsson was a key supplier of Magneto telephone equipment and Coffee Grinder & Biscuit Barrel models appeared in Australian's homes and businesses in 1890s. Ericsson magneto phones were praised in rural and regional areas for their operational reliability. Australia and New Zealand became one of Ericsson's largest markets outside Europe. In fact, in 1900, sales in Australia were greater than in Sweden.

In 1902, Ericsson's senior engineer Hemming Johansson, who would subsequently become president of the company, travelled to Australia and South Africa, which was also a major market. Johansson wanted to demonstrate the company's technical expertise and had brought with him a small switchboard with a central battery system.

Hemming Johansson later wrote about the visit as follows. "Through a stroke of luck, leading engineers from various telephone companies were attending a conference in Sydney during my visit. An offer to arrange a practical demonstration of the latest equipment and discuss technical matters with these gentlemen was readily accepted".

In conjunction with Johansson's trip, Fahlstedt was replaced in Sydney by the Scottish businessman James Paton. Ericsson also recruited agents in other parts of the country and sales were expanded to include switches.

The Australian Post Office (APO), later called Telecom Australia, then AOTC, then finally Telstra, soon began replacing the manual switching system with the automatic Strowger system, and other suppliers took over the market, even with respect to telephones. Ericsson's telephones were renowned for their high quality and sales continued to be sufficiently

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successful to enable James Paton to establish a sales company in Australia in the early 1920s called the Ericsson Telephone Manufacturing Company.

Australia did not emerge as a major market until after James Paton's death in 1949. The new manager for the Australian market was an Australian named Les Rowe, who established a new Ericsson sales company called L M Ericsson Telephone Co. Pty Ltd (ETA) for the sale of switching systems. He faced a tough challenge as the APO had already signed an extensive multi-year contract with two British companies, Standard Telephones & Cables (STC) and Telephone & Electrical Industries (TEI), for delivery of telephone exchanges.

When the expansion of the telephone network began after World War II, the Strowger system was considered limited and outdated. Les Rowe thus saw his chance and presented a small demonstration version of the crossbar switch to the APO's Director General and followed up on this by submitting an offer. At the time, however, the Director General was not receptive.

Rowe stubbornly continued his efforts to influence the APO and took every opportunity to praise the advantages of the crossbar system. When these efforts did not succeed, in 1953 he donated a 60-line crossbar switch to the APO for use in its laboratories. The APO's engineers were extremely impressed by the crossbar switch and in January 1954 ordered an additional 60 lines to be added to the switch that Rowe had donated.

In July 1954 the APO ordered two 600-line exchanges, one for Sydney and one for Melbourne. In late 1956, with growth in demand for telecommunications, the APO established the Automatic Network and Switching Objectives (ANSO) Committee to investigate options for a new Subscriber Trunk Dialling (STD) telephone system for Australia. The committee undertook extensive studies of various telephone systems, and through laboratory experiments came to the conclusion that Ericsson's crossbar switches were at the time superior to those produced by its competitors, which included International Telephone & Telegraph (ITT - the ultimate parent of STC) and Siemens.

The APO was now seriously considering abandoning the Strowger system, and in 1959 chose the Ericsson crossbar system for the Australian telephone network, thanks mainly to their flexibility for small, medium and large exchanges. Ericsson was selected to provide a 6,300 line crossbar exchange to be located in Toowoomba, and the system was delivered in 1960.

Initially, the Ericsson crossbar switches were manufactured under licence by STC and TEI in Australia, but Ericsson believed that there was room for another manufacturer. In 1960, the company purchased Trimax Transformers Pty Ltd, which was renamed L M Ericsson Pty Ltd (Ericsson Australia) in 1963.

After this acquisition, the company's production was converted to telecom equipment. Soon after, a new production plant was built at Broadmeadows in Victoria (the subject of the following historic paper). When STC's and TEI's licences expired in 1963, they were not renewed by the APO. Instead, manufacturing was awarded according to a bidding procedure which resulted in Ericsson capturing one third of the market for public telephone exchanges in Australia.

By the middle of the 1960's, Ericsson was experimenting with Stored Program Control (SPC) which was initially devised at Bell Telephone Laboratories. It was evident that electronic SPC exchanges were the way of the future, and Ericsson and Televerket (the Swedish PTT) decided to combine their research efforts to commercialise a digital switching product.

