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**VERRIGTINGS 1970**  
**Deel 1a**

**42ste KONVENSIE**

18de tot 21ste OKTOBER 1971

**KAAPSTAD**

Die Vereniging van Munisipale Elektrisiteits-  
ondernemings van Suidelike Afrika

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**PROCEEDINGS 1971**  
**Volume 1a**

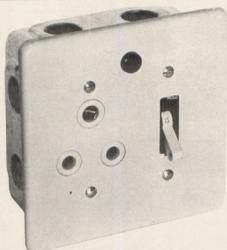
**42nd CONVENTION**

18th to 21st OCTOBER, 1971

**CAPE TOWN**

The Association of Municipal Electricity  
Undertakings of Southern Africa

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**The Association of Municipal Electricity Undertaking  
of Southern Africa**

**PROGRAMME — Cape Town Convention**

Monday, 18th October—Thursday, 21st October, 1971

**VENUE — CAMPS BAY CIVIC CENTRE**

**Monday, 18th October :**

- 8.30 a.m. Registration.  
9.15 a.m. Assemble in Hall.  
9.30 a.m. Opening Prayer.  
Welcome to Cape Town by His Worship  
the Mayor of Cape Town.  
Welcome to Convention by His Worship  
the Mayor of Springs.  
Official Opening of Convention by the  
Hon. Dep. Minister of Economic Affairs  
—Mr. A. H. du Plessis.  
Induction of President.
- 10.30 a.m. Refreshment Interval.  
11.00 a.m. Election of President Elect.  
Venue of Technical Meeting 1972.
- Venue of next Convention.  
Presidential Address.  
Greetings.
- 12.30 p.m. Luncheon Adjournment.  
2.00 p.m. Adoption of Proposed Amended  
Constitution. ?  
Election of Executive Council.  
Report of Secretaries.  
4.00 p.m. Adjournment and Refreshment.
- Evening** Civic Cocktail Party.

**Tuesday, 19th October :**

- 9.00 a.m. PAPER by Mr. J. S. du Toit, Town  
Clerk of Roodepoort, presented on behalf  
of S.A. Institute of Organisation and  
Methods — "Practical application of  
Modern Management Techniques in a  
Municipal Undertaking—a case study."  
9.45 a.m. Discussion on Paper.  
10.30 a.m. Refreshment Interval.  
11.00 a.m. PAPER by Mr. P. J. Botes, Town Electrical  
and Mechanical Engineer of Roode-  
poort — „Programmierung en Skedulering  
as Bestuurhulpmiddels met Spesiale Ver-  
wysing na Munisipale Elektrisiteitsonder-  
nemings."  
11.45 a.m. Discussion on Papers.  
12.30 p.m. Luncheon Adjournment.

**Die Vereniging van Munisipale Elektrisiteits-  
ondernemings van Suidelike Afrika**

**PROGRAM — Konvensie te Kaapstad**

Maandag 18 Oktober—Donderdag 21 Oktober, 1971

**VERGADERPLEK  
BURGERSENTRUM — KAMPS BAAI**

**Maandag 18 Oktober :**

- 8.30 a.m. Registrasie.  
9.15 vm. Vergader in Saal.  
9.30 vm. Openingsgebed.  
Verwelkoming in Kaapstad deur Sy Ag-  
bare die Burgemeester van Kaapstad.  
Verwelkoming by Konvensie deur Sy Ag-  
bare die Burgemeester van Springs.  
Amptelike Opening van die Konvensie  
deur sy Edele die Adjunk-Minister van  
Ekonomiese Sake.  
Inhuldiging van President.
- 10.30 vm. Verversingspouse.  
11.00 vm. Verkiesing van Aangewese President.  
Vergaderplek vir Tegnieese Vergadering  
1972.  
Vergaderplek vir volgende Konvensie.  
Presidentsere.  
Groete.
- 12.30 nm. Verdaging vir Middagete.  
2.00 nm. Aannee van voorgestelde gewysigde  
Grondwet.  
Verkiesing van Uitvoerende Raad.  
Verslag van die Sekretariaat.  
4.00 nm. Verdaging en Verversings.
- Aand** Burgerlike Skermertparty.

**Dinsdag 19 Oktober :**

- 9.00 vm. REFERAAAT deur Mnr. J. S. du Toit,  
Stadsklerk van Roodepoort, aangebied na-  
mens die S.A. Instituut van Organisasie  
en Metodes — „Die praktiese toepassing  
van Moderne Bestuurstegnieke in 'n Muni-  
sipale Onderneming—in gevallestudie."  
9.45 vm. Bespreking van referaat.  
10.30 vm. Verversingspouse.  
11.00 vm. REFERAAAT deur Mnr. P. J. Botes,  
Elektrotegniese en Meganiese Stadsing-  
nieur van Roodepoort—„Programmierung  
en Skedulering as Bestuurhulpmiddels,  
met spesiale verwysing na Munisipale  
Elektrisiteitsondernemings."  
11.45 vm. Bespreking van Referate.  
12.30 nm. Verdaging vir Middagete.

- 2.00 p.m. Reports of Sub-Committees and Representatives.  
 3.30 p.m. Refreshment Interval.  
 4.00 p.m. Discussion on Reports and Papers.  
 5.00 p.m. Adjournment.

Evening Free. *2.26.*

**Wednesday, 20th October :**

- 9.00 a.m. PAPER presented by Mr. C. T. Carter of the Cape Town Electricity Department—"Aluminium Cable, Jointing and Accessories."  
 9.45 p.m. Discussion on Paper.  
 10.30 a.m. Refreshment Interval.  
 11.00 a.m. Address by the President of the International Electro-technical Commission—Mr. S. Goodall—"International Standards"  
 11.30 a.m. Discussion.  
 12.00 noon Adjournment.  
 2.00 p.m. Visit to Paarl—K.W.V. and new Electrical Control Centre of Paarl Municipality

Evening Free.

**Thursday, 21st October :**

- 9.00 a.m. PAPER presented by Mr. J. V. Grant of S.A.B.S.—"Earth Leakage Protection and its influence on the Wiring Regulations."  
 9.45 a.m. Discussion on Paper.  
 10.30 a.m. Refreshment Interval.  
 11.00 a.m. Discussion.  
 12.30 p.m. Adjournment.  
 2.00 p.m. Discussion.  
 3.00 p.m. Refreshment Interval.  
 3.30 p.m. Honorary Membership and presentation of Insignia.  
 Evening Convention Social: Venue to be advised. (Dinner jacket or dark suit).

- 2.00 nm. Verslae van Subkomitees en Verteenwoordigers.  
 3.30 nm. Verversingspouse.  
 4.00 nm. Bespreking van Verslae en Referate.  
 5.00 nm. Verdaging.

Aand V r y.

**Woensdag 20 Oktober :**

- 9.00 vm. REFERAAT deur Mnr C. T. Carter van die Kaapstadse Elektrisiteitsdepartement—"Aluminiumkabel, Lasse en Toebehore."  
 9.45 vm. Bespreking van Referaat.  
 10.30 vm. Verversingspouse.  
 11.00 vm. Toespraak deur die President, van die Internasionale Elektrotegniese Kommissie Mnr. S. Goodall—"Internasionale Standaard."  
 11.30 vm. Bespreking.  
 12 uur middag Verdaging.

- 2.00 nm. Besoek aan Paarl—K.W.V. en die nuwe Elektriese Beheersentrum van die Paarlse Munisipaliteit.

Aand V r y.

**Donderdag 21 Oktober :**

- 9.00 vm. REFERAAT gelewer deur Mnr. J. V. Grant namens die S.A.B.S. „Beskerming teen Aardlekke en die invloed daarvan op die Bedradingsregulasies."  
 10.15 vm. Bespreking van Referaat.  
 10.30 vm. Versversingspouse.  
 11.00 vm. Bespreking.  
 12.30 nm. Verdaging.  
 2.00 nm. Bespreking.  
 3.00 nm. Verversingspouse.  
 3.30 nm. Erelidmaatskap en oorhandiging van Ordetekens.  
 Aand Konvensie Onthaal—Plek van byeenkoms volg later. (Formeel of donker pak).

## LADIES' PROGRAMME

### A.M.E.U. CONVENTION — 1971

#### Monday, 18th October :

- 9.15 a.m. Assemble in Hall.
- 9.30 a.m. Opening Prayer.  
Welcome to Cape Town by His Worship  
the Mayor of Cape Town.  
Welcome to Convention by His Worship  
the Mayor of Springs.  
Official Opening of Convention.  
Induction of President.
- 10.30 a.m. Refreshment Interval.
- 11.00 a.m. Election of President Elect.  
Venue of Technical Meeting 1972.
- Venue of next Convention.  
Presidential Address.  
Greetings.
- 12.30 p.m. Adjourn for Lunch.
- Afternoon** F r e e.
- Evening** Civic Cocktail Party.

#### Tuesday, 19th October :

- Morning** Visit to Nature Reserve at Somerset West,  
Historical Buildings at Stellenbosch and  
luncheon. Return after lunch.
- Afternoon** F r e e.
- Evening** F r e e.

#### Wednesday, 20th October :

- Morning** F r e e.
- Afternoon** Visit to Paarl—K.W.V. and new Electrical  
Control Centre of Paarl Municipality.
- Evening** F r e e.

#### Thursday, 21st October :

- Morning** Visit to Kirstenbosch and tea with the  
Mayor of Cape Town.
- Afternoon** Join Convention for tea and Closing  
Session.
- Evening** Convention Social : Venue to be advised.

## DAMESPROGRAM

### A.M.E.U. KONVENSIË — 1971

#### Mandag 18 Oktober :

- 9.15 vm. Vergader in Saal.
- 9.30 vm. Openingsgebed.  
Verwelkoming in Kaapstad deur sy Ag-  
bare die Burgemeester van Kaapstad.  
Verwelkoming by Konvensie deur sy Ag-  
bare die Burgemeester van Springs.  
Amptelike Opening van die Konvensie.  
Inhuldiging van President.
- 10.30 vm. Verversingspouse.
- 11.00 vm. Verkiesing van Aangewese President.  
Vergaderplek vir Tegniëse Vergadering  
1972.  
Vergaderplek vir volgende Konvensie.  
Presidentsrede.  
Groete.
- 12.30 nm. Verdaging vir Middagete.
- Middag** V r y.
- Aand** Burgerlike Skemerparty.

#### Dinsdag 19 Oktober :

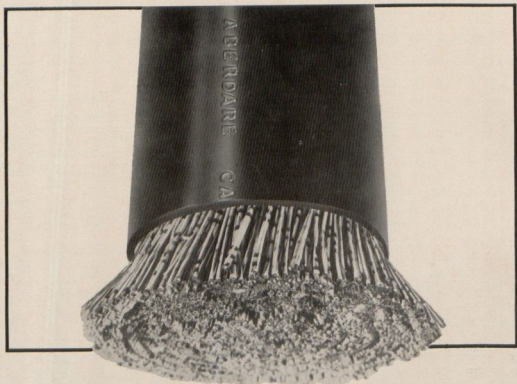
- Oggend** Besoek Natuurresewaat by Somerset-Wes  
Gesiedkundige Geboue op Stellenbosch  
waar die middagete ook geniet sal word.  
Keer na middagete terug.
- Middag** V r y.
- Aand** V r y.

#### Woensdag 20 Oktober :

- Oggend** V r y.
- Middag** Besoek aan die Paarl—K.W.V. en die  
nuwe Elektriese Beheersentrum van die  
Paarlse Munisipaliteit.
- Aand** V r y.

#### Donderdag 21 Oktober :

- Oggend** Besoek Kirstenbosch en drink tee saam  
met die Burgemeestersvrou van Kaapstad.
- Middag** Sluit by die Kongresgangers aan vir tee  
en die laaste Sitting.
- Aand** Konvensie Onthaal—Plek van byeenkoms  
volg later.



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### PLEASE NOTE

The Proceedings are being printed in two volumes.  
Volume 1b will be despatched approximately one  
week after despatch of Volume 1a.

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### LET WEL

Die Verrigtinge word in twee dele gedruk. Deel  
1b word omtrent een week na deel 1a aangestuur.

## REPORT OF THE SECRETARIES

To the President and Members of the Association.

Mr President and Gentlemen,

It gives me great pleasure to submit to you the Report of your Association for the two-year period ended 28th February, 1971.

### OBITUARY

It is with deep regret that we record the death of the following during the period covered by this Report:

John Wilson, Honorary Member of the Association, John will long be remembered as a member of the Association who gave of his best in the furtherance of its activities and also as a sincere friend by those who were privileged to be associated with him.

The many members of the Association who knew Mr D. Lees, known universally as "Scotty" were deeply shocked to hear of his passing so soon after proceeding on retirement. Scotty will long be remembered as a staunch member of the Association and a sincere friend of many.

### FORTY-FIRST CONVENTION

The 41st Convention of the Association was held in Umtali from the 16th to the 19th June, 1969.

Delegates were welcomed by His Worship the Mayor of Umtali, Councillor J. S. Murray, and the official opening of the Convention was performed by Brigadier, the Honourable Andrew Dunlop, Minister of Transport and Power. On behalf of the President, Members of the Association and all others who attended the Umtali Convention, it is a great pleasure to record most sincere appreciation to the Mayor and Town Councillors of Umtali, as well as its citizens in general, for the memorable hospitality extended to delegates on the occasion of their visit to this beautiful town.

To Harry Turner, I wish to place on record the appreciation of all Members for the sincere manner in which he carried out his duties as Chairman of the Convention, as well as his consideration and efficiency in carrying out the duties of President over the past two years.

The first paper presented to the Convention was entitled "The Rhodesia Electricity Supply Commission — A Review of Progress and of Future Trends" by Mr D. R. Irvine (B.Sc.(Eng), M.I.E.E., M.Rhod.I.E.). This paper, besides providing a most interesting account of the growth of the operation of the Rhodesian Electricity Supply Commission in many aspects, introduced a thought provoking discussion on the merits

## VERSLAG VAN DIE SEKRETARIAAT

Aan die President en Lede van die Vereniging:

Meneer die President en here,

Dit doen my groot genoë om die verslag van u Vereniging vir die tweejaartydperk wat op 28 Februarie 1971 geëindig het, aan u voor te lê.

### DOODSBERIGTE

Dit is met diepe leedwese dat ons moet melding maak van die oorlye van die volgende persone gedurende die tydperk wat deur hierdie verslag gedek word:

John Wilson, Erelid van die Vereniging. John sal lank onthou word as 'n lid van die Vereniging wat slegs sy beste gegee het ter bevordering van die Vereniging se bedrywighede en ook as 'n opregte vriend vir diegene wat die voorreg gehad het om met hom in aanraking te kom.

Die talryke lede van die Vereniging wat mnr. D. Lees, algemeen bekend as „Scotty”, geken het, was diep geskok deur die nuus van sy afsterwe so kort nade hy met pensioen afgetree het. Scotty sal nog lank onthou word as 'n staatkamerlid van die Vereniging en 'n opregte vriend van baie mense.

### EEN-EN-VIERTIGSTE KONVENSIE

Die 41ste Konvensie van die Vereniging is vanaf 16 tot 19 Junie 1969 te Umtali gehou.

Die afgevaardigdes is deur Sy Agbare die Burgemeester van Umtali, Raadslid J. S. Murray, verwelkom, en die amptelike opening van die Konvensie is waargeneem deur Sy Edele Brigadier Andrew Dunlop, Minister van Vervoer en van Kragvoorsiening. Dit is 'n besondere voorreg om die opregte waardering van die President, die lede van die Vereniging en alle ander persone wat die Umtali-konvensie bygewoon het, teenoor die Burgemeester en Raadslede van Umtali, sowel as teenoor die inwoners in die algemeen, te betuig vir die onvergeetlike gasvryheid wat aan die afgevaardigdes betoon is by geleentheid van hul besoek aan hierdie pragtige dorp.

Aan Harry Turner wil ek die opregte waardering van alle lede betuig vir die opregte wyse waarop hy sy pligte as Voorsitter van die Konvensie uitgeoef het, sowel as vir sy bedagsaamheid en doeltreffendheid in die uitvoering van sy pligte as President gedurende die afgelope twee jare.

Die eerste referaat wat aan die Konvensie gelewer is, was „Die Rhodesiese Elektriesiteitsvoorsieningskommissie — 'n Oorsig van Voortuitgang en van Toekomstige Tendense" deur mnr. D. R. Irvine, B.Sc.(Ing.), L.I.E.I., L.Rhod.I.E. Hierdie referaat het, behalwe vir die feit dat dit 'n hoogs interessante oorsig oor die ontwikkeling van die werking van die Rhodesie Elektriesiteitsvoorsieningskommissie ten opsigte



and demerits of electricity generation and reticulation being undertaken more and more by statutory organisations.

This paper was followed by one on "Computer Engineering" by Mr J. D. N. van Wyk, Assistant Director responsible for Electrical Engineering Research at the National Research Institute for Mathematical Sciences, Council for Scientific and Industrial Research.

Apart from giving a most interesting insight into a fascinating and vital subject, Mr van Wyk gave his audience a devastating foretaste of man's position in the future computerised and automated world.

"Financial Autonomy" was the title of the next paper presented by Mr Rowan Martin, O.B.E., B.Com., F.I.M.T.A., A.C.W.A., F.C.I.S., City Treasurer, City of Salisbury, Rhodesia.

This excellently presented paper brought forth further meaningful discussion on the financing of Municipal Electricity Undertakings and also the pros and cons of electricity supply by central and local authorities.

A paperette on "Electrical Standards in Central Africa" by Mr R. L. Richards (Standards Association of Central Africa, Salisbury) was of considerable interest and a contribution by Mr A. A. Middlecote (S.A.B.S., Pretoria) entitled "KWH Curves and their Significance" was well received.

There was a Members' Forum session in which Mr A. F. W. H. Eggers (Department of Post and Telegraphs, Pretoria) set out the possibilities of co-ordination between the Post Office Engineering Branch and Municipal Electrical Undertakings in the provision of underground services.

Another contributor to the Forum discussion was Mr E. E. de Villiers who introduced the discussion on the training of non-white artisans.

Mr J. C. Wannenburg, Department of Labour, submitted to the Convention most important notes on the interpretation of certain sections of the Factories, Machinery and Building Work Act, 1941, as amended, the Electrical Wiremen and Contractors' Act and the regulations framed thereunder.

#### 1970 TECHNICAL MEETING

The 1970 Technical Meeting of the Association was held over two days, the 4th and 5th of May, at Potchefstroom.

Our sincere appreciation is extended to the Mayor and Town Councillors of Potchefstroom for the hospitality extended to delegates to this Technical

van baie aspekte gebied het, ook 'n gedagteprikkelende bespreking oor die voor- en nadele daarvan dat die opwekking en verspreiding van elektrisiteit in 'n toenemende mate deur statutêre organisasies behartig wo.d. tot gevolg gehad.

Hierdie referaat is gevolg deur een oor „Rekenaar-ingenieurswese" deur mnr. J. D. N. van Wyk, Assistent-Direkteur met verantwoordelikheid vir navorsing insake elektrotegniese ingenieurswese by die Nasionale Navorsingsinstituut insake Wiskundige Wetenskap van die Wetenskaplike en Nywerheidsnavorsingsraad.

Behalwe 'n baie interessante insig in 'n fassinerende en lewende onderwerp, het mnr. van Wyk, aan sy gehoor 'n vernietigende voorsmaak gegee van die mens se posisie in die gekomputeriseerde en geoutomatiseerde wêreld van die toekoms.

„Finansiële Outonomie" was die titel van die volgende referaat, wat deur mnr. Rowan Martin, O.B.E., B.Comm., G.I.M.T.R., L.V.K.R., G.G.I.S., Stadstoesourier, die Stad Salisbury, Rhodesië, gelewer is.

Hierdie voortrefflik aangebode referaat het verdere vrugbare bespreking oor die finansiering van munisipale elektrisiteitsondernemings en oor die voor- en nadele van elektrisiteitsvoorsiening deur sentrale en plaaslike owerhede uitgelok.

'n Referaartjie oor „Elektriese Standaarde in Sentraal-Afrika" deur mnr. R. L. Richards (Standaardvereniging van Sentraal-Afrika, Salisbury) was hoogs interessant en 'n bydrae deur mnr. A. A. Middlecote (S.A.B.S., Pretoria) onder die titel „KWU-kurwes en hul betekenis" is goed ontvang.

Daar was 'n lede-forumsitting waarin mnr. A. F. W. H. Eggers (Departement Pos- en Telegraafwese, Pretoria) die moontlikheid van koördinasie tussen die Poskantoor se Ingenieurstak en munisipale elektrisiteitsondernemings met betrekking tot die voorsiening van ondergrondse dienste uiteengesit het.

Nog 'n bydrae tot die forumbespreking was mnr. E. E. de Villiers, wat die bespreking oor die opleiding van nie-blanke vakmanne ingelei het.

