

INDUSTRIAL REPORT

TANESCO'S PROTECTION DEPARTMENT

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1. Introduction

This report is based on the practical training which we received with TANESCO - Tanzania Electric Supply Company. It has been compiled on the bits of information gathered from different individuals working with TANESCO at different levels and also on the experience gained during our study with the company. This report deals mainly with the working of the Protection Department which comes under the Electrical Department of the company. The meter department in turn comes under the Protection department. The protection department, as the name implies, concerns itself mainly with the protection of the company's power system. It is there to make sure that in the case of any fault occurrence, there should be minimum disturbance and damage to the system and the equipment involved by isolating the faulty part of the system.

2. Manpower

Three relevant flow-charts of the organization of the company with respect to the protection department accompany this report. The protection department is headed by a Protection Engineer who is also the head of the meter department. This post is held by a full qualified engineer who has wide experience in this field. Immediately below him is an assistant protection engineer who necessarily is a graduate in electrical engineering. To assist them both there is another graduate electrical engineer.

In running the meter department, the protection engineer is assisted by the senior meter technician and the instrument technician. The current holders of these posts were both trained in Britain by the Ferranti Meter Manufacturers.

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You then have the meter readers and a meter 'repair gang' which includes meter mechanics and meter cleaners all of whom are skilled workers who have acquired their skills mainly through experience. There is also the meter sealer who is a semi-skilled worker. Also with the meter department are four labourers and a secretary. The protection department is also entitled to assign jobs to labourers and technicians who are with the electrical workshop.