Therefore in 1970, Ericsson and Televerket formed a joint development company called ELLEMTEL. The new product was designated AXE, and featured the decentralisation of the processor functions to enable the modular construction of large and small exchanges.

Australia was one of the first countries to purchase the AXE with an order from the APO in 1977. The first generation SPC exchanges were hybrid electro-mechanical switching under SPC control (AKE and ARE). The first generation of AXE were also hybrid using reed relays for switching. With the advent of Pulse Code Modulation (PCM), the system was enhanced with a digital group stage largely developed by Ericsson Australia.

Ericsson Australia also played an important collaborative role with the APO to optimise the AXE to the unique requirements of the Australian telecommunications environment. Australia has long collaborated with strategic partners to develop solutions tailored to local needs. This *Journal* contains many technical papers describing where Ericsson and the APO have worked together to adapt the AXE platform to meet real-life technical challenges.

The next significant technological innovation spearheaded by Ericsson (and others) was the development of the cellular mobile telephone system and the introduction of the CCS7 signalling system. Mobiles continue to have a dramatic impact on world-wide communications today. Space does not permit me to detail the numerous technological and regulatory advances throughout the world during the 1970's and 1980's, except to say that Ericsson emerged in the 1990's as one of the dominant suppliers of mobile telephony, utilising the AMPS and GSM standards.

In the mid-1980s, Ericsson Australia was awarded the contract for a nationwide Advanced Mobile Phone System (AMPS – American 1st generation mobile standard) from Telecom Australia. This was followed in the early 1990s by an order for a Global System for Mobile communications system (GSM – European 2nd generation mobile standard).

In 1992 Telecom Australia and the Overseas Telecommunications Commission were merged into the Australian and Overseas Telecommunications Corporation (AOTC), renamed Telstra Corporation in 1993. The subsequent privatisation of Telstra, and the introduction of network competition in Australia, provided Ericsson with the opportunity to supply equipment and services to several new carriers, including Vodafone, Optus and Hutchison.

Ericsson has continued the development of mobile broadband and was a major contributor to the international standardisation of 3rd Generation (3G wideband CDMA) and 4th generation (4G Long Term Evolution LTE) mobile systems. At the present time, Ericsson Australia has been awarded significant contracts in Australia for wideband CDMA and LTE, as well as the related packet data nodes and cloud services.

The evolution path to 5th generation (5G) mobile services is referred to as the "Internet of Things", providing broadband everywhere, anytime. 5G standardisation is being driven by the significant increase in mobile data volumes, throughput and the number of connected devices. 5G will also provide improvements in battery life and lower latency for critical control of real time systems (for example smart vehicles).

In 2015, Ericsson celebrated its 125th year of supplying telecommunications equipment in Australia. Ericsson Australia has delivered Australia's 1G, 2G, 3G and 4G mobile networks and is now collaborating on 5G. This is a significant milestone considering the technological changes that Ericsson has successfully innovated for well over a century in this country.

Acknowledgements

This history was précised from the historical content on the Ericsson global website: "The History of Ericsson – Australia" (Wickman nd). The content covering Ericsson supplying crossbar to the APO and the establishment of the factory at Broadmeadows was précised from "LM Ericsson 100 Years: Volume II" (Attman_&_Olsson_1977) and "Establishing L. M. Ericsson Crossbar Production in Australia" (Spongberg 1967). The content covering the development of cellular mobile systems was précised from "The Ericsson Chronicle: 125 years in Telecommunications" (Meurling & Jeans 2000).

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Introduction to the historical paper

On 6 December 1963, Ericsson opened a purpose-built factory at Broadmeadows in Victoria to manufacture crossbar switching equipment for the Australian Post Office. The historic paper entitled "Establishing L M Ericsson Crossbar Production in Australia" (Spongberg 1967) by C. A. Spongberg, who was the factory manager at the time, was published in the June 1967 issue.

The paper describes the establishment of the factory and the transfer of Ericsson skills and processes to ensure proper quality assurance and documentation. Broadmeadows was used continuously for the production and distribution of telecommunications equipment from 1963 until 2007. It comprised a cosmopolitan workforce of some 3,000 employees at its peak, and the multi-cultural aspect was typical of the manufacturing sector in Australia after the Second World War.

Broadmeadows was a state of the art manufacturing site that fabricated most of the crossbar exchanges, AXE exchanges, PABXs, queuing systems, network terminating units and, in later years, even mobile phones. The scope of these manufacturing activities incorporated or spanned the range of design, testing, metal fabrication, metal plating, painting, component testing, printed circuit board manufacturing, board and system assembly, wire manufacture, transformer winding, capacitor manufacturing and system testing.