Mnr. J. C. Wannenburg, Departement van Arbeid, het uiters belangrike aantekeninge oor die vertolking van sekere bepalinge van die Wet op Fabriek-, Masjinerie en Bouwerk, 1941, soos gewysig, die Wet op Elektrotegniese Draadwerkers en Aannemers en die regulasies ingevolg daarvan afgekondig, aan die vergadering voorgelê.

#### TEGNIËSE VERGADERING 1970

Die Tegniëse Vergadering vir 1970 is oor twee dae, nl. 4 en 5 Mei, te Potchefstroom gehou.

Ons opregte dank en waardering word oorgebring aan die Burgemeester en Stadsraadlede van Potchefstroom vir die gasvryheid wat hulle aan die afgeveer-

Meeting. We also wish to record the appreciation of all concerned to Mr E. de C. Pretorius, Town Electrical Engineer of Potchefstroom for his great assistance in the organisation of this successful gathering. A considerable portion of the meeting was taken up by the Members' Forum during which a wide range of problems were discussed and interesting thoughts exchanged.

Mr H. Hewitt, E.Eng., F.I.E.E., F.Illum.E.S., presented the interesting paper on "An International Approach to Lantern Performance".

As a contribution by the Association to Water Year in the Republic, Professor D. C. Midgley, Professor of Hydraulic Engineering at the University of the Witwatersrand, Johannesburg, presented a most comprehensive and interesting paper on "Water — Its Role in South Africa's Power Supplies".

The paper by Mr D. Hogg, Manager of Deep Space Station, on "Aspects of Space Research" gave an interesting insight into the aspects of Electrical Engineering in South Africa in relation to this fascinating subject.

#### MEMBERSHIP

The following new members were elected during the two years ended 28th February, 1971:

##### Retired Members:

- D. Lees — Benoni.
- J. F. MacHutchon — Cape Town.
- J. W. S. Muir — Knysna.
- I. J. Nicholas — Pearson.
- W. Rossler — Kroonstad.
- A. Rossler — Pietermaritzburg.

##### Current Members:

- Municipality of Graaff Reinert.
- Municipality of Gordon's Bay.
- Municipality of Delmas.
- Municipality of Upington.
- Municipality of Lichtenburg.
- Municipality of Glencoe.

##### Associates:

- P. J. R. Pretorius (Town Electrical Engineer, Vryburg).
- A. C. Pieterse (Electrical Engineer, Ladybrand).
- J. F. Nieuwenhuis (Electrical Engineer, Wolmaransstad).
- P. J. Goussard (Chief Electrician, Koppies).
- G. H. Jantzen (Town Electrical Engineer, Aliwal North).
- T. Pollock (Electrical Engineer, Gordon's Bay).
- P. V. E. Pagel (Electrical Engineer, Kakamas).
- T. L. Swart (Electrical Engineer, Glencoe).
- F. H. Smith (Electrical Engineer, Despatch).

digdes na hierdie tegniese vergadering gebied het. Ons wil ook graag die waardering van alle betrokke boekstaaf teenoor mnr. E. de C. Pretorius, die Elektrotegniese Stadsingenieur van Potchefstroom, vir sy groot nuip in verband met die organisasie van hierdie suksesvolle byeenkoms. 'n Aansienlike gedeelte van die vergadering is in beslag geneem deur die ledeforum, waarin 'n wye reeks probleme bespreek en interessante gedagtes gewissel is.

Mnr. H. Hewitt, E.Eng., G.I.E.I., G.V.V.I., het 'n interessante referaat gelewer oor „'n Internasionale Benadering tot die Dienslewering van Lanterns".

As 'n bydrae tot die Waterjaar in die Republiek deur die Vereniging, het Professor D. C. Midgley, Professor in Hidrouliese Ingenieurswese aan die Witwatersrand Universiteit, Johannesburg, 'n hoogs omvattende en interessante referaat gelewer oor „Water — Sy Rol in Suid-Afrika se kragvoorsienings".

Die referaat deur mnr. D. Hogg, Bestuurder van die Diepruimtestasie, oor „Aspekte van Ruimtenavorising" het 'n interessante blik gelewer op die aspekte van die elektrotegniese ingenieurswese in Suid-Afrika wat met hierdie fassinerende onderwerp verband hou.

#### LIDMAATSKAP

Die volgende nuwe lede is gedurende die twee jaar wat op 28 Februarie 1971 geëindig het, verkies:

##### Afrede Lede:

- D. Lees — Benoni.
- J. F. MacHutchon — Kaapstad.
- J. W. S. Muir — Knysna.
- I. J. Nicholas — Pearson.
- W. Rossler — Kroonstad.
- A. Rossler — Pietermaritzburg.

##### Rade-lede:

- Die Munisipaliteit Graaff Reinert.
- Die Munisipaliteit Gordon'sbaai.
- Die Munisipaliteit Delmas.
- Die Munisipaliteit Upington.
- Die Munisipaliteit Lichtenburg.
- Die Munisipaliteit Glencoe.

##### Geassosieerders:

- P. J. R. Pretorius (Elektrotegniese Ingenieur, Vryburg).
- A. C. Pieterse (Elektrotegniese Ingenieur, Ladybrand).
- J. F. Nieuwenhuis (Elektrotegniese Ingenieur, Wolmaransstad).
- P. J. Goussard (Hoof Elektriese, Koppies).
- G. H. Jantzen (Elektrotegniese Ingenieur, Aliwal Noord).
- T. Pollock (Elektrotegniese, Gordon'sbaai).
- P. V. E. Pagel (Elektrotegniese Ingenieur, Kakamas).
- T. L. Swart (Elektrotegniese Ingenieur, Glencoe).
- F. H. Smith (Elektrotegniese Ingenieur, Despatch).

J. A. Buisset (Electrical Engineer, Orkney).  
C. T. R. Small (Town Electrical Engineer, Riversdale).  
W. J. Opperman (Deputy Electrical Engineer, Springs).

Associate Members :

J. J. Barrie — formerly of Edenvale.  
D. S. Dunstan — formerly of Port Elizabeth.  
J. N. Jones — formerly of Bulawayo.

Technical Associates :

R. A. Leigh (Assistant Electricity Manager, Johannesburg).

Engineer Members :

P. J. Barnard (Electrical Engineer, Delmas).  
D. B. Briers (Town Electrical Engineer, Kroonstad).  
I. F. Boyack (Deputy City Electrical Engineer, Pretoria).  
J. L. Bernhardt (Borough Electrical Engineer, Stanger).  
J. G. Brummer (Electrical Engineer, Stellenbosch).  
M. J. W. Chappel (City Electrical Engineer, Boksburg).  
C. L. Cosser (Electrical Engineer, Bulawayo).  
G. Forbes (Town Electrical Engineer, Upington).  
J. S. Gamble (Electrical Engineer, Oudtshoorn).  
I. H. Hess (Senior Asst. City Electrical Engineer, Cape Town).  
J. A. Loubser (Town Electrical Engineer, Kimberley).  
S. A. Mostert (Electrical Engineer, Beaufort West).  
R. W. Phillips (Electrical Engineer, Mossel Bay).  
D. C. Plowden (City Electrical Engineer, Johannesburg).  
J. ten Cate (Town Electrical Engineer, Lichtenburg).  
T. D. Catchpole (Borough Engineer, Howick).

Re-instated Electrical Engineer :

E. H. Surtees (Electrical Engineer, Boksburg).

Affiliates :

Wardle & Simpson.  
Eberhard-Martin (Pty.) Ltd.  
Amalgamated Power Engineering S.A. (Pty.) Ltd.

Simplex Electric of S.A. (Pty.) Ltd.  
Biderman, Finn, Beekhuizen & Pein.  
Steam & Mining Equipment (Pty.) Ltd.

J. A. Buisset (Elektrotegniese Ingenieur, Orkney).  
C. T. R. Small (Elektrotegniese Ingenieur, Riversdale).  
W. J. Opperman (Adjunk-Elektrotegniese Ingenieur, Springs).

Assosiaat-lede :

J. J. Barrie — voorheen van Edenvale.  
D. S. Dunstan — voorheen van Port Elizabeth.  
J. N. Jones — voorheen van Bulawayo.

Tegniese Geassosieerdes :

R. A. Leigh (Assistent-Elektrotegniese Bestuurder, Johannesburg).

Ingenieur-lede :

P. J. Barnard (Elektrotegniese Ingenieur, Delmas).  
D. B. Briers (Stads-Elektrotegniese Ingenieur, Kroonstad).  
I. F. Boyack (Adjunk-Elektrotegniese Stads-ingenieur, Pretoria).  
J. L. Bernhardt (Elektrotegniese Ingenieur, Stanger).  
J. G. Brummer (Elektrotegniese Ingenieur, Stellenbosch).  
M. J. W. Chappel (Elektrotegniese Ingenieur, Boksburg).  
C. L. Cosser (Elektrotegniese Ingenieur, Bulawayo).  
G. Forbes (Elektrotegniese Ingenieur, Upington).  
J. S. Gamble (Elektrotegniese Ingenieur, Oudtshoorn).  
I. H. Hess (Hof-Assistent-Elektrotegniese Ingenieur, Kaapstad).  
J. A. Loubser (Elektrotegniese Ingenieur, Kimberley).  
S. A. Mostert (Elektrotegniese Ingenieur, Beaufortwes).  
R. W. Phillips (Elektrotegniese Ingenieur, Mosselbaai).  
D. C. Plowden (Elektrotegniese Stads-Ingenieur, Johannesburg).  
J. ten Cate (Elektrotegniese Ingenieur, Lichtenburg).  
T. D. Catchpole (Elektrotegniese Ingenieur, Howick).

Heraangestelde Elektrotegniese Ingenieur :

E. H. Surtees (Elektrotegniese Ingenieur, Boksburg).

Geaffilieerdes :

Wardle & Simpson.  
Eberhard-Martin (Edms.) Bpk.  
Amalgamated Power Engineering S.A. (Edms.) Bpk.  
Simplex Electric of S.A. (Edms.) Bpk.  
Biderman, Finn, Beekhuizen & Pein.  
Steam & Mining Equipment (Edms.) Bpk.

Chemilite (Pty.) Ltd.  
Austevens Enterprises (Pty.) Ltd.  
Carst & Walker Chemicals (Pty.) Ltd.  
Dulmison Preformed Line Products S.A. (Pty.)  
Ltd.  
Hawker Siddeley Electric ATW (Pty.) Ltd.

Transfers :

J. A. Matthews transferred from Engineer to Associate Member.  
J. G. F. Erikson transferred from Engineer to Associate Member.

The following resignations took place during the period under review :

Council Members :

Ventersdorp.  
Harrismith.  
Fort Victoria.

Associates :

M. J. de Jager — Viljoenskroon.  
A. McD. Wilson — Fort Victoria.  
V. G. Flint — Stanger.

Associate Members :

F. J. W. Barnard (Escom, Springs).

Engineer Members :

T. H. Baillie — Broken Hill.  
M. H. L. Boshoff — Uitenhage.  
G. P. van Wyk Schoombee — Bothaville.  
A. Louw — Kakamas.  
G. P. du Plessis — de Aar.  
W. Robertson — Hermanus.  
J. F. Lategan — Stellenbosch.  
N. G. Hosking — Johannesburg.  
J. C. Coetzee — Bethlehem.  
R. G. Stanton — Oudtshoorn.

Affiliates :

Copperbelt Power Co.  
Satchwell Controls.  
Patrick Murray (Pty.) Ltd.  
James Howden & Safanco Ltd.  
North & Robertson (Pty.) Ltd.  
International Combustion Africa Ltd.  
Motorola S.A. (Pty.) Ltd.

Members Deceased :

J. W. Phillips — Retired Member.  
J. W. Ross — Engineer.  
H. Fohren — Engineer.  
E. H. Buchanan — Engineer.  
K. M. Fisher — Engineer.

Chemilite (Edms.) Bpk.  
Austevens Enterprises (Edms.) Bpk.  
Carst & Walker Chemicals (Edms.) Bpk.  
Dulmison Preformed Line Products S.A. (Edms.)  
Bpk.  
Hawker Siddeley Electric ATW (Edms.) Bpk.

Oorplasinge :

J. A. Matthews vanaf Ingenieur-lid na Assosiaatlid.  
J. G. F. Eriksen vanaf Ingenieur-lid na Assosiaatlid.

Die volgende bedakings is gedurende die tydperk waaroor hierdie verslag handel, ontvang :

Rade-lede :

Ventersdorp.  
Harrismith.  
Fort Victoria.

Geassosieerders :

M. J. de Jager — Viljoenskroon.  
A. McD. Wilson — Fort Victoria.  
V. G. Flint — Stanger.

Assosiaatlade :

F. J. W. Barnard (Escom, Springs).

Ingenieurslede :

T. H. Baillie — Broken Hill.  
M. H. L. Boshoff — Uitenhage.  
G. P. van Wyk Schoombee — Bothaville.  
A. Louw — Kakamas.  
G. P. du Plessis — de Aar.  
W. Robertson — Hermanus.  
J. F. Lategan — Stellenbosch.  
N. G. Hosking — Johannesburg.  
J. C. Coetzee — Bethlehem.  
R. G. Stanton — Oudtshoorn.

Geaffilieerdes :

Copperbelt Power Co.  
Satchwell Controls.  
Patrick Murray (Edms.) Bpk.  
James Howden & Safanco Bpk.  
North & Robertson (Edms.) Bpk.  
International Combustion Africa Bpk.  
Motorola S.A. (Edms.) Bpk.

Afgestorwe lede :

J. W. Phillips — Afgetrede lede.  
J. W. Ross — Ingenieurlid.  
H. Fohren — Ingenieurlid.  
E. H. Buchanan — Ingenieurlid.  
K. M. Fisher — Ingenieurlid.

Comparative Membership figures are as follows:

As per previous report	Including admissions up to 28.2.71 and excluding those individuals present whereabouts are unknown.
Retired Members	5
Honorary Members	18
Undertaking Members	133
Engineer Members	136
Technical Associates	5
Associates	24
Associate Members	33
Affiliates	91

#### FINANCE

The Income and Expenditure Accounts for the years under review, together with the Balance Sheets as at the 28th February, 1970, and 1971, are submitted herewith.

The results of the two years operation is a consolidated excess of expenditure over revenue of R1.051-00.

It will be recalled that in our report presented to the Umtali Convention, proposals to amend the Constitution which included the adoption of a new scale of subscriptions were referred to. In view of far reaching amendments to the Constitution following correspondence and discussions with the S.A. Secretary for the Interior, which the Executive Council had undertaken to submit to the members at the 1971 Convention, it was unanimously agreed that no amendments be accepted at Umtali, but that the whole matter be referred back to the Executive Council.

With an income based on a subscription scale adopted in 1956 the Association accordingly found itself in an embarrassing financial position and the situation called for immediate action. The Executive Council accordingly took the step of introducing attendance fees payable by all representatives to Conventions and Technical Meetings. I am happy to say that as a result, the financial position of the Association has now improved materially and the universal acceptance by all Members of this new principle is greatly appreciated.

I wish to convey sincere thanks to the members of the Finance Committee for their continued assistance and in particular to Mr R. Leishman, initially and Mr J. K. von Ahlften, latterly, as convenors of this Committee.

Die vergelykende lidmaatskapsyfers is soos volg:

volgens vorige verslag	Insluitende uit insluitende toelatings tot 28.2.71 en met uitsluiting van daardie persone wie se huidige adresse onbekend is
Afgetrede lede	5
Erelede	18
Ondernemingslede	133
Ingenieurlede	136
Tegniese Geassosieerdes	5
Geassosieerdes	24
Assosiaat-lede	33
Geaffilieerdes	91

#### FINANSIES

Die state van inkomste en uitgawe vir die verslagjare, tesame met die balansstate soos op 28 Februarie 1970 en 1971, word hierby aan u voorgelê.

Die bedryfsresultate van die twee jaar toon 'n gekonsolideerde oorskot van inkomste bo uitgawe van R1.051-00.

Onthou sal word dat, in ons verslag wat aan die Umtali-konvensie voorgelê is, daar melding gemaak is van voorstelle ter wysiging van die Grondwet, waarby die aanvaarding van 'n nuwe skaal van bydraes inbegrepe was. Met die oog op die verreikende wysigings van die Grondwet wat as gevolg van briefwisseling en samesprekings met die S.A. Sekretaris van Binnelandse Sake nodig geword het en wat die Uitvoerende Raad onderneem het om by die 1971-konvensie aan die lede voor te lê, is daar eenparig ooreenkom dat geen wysigings te Umtali aanvaar sou word nie, dog dat die hele saak na die Uitvoerende Raad terugverwys sou word.

Met 'n inkomste wat gebaseer is op 'n skaal van bydraes wat in 1956 aanvaar is, het die Vereniging homself finansiële in die verleentheid bevind en dié toedrag van sake het onmiddellike optrede noodsaaklik gemaak. Die Uitvoerende Raad het gevolglik stappe gedoen om bywoningsgelde vir alle verteenwoordigers wat konvensies en tegniese vergaderings bywoon, in te stel. Dit doen my genoë om te kan sê dat die Vereniging se finansiële posisie as gevolg hiervan aansienlik verbeter het, en die algemene aanvaarding van hierdie nuwe beginsel deur alle lede word baie hoog op prys gestel.

Ek wil graag my opregte dank betuig aan die lede van die Finansiële Komitee vir hul volgehoue hulp en aan die besonder aan mnr. R. Leishman wat aan die begin en mnr. J. K. von Ahlften wat later as saamroepers van hierdie komitee opgetree het.

## THE CONSTITUTION OF THE ASSOCIATION

I do not think that any report submitted to the Association at this stage would be complete without reference to the new Draft Constitution which will be submitted for adoption at the 1971 Convention of the Association. There are fundamental changes in this Constitution to adapt it to the requirements of all concerned in an ever-changing world. I would like to pay tribute to those who have served on the Sub-Committee established by the Executive Council to redraft the Constitution. Their task was not an easy one and I believe that the document they have produced, is one which should meet our needs for many years to come. In terms of the new Constitution members in Rhodesia will no longer occupy the same legal status in the Association as before. I would like personally to convey my appreciation to them for their friendship and assistance over the many years we have been associated. It was necessary to amend the Constitution in respect of their membership—we live in a changing world, I am sure that I express the views of all the membership when I say that we nevertheless look forward to continued association with our friends in Rhodesia, as well as in other countries.

## REGIONAL BRANCHES

No new Regional Branches have been established during the period under review.

## MID YEAR EXECUTIVE MEETING

The mid year Executive meeting held in December, 1969, took place in Johannesburg and the host was the Municipality of Umtali. On behalf of the President and Executive Council, sincere appreciation is conveyed to His Worship the Mayor and Councillors of Umtali for their hospitality on this occasion.

The venue of the Executive Council Meeting held in February, 1971, was East London and on behalf of the President and Executive Council, sincere appreciation is conveyed to His Worship the Mayor and Councillors of that City for their hospitality on this occasion, as well as to the City Electrical Engineer and members of his staff for their assistance.

## SUB-COMMITTEES AND REPRESENTATIVES

It is not easy to convey in a few words the amount of work undertaken by members of the technical sub-committees of the Association, as well as those who represent our interests on other organisations. The effort called for continues to increase

## DIE GRONDWET VAN DIE VERENIGING

Ek glo nie dat enige verslag wat in hierdie stadium aan die Verenigingvoorgelê word, volledig sal wees sonder 'n verwysing na die nuwe konsepgrondwet wat by die 1971-konvensie van die Vereniging vir aanvaarding voorgelê sal word nie. Daar is fundamentele veranderinge in hierdie Grondwet ten einde dit by die behoeftes van alle betrokkenes in 'n immerveranderende wêreld te laat aanpas. Ek wil graag hulde bring aan diegene wat in die Subkomitee wat deur die Uitvoerende Raad aangestel is om die Grondwet te hersien, gedien het. Hulle taak was nie maklik nie en ek glo dat die dokument wat hulle daargestel het, vir baie jare aan ons behoeftes sal voldoen. Ingevolge die nuwe Grondwet sal lede in Rhodesië nie meer dieselfde regstatus in die Vereniging hê as voorheen nie. Ek wil graag my persoonlike dank aan hulle oordra vir hulle vriendskap en ondersteuning oor die baie jare wat ons met mekaar te doen gehad het. Dit was nodig omdat Grondwet te wysig in sover dit hul lidmaatskap aangaan, dog ons leve in 'n veranderende wêreld. Ek is seker dat ek by monde van al die lede spreek as ek sê dat ons desnieuwaande uitsien na volgehore verbondenheid met ons vriende in Rhodesië, sowel as in ander lande.

## STREEKSTAKKE

Geen nuwe streekstakke is gedurende die verslagtydperk gestig nie.