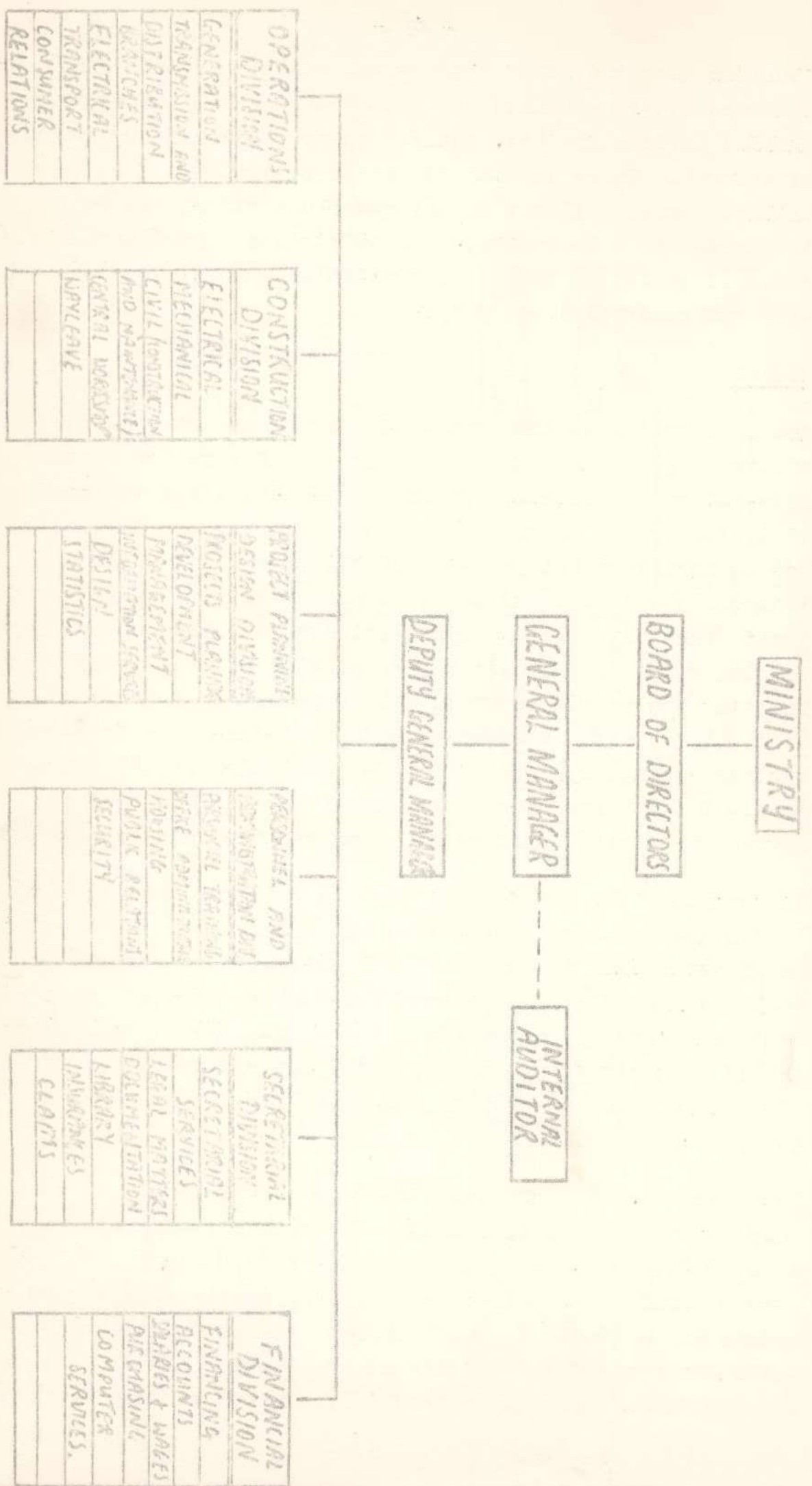
3. Duties

Among other things the protection engineers are concerned with the testing of protection instruments. Before any station, sub-station or control room is commissioned, the equipment has to be tested, no matter how new they may be. In protection one comes across relays, contactors, energizing coils and things of that sort and these have to be tested so as to ensure their functioning when their services are called upon. Testing is also done periodically on the average of once a year, on existing protective systems. The department also has to be kept informed of any changes in the existing power system so that the necessary changes in the protection system can be made. The department has also to prepare drawings of the current protection systems of power stations and sub-stations.

The staff of the meter department is concerned mainly with the testing and repairing of meters and instruments. The senior meter technician is in charge overall. The instrument technician carries out work on instruments such as ammeters, voltmeters and synchrosopes. There are three test benches; one is for testing new single phase meters, the other for old single phase meters and the third for both new and old polyphase meters.

Here meters are adjusted for load and power factor so that they give a reasonable reading within an error margin of about $\pm 2\%$. Of course, before being tested old meters are both cleaned and repaired as necessary by the repair gang. Old meters are normally ones which have been used previously and which are brought for testing at the request of the consumer who has reason to believe that they are not reading correctly.

TANESCO: ADMINISTRATIVE SET UP



After approval the meters are sealed with the company's seal before they are utilized by the consumer. The meter department has the duty of making periodical checks on consumers meters but this is not being implemented at the moment mainly because of lack of staff.

4. Information

Concerning the flow of information both to and from foreign companies with respect to TANESCO, this is normally done only when the need arises; that is to say, if for example Tanesco finds itself in need of some switch gears, meters relays, control panels or things of that nature, then it will normally request leading manufacturing companies such as General Electric, English Electric, Landis and Gyr, Easun, Reyrolle and Ferranti for catalogues together with current prices of the equipment, Tanesco of course, having specified the use of the equipment and any other special features it should contain. These companies then send their catalogues and by comparing and contrasting the equipment offered by the different companies and giving preference to price, Tanesco then decides on the equipment to be bought and places an order. All this correspondence is carried out through the normal postal services. Alternatively, an order may be placed directly to a firm concerning itself with keeping up to date, with the products of leading manufacturers and thereby being able to recommend certain products. With Tanesco this done in the case of purchasing meters whereby orders are placed with Engineering Power and Development Construction based in Kent - U.K.

Together with its products the company sends the detailed drawing of the item and also the current, voltage and other relevant schematic diagrams. These then come to the protection department for checking via the Operations Manager and if there are any discrepancies or corrections to be made, then the department writes back to the company via the Operations Manager to take note of and to rectify the drawings or the product for that matter. As before all correspondence is done through the postal services. Only when there is urgent need then the Telex may be used for correspondence. Verbal contact via the telephone is hardly ever made. In some cases where a

a major project is being undertaken or some new and complicated equipment is being utilized, then the manufacturing company may decide to send along its personnel for installing and supervising purposes but this of course has to be agreed upon with Tanesco.

5. Main Topic

From all the jobs that we did during our stay with the protection department, we have singled out the Ruvu Pump Station Project to report on. This project illustrates a typical sub-station and it shows the type of equipment and the estimated costs it takes in putting up such a project. This project was supervised and worked on by a graduate trainee who is earmarked for the position of assistant plant engineer on completion of his training. The project is very near completion with just a few minor finishing touches left to be done.

Following are tables showing the type of equipment used, the country of origin and the estimated costs. It is by no means an exhaustive account but it serves to show all the major points.

6. Overall Equipment

EQUIPMENT	ESTIMATED COST (TZ.SHS)
33 KV Oil Circuit Breakers together with Metering and Protection	100,000 Shs.
Protection Improvements for Existing Switchgear	10,000 Shs.
Two 2.5 MVA 33/11 KV Transformers Including Transport, Overhaul and Resiting. (Transformers were previously used at Tanga)	300,000 Shs.
Nine Panels, 11 KV Reyrolle LMT Switchgear	300,000 Shs.
Cabling - Both High and Low Tension	60,000 Shs.