The factory was at the forefront of adapting automated control and industrial robots for activities such as high-speed "pick and place" for circuit board assembly. (One automated production plant was commissioned in 1990 by the then Prime Minister R. J. Hawke.) This technology later transitioned to undertake surface mount assembly for AMPS and GSM transceivers. Broadmeadows was also the centre for the repair and refurbishment of Ericsson mobile phones, before amalgamation with Sony.

Local manufacturing began to wind down from 1998 and production shifted over the next three years to off-shore contract manufacturing facilities. Distribution continued from Broadmeadows until the end of 2007 when the factory was completely closed and the administration and models were relocated to Docklands and Port Melbourne.

The historical paper

ESTABLISHING L M ERICSSON CROSSBAR PRODUCTION IN AUSTRALIA

C. A. SPONGBERG, M.A.I.E.E., Dip.E.E., B.M.E.*

INTRODUCTION

In previous issues of this *Journal* announcements have been made of the adoption by the Australian Post Office of the L. M. Ericsson crossbar system as the new standard for automatic switching in the Australian telephone networks. References have also been made to the manufacturing agreements between L. M. Ericsson, Sweden and two Australian manufacturers Standard Telephones and Cables Pty. Ltd. and Telephone and Electrical Industries Pty. Ltd, both of Sydney, New South Wales, for the production of subject equipment.

It is the intention of the author of this paper to describe the third phase of this development — the production of L. M. Ericsson crossbar equipment by L. M. Ericsson Pty. Ltd. in Victoria, Australia.

In order not to repeat what has already been published by other writers in the crossbar production field, it is not intended to give a detailed explanation of the various production processes, but rather cover the subject of production from an administrative and organisational point of view. It is hoped by this to bring to light some important factors which are to be covered in the establishing of production facilities.

Background of L. M. Ericsson in Australia

L. M. Ericsson Telephone Company Pty. Ltd. was formed in 1951, primarily as a Sales Company of the L. M. Ericsson Group. Ten years later the Company acquired its first factory in Australia by entering as a main partner in the former Trimax Transformers Pty. Ltd., Coburg, Victoria.

Trimax had, since 1937, been a supplier of transformers, amplifiers, power supplies and other telecommunication equipment to the Australian Post Office. At the time of the acquisition, the name of the Company was changed to L. M. Ericsson-Trimax Pty. Ltd., and the Company undertook, in addition to earlier production lines, the assembly of crossbar P.A.B.X. equipment.

When L. M. Ericsson Telephone Company Pty. Ltd. was granted contracts with the Australian Post Office for crossbar equipment, both for city and rural exchanges as well as trunk and telex exchanges, it became apparent that additional production facilities were required adequately to cope with the volume of orders. The contracts stipulated that the bulk of the equipment should be produced in Australia, and detailed plans for the implementation of local production by L. M. Ericsson were drawn up during 1961-62. The name of the manufacturing and trading company became L. M. Ericsson Pty. Ltd.

* Mr. Spongberg is Factory Manager, L. M. Ericsson Pty. Ltd., Victoria.

PLANNING AND ERECTION OF FACTORY

Factory Facility Planning

The successful conveying of technical production know-how from one country to another is a matter of balance. The appropriate importing of a product, a process, a management system or control, is influenced by the interaction of the technical, cultural, political and economic systems of the two countries.

Attitudes and regulations regarding such things as labour, importation, investment have a bearing on the forecasting and controlling of costs for labour, material, overhead and capital. The most suitable production processes have to be chosen together with machine and tool investment, in conjunction with effective production planning, to establish adequate and economical output and inventory levels. All these factors play a vital part in the decisions and actions to be taken when planning for production.

Experience from similar operations in other parts of the world is of course advantageous, as long as such experience is effectively combined with local practices. Each new situation must be thoroughly considered.

Within the L. M. Ericsson Group an internationally-trained staff of people is available for new factory facility planning. This group of engineers and economic advisers is located at the parent company in Stockholm, Sweden and helps to establish factory layouts, suggests machine and tool procurement and the selection and training of specialist personnel. After the commencement of production, the group's services are available for helping further development of production processes and factory management procedures.