## HALFJAARLIKSE VERGADERING VAN DIE UITVOERENDE RAAD

Die halfjaarlikse vergadering van die Uitvoerende Raad wat in Desember 1969 gehou is, het in Johannesburg plaasgevind, met die Munisipaliteit van Umtali as die gasheer. Namens die President en Uitvoerende Raad wil ek ons waardering oordra aan Sy Agbare die Burgemeester en Raadslede van Umtali vir hul gasvryheid by hierdie geleentheid.

Die vergaderplek van die Uitvoerende Raadsvergadering in Februarie 1971 was Oos-Londen en, namens die President en die Uitvoerende Raad, wil ek ons opregte waardering uitspreek teenoor Sy Agbare die Burgemeester en Raadslede van daardie stad vir hul gasvryheid by hierdie geleentheid, sowel as teenoor die Elektrotegniese Stadsingenieur en die lede van sy personeel vir hul bystand.

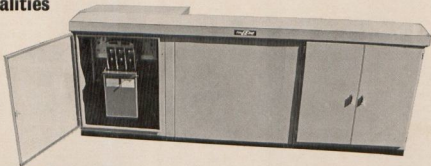
## SUBKOMITEES EN VERTEENWOORDIGERS

Dit is nie maklik om in 'n paar woorde 'n beeld te gee van die hoeveelheid werk wat deur die lede van die tegniese subkomitees van die Vereniging onderneem word nie, asook deur diegene wat ons belange in ander organisasies behartig nie. Die opofferinge

# 50 000 CONSUMERS!

in 56 Municipalities

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BEING FED  
FROM THE**

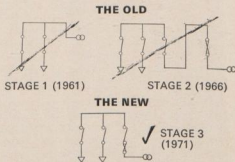


## **MINEESUB**

## **SAFE ECONOMICAL ROBUST YET ELEGANT**

Introduced by English Electric more than a decade ago to meet South Africa's need for a reliable tamper-proof system of HT township and industrial reticulation, the MINEESUB compact Load Centre has undergone three major stages of development.

Today the latest type T3/OF MINEESUB retains all the advantages of earlier proven models and many new features that together provide the most modern and economical three-phase H.V. tripping with integral earthing and testing.



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3 PHASE FUSED TRIPPING TEE-OFF**

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DRIEHOEK, TVL. P.O. BOX 552, GERMISTON.

### **TYPE T3/OF SPECIFICATION**

ASTA certified 250 MVA at 6.6 kV and 11kV •  
Spring-assisted hand mechanisms • Integral  
cable earthing and testing • Fuses easily replaced  
• Line switches 630 amp • Fuse switch 85 amp  
11kV and 135 amp 6.6 kV • Impulse withstand in  
excess of 95 kVp • Switches tested to BS 2631 •  
Switch fuse tested to ASTA No. 22: 1967 • Load  
making-breaking three phase.

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and all members owe a deep debt of gratitude to those who undertake these tasks.

At the Executive Meeting held in February, 1971, it was agreed that for the first time in the Association's history, a representative of the Association should attend a meeting of the IEC officially as its delegate. Mr G. C. Theron was delegated to proceed to the meeting held in June, 1971, in Brussels. We are grateful to the Town Council of Vanderbijlpark for granting Mr Theron the necessary leave to enable him to represent the Association at this most important international gathering.

R. G. EWING,  
for Davidson & Ewing (Pty.) Ltd.  
Secretaries.

15th June, 1971.

wat geverg word, neem steeds toe en alle lede is veel dank verskuldig aan diegene wat hierdie take op hul skouers neem.

By die Uitvoerende Raadsvergadering wat in Februarie 1971 gehou is, is daar ooreengekom dat, vir die eerste keer in die geskiedenis van die Vereniging, 'n verteenwoordiger van die Vereniging 'n vergadering van die IEK amptelik as die Vereniging se afgevaardigde sal bywoon. Mnr. G. C. Theron is afgevaardig om die vergadering, wat in Junie 1971 in Brussel gehou is, by te woon. Ons dank gaan aan die Stadsraad van Vanderbijlpark vir die feit dat hulle aan mnr. Theron die nodige verlof toegestaan het om die Vereniging by hierdie hoogs belangrike internasionale byeenkoms te verteenwoordig.

R. G. EWING,  
namens Davidson & Ewing (Edms.) Bpk.  
Sekretarisse.

15 Junie 1971.





ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS OF SOUTHERN AFRICA  
 VERENIGING VAN MUNISIPALE ELEKTRISITEIT ONDERNEMINGS VAN SUIDELIKE AFRIKA

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 28th FEBRUARY, 1970 & 1971  
 INKOMSTE- EN UITGAWEREKENING VIR DIE JAAR GEËINDIG 28 FEBRUARIE 1970 & 1971

1970		1971	1970		1971
R		R R	R		R R
100	Audit Fees/Ouditgelde 1970	100	169	Income from Investments ....	39
107	Bank Charges/Bankkoste ....	82		Inkomste uit Beleggings	
2 259	Convention and Technical Meeting Expenses/Konvensie en Tegniese Vergaderingskoste	311	6 728	Interest Received/Rente Ontvang	
—	Potchefstroom Technical Meeting/Tegniese Vergaderingskoste	311	2 328	Subscription and Attendance Fees/Subskripsie en bywoninggelde	6 925
2 259	Umtali ....	—		Excess of Expenditure over Income Oorskot van Uitgawe oor Inkomste	—
4	Depreciation — Furniture and Fittings/Waardevermindering—Meubels en Toebehore	4			
264	Executive Council Expenses/Uitvoerende Raadkoste	203			
	Mid-year Meeting/Mid-jaar vergadering				
20	Insurance/Assuransie ....	26			
2 134	Loss on Production of Proceedings/Verlies met Produksie van Verrigtinge	1 110			
201	Postages and Telegrams (General)/Posgeld en Telegramme (Algemeen)	114			
493	Printing and Stationery (General) Drukwerk en Skryfbehoeftes (Algemeen)	532			
2 160	Secretarial Fees/Sekretarieelgelde	2 160			
104	Subscriptions/Subskripsie ....	21			
5	Sundry Expenses/Diverse Uitgawe	46			
341	Telephones/Telefoon ....	312			
836	Translation Fee/Vertalinggelde	218			
197	Travelling Expenses (General) Reiskoste (Algemeen)	393			
9 225		5 632			
—	Excess of Income over Expenditure/Oorskot van Inkomste oor Uitgawe	1 332			
	transferred to Accumulated Funds oo:gedra na Opgehoopte Fonds				
9 225		R6 964	9 225		R6 964

**REPORT OF THE AUDITORS TO THE MEMBERS OF  
THE ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS OF SOUTHERN AFRICA**

**ODITEURSVERSLAG AAN DIE LEDE VAN  
DIE VERENIGING VAN MUNISIPALE ELEKTRISITEIT ONDERNEMINGS VAN SUIDELIKE AFRIKA**

We have audited the books of Account and examined the Securities of the Association. We have obtained all the information and explanations which, to the best of our knowledge and belief, were necessary for the purpose of our audit. In our opinion proper books of account have been kept as far as appears from examination of those books and we certify that the attached Balance Sheet and Income and Expenditure Account are in agreement with the books of account. We further certify that the Balance Sheet gives a true and fair view of the state of the Association as at the 28th February, 1971, and the Income and Expenditure Account gives a true and fair view of the results ended on that date.

**LAZARUS BROTHERS & BARR**  
Chartered Accountants (S.A.)

*Auditors*

EAST LONDON  
4th August, 1971

Ons het die rekeningboeke en die sekuriteite van die Vereniging geouditeer en nagegaan. Ons het al die inligting en verduidelikings gekry wat, na die beste van ons wete en kennis, vir die doeleindes van ons audit nodig was. Na ons mening is behoorlike rekeningboeke gehou vir sover dit uit ons ondersoek van daardie boeke blyk, en ons sertifiseer dat die aangehete Balansstaat en Inkomste- en Uitgawerekening met die rekeningboeke ooreenstem. Ons sertifiseer verder dat die Balansstaat 'n juiste en redelike oorsig verstrek van die toestand van die Vereniging se sake soos op 28 Februarie 1971, en dat die Inkomste- en Uitgawerekening 'n juiste en redelike oorsig verstrek van die resultate vir die jaar wat op daardie datum geëindig het.

**LAZARUS BROTHERS & BARR**  
Geoktrooierde Rekenmeesters (S.A.)

*Ouditeure*

OOS-LONDEN  
4 Augustus 1971

## THE APPLICATION OF MODERN MANAGEMENT PRINCIPLES AND TECHNIQUES TO A MUNICIPAL UNDERTAKING

A paper read to the Association of Municipal Electrical Undertakings of Southern Africa

by

J. S. du TOIT, B.Comm., B.Admin., A.I.A.C.(S.A.), A.I.T.C.(S.A.), S.A.I.O.M.

(Town Clerk, Roodepoort Municipality, Transvaal)

### 1. MANAGEMENT OR ADMINISTRATION? THE PROBLEM OF CONCEPTUAL CONFUSION

1.1 The problem with a paper on this subject is that the words "management" and "administration" mean different things to different people. These concepts are sometimes used synonymously, although various present day writers still give divergent expositions of the meaning of these concepts. Newman<sup>1</sup> sees administrative action as the practical application of the techniques of organisation and management. He states that the functions of any administrator can be divided into the following basic processes: planning, organising, assembling resources, directing and controlling.

1.2 Marx<sup>2</sup> and others see administration as "the systematic ordering of affairs and the calculated use of resources, aimed at making those things happen which we want to happen and simultaneously preventing developments that fail to square with our intentions".

1.3 Fayol<sup>3</sup> comes to the conclusion that all work which is being carried out by an undertaking consists of technical activities, commercial activities, financial activities, security activities, accounting activities and management (administrative) activities. The latter embraces activities such as planning, organising, directing, co-ordinating and control.

1.4 Although some of our own academics do not favour the approach of especially some American management consultants<sup>4</sup>, the clearest and most logical exposition of the concept of "management" is, to my mind, given by Allen<sup>5</sup>. He distinguishes between what he terms management functions of an executive and any other functions that a manager performs. Allen sees management functions as comprising, plan-

## DIE TOEPASSING VAN MODERNE BEGINSELS EN TEGNIESE VAN BESTUUR BY 'N MUNISIPALE ONDERNEMING

'n Referaat gelewer aan die Vereniging van Munisipale Elektriesiteitsondernemings van Suidelike Afrika

deur

J. S. du TOIT, B.Comm., A.I.A.H.(S.A.), G.I.S.(S.A.), S.A.I.O.M.

(Sadsklerk, Munisipaliteit Roodepoort, Transvaal)

### 1. BESTUUR OF ADMINSTRASIE? DIE PROBLEEM VAN BEGRIPSVERWARRING

1.1 Die probleem met 'n referaat oor hierdie onderwerp is dat woorde soos „bestuur” en „administrasie” nie vir alle persone dieselfde betekenis het nie. Hierdie begrippe word soms as sinonieme gebruik ofskoon verskillende skrywers selfs nog in die jongste tyd uiteenlopende uiteensettings gee van wat hierdie begrippe behels, Newman<sup>1</sup> sien administratiewe handeling as die praktiese toepassing van die tegnieke van organisasie en bestuur. Hy maak die stelling dat die werk van enige administrator in die volgende basiese prosesse verdeel kan word: beplanning, organisering, bymekaarbring van middele, opdraggewing en beheer.

1.2 Marx<sup>2</sup> en andere sien administrasie as „the systematic ordering of affairs and the calculated use of resources, aimed at making those things happen which we want to happen and simultaneously preventing developments that fail to square with our intentions.”

1.3 Fayol<sup>3</sup> kom tot die gevolgtrekking dat alle werk wat in 'n onderneming verrig word, bestaan uit tegniese aktiwiteite, kommersiële aktiwiteite, finansiële aktiwiteite, sekerheidsaktiwiteite, rekenpligtige aktiwiteite en bestuurs- (administratiewe) aktiwiteite. Laasgenoemde behels aktiwiteite soos beplanning, organisering, opdraggewing, ko-ördineren en beheer.

1.4 Hoewel sommige van ons eie akademici nie baie hou van die benadering van veral Amerikaanse bestuurkonsultante nie,<sup>4</sup> word myns insiens die duidelikste en mees logiese uiteensetting van die begrip „bestuur” deur Allen<sup>5</sup> gegee. Hy tref 'n onderskeid tussen wat hy as bestuursfunksies van 'n persoon beskou en enige ander funksies wat 'n bestuurder mag vervul. In hoofsaak behels bestuursfunksies vir Allen

1. Newman, W. H.: Administrative Action, p. 4.  
2. Marx, F. M.: (Red.) Elements of Public Administration, p. 1.  
3. Fayol, H.: General and Industrial Management, 1916.  
4. Cloete, J. J. N.: Paper on "Die Opleiding en Ontwikkeling van Leidinggewende Funkisionarisse; Bedryf en Bestuur, 1970".  
5. Allen, L. A.: Management and Organisation, pp. 24, 25.

1. Newman, W. H.: „Administrative Action”, p. 4.  
2. Marx, F. M.: „(Red.) Elements of Public Administration”, p. 1.  
3. Fayol, H.: „General and Industrial Management”, 1916.  
4. Cloete J. J. N.: Referaat oor Die Opleiding en Ontwikkeling van Leidinggewende Funkisionarisse; Bedryf en Bestuur, 1970.  
5. Allen, L. A.: „Management and Organisation”, pp 24, 25.

ning, organising, co-ordinating, motivating and control. The value of Allen's contribution lies therein that he not only clearly distinguishes which activities must be included under the various elements of management but he also gives a clear account of management as a dynamic activity.

I may, therefore, be excused, if amidst all this conceptual confusion, I lean rather heavily on Allen in seeking to apply modern management principles and techniques to a municipal undertaking.

1.5 Dale<sup>6</sup> is of the opinion that activities such as "innovation" and "representation" should be added to those management functions mentioned above, in view of the fact that managers have to pay attention thereto from time to time. He refers to Drucker<sup>7</sup> where the latter says "Managing a business cannot be a bureaucratic, administrative or even a policy-making job. (It) must be a creative rather than an adaptive task". Dale admits, however, that innovation and adaptation could be treated as part of the process of planning.

1.6 Reynders<sup>8</sup> quotes Vlerick where the latter describes "management" as "getting things done through (other) people" and interprets this phrase as follows:

- ♦ it is a process, a succession of activities (think, decide, convey and receive communications, react);
- ♦ it is directed towards the realisation of an objective (the "things" that should be achieved);
- ♦ it is not doing these things by oneself, but getting them done through others;
- ♦ it is getting things done through people (work with and through people);
- ♦ it is work by a group of people.

Reynders emphasises that although the separation of the elements of management in this manner facilitates analysis, the one element cannot succeed without the other or without the whole suffering in the event of its absence. One must be careful not to over-emphasise the one element at the expense of the other. The circumstances under which an undertaking has to operate and the nature of its operations, will themselves determine the relative importance of a particular element at a given point of time.

1.7 In summarising one can, therefore, describe administration in simple terms as that conscious and purposeful action which is necessary for the achievement of a particular objective; whilst in the process

beplanning, organisering, ko-ordinering, motivering en beheer. Die waarde van Allen se bydrae lê egter daarin dat hy nie slegs duidelik onderskei welke aktiwiteite hy onder hierdie elemente van bestuur insluit nie, maar „bestuur” as ’n dinamiese aktiwiteit beskryf.

Ek kan derhalwe seker verskoon word as ek temidde van al hierdie begripsverwarring swaar op Allen leun wanneer ek praktiese toepassing van moderne beginsels en tegnieke van bestuur in ’n munisipale onderneming soek.

1.5 Dale<sup>6</sup> voel egter dat by die tradisionele bestuurfunksies soos reeds genoem, „vernuwing” (innovation) en „verteenvoordinging” ook gevoeg moet word aangesien bestuurders van tyd tot tyd aandag daaraan moet gee. Hy verwys na Drucker<sup>7</sup> waar laasgenoemde sê „Managing a business cannot be a bureaucratic, administrative or even a policy-making job. (It) must be a creative rather than an adaptive task”. Dale gee egter toe dat vernuwing en aanpassing as deel van die proses van beplanning gesien kan word.

1.6 Reynders<sup>8</sup> haal Vlerick aan waar laasgenoemde „bestuur” omskryf as „getting things done through (other) people” en hierdie segswyse soos volg vertolk:

- dit is ’n proses, ’n opeenvolging van handeling (dink, beslis, mededelings oordra en ontvang, reageer);
- dit is gerig op die bereiking van ’n doel (die „things” wat te verwesenlik is);
- dit is nie self doen nie, maar gedaan kry deur andere;
- dit is gedaan kry deur mense (die werk met en deur mense);
- dit is werk deur ’n groep mense.

Reynders beklemtoon dat hoewel die skeiding van die elemente van bestuur, ontleding van die begrip vergemaklik, die een nie sonder die ander kan werk sonder om die dele en die geheel te benadeel nie. Daar moet ook gewaak word teen die oorbeklemtoning van die een element ten koste van die ander. Die omstandighede waarin ’n bedryf homself bevind en die aard van sy aktiwiteite sal self bepaal hoe belangrik ’n bepaalde element op ’n bepaalde tydstip vir sodanige bedryf is.

1.7 Opsomming kan dus gesê word dat administrasie, in eenvoudige terme gestel, die bewustelike en doelgerigte optrede vir die verwesenliking van ’n bepaalde doelwit behels, terwyl wanneer alle admini-

6. Dale, E.: Management Theory and Practice, p. 6.  
7. Drucker, P. F.: The Practice of Management, p. 47.  
8. Reynders, H. J. J.: Article in magazine for Organisation and Methods, December, 1966.

6. Dale, E.: „Management Theory and Practice”, p. 6.  
7. Drucker, P. F.: „The Practice of Management”, p. 47.  
8. Reynders, H. J. J.: Artikel in Tydskrif vir Organisasie en Metode, Desember, 1966.

of analysing all administrative action, a distinction can be drawn between management work performed by executives and the work performed by others who merely carry out instructions and do not have to plan, organise, motivate, co-ordinate, etc., the work of others in discharging their own responsibilities. I personally see the concept of management as the sum total of certain pre-arranged dynamic processes that are integrated in such a manner that, as Drucke,<sup>7a</sup> sees it, they manifest themselves as the lifegiving elements of an undertaking. As a machine is more than just the collection of the various parts thereof, so management as defined above, must also be seen as the interaction of the various elements thereof. It is for this reason that I prefer not to distinguish the element co-ordination from the elements of planning, organising, leading (motivating) and control, but to see it as an essential function which should be performed on a continuing basis. I prefer to see effective management as the interaction of the following elements :

- co-ordinated planning;
- co-ordinated organising;
- co-ordinated activating leadership;
- co-ordinated control.

Management as one finds it in practice is, to a greater or lesser degree, usually defective. Municipal undertakings are no exception. It is, therefore, important that we in municipal service shall take notice of the techniques that have been developed by the more competitive private sector in order that we may be more effective in carrying out our own management functions.

## 2. LEADERS, THEIR STATUS, ROLES AND LIMITATIONS

**2.1** Before an attempt is made to indicate the manner in which municipal undertakings should be managed one should first ascertain who the managers or leading functionaries are. Their status and/or authority and the manner in which their behaviour influences the achievement of the objective, must first be clarified.

**2.2** In those provinces where the "management-committee system" is part of the constitutional set-up of a local authority, one experiences several problems in ascertaining where the "management" work of such committees begins and where it ends. Although they have certain clearly demarcated "management" functions, they can only be legally exercised during meetings. They are mainly of a consultative, policy and decision making nature, depending upon whether

stratiewe handeling ontleed word, daar onderskeid getref kan word tussen bestuurswerk verrig deur die leidinggewende funksionaris en ander werk verrig deur almal wat bloot maar opdragte uitvoer en in die uitvoering daarvan nie hoef te beplan, organiseer, motiveer, ko-ordineer, ens. nie. Persoonlik sien ek die begrip „bestuur" as die somtotal van sekere geordene dinamiese prosesse wat op so 'n wyse geïntegreer is dat dit, soos Drucker<sup>7a</sup> dit sien, die lewewegende element in 'n bedryf uitmaak. Soos 'n masjien meer is as net 'n versameling van die onderdele daarvan, so moet bestuur, in bestaande terme gedefinieer, ook gesien word as die wisselwerking tussen die verskillende elemente daarvan. Juis om hierdie rede verkies ek om die element koördinasie nie los van die elemente van beplanning, organisering, leidinggewing (motivering) en beheer te sien nie, maar wel as 'n noodsaaklike funksie wat deurlopend vervul behoort te word. Ek verkies dus om die doeltreffende bestuursproses te sien as die wisselwerking van die volgende elemente :

- gekoördineerde beplanning;
- gekoördineerde organisering;
- gekoördineerde aktiverende leidinggewing;
- gekoördineerde beheervoering.