7. Details of the Equipment Used

The 33 KV oil circuit breaker was manufactured in England by Associated Electric Industries Limited.

33 KV Control Panel

Component	Country of Origin	Life Expectancy	Price per Unit	Capacity	Average time of Delivery
Ammeter	England	20 yrs	-	0 - 40A	12-18 mths
Voltmeter	England	20 yrs	-	0 - 40KV	12-18 mths
Two Overcurrent Relays	England	20 yrs	400 TShs	-	12-18 mths
One Earthfault Relay	England	20 yrs	400 TShs	-	12-18 mths
One KVAH	England	20 yrs	300 TShs	-	12-18 mths
One KWH	England	20 yrs	300 TShs	-	12-18 mths

8. Tap Changer Control Panels

Components: Two tap position indicators
Two voltage regulating relays
Two sequence selector switches
Four indicating lamps.

The panels and their components are all from England. Since they come as a complete unit, it was not possible to obtain the prices of the individual components. Neither was it possible to know the year of manufacture.

Relays are supposed to be tested at least once a year and subject to good maintenance they can last up to a period of 20 years. This, however, does not mean that after this period they are indiscriminately thrown away, they are left on until they can no longer be relied upon.

The testing equipment used by the protection department had been manufactured by the Bryce Electric Construction Company. It comprises of a primary and a secondary injection kit. The

DETAILS OF 11 KV REYROLLE L.M.T. SWITCHGEAR

PANEL	RELAYS	AMMETERS	VOLTMETERS	MEGAWATT METER	O.C.B. RATING
2.5 MVA Transformer No.1	2 Overcurrent 2 Auxilliary 1 Tripping 1 Restricted Earthfault 1 Standby Earthfault	3 (0-400 A)	1 (0-15 KV)	1 (0-5 MW)	11 KV
2.5 MVA Transformer No.2	As Above	As Above	As Above	As Above	As Above
11 KV Interconnector	1 Auto Reclosing 1 Remote Tripping Indicator 1 Earthfault 2 Overcurrent	3 (0-300 A)	-	-	11 KV
500 KVA Transformer No.3	1 Tripping 1 Remote Tripping Indicator 2 Overcurrent 1 Earthfault	3 (0-150 A)	-	-	11 KV
750 KVA Transformer No.4	1 Tripping 1 Remote Tripping Indicator 2 Overcurrent 1 Earthfault	3 (0-150 A)	-	-	11 KV
750 KVA Transformers 5,6, 7.	As Above	As Above	As Above	As Above	As Above
Bus Coupler					11 KV

former costs about 9,500 T.Shs and has a maximum output of 600 amps with a life expectancy of twenty to twenty five years. The latter costs around 6,000 T.Shs and has a maximum capacity output of 10 amps with a life expectance of the one above.

9. Conclusion

On the whole we found the training we got with the Protection Department very profitable, very educational and very enlightening. It was profitable in that we gained a lot of experience, educational in that we came across things that are rarely taught in school and even that what was taught us became even more clear and it was enlightening in that we now know the ups and downs of a company and how the ups are projected even higher and the downs are raised to level ground.

On the whole we feel that the protection department could do with one or more members of staff since there is a lot of office work to be done as well as a lot of running ground for testing and commissioning purposes.

It is very obvious that the protection department needs a car to carry out their chores but this does not happen to be the case. The department has to rely on cars that are available in the car pool and this leads to a delay of several hours or to the postponement of a job for a whole day. Obviously, there is need for the acquirement of a car by the department as soon as possible.

The protection department is always involved in very many numerical calculations and at the moment these are either done manually or with the aid of a desk calculator. Some of these calculations are very laborious and time consuming and in most cases very accurate results are called for which obviously cannot be obtained with the present methods of calculation. Since Tanesco has a computer of its own we fail to see why full use of it is not made, especially in the technical field.

Dispersed through Tanesco are a number of expatriates and we were informed that plans are underway to make do without them in future and to have citizens in their places instead. At this

moment this cannot be implemented but we see a lot of scope for future graduates in Tanesco.

As we mentioned earlier, the meter department is duty bound to make periodical checks on consumers meters but this cannot be implemented for lack of staff. We therefore propose that the meter department employ more staff for this specific purpose both in the interest of Tanesco and its consumers.

Finally we would like to thank the staff of the protection department for the invaluable help and effort they put into making us understand what they were doing and for their sincerity in wanting us to know what we were doing.

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