Due to continued technical developments in the equipment to be produced, and the possible introduction of improved processes of production, the factory must have a layout which is also able to handle changes. Such changes are usually governed by the general plans for stages of growth which can vary from one factory to another depending on local circumstances.

Location of Factory

When selecting land for a factory for the production of crossbar equipment, there are five main points which require thorough investigation and subsequent decision:

(i) Supply of labour.
(ii) Gas, water, sewerage and electricity supply.
(iii) Access to main transport facilities.

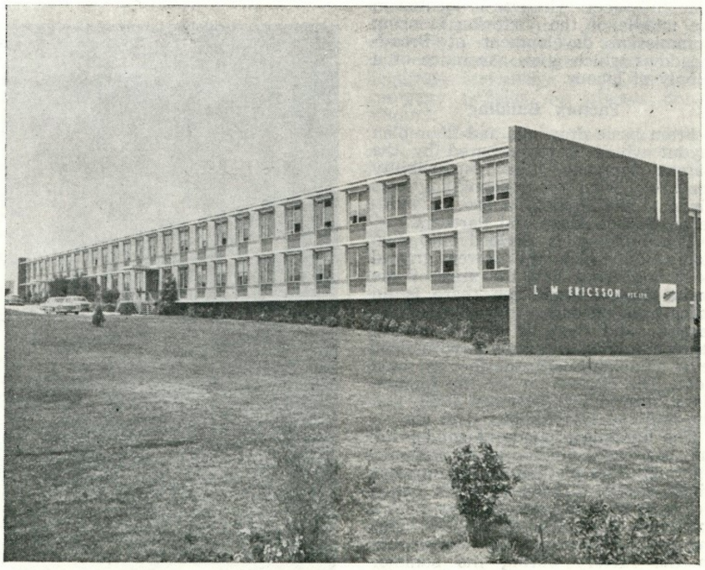

Fig. 1 — L. M. Ericsson Pty. Ltd., Broadmeadows, Victoria.

Fig. 2 — Tea Break in the Cafeteria.

(iv) Air cleanliness.
(v) Financial aspects.

After a study of the conditions in Victoria, it was decided to locate the L. M. Ericsson factory in the northern part of Melbourne at Broadmeadows. In our study, areas such as Frankston, Dandenong, Greensborough, Lilydale and others were considered, but in each of these places one or more of the requirements were not at that time fully met. The site is located in the middle of the Victorian Housing Commission development at Broadmeadows which gives assurance of a supply of labour.

Factory Building

From basic drawings and floor plan layout which were prepared by the parent company, the responsibility for the design of the building was given to the Melbourne firm of architects, Garnet Alsop and Partners.

The building is divided into two floors, of which the lower ground floor has about half the area of the main floor. In addition there is an office building across the front of the factory, and there is also a central store adjoining the factory with floor level coinciding with the factory main floor. The excavation for the foundations started in December 1962, and the building was completed to such a

The building is made of solid brick and has a new method of natural roof lighting. This method of lighting has given excellent light at work bench height even during winter days, with a minimum of artificial light. This lighting method increases the temperature in the factory during the summer months, compared with, for example, a saw-tooth roof construction. The factory is ventilated through mechanical filters, and is pressurised to keep dust out. In the Paint Shop, there is an additional pressurised system over and above the factory pressure, for the same reason. The building was erected by F. T. Jeffrey Pty. Ltd. and was officially opened on December 6, 1963 by the former Postmaster-General, the Hon. C. W. Davidson.

Early in 1967 a company-sponsored Child Minding Centre opened to take up to 90 children in the 3-5 years age group. This building is fully equipped with beds, play rooms and facilities for the serving of hot and cold meals. The Centre is on a strictly non-profit basis, with a staff of one matron and about nine nurses. A Social Hall has also been built on the premises for the employees of L. M. Ericsson. It offers facilities for evening entertainment such as dancing, movies, study and other various club activities.

HIGHLIGHTS OF PRODUCTION

The production of crossbar equipment is facilitated by a high degree of standardisation of piece parts. The main components, the RAF Relay and the RVD Switch, are employed in such large quantities as to permit a well developed mechanisation of both machine-shop processes (primary departments) and of the assembly-wiring-testing operations (secondary departments).

In the primary departments the emphasis is on making full use of the standardisation by investing in high speed, advanced tooling to minimise production lead-time and tool maintenance. The predominance, (70%) of the work is in the press-shop, making it possible to employ simple automatic feeding and stacking devices. Wherever progressive tooling has not been introduced, the arrangements of the required machines and the associated operations for a particular piece-part is such that it achieves a progressive flow of work operations with a minimum of inter-operation delays.