In die praktyk word gevind dat bestuurswerk in 'n mindere of meerdere mate gebrekking is. Munisipale ondernemings is hierop geen uitsondering nie. Derhalwe is dit belangrik dat ons sal kennis neem van die tegnieke wat deur die sterk mededingende bedryfswese ontwikkel is om die bestuurstaak doeltreffender te maak.

## 2. DIE LEIDINGGEWENDE FUNKSIONARISSE: HULLE STATUS, ROLLE EN BEPERKINGE

**2.1** Voordat bepaal word op welke wyse daar in 'n munisipale onderneming bestuur behoort te word, moet eers vasgestel word wie die bestuurders of leidinggewende funksionaris is. Duidelikheid moet verkry word oor die status en/of gesag waaroor hulle beskik en op welke wyse hulle optrede die verwezenliking van die einddoel, waarna gestreef word, beïnvloed.

**2.2** In daardie provinsies waar 'n munisipale „bestuurskomiteestelsel" deel van die konstitusionele opset van 'n plaaslike owerheid uitmaak, het 'n mens dikwels probleme om te probeer vasstel waar sulke komitees se bestuurswerk begin en waar dit eindig. Alhoewel hulle sekere duidelik omylende „bestuurspligte" het, is hulle funksies wat wettiglik slegs tydens vergaderings uitgevoer kan word, hoofsaaklik van 'n raadgevende, beleidmakende, besluitnemende en be-

7a. Drucker, P. F.: Op. cit. p. 1.



7a. Druker, P. F.: Op. Cit. p. 1.



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the committee is acting in terms of delegated authority or not. Before one delves too deeply into the question of whether the so-called "management committees" really manage or whether they are merely administrative organs to a limited degree, one should rather ascertain how effectively or ineffectively those persons who are responsible to them, namely the heads of departments, divisions and branches, perform their management work, because the success or otherwise of management committees is measured by the effective execution of management work by these executives. The critics (the ratepayers who usually have a poor grasp of the manner in which the organisation functions) are only interested in effective realisation of specific management objectives.

**2.3** Heads of departments form the traditional top management. They are assisted by sub-ordinate managers, the heads of service branches as well as the leaders of small groups (the so-called foremen) depending upon the sizes of their departments and their abilities and/or attitudes in delegating management work. As already indicated under the definition of administration, these functionaries, apart from management work, also perform other work (operational work).

**2.4** Ideally, top management should mainly carry out management work and relatively little other work whilst on the lowest level of management the opposite should be the case. **It should be emphasised that an undertaking in which all management work is performed at the top, cannot function effectively.** Successful management work is teamwork with role, function and objective of every level of management clearly demarcated.

**2.5** The status and role of a leading functionary are not necessarily indicative of his effectiveness as a leader in the organisation. His effectiveness is determined by his ability and his willingness to perform the role of a worthy (professional) manager. It is possible for the most of us to single out the good or worthy managers as well as the less successful or poor managers within the spheres of our work. In this respect Parrot<sup>9</sup> distinguishes between the amateur and the professional manager. He finds it easy to locate an amateur by reference to the following characteristics:

- ♦ He specialises in the work of his sub-ordinates because that is the work that he knows best, better than management work;
- ♦ He makes most of the decisions himself—out of habit;

herende aard, afhange van daarvan of hulle ingevolge gedelegeerde bevoegdheid optree, al dan nie. Voordat 'n mens te diep op die saak ingaan of die sogenaamde „bestuurkomitees” wel bestuur en of hulle bloot maar in beperkte sin administreer, is dit eger noodsaaklik om te bepaal hoe goed of sleg diegene oor wie hul gestel is, naamlik die hoofde van departemente, afdelings en vertakkinge van die diens hulle eie bestuurswerk verrig, want aan die doeltreffende funksionering van hierdie uitvoerende beamptes word die sukses of andersins van bestuurskomitees gemeet. Die kritici (die belastingbetaler wat gewoonlik 'n swak begrip het van hoe die organisasie funksioneer) stel slegs in die doeltreffende verwesenliking van bepaalde bestuursdoelwitte belang.

**2.3** Hoofde van departemente maak tradisioneel die topleiding uit. Afhange van die grootte van hulle departemente en hulle vermoë en/of beleid om van hulle bestuurswerk te deleger, word hulle bygestaan deur ondergeskikte leidinggewende funksionarisse, die hoofde van diensvertakkinge en selfs die leiers van kleingroepe, die sogenaamde voormanne. Soos reeds onder die definisie van „administrasie” aangedui, verrig hierdie funksionarisse behalwe bestuurswerk ook ander werk (substantiewe of operasionele werk).

**2.4** 'n Ideale toestand is dié waar die topleiers hoofsaaklik bestuurswerk en relatief min ander werk verrig terwyl op die laagste bestuursvlak hoofsaaklik ander werk en relatief minder bestuurswerk verrig word. 'n Saak wat eger baie goed begryp moet word, is dat 'n bedryf waarin alle bestuurswerk slegs op die boonste vlak verrig word, nie doeltreffend kan funksioneer nie. Suksesvolle bestuurswerk is spanwerk met die rol, funksie en doelwit van elke leidinggewende funksionaris op elke vlak duidelik omlyn.

**2.5** Die status en rol van 'n leidinggewende funksionaris is eger, op sigself, nie noodwendig 'n aanduiding van sy doeltreffendheid as bedryfsleier nie. Sy doeltreffendheid word bepaal deur sy vermoë en gewilligheid om die rol van 'n volwaardige bestuurder te vervul. Waarskynlik kan die meeste van ons in die kringe waarin ons werk of beweeg, goeie of volwaardige bestuurders uitken asook minder-suksesvolle of swak bestuurders. Parrot<sup>9</sup> onderskei in hierdie verband tussen die „amateur bestuurder” en die „beroepsbestuurder”. Vir hom is dit maklik om die amateur uit te ken aan die volgende eienskappe:

- ♦ Hy spesialiseer in die werk van sy ondergeskiktes want dit is die werk wat hy die beste ken, beter as bestuurswerk.
- ♦ Hy maak self die meeste van die besluite—uit gewoonte.

9. Parrott, R. H.: Article on "The Profession of Management" in Municipal Affairs Magazine, March, 1966.

9. Parrot, R. H.: Artikel oor „The Profession of Management” in Tydskrif Municipale Aangeleenthede, Maart 1966.



- ◆ He organises around personalities—instead of around the work that has to be performed;
- ◆ He first acts and thinks later—he, therefore, does not make considered logical decisions but usually follows precedents and his intuition.
- ◆ He exercises control either by means of overruling or through personal example—he only acts after things have gone wrong;
- ◆ He is an effective personal leader—this he must be at least.
- ◆ Hy organiseer om persoonlike — in plaas van om die werk wat gedoen moet word.
- ◆ Hy tree eers op en dink later daaroor na — dus maak hy nie oorwoë en logiese besluite nie, maar tree gewoonlik op volgens presedente en aanvoeling.
- ◆ Hy beheer deur òf te oordonder òf deur persoonlike voorbeeld — hy tree slegs op wanneer dinge eers verkeerd geloop het.
- ◆ Hy is 'n effektiewe persoonlike leier — dit moet hy ten minste wees.

In contrast to the amateur manager Parrot describes a professional manager as a person that performs his management work on a definite basis, who is not only guided by the lessons of the past but also by management principles that have in their practical application, stood the test of time.

2.6 The professional manager has to thank the ever increasing size of firms (which utilise investment capital supplied by others) for the development of his profession. Diedericks<sup>10</sup> points out that the professional manager has an increasingly important role to perform in the South African economy in that he must, amongst other things, **supply the initiative necessary to achieve the highest possible standard of living for all groups by means of the most beneficial utilisation and our natural resources.** He emphasises: "hiervoor is goeie bestuur, in al sy fasette in alle aktiwiteite nodig." He continues to point out that not only is good management necessary in business undertakings but also on all government levels and in municipal and public utility undertakings. He describes these professional managers as follows:

"Men who are also inspired with idealism, a high sense of ethical and moral values, integrity, loyalty and vision, who can do creative thinking and are prepared to take calculated business risks within the framework of economic and social conditions which are largely unpredictable."

2.7 Although there is apparently a great need for professional managers in our country, it does not mean to say that all those who are in management positions are necessarily good managers or that they are permitted by circumstances to carry out their management functions effectively. A person's shortcomings as manager may perhaps be ascribed to the rut of tradition into which he has fallen, his lack of proper training, his wrong attitude towards his profession and, therefore, also towards those persons through which he has to achieve results; or it may

Hierteenoor stel Parrot die beroepsbestuurder (volwaardige bestuurder) wat sy bestuurswerk op 'n vaste grondslag verrig, gelei deur lesse geleer in die verlede asook bestuursbeginsels wat die toets van die praktyk deurstaan het.

2.6 Die beroepsbestuurder het die opkoms van sy beroep te danke aan die steeds groterwordende bedryfseenhede wat gebruik maak van beleggingskapitaal voorsien deur verskeie instansies. Diedericks<sup>10</sup> wys daarop dat die beroepsbestuurder in die Suid-Afrikaanse ekonomie 'n steeds belangriker rol vervul om onder andere **die inisiatief te voorsien om die hoogste moontlike lewenstandaard vir alle groepe moontlik te maak deur die voordeligste benutting van ons hulpbronne te bewerkstellig.** Hy beklemtoon: „Hiervoor is goeie bestuur, in al sy fasette, in alle aktiwiteite nodig”. Hy gaan verder deur daarop te wys dat nie slegs goeie bestuur in die sake-ondernemings nie, maar ook op alle owerheidsvlakke, dus ook by munisipale ondernemings en nutsondernemings noodsaaklik is. Hierdie beroepsbestuurders beskryf hy soos volg:

„Men who are also inspired with idealism, a high sense of ethical and moral values, integrity, loyalty and vision, who can do creative thinking and are prepared to take calculated business risks within the framework of economic and social conditions which are largely unpredictable”.

2.7 Hoewel daar dus skynbaar 'n groot behoefte in ons land aan volwaardige bestuurders bestaan, wil dit nie sê dat almal wat bestuursposte beklee, noodwendig goeie bestuurders is, of deur omstandighede toegelaat word om goeie bestuurders te wees nie. 'n Persoon se tekortkominge as bestuurder mag dalk toegeskryf word aan die groef van tradisie waarin hy verval het, sy gebrek aan korrekte opleiding, sy verkeerde ingestelheid teenoor sy beroep en dus ook teenoor diegene deur middel van wie hy resultate moet behaal; of dit kan te wyte wees aan die werksklimaat in 'n beson-

10. Diedericks, Dr N.: Speech before S.A. Institute of Management, published in "S.A. Manager", February, 1970.

10. Diedericks, dr. N.: Toespraak voor S.A. Instituut vir Bestuur, opgeneem in „S.A. Manager”, Februarie, 1970.

be due to the work climate in a particular undertaking which came about as a result of the deeds or misdeeds of top management, the board of directors or to come nearer home, the local council.

**2.8** A worthy manager of a municipal undertaking, may for example, realise the need for realistic long range planning and submit proposals to his council for the extension of particular undertakings in order to satisfy anticipated future needs. He may find however, that because this type of planning requires sacrifices to be made by the present ratepayers, their representatives are more interested in the satisfaction of their present needs in consequence of which necessary development works are delayed or postponed. To use another example, the departmental head may, because he wants to be a worthy manager, take positive steps to organise his department on a rational basis; to formulate clearly the job requirements of the various functionaries and once he has done this, endeavour to obtain suitable persons to fill these positions, whilst in practice he may find that other, irrelevant considerations have played a part in the appointment of a less suitable person to a particular post.

**2.9** Where loan funds have to be applied for, matters are further complicated for the municipal manager (prior to the commencement of the particular work or scheme) on account of the considerable amount of paper work that has to be completed for purposes of obtaining the necessary approval from higher authority; although such approval can, in many cases, be taken for granted. There must, therefore, necessarily be a delay between the planning stage and the execution stage of such projects.

**2.10** In spite of the various frustrations and problems of the municipal manager, of which the above are only a few examples, it remains nevertheless an indisputable fact that **the worthy manager adapts himself timeously to the conditions under which he operates and endeavours to eliminate as much as possible the adverse consequences of such delaying factors.** The amateur manager, by way of contrast, finds himself in a position where there is little that he can do except to feel sorry for himself. The maintenance of a positive managerial approach which will now be analysed in greater detail, is beneficial to both the leading functionary and his employer.

### 3. PLANNING SIMPLIFIES CO-ORDINATED ACTION

**3.1 Introduction:** Planning entails much more than the mere making of plans. Plans are, indeed, often made by persons for doing unnecessary or harmful things. Planning, with special reference to muni-

dere bedryf veroorsaak deur die dade en misdade van die beleidsbepalende funksionaris, byvoorbeeld die direksie of, om nader huis toe te kom, die stadsraad.

**2.8** 'n Volwaardige bestuurder van 'n munisipale onderneming mag, byvoorbeeld, die noodsaaklikheid van realistiese vooruitbeplanning besef en voorstelle aan sy raad voorlê vir die uitbouing van 'n bepaalde onderneming of diens om vir die verwagte behoeftes van die toekoms voorsiening te maak. Hy mag egter vind dat aangesien hierdie tipe van beplanning sekere opofferings van die huidige belastingbetalerskorps verg en hulle meer belangstel in onmiddellike bevrediging van behoeftes, noodsaaklike werke vertraag word of op die lange baan geskuif word. Om 'n ander voorbeeld te gebruik: 'n departementshoof mag, omdat hy 'n volwaardige bestuurder wil wees, positief optree om sy departement op rasionele grondslag te organiseer, 'n duidelike beeld te vorm van die posvereistes vir die verskillende funksionarisse en daarna te trag om geskikte persone te vind om hierdie poste te beklee, terwyl hy in die praktyk bevind dat ander, nie tersaaklike oorwegings geld by die aanstelling van 'n minder geskikte persoon in die onderhewige betrekking.

**2.9** Net om sake vir die munisipale bestuur verder te bemoeilik (voordat daar met 'n bepaalde noodsaaklike werk of skema 'n aanvang gemaak kan word), moet daar, omdat leningsfondse by die saak betrokke is, 'n aansienlike hoeveelheid papierwerk verrig word om 'n goedkeuring van hoër gesag te kry, welke goedkeuring vir die meeste gevalle vanselfsprekend is. Daar moet dus noodwendig tussen die beplanningstadium en die uitvoeringstadium van so 'n projek gesloer word.

**2.10** Ten spyte van die verskillende frustrasies en probleme van die munisipale bestuurder, waarvan bostaande slegs enkele voorbeelde is, bly dit onteenseglik 'n feit dat **die volwaardige bestuurder homself betyds na omstandighede skik en deur middel van tydige optrede soveel moontlik van die nadelige gevolge van sulke belemmerende faktore teenwerk.** Daarteenoor bevind die amateur bestuurder homself in 'n posisie waar hy blykbaar nie veel meer kan vermag as om steeds sy lot te bekla nie. Dit is derhalwe lonend vir sowel die leidinggewende funksionaris, asook vir sy werkgewer, om 'n positiewe bestuursbenadering te handhaaf; 'n benadering wat nou in groter besonderhede ontleed sal word.

### 3. BEPLANNING VEREENVOUDIG GEKO-ORDINEERDE OPTREDE

**3.1 Inleiding:** Beplanning behels veel meer as blote planmakery. Trouens, planne word dikwels deur sommige persone beraam om onnodige of selfs skadelike dinge te doen. Beplanning met spesiale ver-

cial activities, embraces **the forecasting of future events** (population growth, change in living conditions, increase in the number of motor cars, advent of television) and needs (increase or decrease of power consumption for a particular purpose as a result of competitive products) **and the preparation of sound and effective plans of action for dealing with such events and needs when they manifest themselves.**

3.2 In particular planning embraces the following :

- (a) **The forecasting of events** by reference to known facts and tendencies. Examples of basic statistics that a municipal undertaking can collect and collate in an orderly manner are : progressive totals of water and light consumers (sub-divided into various categories) totals of water and electricity purchases and sales, progressive totals of living units (distinguishing between flats and houses) progressive totals of motor registrations (distinguishing between the various types of vehicle); progressive totals of the value of building plans approved (analysed into types of building and floor space in the case of factories and shops) number of residents (differentiating among the various racial groups); periodic traffic counts on main roads (indicating various types of vehicle origins and destinations); number of books on loan from city library (with analysis of various types of reader). It is, however, important that these data are not only collected but are statistically interpreted and that projections of future events such as population increase, consumption trends, etc. are made for the purpose of determining the needs in the near as well as of the distant future. These statistics furnish the basic facts upon which long range planning is based
- (b) **The creation of a framework of inter-related objectives** that can be achieved having due regard to limited means available. When population growth, consumption patterns, etc. have been determined by means of projections, one is in a position to ascertain whether or not existing facilities and services would satisfy future needs and if not, the extent of their deficiencies. In this manner one can ascertain which schemes should be embarked upon in order to satisfy future needs. In view of the fact that the means, to pay for those public facilities and services that make living conditions more and more pleasant, are always inadequate, a stage will be reached where priorities will have to be decided upon and the target dates set for the achievement for the various objectives may have to be changed accordingly. It may, for example, be decided that schemes for extending power or water supply or the construction of a main thoroughfare should take pre-

wysing na 'n munisipaliteit se bedrywighede behels **die voorskatting van toekomstige gebeure** (bevolkingsgroei, veranderde leefwyse, toename in getal motors, koms van beelradio, ens.) **en behoeftes** (toename of afname van kragverbruik vir bepaalde doeleindes as gevolg van mededingende produkte) **en die opstel van gesonde en effektiewe planne van aksie om daardie gebeure en behoeftes tegemoet te sien soos dit tevoorskyn tree.**

3.2 In die besonder behels beplanning dus :

- (a) **Die voorspelling van gebeure** aan die hand van bekende feite en tendense. Voorbeelde van basiese statistiek wat sonder veel moeite op gekoördineerde wyse deur 'n munisipale owerheid versamel en bygehou kan word, is: progressiewe totaal water- en kragverbruikers (onderskei in verskillende klasse), totale hoeveelheid krag en water aangekoop of verkoop, getal wooneenhede (onderskei tussen woonstelle en woonhuise), progressiewe totaal van motorregistrasies (onderskei tussen verskillende tipe voertuie); progressiewe totaal van die waarde van bouplanne goedgekeur (met ontleding wat aandui: tipe gebou en oppervlakte); getal inwoners (met aanduiding van rasse-groepe); periodieke vervoertellings op hoofpaaie (met ontleding van tipe voertuig); getal boeke uitgeleen deur stadsbiblioteek (met ontleding van tipe leser). Dit is egter belangrik dat hierdie getal-gewens nie net versamel word nie, maar statisties vertolk en so akkuraat moontlik in die toekoms in geprojekteer word ten einde aan die hand van sulke projeksies bevolkingstoename, gebruikspatrone, ens. vir die nabye sowel as vir die verre toekoms te kan bepaal. Sulke statistiek verstrek die basiese feite waarop voortuitbeplanning berus.
- (b) **Die daarstelling van 'n raamwerk van verbandhoudende doelwitte** wat bereik kan word met inagnome van beskikbare middele. Wanneer bevolkingsgroei, verbruikspatrone, ens. aan die hand van projeksies bepaal is, kan daar vasgestel word of bestaande geriewe, en dienste voldoende is om in toekomstige behoeftes te voorsien en indien nie die geval nie, in watter mate nie. Aldus kan vasgestel word watter skemas om van stapel te stuur ten einde aan die toekomstige behoeftes te kan voorsien. Aangesien middele altyd ontoereikend is om te betaal vir al daardie openbare geriewe en dienste wat lewensomstandighede steeds genotvoller moet maak, sal daar op bepaalde prioriteite besluit moet word en doeldatums vir die bereiking van sulke doelwitte die ooreenkomstig verskuif word. So mag daar besluit word dat skemas vir krag- en watervoorsiening of 'n hoofpadaanleg, voorrang bo die bou van 'n stadsteater moet geniet.

cedence over the building of a civic theatre.

- (c) **Programming of activities**, i.e. the arrangement of work in a logical sequence with a view to the most effective execution thereof. This obviates the unnecessary jumping from one project to another, thereby ensuring an even work flow as one project has been completed and another is commenced without the occurrence of preventable waste of labour, time and plant. Programming focuses the necessary concentrated attention on those projects which must be commenced immediately and obviates initial waste of time by staff attending to less important work.
- (d) **The scheduling of activities**, i.e. the arrangement of all activities that lead to the completion of a particular project in logical sequence. The work schedule indicates target dates for the completion of key activities, thereby facilitating control. Since most municipal projects are, broadly speaking, a repetition of similar projects executed in the past, it should not be difficult to complete a schedule of standard activities for such projects, as well as process work charts that indicate not only parallel work flow but also the confluence of such activities. These visual aids (work recipes) enable the leading functionaries to visualise the execution of the work in a local sequence without racking their brains, and, therefore, to take the necessary corrective action timeously ensuring that the means of production are utilized as effectively and economically as possible in achieving the desired objective. This prevents the work from coming to a standstill to determine the next step or to wait for materials to arrive on the job.
- (e) **The co-ordinating of plans** in order to provide a harmonious plan of action so that, whilst means are scarce, the desired results may be achieved under a given set of circumstances at the lowest possible cost. The marrying up of plans start with long range planning. There is obviously no sense in the City Electrical Engineer planning for the supply of power to new residential areas on the basis of a 5% increase per annum whilst the various service divisions of the City Engineer's Department (water and sewerage) are only planning for a 3% increase in the number of house connections. If the one department underestimates requirements whilst the other department overestimates growth, there must of necessity be a waste in the form of loan charges on unused capital works. In fact, when all departments plan for the future it is often possible for an electrician
- (c) **Die programmering van werksaamhede**, dit wil sê die rangskikking van werk in 'n logiese volgorde met die oog op die beste afhandeling daarvan ter bereiking van die einddoel. Dit voorkom dat daar onnodig rondgesping word van projek na projek, maar sorg dat die uitvoering van een projek met dié van 'n ander ineenvloei sonder voorkombare verkisting van arbeid, tyd en middele. Programmering vestig ook die nodige gekonsentreerde aandag op daardie werke wat dadelik 'n aanvang mee gemaak moet word en voorkom aanwanklike tydbesteding aan minder belangrike werke.
- (d) **Die skedulering van werksaamhede**, dit wil sê die rangskikking in logiese volgorde van alle aktiwiteite wat lei tot die afhandeling van 'n bepaalde werk. Die skedulering toon doeldatums wat aan die sleutelaktiwiteite toegeken is en aldus die kontrole daaroor vergemaklik. Aangesien die meeste munisipale projekte in breë trekke 'n herhaling is van dergelike projekte wat in die verlede afgehandel is, behoort dit redelik maklik te wees om 'n lys van standaard aktiwiteite vir eenderse projekte op te stel, asook werkprosekaarte wat die saamvloei en ineenvloeiing van aktiwiteite aandui. Sulke visuele hulpmiddels (werkresepte) stel die leidinggewende funksionarisse in staat om sonder veel breinwerk die afhandeling van 'n taak in logiese volgorde met 'n oogopslag raak te sien en van die staanspoor af die korrekte maatreëls betyds te tref dat arbeid en hulpmiddele effektief en spaarsaamig aangewend word om 'n bepaalde doelwit te verwesenlik. Dit voorkom dat werkverrigting kortkort tot stilstand kom omdat eers oor die volgende stap besluit moet word of dat daar op materiaal gewag word om die werk te kan voortset.
- (e) **Die koördineering van planne** om 'n harmonieuse plan van aksie daar te stel, sodat, terwyl middele skaars is, die gewenste resultate teen die laags moontlike koste onder bepaalde omstandighede behaal kan word. Die afstem van planne op mekaar begin reeds met langtermynbeplanning. Dit sou tog sinneloos wees vir die stadsselektrotreiese ingenieur om ten opsigte van nuwe woonbuurtes te beplan vir 'n woonbuurtuitbreiding van 5% per jaar, terwyl die stadsingenieur se verskillende diensafdelings (water en riolering) slegs beplan vir 'n 3% toename in die getal aansluitings. As die een departement onderbemaam terwyl die ander oorbemaam, moet daar verkisting wees in die vorm van leningskoste op onbenutte kapitaal-aanlegte. Trouens, wanneer elkeen van hierdie departemente betyds vooruit beplan, kan dit dikwels moontlik wees dat 'n elektriese kabelleiding

cal cable and water main serving a particular area to be laid in the same trench, without digging up a newly constructed tarred road in order to provide some or other service connection. In cases where several departments are sharing for example, pooled trucks, the Transport Superintendent is placed in a position to timeously arrange the rational utilisation of trucks thereby reducing the capital outlay of the Council on items of transport.

- (f) **The provision of funds**, whether through the municipal revenue and expenditure budget or by means of a loan programme, requires that the works and services to be supplied and the expenditure to be incurred in connection therewith, are at least determined annually in advance. The more accurate the programming and scheduling of the various projects are, the more accurate the financial planner can ascertain which funds will be spent during a particular period. Heads of departments can furnish reliable particulars of calculated expenditure for purposes of preparation of the budget which will then not be based on guesswork. The problem is often that although a head of a department may be in a position to state with reasonable accuracy **how much** a project will cost, he has not planned the execution of work with the same accuracy and is therefore, unable to state exactly **when** the expenditure will be incurred.
- (g) **The development of procedures** is necessary in order to ensure that the work as planned can be carried out without any hitch. By means of **work study** the best method for the execution of a particular type of work can be ascertained. Indeed, practical experience has taught most of us that one method of doing a thing is better than another. By making use of proven methods, standardising procedures and continually improving methods, increased efficiency in the execution of the work as planned becomes possible. The work itself is simplified as the plan of action and the procedures to be followed are known in greater detail to all concerned.
- (h) **Interpretation of policy decisions** must take place at an early stage so that the work does not come to a standstill as a result of some or other policy aspect which requires clarification. Policy decisions determine the conditions as well the circumstances under which the various jobs have to be carried out.

**3.3. Resume :** Viljoen "expresses himself as follows :

11. Viljoen, Prof. G. van N.: Speech in "Programmering vir Gekoördineerde Optrede" published in "Die Staatsampenaar", November, 1969.

en 'n waterpyp wat dieselfde gebied bedien, in dieselfde sloot geplaas word, om nie eers te praat van die opgraving van 'n pad kort na betering daarvan ten einde een of ander diensmiddel aan te lê nie. Wanneer verskillende departemente sekere hulpmiddele deel byvoorbeeld poelvrugmotors, stel dit die vervoersuperintendent in staat om betyds reëlings te tref vir die rasionele aanwending van sulke vrugmotors en vermindert dit die stadsraad se kapitale uitleg op vervoermiddele.

- (f) **Die voorsiening van fondse**, hetsy deur 'n munisipale inkomsteuitgawebegroting of 'n leningprogram, verg dat daar minstens jaarliks vooruit bepaal sal word welke werke of dienste voorsien behoort te word en welke uitgawe dit sal meebring. Hoe akkurater daar te werk gegaan is met die programmering en skedulering van die onderhawige projekte, hoe akkurater kan daar vasgestel word welke fondse binne 'n bepaalde tydperk bestee sal word. Dit maak dit derhalwe moontlik vir die departementshoofde om betroubare besonderhede van berekende uitgawes te verstrek en nie begroting, wat berus op raaiwerk, vir ooreweging aan hulle raad voor te lê nie. Die probleem is dikwels dat hoewel 'n departementshoof redelik akkuraat kan aandui **wat** 'n projek sal kos, hy nie deeglik genoeg vooruit beplan het om net so presies te kan sê **wanneer** die uitgawes aangegaan sal word nie.
- (g) **Die ontwikkeling van prosedures** is nodig om die werkverrigting wat goed beplan is, foutloos te laat verloop. Deur middel van **werkstudie** kan daar bepaal word wat die beste metode is om 'n bepaalde soort werk te verrig. Selfs die praktyk het die meeste van ons al geleer dat een metode beter as 'n ander is. Deur steeds op beproefde metodes voort te bou, daarop te standaardiseer en te verbeter, kan groter doeltreffendheid van beplande werkverrigting in die hand gewerk word. Dit vereenvoudig ook die werk wanneer almal bewus is van die plan van aksie en die prosedures wat gevolg moet word by die uitvoering daarvan.
- (h) **Die maak en vertolkting van beleidsvoorskrifte** in 'n vroeë stadium voorkom dat werkverrigting sloer of tot stilstand kom as gevolg van onduidelikheid omtrent een of ander beleidsaspek. Beleidsvoorskrifte bepaal die voorwaardes waaronder en die omstandighede waarin take verrig sal word.

**3.3 Opsomming :** Viljoen<sup>11</sup> druk homself soos volg uit :

11. Viljoen, prof. G. van N.: Toespraak oor „Programmering vir Gekoördineerde Optrede“ gepubliseer in „Die Staatsampenaar“, November 1969.

„Die harde werker, die oortydwerker, op lae en op hoë vlak, is nie altyd 'n verstandige werker nie. Die man wat sy lessenaar en sy lêers vir hom sy werk laat dikteer, weet meesal nie waarheen of waarom dit gaan nie. Hy verwaarloos die hoë plig om soms rustig terug te sit en te dink: die plig om **globaal** te dink deur die geheel van sy aktiwiteitsterrein te oorskou en om weer helder te formuleer presies waarheen en waarom dit alles gaan; en ook **analities** te dink deur al die elemente van die ketting van aktiwiteite te identifiseer en te ontleed, hulle noodsaaklikheid en hulle onderlinge samehang weer krities te beproef en hulle dan deur programmering rasioneel te orden. Dan kan hy weer aan die werk spring, maar nou volgens 'n meesterplan.”

#### 4. CO-ORDINATED ORGANISING.

**4.1 Introduction:** This element of management requires the arrangement of the work (the various jobs to one another) as well as the placing of workers in that work relationship which will be conducive to the most effective execution of the work. Dale<sup>12</sup> points out that in the world of today organisations of any size are in fact bureaucracies (government by means of bureaus or offices).

„That is, they have hierarchies of officials, each chosen for his supposed expertise in some phase of the work, and a man or a group of men at the top charged with co-ordination of the entire effort, plus some impersonal rules. They are not necessarily bureaucratic, however, in the sense that they are bogged down by the red tape”.

An organisation can best be depicted by means of an organisation chart indicating diagrammatically the status, role and function of each worker. The organisation chart is, therefore, elucidated by means of a job description for each functionary indicating the objective of his post, his duties and responsibilities, his liaison with other functionaries and the requirements that he must comply with.

#### 4.2 Organising, therefore, embraces —

- (a) **The design of a sound organisational structure,** that is, the identification of the work to be carried out in order to achieve given objectives, the grouping and co-ordinating of work in such a manner that well-balanced organisational units are formed, whilst entrusting to each functionary those responsibilities that are necessary to achieve the specified objectives without there being any overlapping of responsibilities or there being a function which has not been entrusted to someone.
- (b) **The delegation of authority commensurate with responsibilities.** Leading functionaries are often

„Die harde werker, die oortydwerker, op lae en op hoë vlak, is nie altyd 'n verstandige werker nie. Die man wat sy lessenaar en sy lêers vir hom sy werk laat dikteer, weet meesal nie waarheen of waarom dit gaan nie. Hy verwaarloos die hoë plig om soms rustig terug te sit en te dink: die plig om **globaal** te dink deur die geheel van sy aktiwiteitsterrein te oorskou en om weer helder te formuleer presies waarheen en waarom dit alles gaan; om ook **analities** te dink deur al die elemente van die ketting van aktiwiteite te identifiseer en te ontleed, hulle noodsaaklikheid en hulle onderlinge samehang weer krities te beproef en hulle dan deur programmering rasioneel te orden. Dan kan hy weer aan die werk spring maar nou volgens 'n meesterplan . . .”

#### GEKO-ORDINEERDE ORGANISERING

**4.1 Inleiding:** Hierdie element van bestuur verg die rangskikking van die werk (die in verband bring van take met mekaar), asmede die plasing van werkers in daardie onderlinge werksverband wat die meeste bevorderlik vir doeltreffende werkverrigting is. Dale<sup>12</sup> wys daarop dat in die moderne wêreld die meeste organisasies van enige grootte in werklikheid burokrasieë (regering deur middel van buro's of kantore) is.

„That is, they have hierarchies of officials, each chosen for his supposed expertise in some phase of the work, and a man or a group of men at the top charged with co-ordination of the entire effort, plus some impersonal rules. They are not necessarily bureaucratic, however, in the sense that they are bogged down by red tape.”

'n Organisasie word die beste deur middel van 'n organisasiekaart voorgestel wat die status, rol en funksie van die verskillende werkers diagrammaties poggend voor te stel. Verdere lig op die organisasiekaart word gewerp deur middel van 'n taakbeskrywing vir elke funksionaris wat aandui: doelwit van sy pos, pligte en verantwoordelikhede, skakeling met ander funksionarisse, vereistes gestel vir die bekleër van die pos.

#### 4.2 Organiserings behels derhalwe:

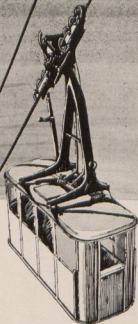
- (a) **Die ontwerp van 'n gesonde organisatoriese struktuur,** dit wil sê die identifisering van die werk wat gedoen moet word om gegewe doelwitte te verwesenlik, die groepering en koördinerende van werk om goedgebalanseerde organisatoriese eenhede te vorm terwyl in elke afdeling ingeword word daardie verantwoordelikhede wat nodig is om gemelde doelwitte te bereik sonder dat werksaamhede mekaar oorvleuel of dat sommige take niemand se verantwoordelikhede is nie.
- (b) **Die delegering van gesag in ooreenstemming met verantwoordelikhede.** Dit is geen ongewone ver-

12. Dale, E.: Op. cit. p. 184.

12. Dale, E.: Op. cit., p. 184.

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loathe to delegate some of their responsibilities and those that do delegate often sin by keeping all authority to themselves. Their sub-ordinates must, therefore, ensure that everything goes according to plan but are, due to lack of authority, unable to take the necessary action to ensure that this will be the case. Leading functionaries, therefore, find it easier to delegate **responsibility** without delegating **authority**. The view taken by Josephs<sup>13</sup> is: "It's not what an executive does that matters, it's what gets done". He has good advice for the person who finds it difficult to delegate; he advises him to first take stock of the situation and to decide which functions he must of necessity carry out himself and thereafter delegate some of his responsibilities and authority to his subordinates bit by bit. There is, however, a danger that too many responsibilities and too much authority may be delegated to merely a few exceptional subordinates. This is a mistake. Josephs points out that: "The principle of delegation is to spread the work, so beware of piling it all on a few bright, eager ambitious assistants". Successful delegation is, therefore, based upon confidence, interest in the progress of subordinates and good communication. According to Humble<sup>14</sup> the following requirements must be complied with from the point of view of the subordinate manager:

- ♦ say what is expected of me;
- ♦ give me an opportunity;
- ♦ tell me how I get on;
- ♦ give me guidance where necessary;
- ♦ pay me according to my contribution.

It is not unusual to find in the case of leading functionaries who delegate responsibilities and authority for the first time **that they fail in following up** the progress made by subordinates. **There must always be the necessary feedback of information.**

- (c) **The creation of sound relationships.** An organisational structure which is basically sound can fail to achieve the results expected from it if staff relationships are bad. Where ever people work in groups, teamwork is of the utmost importance. It is a requirement of teamwork that the members of the team identify themselves with the objectives provided by top management. If any one member of the team thwarts the efforts of

13. Josephs, R.: Article in "International Management", August, 1969. Author of "Streamlining Your Executive Workload".

14. Humble, W. Paper delivered before S.A. Institute for Personnel Management", September, 1966.

skynsel dat leidinggewende funksionaris se dit moeilik vind om van hulle verantwoordelikhede te deleger nie en dat diegene wat wel verantwoordelikhede deleger soms sondig deur alle gesag tot hul eie persoon te beperk. Die ondergeskikte(s) moet dus sorg dat sake steeds reg verloop maar kan weens gebrek aan gesag min doen om die verloop van sake te verander. Leidinggewende funksionaris se is gou om **verantwoordelikhede** te deleger maar deleger nie so gereedlik **gesag** nie. Josephs<sup>13</sup> se uitgangspunt is: „It isn't what an executive does that matters, it's what gets done." Vir die persoon wat dit moeilik vind om te deleger, het hy die goeie raad om eerstens voor.aad te neem van alles wat hy doen en daarna ten opsigte van daardie funksie wat hy nie noodwendig self hoef te vervul nie, gaandewag bietjie vir bietjie van sy verantwoordelikhede en gesag aan ondergeskiktes af te staan. Daar is egter 'n gevaar dat te veel verantwoordelikhede en gesag aan slegs die uitsonderlike ondergeskiktes gedeleger word. Dit is 'n fout. Josephs wys daarop dat: „The principle of delegation is to spread the work, so beware of piling it all on a few bright, eager, ambitious assistants". Suksesvolle delegering is derhalwe, gebaseer op vertroue, belangstelling in die vordering van ondergeskiktes en goeie kommunikasie. Gesien uit die oogpunt van die ondergeskikte bestuurder, moet daar volgens Humble<sup>14</sup> aan die volgende behoeftes voorsien word:

- ♦ sê wat van my verwag word;
- ♦ gee my 'n kans;
- ♦ sê hoe ek presteer;
- ♦ gee my leiding waar nodig;
- ♦ betaal my volgens my bydrae.

Nou is **die versuim om op te volg** nie 'n ongewone verskynsel by leidinggewende funksionaris se wat vir die eerste keer verantwoordelikhede en gesag deleger nie. **Daar moet steeds 'n toevoering van inligting** wees.

- (c) **Die daarstelling van gesonde verhoudings.** 'n Basies gesonde organisatoriese struktuur kan faal om die verwagte resultate te lewer indien personeelverhoudings ongesond is. Waar mense in groepe saamwerk, is spanwerk van die uiterste belang. 'n Vereiste vir spanwerk is dat spanlede hulle self identifiseer met die doelwitte wat deur die toeleiding daargestel is. Indien enige lid van die span dwarstrek of laat slaphang, doen hy afbreuk

13. Josephs, R.: Artikel in „International Management", Augustus 1969. Skrywer van „Streamlining your Executive Workload".

14. Humble, W.: Referaat gelewer voor S.A. Instituut vir Personeelbestuur, September 1966.



others or fail to pull his weight, his attitude must of necessity mitigate against the effectiveness of the team effort. If the person with such a negative attitude is, in addition, a leading functionary, it may happen that the entire team effort comes to nothing. It is, therefore, important that any deviation of the actual results achieved from the results expected from a team should be investigated in order to ascertain what the cause of such deviation is. Sound work relationships do to the organisation what oil does to the cocks of a machine.

- (d) **Maximum utilisation of work potential.** No worker is able to prove his worth if he is not given an opportunity to, in the first place, prove himself to himself and in the second place to prove himself to his superiors. It is of the utmost importance that more opportunities for subordinates to excel are continually created, without them being squeezed ripe! In a municipal undertaking, for example, an engineer can safely delegate responsibilities and authority to certain trained subordinates (technical assistants) but then he must do so with due regard to the correct approach, as set out in the above quotation from Humble.

**4.3 Resumé:** An organisation is a living organism. It should at all times be composed and adapted in a manner that will ensure the achievement of the stated objectives as effectively as possible at minimum cost. As circumstances change so the organisation must be adapted. One should never lose sight of the fact that experience has taught us certain definite principles of organisation. These principles can be summarised as follows:

- ♦ an organisation should strive after the achievement of clearly stated objectives;
- ♦ specialisation according to aptitudes and areas of interest increase productivity;
- ♦ co-ordination ensures that all action is aimed at the objective;
- ♦ a clear chain of command must be distinguished;
- ♦ authority must be commensurate with responsibilities;
- ♦ decisions should be taken on the lowest competent level;
- ♦ there should, as far as possible be unity of authority;
- ♦ the span of control must be in accordance with the ability of the leading functionary to control;
- ♦ the chain of command must be kept as short as

aan die spanpoging. As so 'n negatief- ingestelde persoon boonop 'n leidinggewende funksionaris is, kan hy die nele spanpoging lamlê. Dit is derhalwe belangrik om enige afwyking tussen die **werklike resultaat van die verwagte resultaat van 'n spanpoging te ondersoek** en presies vas te stel wat die aanleidende oorsaak is. Gesonde werksverhoudinge doen aan die organisasie wat olie aan die ratte van 'n masjien doen.

- (d) **Die maksimale benutting van werkspotensiaal.** Geen werker kan toon waartoe hy in staat is as hy nie 'n geleentheid gegee word om in die eerste plek homself teenoor homself en in die tweede plek homself teenoor sy meederes in gesag, te bewys nie. Dit is van die uiterste belang om steeds meer en meer geleenthede te skep vir ondergeskiktes om te presteer sonder om noodwendig personeel ryp te druk! In 'n munisipale onderneming kan, byvoorbeeld die ingenieur baie pligte, verantwoordelikhede en gesag veilig aan sekere opgeleide ondergeskikte persone (tegniese assistente) delegeer, maar dan moet hy dit doen met inagnome van die korrekte benadering tot sodanige delegering soos verduidelik deur Humble en ander hierbo aangehaal.