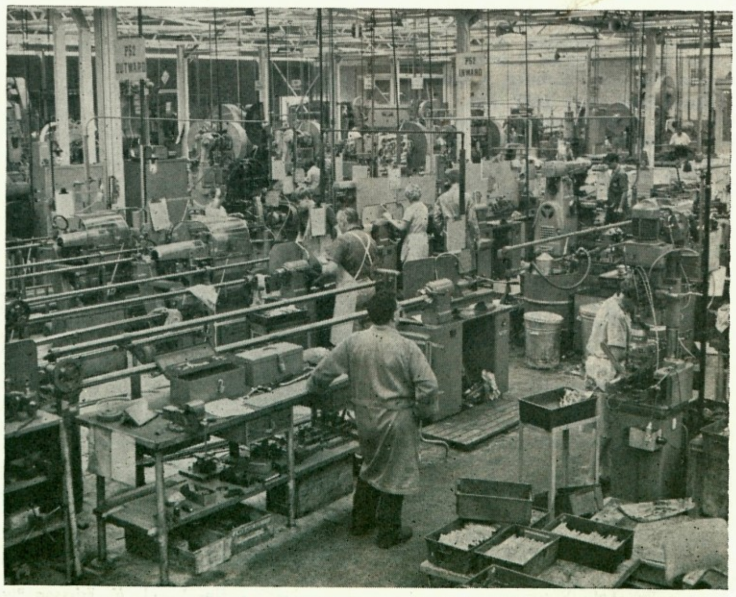

Fig. 3 — Primary Production Departments.

Fig. 4 — Secondary Production Departments.

In general the machine tools are of standard types. Only a few special purpose machines are in use, for example, contact riveting, jack and plug assembly and strip tinning. These machines were designed by L. M. Ericsson in conjunction with the design of the piece parts.

A flow-line concept has also been introduced in the secondary departments. The successful implementation of a relay set production flow-line, including all operations from coil winding, relay adjustment, cable-form making, wiring, testing and packing has been in operation since the end of 1966. Further improvements of the individual handling operations are being undertaken to gain additional reductions in lead-time and work-in-progress.

Another highlight of production which may be of interest, is the successful introduction of the metric measuring system including established tolerances in accordance with the recommendations of the International Organisation for Standardisation (I.S.O.) in all phases of our production, including the production of tools. Contrary to some opinions in the industry, the training of the operators, leading-hands, tool-room and inspection personnel is less difficult with metric than commonly assumed.

A course in measuring technique was arranged for a few people in leading and supervisory positions. No other arrangements were made except a ban on all measuring devices not graduated in metric dimensions.

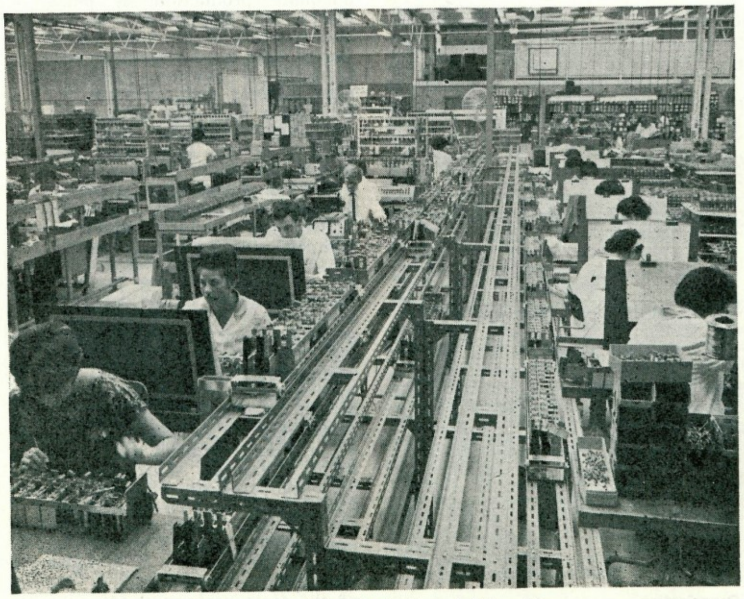

Fig. 5 — Flow-Line Production of Relay Sets.