**4.3 Samevatting. 'n Organisasie is 'n lewende organisme.** Dit behoort te alle tye so saamgestel en ingestel te wees dat die vooropgesette doelwitte so doeltreffend moontlik verwesenlik kan word teen minimale koste. Soos omstandighede verander, moet die organisasie aangepas word. Daar moet egter nooit uit die oog verloor word dat die ondervinding geleer het dat daar definitiewe beginsels van organisasie is nie. Hierdie beginsels kan soos volg opgesom word:

- ♦ 'n organisasie behoort 'n duidelike doelwit na te strew;
- ♦ spesialisasie ooreenkomstig aanleë en belangstelling verhoog produktiwiteit;
- ♦ koördinering sorg dat alle handeling op die doelwit afstuur;
- ♦ 'n duidelik bevelsketting (gesagslyn) moet onderskei kan word;
- ♦ gesag moet in ooreenstemming met verantwoordelikeheid wees;
- ♦ beslissings behoort op die laagste bedrewe vlak gemaak te word;
- ♦ eenheid van gesag, dit wil sê sover moontlik net een baas;
- ♦ die spanwydte van beheer moet in ooreenstemming met die leidinggewende funksionaris se vermoë om te beheer wees;
- ♦ die bevelketting moet so kort moontlik gehou

possible (minimum organisational levels);

- ♦ division of work amongst departments must be well-balanced.

One should, however, guide against visualising and treating an official as merely a pawn. Industrial psychologists have proved that apart from the formal organisation there is also an **informal organisation**. The more the worker becomes frustrated, the greater the necessity to pay attention to the informal organisation. The achievement of an organisation's objectives can be seriously hampered should the informal organisation (social contact during teatime and after work) set itself objectives that clash with the objectives of the formal organisation.

## 5. ACTIVATING LEADERSHIP

**5.1 Introduction:** Some writers emphasise the concept motivation in order to describe the process of inducing the worker to take action. Others, in turn, emphasise communication. Usually not enough emphasis is laid on the fact that the responsibility to motivate or to communicate lies with the leading functionary. Not all leadership produces results. Leadership only succeeds if those who are being led react in the desired manner. For leadership to succeed, people must be activated to take the desired action. Leadership must have as its aim the harmonious action of various organisational units in order that the organisation as a whole can function in a co-ordinated manner. Much is, therefore, expected from the leader who must himself act basically correct in order to succeed as a leader.

### 5.2 Activating leadership comprises:

- (a) **Decision making:** that is, arriving at conclusions, the making of judgements, thereafter determining a course of action. An indecisive leader is unable to lead and soon loses the respect of those who have to follow him. Juran<sup>15</sup> points out that "future events have a way of sneaking in, as uninvited guests, behind today's decisions. The uninvited guests are of two main classes:

1. In deciding this case, we are committing ourselves to a whole course of action.
2. In deciding this case, we are setting a precedent for a host of cases".

No wonder that some leading functionaries find it easier to decide not to decide anything at all!

The following advice is offered to them:

word (minimum vlakke);

- ♦ werkverdeling tussen departemente moet gebalanseerd wees.

Daar moet egter daarteen gewaak word om die amptenaar bloot as 'n pion te sien en te behandel. Bedryfsielkundiges het bewys dat behalwe die formele organisasie daar ook 'n **informele organisasie** bestaan. Hoe meer werkers gefrustreerd is, hoe belangriker is dit om op die teenwoordigheid van die informele organisasie te let aangesien dit die verwesenliking van die organisasie se doelwit ernstig kan belemmer indien die informele organisasie (byvoorbeeld d.m.v. sosiale verkeer gedurende teetyd of na ure) homself doelwitte stel wat nie rym met die formele organisasie se doelwitte nie.

## 5. AKTIVERENDE LEIDINGGEWING

**5.1 Inleiding:** Sommige skrywers lê klem op die begrip motivering om die proses van aansporing tot handeling aan te dui. Andere weer beklemtoon kommunikasie. Gewoonlik word daar nie genoeg beklemtoon dat die verantwoordelikheid om te motiveer en te kommunikeer noodwendig in die leidinggewende funksionaris gesetel is nie. Nie alle leiding word noodwendig gevolg nie. Leidinggewing is geslaagd indien diegene wat die leiding ontvang korrek daarop reager. Leidinggewing moet dus mense kan aktiveer dit wil sê tot die gewenste handeling laat oorgaan. Leidinggewing moet daarop ingestel wees om die verskillende organisatoriese eenhede in harmonie met mekaar te laat optree sodat die organisasie in sy geheel gekoördineerd kan optree. Dit verg nogal baie van die bedryfsleier wat, om te kan slaag, 'n basies korrekte patroon van optrede moet volg.

### 5.2 Aktiverende Leidinggewing behels:

- (a) **Besluitneming**, dit wil sê die maak van gevolgtrekkings, die vel van oordele en die bepaling van 'n patroon van optrede. 'n Onbelsliste leier kan nie lei nie en verloor gou die agting van diegene wat hom moet volg. Juran<sup>15</sup> wys daarop dat „future events have a way of sneaking in, as uninvited guests, behind today's decisions. The uninvited guests are of two main classes:

1. In deciding this case, we are committing ourselves to a whole course of action.
2. In deciding this case, we are setting a precedent for a host of cases".

Geen wonder dat sommige leidinggewende funksionaris dit makliker vind om te besluit om nieks te besluit nie!

Vir diesulke is daar goeie raad:

15. Juran, J. M.: Article, "Making the Right Decision"—"International Management", 1967. Author of "Managerial Breakthrough".

15. Juran, J. M.: Artikel, „Making the Right Decision”—„International Management”, 1967. Skrywer van „Managerial Breakthrough”.

- ◆ define the problem properly;
  - ◆ collect, complete and accurate information that will shed light on the problem;
  - ◆ judge the actuality (importance) of the problem with reference to the present situation as well as the future;
  - ◆ think in terms of alternative solutions and find the best solution;
  - ◆ consult subordinates who must subsequently give effect to the decision.
- (b) **Communication.** In order to be of any value at all decisions must be communicated to and understood by those persons who are responsible for their execution. These workers must know precisely where, when and how they must act. Communication must, as far as possible be first hand. (direct) because the greater number of persons within the line of communication, the greater the possibility of distortion. The objective to be achieved by means of the communicated message must have an emotional impact, that is, it must take the worker's own feelings into account. Action (application) must follow as quickly as possible upon communication. Once a directive is issued, make the worker think and control that the results of his thought processes coincide with the objectives to be achieved.
- (c) **Motivation** entails the dynamics of behaviour viz., that propelling force that activates a worker to a desired response. An important aspect to bear in mind is that factors of motivation differ from community to community, from person to person and even within the same person. The satisfying of primary (biological) and secondary (psychological or social) needs plays an extremely important part in the worker's life. In our present economic and social structure the primary needs are comparatively easily satisfied and consequently the secondary motives like competition, participation, etc., become more and more dominant and have a greater motivation potential. Management cannot ignore the complex nature of motivation and work-motivation (job-motivation) can be seen as management's endeavour to fathom the worker's secondary needs and to satisfy them by means of incentives. (Because of hierarchy of motives their relative importance must be determined before a motivation-program for workers is embarked upon. The motivation potential of the following needs or drives, among others, should be utilised :
- ◆ **the need to participate:** a worker is inclined to make decisions, in which he participated, his own and to be less critical towards such. This
  - ◆ definieer die probleem behoorlik;
  - ◆ samel volledige en korrekte inligting in wat lig op die probleem kan werp;
  - ◆ beoordeel die wesenlikheid (belangrikheid) van die probleem met verwysing na die huidige sowel as toekomstige tydvakke;
  - ◆ dink in terme van alternatiewe oplossings en vind die beste oplossing;
  - ◆ raadpleeg ondergeskiktes wat die latere besluit moet uitvoer.
- (b) **Kommunikasie :** Om van enige nut te wees, moet besluite oorgedra word aan en verstaanbaar wees vir diegene wat uitvoering daaraan moet gee. Hulle moet presies weet waar, wanneer en hoe hulle moet optree. Kommunikasie moet sover moontlik eerstehands (regstreeks) wees want hoe meer persone in die kommunikasielyn, hoe groter die moontlikheid van verdraaiing. Die doelwit van dit wat met die gekommunikeerde boodskap bereik wil word, moet 'n emosionele inslag hê, dit wil sê met die werker se eie gevoelens rekening hou. Optrede (toepassing) moet so gou moontlik op kommunikasie volg. Sit die toehoorder aan die dink en kontroleer dat die resultate van sy denke ooreenstem met die oogmerke wat deur middel van die bepaalde opdrag bereik moet word.
- (c) **Motivering** dui op die dinamika van gedrag dit wil sê daardie stukrag wat die werker tot 'n gewenste handeling aktiveer. Daar moet pertinent rekening gehou word met die feit dat motiveringsfaktore verskil van gemeenskap tot gemeenskap, van persoon tot persoon en selfs binne dieselfde persoon. Die werker se bestaan draai om die bevrediging van primêre (biologiese) en sekondêre (sosiale of sielkundige) behoeftes. In die huidige ekonomiese en sosiale struktuur word eersgenoemde gereedlik bevredig en aldus raak sekondêre behoeftes byvoorbeeld erkenning, mededinging, deelname, ens. meer en meer dominerend en het dus 'n groter motiveringswaarde. Bestuur kan nie hierdie komplekse aard van motivering verontagsaam nie en werksmotivering kan dan ook gesien word as 'n poging van bestuur wat trag om die werker se sekondêre behoeftes te peil en dit te bevredig deur middel van aansporings of te wel stukragte tot gewenste optredes. As gevolg van die heriargie van behoeftes moet ook vasgestel word, by die motivering van werkers, wat die relatiewe belangrikheid van hulle onderskeie dryfvere is, wat inderwaarheid hulle motiveer om te werk. Die volgende dryfvere of drange, onder andere, se motiveringswaarde behoort benut te word :
- ◆ **die behoefte aan deelname :** 'n Werker is geneig om die beslissings waarin hy 'n aandeel gehad het sy eie te maak en inder krities daaroor

facilitates identification with the achieving of a set goal and in general fosters work morale.

- ♦ **the need for acknowledgement:** when workers receive earned credit it has a strengthening effect that motivates a repetition of the particular action.
  - ♦ **the need for competition:** competition stimulates initiative and ingeniousness because success has a positive influence on the worker's personality and work-attitude.
  - ♦ **the need of material gain:** to satisfy his complex needs incentives of a purely economic nature, may stimulate a worker to significant achievements in the work situation. These incentives have restrictions and are not necessarily the obvious choice.
- (d) **Team selection:** A successful leader knows which persons he must bring together to form a team, the members of which will co-operate harmoniously and effectively to ensure achievement of the specific objective. When the leader of an organisation has inherited an ineffective team he must, as soon as he knows the team members well enough, endeavour to improve the composition thereof by means of a system of job rotation. From time to time the opportunity will arise (as a result of resignations, reorganisation, staff transfers, etc.) to appoint better equipped persons to key positions. This, however, requires that the selection process should take place on the following basis:
- ♦ Specify the task clearly in terms of duties, responsibilities and authority;
  - ♦ determine the qualification specifications (personal specifications, educational and professional specifications and previous experience);
  - ♦ invite and consider applications with due regard to stated requirements;
  - ♦ test the applicants in order to determine whether they comply with the stated requirements.
  - ♦ conduct interviews in order to obtain additional information and to form a better image of the personality of an applicant;
  - ♦ appoint the most suitable applicant and acquaint him fully with his duties and responsibilities;
  - ♦ follow up on a continuous basis and raise the morale of the worker;
  - ♦ judge the worker's achievements with reference to the requirements laid down for his post;
- (e) **Personal development:** that is, acquainting the workers with their work by improving their
- te wees. Aldus vind identifikasie met die ver-wesenliking van 'n bepaalde doelwit geredeliker plaas;
- ♦ **die begeerte na erkenning:** Namate werkers verdienende krediet ontvang vir bydraes gelewer het dit 'n versterkings-effek wat herhaling van die betrokke optredes aanspoor;
  - ♦ **die behoefte aan mededinging:** Mededinging stimuleer inisiatief en vindingrykheid omdat sukses ook strekend inwerk op die werker se persoonlikheid;
  - ♦ **die behoefte aan materiële gewin:** Ten einde sy komplekse dryfvere te bevredig, kan aanspoerings wat bloot ekonomies van aard is, 'n werker soms tot groot prestasie stimuleer. Dit het egter beperkinge en is nie altyd die logiese aansporing nie.
- (d) **Spansamestelling.** Die goeie leier weet welke persone hy moet saamvoeg om 'n span saam te stel wat effektief en harmonieus sal saamwerk om 'n bepaalde doelwit te verwesenlik. Wanneer die bedryfsleier 'n swak span geërf het, moet hy maar probeer om, nadat hy die spanlede leer ken het, deur 'n uitruilingsproses die spansamestelling te verbeter. Van tyd tot tyd doen die geleentheid homself voor om, as gevolg van bedankings, her-organisasie, personeeloorplasing, ens. beter toegeruste persone in sleutelposisies aan te stel. Dit verg egter dat die keuringsproses op die volgende grondslae plaasvind:
- ♦ spesifiseer die taak in duidelike terme van pligte, verantwoordelikhede en gesag;
  - ♦ stel die kwalifikasie spesifikasies (persoonlike spesifikasies, opvoedkundige en professionele spesifikasies en vorige toepaslike ondervinding);
  - ♦ vra en oorweeg aansoeke met inagname van gestelde vereistes;
  - ♦ bepaal deur toetsing of die aansoekers aan die gestelde vereistes beantwoord;
  - ♦ voer onderhoude om bykomstige besonderhede te bekom en 'n beter beeld van die persoonlikheid van die persoon te verkry;
  - ♦ stel mees geskikte aansoeker aan en maak hom ten volle vertrouwd met sy pligte en verantwoordelikhede;
  - ♦ doen opvolgingswerk op gereelde grondslag en verhoog die moraal van die werker;
  - ♦ beoordeel die werker se prestasie met verwysing na vereistes gestel vir sy pos.
- (e) **Personeelontwikkeling,** dit wil sê die verbetering van kennis, vaardighede en werksbenadering van

knowledge, skills as well as attitudes towards the work. Training, personnel guidance, counselling and performance appraisal are often, if not generally, neglected by municipalities. Consider all the professional institutes which, apart from taking down examinations, do very little to furnish the municipal employee with any form of programmed training. How often does it not happen that the newcomer is left to himself to pick up the details of his work as best he can? Not only those performing routine work but also leading functionaries on all levels can profit by management development. Every functionary has one or more shortcomings that can be corrected through training. Every leading functionary has, therefore, a responsibility for the training of subordinate functionaries. Although every person has his limitations, he nevertheless has a claim to being developed to the maximum of his potential. However, the worker also has a duty in respect of his own development.

"No system of training can be a substitute for what an individual can achieve for himself. The aim of good management training practice must be to provide the means by which, under the guidance of competent supervisors, a manager can help himself".<sup>16</sup>

**5.3 Resumé:** Allen<sup>16a</sup> explains the function of leading in the following terms:

"A leader is one who guides and directs other people. Because he has others subordinate to him and subject to his command, the leader must give their efforts direction and purpose . . . **leadership is a kind of work.** It is not the exudation of a special psychic quality or the exercise of a unique combination of personality traits. All kinds of people can be leaders just as all kinds can be led . . . **all work performed by leaders is not management work.** This helps to explain why, although a good manager must be an effective leader, many outstanding leaders, in fact, have been exceedingly poor managers . . . A person is **born** with the talent for personal leadership; he must **learn** management leadership".

**6. CONTROLLING**

**6.1 Introduction:** The process of controlling

16. Hunt, Sir Joseph: Chairman, "Management Training and Development Committee of Central Training Council", United Kingdom.  
16a. Allen, L. A.: op cit., p. 5.

werkers deur middel van behoorlike bekendstelling met die werk. Opleiding, persoonlike voorligting en raadgewing en prestasiebepaling word dikwels indien nie vry algemeen nie, deur munisipaliteite verwaarloos. Dink maar aan al die professionele institute wat, hoewel hulle hier en daar eksamens afneem, bloedweinig doen om geprogrammeerde opleiding vir munisipale amptenare te voorsien. Hoe dikwels gebeur dit nie dat die nuweling maar sy weg moet vind so goed as wat hy kan nie? Hoeveel makliker sal hy dit nie vind en hoe waardevoller sal sy dienste nie wees indien duidelike procedure-handleidings van die begin af tot sy beskikking is nie? Nie slegs roetine werkers nie, maar ook leidinggewende funksionaries op alle vlakke kan by bestuursontwikkeling baat. Elkeen van hierdie funksionaries het een of meer tekortkominge wat deur opleiding reggeskaaf kan word. Elke leidinggewende funksionaris het derhalwe 'n opleidingsverantwoordelikheid teenoor funksionaries wat ondergeskik aan hom is. Elke persoon het sy beperkinge maar het 'n aanspraak om te ontwikkel tot die maksimum bedreweheidsspeil wat sy eie beperkinge toelaat. Die werker het egter ook 'n plig ten opsigte sy eie ontwikkeling.

"No system of training can be a substitute for what an individual can achieve for himself. The aim of good management training practice must be to provide the means by which, under the guidance of competent supervisors, a manager can help himself".<sup>16</sup>

**5.3 Samevatting:** Allen<sup>16a</sup> verduidelik die funksie van leidinggewing volg:

"A leader is one who guides and directs other people. Because he has others sub-ordinate to him and subject to his command, the leader must give their effort direction and purpose . . . **leadership is a kind of work.** It is not the exudation of a special psychic quality or the exercise of a unique combination of personality traits. All kinds of people can be leaders just as all kinds can be led . . . **all work performed by leaders is not management work.** This helps to explain why, although a good manager must be an effective leader, many outstanding leaders, in fact, have been exceedingly poor managers . . . A person is **born** with the talent for personal leadership; he must **learn** management leadership".

**6 BEHEERUITOEFENING**

**6.1 Inleiding:** Deur beheeruitoefening word, deur

16. Hunt, Sir Joseph, Voorsitter, "Management Training and Development Committee of Central Training Council", Verenigde Koninkryk.  
16a. Allen, L. A.: op cit., p. 5.

ensures that tasks are properly carried out and makes use of control measures that have stood the test of time. The modern concept of controlling embraces a system which not only provides a historical regard of what takes place in an undertaking, but focusses attention on the reasons why certain things actually happened and furnishes opportunities to the executive to make course corrections in the event of the organisation being found to be on the wrong track. The Bible teaches us that a tree is known by the fruit it bears. Similarly, the results of a worker's labour must ever be measured quantitatively as well as qualitatively. This is not an easy task especially where there is a great diversity of work and when the workers are numerous.

**6.2** Traditionally, the process of control in a local authority embraces the preparation of a financial plan (the revenue and expenditure as well as the loan fund budgets) which determines the activities of the municipality for a period of 12 months. When dealing with the concept of planning, as has already been pointed out, the better the prior fact collection and interpretation, the better the financial plan will be. When the budget is based merely on rough estimates and wild guesses and when endeavours are subsequently made to keep expenditure strictly within the limits of the budget, such a budget loses much of its value as a system of control. When necessary deviations from the budget are properly analysed, such investigations can make a valuable contribution towards more realistic budgeting in the future. Neither does it mean to say that everything is in order when expenditure is kept within the limits of the budget. It can happen that such liberal provision is made for expenditure that even with a waste of labour, materials and plant it is unlikely that a vote will be overspent. It is, therefore, necessary that methods should be developed by the aid of which the fruits of labour can be measured quantitatively as well as qualitatively.

**6.3 The development of standards of performance:** (that is, those standards with the aid of which the work of subordinates can be measured with reference to the predetermined objectives, policy directives, programmes, schedules and budgets), thereby enabling the responsible authority to judge performance objectively instead of subjectively. With subjective performance appraisal, the appraiser approaches the results from the point of view of his own sense of values. The dentist probably sees his client as a bunch of teeth surrounded by a body, whilst to the undertaker we are potential corpses. Examples of appraisal standards that can be applied to a municipal undertaking are: cost standards for specific types of work, physical standards such as square meters road tarred or re-

die aanwending van beproefde kontroles, verseker dat iake oehoorlik uitgevoer word. Die moderne opvatting van bekeeruitoefening behels 'n sisteem wat nie slegs 'n historiese rekord is van wat in 'n bedryf gebeur nie, maar laat die soeklig val op die redes waarom sekere dinge wel gebeur het, en voorsien gegewens wat die uitvoerende gesag in staat stel om rigtingaanpassings te maak indien daar gevind word dat die organisasie die spoor byster geraak het. Die Bybel leer ons dat die boom aan sy vrugte geken sal word. So moet die vrugte van die werker se arbeid steeds kwantitatief asook kwalitatief beoordeel word. Wanneer die werk uiteenlopend en die werkerskorps groot is, is dit geen geringe taak nie. Hoe groter die werkerskorps, hoe belangriker word die beheerfunksie want hoe groter is die gevaar van ondoeltreffende werkverrigting en verkwisting.

**6.2. Beheeroefening by 'n plaaslike owerheid** beheis tradisioneel die opstel van 'n finansiële plan (begroting van inkomste en uitgawe asook leningsfondsbegroting) wat twaalf maande van die munisipaliteite se werksaamhede reël en aan bande lê. Daar is reeds onder die bespreking van die begrip beplanning daarop gewys dat hoe beter die voorafgaande feite insameling en -vertolking, hoe beter die finansiële plan. Wanneer die begroting bloot op rowwe ramings en wilde vooruitskattings berus en daar dan agterna gepoog word om uitgawes streng binne die perke van die bedrae waarvoor begroot is te hou, mis die begroting in 'n groot mate sy doel as 'n beheermiddel. Indien die noodsaaklike afwykings van die begroting analities ondersoek word, kan dit egter bydra om in die toekoms meer realisties te begroot. Wanneer uitgawes binne die neergelegde perke bly, wil dit egter nog nie sê dat alles oodwendig reg is nie. Dit kan gebeur dat daar so ruimskots vir uitgawes voorsiening gemaak is dat dit onwaarskynlik is om selfs met verkwisting van arbeid, voorrade en hulpmiddels 'n begrotingspos te oorspandeer. Dit is derhalwe nodig om ander metodes te ontwerp en te ontwikkel met behulp waarvan die vrugte van die arbeid kwantitatief en kwalitatief beoordeel word.

**6.3 Die ontwikkeling van prestasie-standaarde** (dit wil sê daardie maatstawwe waarmee die werk van ondergeskiktes gemeet kan word met verwysing na gestelde doelwitte, beleidsvoorskrifte, programme, skedules en begrotings), stel die verantwoordelike gesag in staat om prestasie objektief in plaas van subjektief te beoordeel. Met subjektiewe prestasie-beoordeling benader die beoordeelaar die resultaat vanuit die oogpunt van sy eie sin vir waardes. Vir die tandarts is elkeen van ons 'n klomp tande omring deur 'n liggaam terwyl die begrafsionondernemer ons as potenssiële lyke sien. Voorbeelde van prestasie-standaarde vir 'n munisipale onderneming is koste-standaarde vir bepaalde tipes werk, fisiese standaarde soos vierkante meter pad beteer of herseël, lengte randsteen gelê, kubieke meter

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sealed, length of kerb/ing laid, cubic metres rock blasted, metres of cable laid, number of domestic wiring systems inspected, the number of enquiries attended to and even a negative standard such as the absence of complaints concerning refuse removal services!

**6.4 The measuring of performance** against the set standard is, however, of the utmost importance if the standards are to be of any value. Measurement requires that the progress and quality of the work should be determined on a continuing basis. Work can be measured by means of:

- reports that are clear and meaningful and preferably measure the work against previous results obtained. A report may deal with financial aspects or may draw physical comparisons. The problem with reports is that, although in the reading thereof one obtains certainty as to what has been done, the controlling authority is not sure that the results could not have been improved upon. The problem is also that many compilers of reports make the mistake of assuming that the more detail a report contains, the more valuable these reports become as a controlling measure. The arduous task of compiling such reports is seldom rewarded by a painstaking reading or study thereof. As Newman<sup>17</sup> points out, this is no new problem. Lord Wellington wrote as follows from Spain in 1810 to the British Secretary for War, Lord Bradford:

"My Lord,

If I attempted to answer the mass of futile correspondence that surrounds me, I should be debarred from all serious business of campaigning.

I must remind your Lordship — for the last time — that so long as I retain an independent position, I shall see that no officer under my command is debarred by attending to the futile drivelling of mere quill driving in your Lordship's Office — from attending to his first duty — which is, and always has been so to train private men under his command that they may, without question, beat any force opposed to them in the field".

- returns that indicate in detail particulars of completed work enable the expert supervisor to form a reasonably accurate impression of the work output but is of little assistance to the lay councillor;
- inspection is another measure upon which too much reliance is often placed. It is usually easy to bluff the inspector if such inspection is not on continuous basis and this is a costly affair!

**6.5 Evaluating of results** is therefore necessary. Deviations from the predetermined norms must be ascertained. The simplest method is to set a reasonable **target date** for the completion of a particular task.

17. Newman, W. H.: op. cit., p. 423.

rots weggeskiet, lengte kabel gelê, getal huisbedradings.eelseis ondersoek, getal navrae beantwoord en selfs 'n negatiewe standaard soos afwesigheid van klages oor die reinigingsdiens!

**6.4. Die meting van prestasies** aan die hand van gestelde standaarde is egter noodsaaklik anders is die standaard self van min waarde. Meting verg die deurlopende bepaling van die stand en kwaliteit van werk dat gedoen word of reeds afgehandel is. Meting kan geskied deur middel van

- verslae wat duidelik en insiggewend moet wees en verkieslik resultate moet meet teen vorige goeie prestasies. 'n Verslag kan oor finansiële aspekte gaan of fisiese vergelykings tref. Die probleem met verslae is dat hoewel daar (by die lees daarvan) sekerheid bestaan oor wat bereik is, die beherende gesag nie seker is dat daar nie beter gedoen kon gewees het nie. Die probleem met verslae is dat baie ops.ellers die fout begaan om te dink dat hoe meer detail dit bevat, hoe nuttiger dit noodwendig as 'n beheermiddel moet wees. Die geswoeg met die opstel van sulke verslae word selde beloon deur die noukeurige deurlees daarvan. Dit is soos Newman<sup>17</sup> daarop wys, geen nuwe probleem nie. Lord Wellington skryf soos volg in 1810 vanaf Spanje aan die Britse Sekretaris vir Oorlog, Lord Bradford:

„My Lord,

If I attempted to answer the mass of futile correspondence that surrounds me, I should be debarred from all serious business of campaigning.

I must remind your Lordship — for the last time — that so long as I retain an independent position, I shall see that no officer under my command is debarred by attending to the futile drivelling of mere quill driving in your Lordship's Office — from attending to his first duty — which is, and always has been, so to train private men under his command that they may, without question, beat any force opposed to them in the field.";

- opgawes wat in detail aandui welke resultate behaal is, stel die deskundige toesighouer in staat om 'n redelike goeie beeld van werksprestasie te bepaal, maar laat die leke-raadslid koud;
- inspeksie is 'n metode waarop daar miskien te veel staatgemaak word. Dit is gewoonlik maklik om wanneer inspeksie nie voltyds en deurlopend is nie (en dit is baie duur) die inspekteur te bluff.

**6.5. 'n Waardebepaling van resultate** is derhalwe nodig. Afwykings van die norme wat vooraf gestel word, moet bepaal word. Die maklikste wyse is om redelike **doeldata** te stel vir die afhandeling van 'n

17. Newman, W. H., op. cit., p. 423.



Where the task is completed timeously, there is little reason for complaint except if too much time for its completion is being allowed for in the first instance. Comparisons can, however, be drawn with the results obtained when tackling a subsequent task of a similar nature. The object is not a system of slave driving but merely to obtain a reasonable day's good work from every employee. The constant completion of work of a satisfactory standard on or before specified target dates is a good reason for increasing the worker's pay.

**6.7 Corrective action** must be taken as soon as a deviation from the set standard comes to light. It may happen, in a particular set of circumstances, that the predetermined standard is unrealistic or that unforeseen factors have caused unsatisfactory performances. What is very important, is that the cause of each deviation must be accurately determined. If this is not done, corrective steps cannot be taken. It may happen that a deviation takes place as a result of a problem in personnel relationship, as a result of problems of motivation (monetary rewards too low, too little job satisfaction, boredom, etc.), undue delay in delivering of material, or machinery that has become obsolete. When deviations from the standards set are not determined on a continuing basis, reduced productivity can take place long before the supervisor becomes aware of such fact.

**6.7 The principle of management by exception** approaches the controlling function from the point of view that one should not concern oneself with that which happens according to plan. It implies, however, that there should be a plan, a programme or time schedule against which performance can be measured and deviations determined. Such a system does not weary the controlling functionary with detail. **That which requires his attention is brought to his notice pertinently.**

**6.8** The practising of certain principles of control increase the effectiveness of control.

(a) **"The small foxes that spoil the vineyard"**

In any group of occurrences a small number of causes can be expected to give rise to the largest proportion of results. In every group one can expect to find workers that do most of the work, make most of the mistakes, are either exceptionally brilliant or extremely dull. When for example damage to machinery or vehicles is investigated, it will be found that a small number of employees are responsible for the majority of these occurrences. The value of the principle of watching out for the small foxes lies therein that most of our attention and resources should be concentrated on the **identification and control of a small num-**

bersondere taak. Indien die taak dan betyds afgehandel is, is daar geen rede vir kommer nie, behalwe ingeval te veel tyd oorspronklik toegestaan is. Dit kan egter beproef word met die resultate behaal by 'n daaropvolgende gelyksoortige taak. Die doel is nie 'n soort slawedrywery nie, maar om slegs 'n redelike dag se goeie werk van elke werker te verkry. Konstante afhandeling van werk van bevredigende gehalte op of voor 'n gegewe doeldatum is goeie beweegrede vir hoër besoldiging.

**6.6 Korrektiewe optrede** moet so gou moontlik volg nadat afwykings van die gestelde standaard aan die lig gekom het. Dit kan wees dat die standaard wat in die besondere omstandighede gestel is, onrealisties is, of dat onvoorsiene omstandighede die oorsaak van die onbevredigende toedrag van sake is. Wat van die uiterste belang is, is dat die oorsaak van elke afwyking met juistheid vasgestel sal word. Indien dit nie gedoen word nie, kan die regte korrektiewe stappe nie gedoen word nie. 'n Afwyking kan ontstaan as gevolg van verhoudingsprobleme in die betrokke groep, gebrek aan motivering, (te lae besoldiging, te min werksbevreeding, verveeldheid, ens.) onnodige oponthoud met aflewering van materiaal, masjinerie wat ondoeltreffend geraak het as gevolg van ouderdom. Wanneer afwykings van die standaard nie deurlopend bepaal word nie, kan dalende produktiwiteit intree lank voordat die toesighouer daarvan bewus is.

**6.7 Die uitsonderingsbeheerbeginsel** benader die beheeruitoefeningstaak vanuit die standpunt dat 'n mens jou tog nie hoef te bekommer oor dit wat volgens plan verloop nie. Dit impliseer egter dat daar wel 'n plan, 'n program of tydskedule sal wees waaraan die werkverrigting gemeet kan word en afwykings bepaal word. So 'n sisteem vermoei nie die beherende funksionaris met detail nie. **Dit wat sy aandag vereis, word pertinent onder sy aandag gebring.**

**6.8.** Die handhawing van sekere beginsels van beheer verhoog die doeltreffendheid daarvan.

(a) **Die klein vossies wat die wingerd bederf.**

By enige aantal voorvalle kan verwag word dat 'n geringe aantal oorsake vir die grootste persentasie van die ongewenste gevolge verantwoordelik is. In elke groep is daar diegene wat die meeste werk lewer of die meeste foute maak, besonder briljant of besonder dom is. Wanneer byvoorbeeld skade aan masjinerie of voertuie ondersoek word, sal gevind word dat 'n klein getal werknemers vir die meeste voorvalle verantwoordelik is. Die waarde van die beginsel van te let op die klein vossies lê daarin dat ons die grootste gedeelte van ons aandag en bronne kan toespits op die uitkenning en beheer van die geringe voorvalle met ernstige gevolge.

ber of occurrences with continuing serious consequences.

(b) **Control must be exercised at the right point**

The right point is the place where the action takes place. Newman<sup>18</sup> gives several hints for choosing the best points of control and comes to the following conclusions:

"Considerable judgment is necessary to figure out the best control points in a particular operation. Important considerations in picking up these strategic points are:

- (1) catching important deviations in time to take corrective action;
- (2) practicability and economy in making observations;
- (3) providing at least some comprehensive controls that consolidate and summarise large blocks of detailed activities; and
- (4) securing a balance in the control so that some aspects of the work, such as building a long-run goodwill, or developing executives, will not be slighted because of close controls in other phases".

(c) **Self control by the worker is the best control**

The worker is naturally averse to corrective measures imposed by others. If, however, a method exists by means of which his own deviations can be ascertained, analysed and corrected by himself, such corrections will not only be better but be of more lasting value.

**6.9 Resumé:** Once plans of action have been formulated, the necessary means provided, directives issued and guide lines provided, the executive functionaries must resort to action and ensure that the end results will be in accordance with the plans as formulated. The successive steps of the process of controlling is: preparation of standards at strategic points, investigations into and reports on performances, discovery of deviations (if any) and the taking of corrective action (where necessary). Every type of action, secretarial, financial, technical, educational, etc., determines by virtue of its own nature the form which the performance standards should take, how progress should be measured and how corrective steps should be taken. In every situation where corrective action has to be taken, the underlying causes of the deviations should be discovered. These causes may be of an organisational or technical nature or may spring from problems in relationships or may be due to lack of motivation.

## 7. CONCLUDING REMARKS

**7.1** From the above viewpoints of the various

(b) **Beheer moet by die regte plek toegepas word.**

Die regte punt is die plek waar die handeling geskied. Newman<sup>18</sup> gee wenke vir die kies van die beste beheerpunte en kom dan tot die volgende gevolgtrekking:

„Considerable judgment is necessary to figure out the best control points in a particular operation. Important considerations in picking these strategic points are—

- (1) catching important deviations in time to take corrective action;
- (2) practicability and economy in making observations;
- (3) providing at least some comprehensive controls that consolidate and summarise large blocks of detailed activities; and
- (4) securing a balance in the control so that some aspects of the work, such as building a long-run goodwill, or developing executives, will not be slighted because of close controls in other phases".

(c) **Die beste beheer is deur die werker self.**

Die werker is van nature gekant teen korrektiewe maatreëls deur ander toegepas. Indien hy egter om 'n metode beskik om sy eie afwykinge raak te sien, te ontleed en reg te stel, sal sulke regstellings nie slegs beter nie, maar meer blywend wees.

**6.9. Opsomming:** Sodra planne van optrede uitgewerk is, die nodige middele beskikbaar is, opdragte gegee en riglyne verskaf is, moet die uitvoerende funksionarisse aan die werk spring en sorg dat die resultate ooreenkomstig die vooropgestelde planne sal wees. Die opeenvolgende stappe in die beheeruitvoeringsproses is: opstel van standaarde by strategiese punte, ondersoek en verslag doen oor prestasies, bepaling van afwykinge (indien enige) en die doen van korrektiewe stappe (waar nodig). Elke soort handeling, sekretarieel, finansiële, tegniese, opvoedkundig, ens. bepaal uiteraard welke vorm prestasie-standaarde sal aanneem, hoe afwykings gemeet en hoe korrektiewe stappe gedoen moet word. In elke situasie waar korrektiewe optrede nodig is, moet die grondoorzaak van die afwyking vasgestel word. Hierdie oorsake kan organisatories en tegniese van aard wees of selfs spruit uit verhoudingsvraagstukke of gebrek aan motivering.

## 7. SLOTOPMERKINGS

**7.1** Dit moet vir die meeste lesers uit bostaande

18. Newman, W. H.: op. cit., pp. 414—418.

18. Newman, W. H., op. cit., pp. 414—418.

experts in the field of managerial science, it is clear that planning, organising, co-ordinating, directing and controlling the work of other persons is an **integrated process that takes place or should take place continuously**. If any element of management is defective, the end result of a manager's efforts must necessarily fall short of expectations. A mere knowledge of the principles and techniques of management does not necessarily ensure success. The manager must, according to Allen<sup>19</sup> be ever mindful of the following requirements of sound management :

- ◆ skill in application of management techniques;
- ◆ constructive planning of progress;
- ◆ the adaptation of the organisation on a continuous basis to ensure sound growth;
- ◆ control must be meaningful and goal orientated.

7.2 Above all the manager must ever be mindful of the fact that he is dealing with people. He is advised to take note of the following hints taken from "Executive Report, International Management", May, 1968 :

**"Learn what makes your staff tick**

If you want to get the most out of your staff, try to understand what makes them tick. Then, you can motivate them. Employees fall into six main psychological groups, says America's Kirk-West Corporation in Management Cross-Sections. These are listed below with some advice on how to treat each one :

- ◆ Employee who seeks security — cautious about money, health and opinions; plans his day in advance, seeks advice frequently, never takes chances. Don't throw him into a job 'cold' because he is too insecure to think his way through it. Re-assure him often.
- ◆ Employee who wants perfection—makes great sacrifices to do the job right; feeds on his accomplishments and thinks no one else can do as well. Challenge him with difficult tasks, for he will succeed under pressure. Allow him as much freedom as you can.
- ◆ Employee who needs attention — may shower his superiors with suggestions and will argue at length to get his ideas across; if given too little attention, he may slow down his production. Compliment him. Until he learns to give his colleagues the centre of the stage when they deserve it, he is not considered good management material.
- ◆ Employee who loves responsibility — likes to feel indispensable and wishes the boss would leave town

gesigpunte van die onderskeie deskundiges op die gebied van die bestuurskunde duidelik wees dat **bestuur** die beplanning, organisering, koördinerig, dirigerig en beheer van die werk van ander persone, 'n **geïntegreerde proses is wat voortdurend plaasvind of behoort plaas te vind**. Indien enige element van bestuur swak is, moet die resultaat van die bestuurder se pogings noodwendig kortskiet. Blote kennis van bestuurbeginsels en bestuurstegnieke verseker nie noodwendig sukses nie. Die bestuurder moet volgens Allen<sup>19</sup> steeds gedagtig wees aan die volgende vereistes :

- ◆ behendigheid by toepassing van bestuurstegnieke;
- ◆ konstruktiewe voortuitgang moet beplan word;
- ◆ die organisasie moet deurloopend aangepas word om gesonde groei te bevorder;
- ◆ beheer moet betekenisvol en doelgerig wees.

7.2. Bowenal moet die bestuurder gedurig gedagtig daaraan wees dat hy met mense te doen het. Hy kan gerus let op die volgende wenke geneem uit „Executive Report, International Management”, Mei 1968 :

**„Learn what makes your staff tick**

If you want to get the most out of your staff, try to understand what makes them tick. Then, you can motivate them. Employees fall into six main psychological group, says America's Kirk-West Corporation in Management Cross-Sections. These groups are listed below with some advice on how to treat each one :

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- ◆ Employee who needs attention — may shower his superiors with suggestions and will argue at length to get his ideas across; if given too little attention, he may slow down his production. Compliment him. Until he learns to give his colleagues the centre of the stage when they deserve it, he is not considered good management material.
- ◆ Employee who loves responsibility — likes to feel indispensable and wishes the boss would leave

19. Allen, L. A.; op. cit., pp. 16, 17.

19. Allen, L. A., op. cit., pp. 16, 17.

so he could run the whole show.

Give him responsibility but clearly define the limits of his authority; otherwise he will step into your shoes at the slightest opportunity.

- ◆ Employee who seeks prestige—tries to keep up with the latest developments and wants to be thought an expert; will answer every question even if he is uninformed about it; mingles with people above his level.

Make him feel important. The more essential you make him feel, the better will be his work.

- ◆ Employee who needs approval—wants to be liked by everyone, including strangers, and sometimes neglects his duties to help others.

Handle him gently. Harsh criticism will undermine him and render him valueless for a month".

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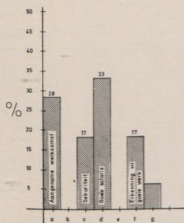


Fig. I  
(Stadsingenieur)  
(Town Engineer)

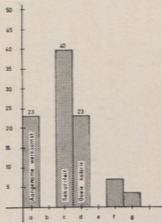


Fig. II  
(Dept BBOV)  
(Dept CPPT)

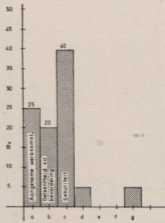


Fig. III  
(Dept von die Adm Best)  
(Dept of the Adm Man)

## Plan of action for long range planning by a City of medium size

**OBJECTIVE:** To determine the need for municipal works and services for the ensuing 20 years on a continuing basis and having due regard to limited sources of income, to prepare effective plans of action to satisfy the needs as and when they occur.