MANPOWER REQUIREMENTS

The estimate of manpower requirements is a part of the factory facility planning. As such, it was originally a plan showing the numbers and types of managers, technicians and workers needed at the start of production in Broadmeadows. The plan outlined a program for supplying these needs from local and overseas sources and included specific steps to develop local manpower into successively higher supervisory levels.

The original team from the parent company for the factory consisted of a Factory Manager, Production Manager, Technical Manager and six Foremen. The personnel selected had previous experience in similar work positions in the Swedish factories or abroad. The team was engaged on this project for periods ranging between six months to three years. Their main task was to help select and train local personnel at all levels of production supervision and technical support. The training not only included the conveying of information of various production processes, but also the know-how of making full use of documentation supplied and acquiring knowledge of the inherent company policies not always documented.

The Production Engineering, Planning, Procurement and Personnel Management was handled by locally employed people, some of whom were sent to the parent company for study. Exchange of knowledge continued through the years and will continue to do so as the factory grows and new products and/or production methods are being contemplated. It is recognised that the different stages of growth of the factory will require different contributions of knowledge from the parent company.

Training of Factory Personnel

With the establishing of production facilities in Melbourne the Management was faced with problem of starting production operations from scratch. Speed was essential because of contractual requirements. This in itself imposed a heavy load of selection-recruitment on the Personnel Department.

Speed was also essential from another point of view. The training

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scheme had to be short and efficient to reduce precedents of low performance and productivity which could have become a problem in time. It was decided to organise training facilities under the supervision of the Personnel Department with assistance from a professional group of training consultants. The organisation selected to undertake this project was chosen mainly because of the new process analysis method of training which had been developed by the consultants and been used successfully in other parts of the world. The essence of the technique is the thorough analysis of the operation to be taught so as to determine the precise skills required for its proper performance. This skill analysis is followed by the design of appropriate selection tests and training procedures. The training method incorporates special methods for the development of both skill and consistent output.

Relay adjustment was the first process analysed in accordance with this method. The result was encouraging and as a consequence all major operations in the secondary departments are today covered by this scheme.

ENGINEERING TO SUPPORT PRODUCTION

It is essential that strong engineering support for factory operations be provided. This type of engineering, to be distinguished from design-development engineering, is giving support and guidance to the production operations from the point of product engineering, including the setting of quality standards, provision of tooling and methods to the point of appraising the conformity of set quality standards of the product produced or purchased. In other words, function controls of all required technical input information of the products for the production/purchasing, and by means of its own inspection activities in the factory and of sub-suppliers, it is able to obtain all necessary output information of the products-in-process or completed, to adequately control quality at the most efficient level.

In a broad sense the organisation covers four major functions:

(i) Product Control
(ii) Production Engineering
(iii) Quality Control
(iv) Inspection.

The four functions constitute an integrated control effort in an overall company quality control system to assure quality of the products at minimum costs and render assistance to the production in cases of non-conformity to set standards.

Product Control

The Product Technique Section is in charge of all product drawings related to production. It is responsible to accumulate performance requirements of the products, act in the capacity of a common pool of product know-how and instigate actions to assure full use of existing L. M. Ericsson documentation. It is responsible for issuing of requisitions for alterations or changes of the products being produced. It investigates production problems related to design and suggests changes in design to facilitate production. Furthermore, the section is responsible for planning and availability of documentation to be used by the Production Planning Department in formulating the production program.

The Record and Print Distribution Section is in charge of the recording of official technical documentation used within the company. It serves as a printing and distribution centre of copies for a number of permanent drawing files located in various areas of the office and factory buildings. It is the responsibility of this section to issue new copies of these files whenever the originals are subject to changes or obsolescence.

The Chemical and Metallurgical Laboratory is in charge of any raw materials testing required for the purpose of establishing sub-suppliers. Any subsequent test requested by the Incoming Goods Department on batch deliveries of raw materials is also carried out by this section. It is the responsibility of this section to assist production in the control of electroplating, painting, impregnation and heat treatment processes.

Production Engineering

Work Study is responsible for the critical analysis of the way and conditions under which work is done and the development of better and more economic methods and measurement of the labor required.

Tools and Methods is responsible for the design of tooling, special machine and ancillary equipment, the preparation of tooling schedules, estimating tool production times and investigation of production problems related to tooling.

Quality Control

Inspection Planning has the responsibility for any action required to determine that quality objectives and goals are sufficiently defined to permit adequate production. It plans and directs the inspection measurements and controls to be provided on processes and products. It is also responsible to analyse quality assessment reports and other feedback information from the field and make recommendations for adjustment to product design, production processes and inspection procedures.

Quality Assessment is responsible to designate quality characteristics to be measured in establishing methods and procedures for performing a continuous assessment of the quality of products being produced. Its main objective is to determine the actual level of quality and to detect any significant variation to such levels. The information is reported to Management and the parent company and is used by Inspection Planning in the direction of corrective actions.

Reliability Laboratory is in charge of reliability studies of components being produced and/or purchased. The standards of reliability required for the products are determined by the technical departments of the parent company. It is then the responsibility of this section to appraise conformity to these standards. Reports of the tests performed are submitted

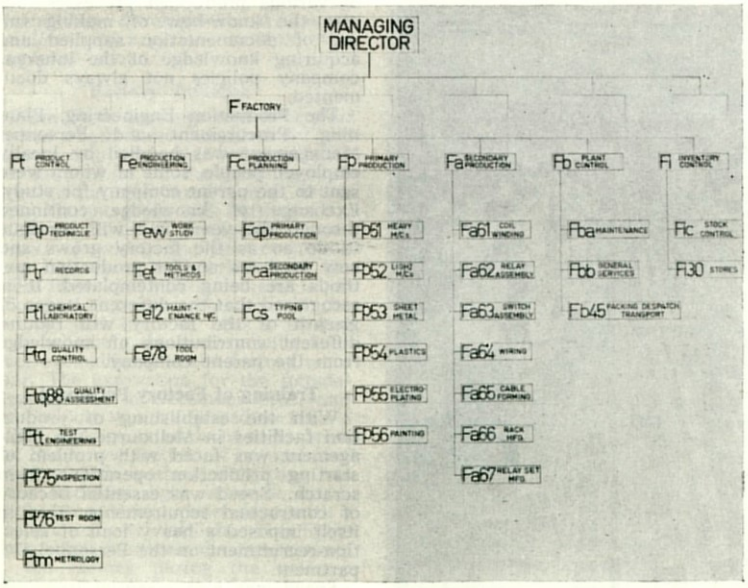

Fig. 6 — Factory Organization.

to the parent company and to certain customers on their request.

The reliability activities may be grouped under three headings:

(i) Establishing the reliability requirements.

(ii) Reliability analysis of components prior to production.

(iii) Continuous reliability testing of components of approved design, purchased or of own production.

Establishing the Reliability Requirements: The initial new design control activity is the responsibility of the technical departments of the parent company. The reliability targets and standards have been chosen with due attention to the state of the technical art and the overall functional requirements as experienced from actual operations in the field. The standards are thus very realistic and cannot be altered without the consent of the parent company.

Reliability Analysis of Components Prior to Introduction: This portion of the reliability activities is covered by the parent company in its approval of the design for production. In the design approval is also included the recommended production processes and tools to be used to attain desired reliability level. It is a well established L. M. Ericsson practice to keep the production of a newly-introduced product for several years as close as possible to the department responsible for the design. This practice is for the purpose of obtaining adequate attention to production processes and their effect on the product reliability. Not until the design is proved feasible to be produced in large quantities is the product authorised for production in other factories within the L. M. Ericsson group.

Similar caution is exercised on the introduction of purchased components. The reliability testing facilities are being utilised to assess all aspects of the component reliability before approval is granted to use such component in an L. M. Ericsson product. As a reference, a list of approved suppliers and their components is issued to the Purchasing Departments within L. M. Ericsson. The list is maintained by the Quality Control Department.

Continuous Reliability Testing of Components of Approved Design, Purchased or of Own Production: Continuous testing is necessary for the purpose of making sure that the design and production data continuously and repeatedly result in the production or purchasing of products with required reliability. This will normally involve the taking of random samples from the running production or Incoming Inspection. The samples are subjected to detailed examination and accelerated tests in accordance with established procedures and standards. In addition to the continuous reliability assurance on the products, the continual testing provides exhaustive data on which to base reliability improvement programs.

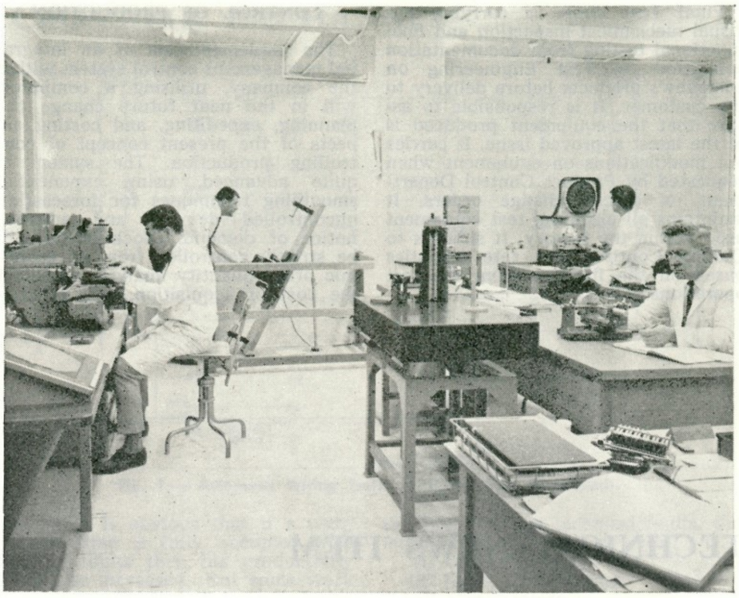

Fig. 7 — Metrology Department.

Production Test Engineering is in charge of test methods, instructions and the design of electrical test equipment used by inspection authorities and certain production departments in the factory. Included here are techniques for creating measurement practices and instrumentation procedures for the application to those quality information requirements that are established by the Inspection Planning Section.

Metrology is in charge of calibration and re-checking of electrical and mechanical measuring devices used within the company. It conforms with N.A.T.A. (National Association of Testing Authorities) requirements for registration. The section is also responsible to carry out "First-Off Piece Part Examination" from new or modified tools and to render service to tool room and production when special examinations are required.

Inspection

Incoming Goods Inspection is responsible to ensure that incoming raw material and components from subsuppliers are subjected to test and inspection as laid down by Quality Control. It acts in this capacity as a receiving and distribution point working from test schedules and sampling tables. The actual tests are performed by the various specialised test authorities within the factory organisation. The section is also responsible to maintain a suppliers' quality rating system.

Piece Part Inspection is carrying out quantitative and qualitative inspection and sorting of parts being produced. It works from inspection instructions and sampling tables provided by Quality Control. It is responsible to record fault rate on piece part production and submit weekly inspection reports. On request from Quality Control it performs special quality auditing.

Assembly Inspection is responsible to carry out test and inspection procedures required during the various stages of assembly and adjusting operations. It works from test instructions and sampling tables provided by Quality Control. The section is requested to record fault rate on a daily basis and submit reports to Quality Control.

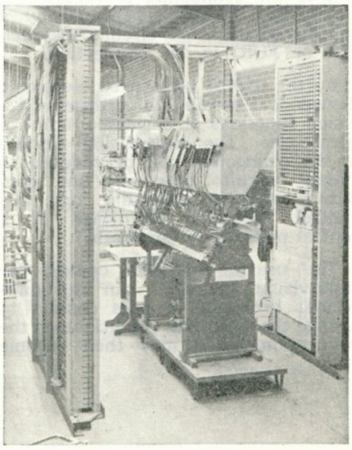

Fig. 8 — Automatic Test Equipment for the Final Inspection of Rack Wiring.

Final Test Room is carrying out visual mechanical inspection and final functional testing from documentation submitted by Test Engineering on company's products before delivery to the customer. It is responsible to assure that the equipment produced is of the latest approved issue. It carries out modifications on equipment when requested by Product Control Department on official change orders. It maintains all electrical test equipment used within the factory. It submits to Quality Control fault rate statistics based on the findings from the test operations.

CONTROL OF PRODUCTION

The implementation of an integrated management control system within the company, utilising a computer, will in the near future change the planning, expediting, and costing aspects of the present concept of controlling production. The system is quite advanced, using exponential smoothing techniques for forecasting uncontrolled demand and advance notice of demand. Stock levels will be strictly controlled from an economic order quantity analysis based on the cost of acquisition, cost of possession and some safety stock parameters. It is not possible to cover adequately the complexity of this system in this paper.

CONCLUSION

In conclusion it may be said that the factory today is effectively producing equipment, but that quite a lot of work always lies ahead to keep pace with the competition in the telecommunication field. It is a true challenge with real incentives, for both the customer and the supplier.

C. A. SPONGBERG

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