No.	SUBJECT	ACTIVITY	LIAISON AND CO-ORDINATION
1	Boundaries	Determine the final boundaries of area for which a plan will be prepared	(a) With adjacent/nearby local authorities in regard to their plans for expansion (b) With higher authorities (provincial authorities) in regard to matters of policy (c) With regional planning bodies (if any)
2	Statistics	(a) Creation of a statistical office (b) Collection on a continuous basis of relevant data, e.g. population growth, buildings completed (classified into number of dwellings, flats, floor area for business purposes, floor area for industrial purposes) water consumption, electricity consumption, number of refuse removal services rendered, visits to clinics, visits to libraries, vehicles licensed, etc. (c) Interpretation of the abovementioned data and discovery of trends (d) Forecasting future needs and trends	(a) By municipal departments mutually (b) With Government Statistical office (c) With organisations making similar surveys (d) With Universities and other bodies that undertake economic studies
3	Population	(a) Ascertaining and measuring of trends, i.e., net increase or decrease up to planning date having due regard to factors that stimulate township development as well as other forms of development (b) Analysis of population composition according to income groups, language groups and racial groups. (c) Quantitatively and Qualitatively determining of needs of each in respect of housing, municipal works services	(a) With township developers (b) With Department of Community Development in regard to housing policy
4	Transport and traffic flow	(a) Determining of net increase/decrease of number of licensed vehicles as well as average number of vehicles per family (b) Ascertaining direction and intensity of traffic flow (c) Ascertaining development potential of public transport systems (d) Determining demand for public transport in the light of conditions that have influence thereon	(a) With educational authorities in regard to siting of schools (b) With S.A. Railways in regard to proposed new lines and the expansion of existing lines (c) With public transport suppliers (d) With provincial authorities in regard to highway planning that may influence traffic flow (e) With neighbouring local authorities in regard to their own highway planning
5	Main and secondary road networks	Ascertaining by reference to 4 above, geographical factors, cost of land, etc., best possible situation for new main and secondary roads, also which of the existing roads should be widened as well as the number and type of interchanges necessary to facilitate traffic flow	(a) With township developers (b) With town and regional planning authorities (c) With provincial planning authority (d) With neighbouring local authorities

## Plan van aksie vir langtermynbeplanning deur 'n mediumgrootte stadsowerheid

**DOELWIT:** Om op 'n deurlopende grondslag die behoeftes aan munisipale werke en dienste vir die volgende 20 jaar te bepaal en, met inagnome van beperkte finansieringsbronne, effektiewe planne van aksie op te stel om daardie behoeftes te bevredig soos hulle ontstaan.

No.	ONDERWERP	AKTIWITEIT	SKAKELING EN KO-ORDINASIE
1	Grense	Bepaal finale grense van gebied waarvoor beplan word.	(a) Met aangrensende/nabygeleë plaaslike owerhede ten opsigte van hulle uitbreidingsoogmerke. (b) Met hoër gesag (Provinsiale Owerheid) in verband met beleidsoorwegings. (c) Streeksbeplanningsorganisasies (indien enige).
2	Statistiek	(a) Skepping van eie Buro van Statistiek. (b) Insameling op deurlopende basis van tersaaklike gegewens, byvoorbeeld bevolkingsaanwas, geboue opgerig (met klassifikasie in getal woonhuise, woonstelle, vloerruimte vir sakdoel-eindes, vloerruimte vir fabrieksdoel-eindes), watervrbruik, elektriese kragverbruik, getal vuilgoedverwyderingsdienste gelewer, kliniekbesoeke, biblioteekbesoek, gelisensieerde voertuie, ens. (c) Vertolking van bogenoemde gegewens en neigings geopenbaar. (d) Voorspelling van toekomstige behoeftes en neigings.	(a) Munisipale departemente onderling. (b) Met Staatsburo vir Statistiek. (c) Met organisasies wat soortgelyke opnames maak. (d) Met universiteite en ander liggame wat ekonomiese studies maak.
3	Bevolking	(a) Bepaling en meting van tendense, dit wil sê netto toename of afname tot en met beplanningsdatum, met inagnome van faktore wat dorpsstigting en ander vorme van ontwikkeling stimuleer. (b) Ontleding van samestelling in inkomstegroepe, taalgroepe en rasse-groepe. (c) Kwantitatiewe en kwalitatiewe bepaling van behoeftes ten opsigte van: behuising; munisipale werke en dienste.	(a) Met dorpsontwikkelaars. (b) Met Departement van Gemeenskapsbou ten opsigte te van behuising-beleid.
4	Vervoer en Verkeersvloei	(a) Bepaling van netto toename/afname in getal gelisensieerde voertuie asook gemiddelde getal voertuie per gesin. (b) Bepaling van inrigtings- en intensiteit van verkeersvloei. (c) Bepaling van ontwikkelingspotensiaal van publieke vervoerselsels. (d) Bepaling van vraag na publieke vervoer in lig van omstandighede wat 'n uitwerking daarop het.	(a) Met onderwysowerhede in verband met plasing van skole. (b) Met Suid-Afrikaanse Spoorweë in verband met beoogde nuwe trajekte en uitbouing van bestaande trajekte. (c) Met publieke vervoerondernemers. (d) Met Provinsiale Owerheid in verband met hoofwegbeplanning wat verkeersvloei mag beïnvloed. (e) Met aangrensende plaaslike owerhede in verband met hulle hoofwegbeplanning.
5	Hoof- en Sekondêre Padnetwerke	Bepaal met verwysing na 4 hierbo, geografiese faktore, grondkoste, ens, wat die mees geskikte ligging van nuwe hoof- en sekondêre paas sal wees, welke bestaande paasie wyer gemaak moet word asmede hooftelheid en aard van wisselaars nodig om verkeer beter te laat vloei.	(a) Met dorpsstigters. (b) Met dorps- en streeksbeplanningsowerhede. (c) Met provinsiale beplanningsowerhede. (d) Met naburige plaaslike owerhede.

No.	SUBJECT	ACTIVITY	LIAISON AND CO-ORDINATION
6	Business centres	<p>(a) Determine the locality of the various regional and community business centres that will be necessary to best cater for the requirements of shoppers as well as the influence that the creation of additional centres will have on existing centres</p> <p>(b) Determine the form that retail trade will take as well as the demands which will be made upon the local authority in regard to parking, traffic flow, etc.</p>	<p>(a) With township developers</p> <p>(b) Town and regional planning authorities</p> <p>(c) Various commercial organisations</p> <p>(d) Persons or bodies making studies of shopping patterns</p>
7	Township development	<p>(a) Ascertain the ability of local authority to supply essential services as well as the ability of neighbouring local authorities to do likewise</p> <p>(b) Discover factors that will facilitate/retard township development</p> <p>(c) Ascertain the effect that the availability of a large number of vacant residential premises in an adjoining or neighbouring municipality will have on own development</p>	<p>(a) With township developers</p> <p>(b) With neighbouring municipalities</p> <p>(c) With persons or bodies making economic studies for township developers</p>
8	Water supply	<p>(a) Ascertain whether existing sources are adequate to provide for future needs</p> <p>(b) Ascertain in which way and to what extent existing sources must be augmented if necessary</p> <p>(c) Ascertain whether additional main supplies will be required and if so, what the work will cost</p>	<p>(a) With bulk suppliers in regard to the possibility of providing new supply points</p> <p>(b) With Department of Water Affairs in regard to policy re re-use of water</p> <p>(c) With C.S.I.R. re technical developments within the sphere of (b) above</p>
9	Power supply	<p>(a) Ascertain whether existing sources of supply are adequate in order to provide for expected future needs</p> <p>(b) Ascertain in which way existing sources of supply can be augmented, if necessary</p> <p>(c) Ascertain whether additional main supplies will be necessary and if so, how much the work will cost</p> <p>(d) Determine in which way and to what extent changing future modes of living (introduction of television) or use made of competitive products (for example domestic gas) will influence future demand</p>	<p>(a) With Electricity Control Board in regard to matters of policy</p> <p>(b) With ESCOM in regard to bulk supply</p> <p>(c) With relevant authorities in regard to the type of, and times for presentation of television programmes</p>
10	Sewerage	<p>(a) Determine to which extent outfall sewers and purification works can be augmented to cater for additional areas or the more intensive development of existing areas and what the work will cost</p> <p>(b) Determine whether proposed new areas for development can be served by the existing reticulation and if not, in which manner these areas can best be served</p> <p>(c) Investigate possible suitable sites for sewerage purification works and acquire land well ahead of development</p>	<p>(a) With neighbouring municipalities that can share in a regional scheme</p> <p>(b) The Department of Water Affairs re policy aspects</p> <p>(c) Provincial authorities in regard to overall planning and policy considerations in regard to the placing of sewage purification works</p>

No.	ONDERWERP	AKTIWITEIT	SKAKELING EN KO-ORDINASIE
6	Inkoopentra	<p>(a) Bepaal welke streeks- of plaaslike inkoopentra nodig sal wees om die beste aan kopers se behoeftes te voorsien en die uitwerking wat die skepping van nuwe sentra op bestaande sentra sal hê.</p> <p>(b) Bepaal die vorm wat die kleinhandel sal inneem en welke eise dit aan die plaaslike owerheid stel ten opsigte van parkering, verkeersvloei, ens.</p>	<p>(a) Met dorpsdigters.</p> <p>(b) Dorps- en streeksbeplanningsowerhede.</p> <p>(c) Verskeie sakekamers.</p> <p>(d) Instansies wat studies van inkoopstendense maak.</p>
7	Dorpsstigting	<p>(a) Bepaal vermoë van plaaslike owerheid om in noodsaaklike dienste te voorsien asook vermoëns van naburige plaaslike besture om dieselfde te doen.</p> <p>(b) Bepaal faktore wat dorpsstigting bevorder en/of vertraag.</p> <p>(c) Bepaal uitwerking van voorsiening van groot getalle woonpersele in aangrensende of naburige munisipaliteite op eie ontwikkeling.</p>	<p>(a) Met dorpsdigters.</p> <p>(b) Met buurmunisipaliteite.</p> <p>(c) Met instansies wat ekonomiese studies vir dorpsdigters maak.</p>
8	Watervoorsiening	<p>(a) Bepaal of bestaande bronne voldoende is om in verwagte behoeftes te voorsien.</p> <p>(b) Bepaal op welke wyse en in welke mate bestaande bronne aangevul kan word indien nodig.</p> <p>(c) Stel vas of bykomstige hoofleidings benodig sal word en, indien die geval, wanneer en hoeveel dit sal kos.</p>	<p>(a) Met grootmaatverskaffers insake hulle uitbreidingsmoontlikhede en nuwe voorsieningspunte.</p> <p>(b) Met Departement van Waterwese in verband met beleid insake herverbruik van water.</p> <p>(c) Met W.N.N.R. insake tegniese ontwikkeling op gebied van (b) hierbo.</p>
9	Kragvoorsiening	<p>(a) Bepaal of bestaande bronne voldoende is om in verwagte behoeftes te voorsien.</p> <p>(b) Bepaal op welke wyse en in welke mate bestaande bronne aangevul kan word indien nodig.</p> <p>(c) Stel vas of bykomstige hoofleidings benodig sal word en, indien die geval, wanneer en hoeveel dit sal kos.</p> <p>(d) Bepaal op welke wyse en in welke mate veranderde lewenswyse in die toekoms (invoering van beeldradio) of gebruikmaking van mededingende produkte (byvoorbeeld huishoudelike gas) toekomstige vraag gaan beïnvloed.</p>	<p>(a) Met Elektrisiteitsbeheerraad in verband met beleidsaangeleenthede.</p> <p>(b) Met Evkom insake grootmaattoevoer.</p> <p>(c) Met owerheidsliggame in verband met aard en tye van beeldradio-aanbieding.</p>
10	Riolering	<p>(a) Bepaal in welke mate bestaande hoofleidings en suiweringswerke verander kan word om groter gebiede of gebiede wat intensiewer ontwikkel word, te bedien en wat dit sal kos.</p> <p>(b) Bepaal welke gebiede beoog vir ontwikkeling, nie deur bestaande netwerke bedien kan word nie en op welke wyse sulke gebiede die beste bedien kan word.</p> <p>(c) Ondersoek terreine wat moontlik geskik kan wees vir suiweringswerke en koop die geskikste betyds.</p>	<p>(a) Met naburige munisipaliteite wat in skemas kan deel.</p> <p>(b) Met Departement van Waterwese in verband met beleidsaspekte.</p> <p>(c) Met Provinsiale Owerhede in verband met beplanning op breër vlak en beleidsoorwegings veral met betrekking tot plasing van rioolwerke.</p>

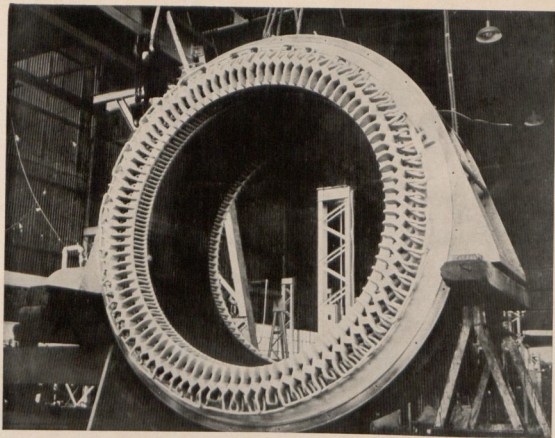


No.	SUBJECT	ACTIVITY	LIAISON AND CO-ORDINATION
11	Refuse removal	<p>(a) Calculate the quantity of refuse to be removed in cu. metres in order to ascertain the size of depositing sites. Determine where such sites should be situated with due regard to township development and when such sites should be made available</p> <p>(b) Ascertain the composition of refuse having regard to changing living patterns (electrical stoves, tinned food)</p> <p>(c) Ascertain to what extent the partial processing or treatment of refuse and rubbish can reduce the volume thereof and whether such processes will be economical</p>	<p>(a) With neighbouring or nearby towns with similar problems with a view to possible co-operation</p> <p>(b) With organisations that have already been successful in partially processing refuse</p> <p>(c) With township developers in order to determine where and when the need for refuse removal will arise</p>
12	Parks and Recreation	<p>(a) Determine where residential areas are likely to be established and which land naturally lends itself for development as recreational sites and open spaces</p> <p>(b) Determine in respect of the various racial groups, the nature and extent of the various sport and recreational activities which must be catered for, distinguishing between intramural activities (communal halls, recreation halls) and extramural activities (sports fields, swimming baths, etc.)</p> <p>(c) Determine the areas of park and recreation sites required by reference to abovementioned needs</p>	<p>(a) With provincial and other authorities with a view to the planning of parks</p> <p>(b) With adjoining or nearby municipalities in regard to their planning proposals</p>
13	Cemeteries and crematorium	<p>(a) Determine with the aid of population projection and death rates for various population groups how much land will be required for burials for say the next 75 years and to what extent provision should be made for cremations</p> <p>(b) Investigate likely sites for cemeteries and acquire them timeously</p>	<p>With adjoining or neighbouring towns with similar problems with a view to co-operation</p>
14	Library services and museum	<p>(a) Determine the nature and scope of the library services by reference to population projections</p> <p>(b) Determine the most suitable site for well as sites for the various branch libraries and further to which ex-libraries and further to which extent use can be made of a mobile library service</p>	<p>(a) With provincial library services with a view to co-operation and mutual assistance</p> <p>(b) With educational authorities in regard to the educational functions of the library</p>
15	Public Health	<p>(a) Determine the nature and scope of environmental services (health inspections) in the light of anticipated township development</p> <p>(b) Determine the nature and scope of personal health services (health visits, clinic services, etc.) in the light of anticipated population growth and composition</p>	<p>With State Department of Public Health in regard to policy matters</p>

No.	ONDERWERP	AKTIWITEIT	SKAKELING EN KO-ORDINASIE
11	Vuilgoedverwydering	<p>(a) Bereken die kubieke meter vuilgoed waarvoor stortingsterreine gevind moet word, bepaal waar sulke terreine geleë moet wees met inagname van dorpsdigting en wanneer sulke terreine beskikbaar moet wees.</p> <p>(b) Bepaal wat die samestelling van die vuilgoed sal wees met inagname van veranderende lewenswyse (elektriese stowe, blikkieskos, ens.).</p> <p>(c) Bepaal in welke mate die gedeeltelike verwerking of behandeling van vuilgoed en rommel die totale kubieke maat vuilgoed sal verminder en of sulke prosesse lonend sal wees.</p>	<p>(a) Met aangrensende of naburige dorpe met dieselfde probleme met die oog op moontlike samewerking.</p> <p>(b) Met instansies wat reeds sukses behaal het met die gedeeltelike verwerking van vuilgoed.</p> <p>(c) Met dorpsdigters om te kan bepaal waar en wanneer die behoeftes aan die dienste sal ontstaan.</p>
12	Parke en Ontspanning	<p>(a) Bepaal waar woongebiede uitgelê sal word en welke gebiede natuurlike parke, ontspanningsterreine en oop ruimtes sal uitmaak.</p> <p>(b) Stel vas ten opsigte van verskillende rassegroepe, die aard en die omvang van die verskillende sport- en ontspanningsaktiwiteite waarvoor daar in die toekoms 'n behoefte sal bestaan. Onderskei tussen binnemuurse aktiwiteite (gemeenskapsale, ontspanningsale) en buitemuurse aktiwiteite.</p> <p>(c) Bepaal grootte van parke en ontspanningsterreine benodig aan die hand van bevolkingsprojeksies en -behoefes.</p>	<p>(a) Met provinsiale- en ander owerhede ten opsigte van beplanning van streeksparke.</p> <p>(b) Met aangrensende of naburige munisipaliteite ten opsigte van hulle beplanning.</p>
13	Begraafplase en Krematorium	<p>(a) Bereken met behulp van bevolkingsprojeksie en sterftekoerse vir verskillende bevolkingsgroepe hoeveel grond benodig sal word vir teraardebestellings vir sê die volgende 75 jaar en welke persentasie van verassing gebruik sal maak.</p> <p>(b) Ondersoek moontlike geskikte terreine vir begraafplaasdoeleindes en skaf dit betyds aan.</p>	Met aangrensende of naburige dorpe met dieselfde probleme met die oog op samewerking.
14	Biblioteekdienste en Museum	<p>(a) Bereken die aard en omvang van die biblioteekdiens aan die hand van bevolkingsprojeksies.</p> <p>(b) Bepaal die mees geskikte plekke vir die plasing van die hoofbiblioteek en museum en van die verskillende takbiblioteke en in welke mate van 'n reisende biblioteekdiens gebruik gemaak kan word.</p>	<p>(a) Met Provinsiale Biblioteekdiens ten opsigte van samewerking en onderlinge hulpverlening.</p> <p>(b) Met opvoedkundige instansies ten opsigte van uitbouing van opvoedkundige aspekte van biblioteek en museum.</p>
15	Openbare Gesondheid	<p>(a) Bepaal die aard en omvang van omgewingsdienste - (gesondheidsinspeksies) in lig van geraamde dorpsontwikkeling.</p> <p>(b) Bepaal die aard en omvang van soonlike gesondheidsdienste (gesondheidsdienste (gesondheidsbesoeke, kliniese dienste, ens.) in lig van verwagte bevolkingsamestelling.</p>	Met Staatsgesondheid ten opsigte van beleidsaspekte.

No.	SUBJECT	ACTIVITY	LIAISON AND CO-ORDINATION
16	Civilian protection services	<p><b>1. Firefighting and prevention and ambulance services</b></p> <p>(a) Determine by reference to anticipated township development the need for this type of service in residential areas, business areas and industrial areas</p> <p>(b) Determine the most suitable sites for main and branch stations</p> <p>(c) Ascertain the type and cost of buildings, equipment and labour required</p> <p><b>2. Traffic control and accident prevention</b></p> <p>(a) Undertake traffic counts and study traffic flow on continuous basis</p> <p>(b) Discover trends by studying the data</p> <p>(c) Plan road networks, interchanges, parking areas, etc., in order to solve anticipated traffic problems</p> <p>(d) Educational programmes for children and adults</p>	<p><b>1. Firefighting and prevention and ambulance services</b></p> <p>(a) With neighbouring municipalities in regard to mutual assistance under normal conditions as well as during emergencies</p> <p>(b) With S.A. Defence Force in regard to help during emergencies and also re subsidies on equipment</p> <p>(c) With local voluntary organisations with a view to co-ordinated action during a state of emergency</p> <p><b>2. Traffic control and accident prevention</b></p> <p>(a) With provincial traffic authorities in regard to co-ordination and uniform law enforcement</p> <p>(b) With neighbouring municipalities with a view to co-operation</p>
17	Housing	<p>(a) Determine in the light of anticipated population growth the number of families to be housed with the aid of funds provided by the State (distinguish between economic and sub-economic housing and ascertain housing needs for old age people)</p> <p>(b) Ascertain which areas are suitable for establishment of townships for housing purposes having regard to land prices and the government's formula for the financing of housing projects</p> <p>(c) Obtain State funds and purchase land for housing purposes timeously</p>	<p>(a) With Department of Community Development in regard to adaptations in housing policy in the light of changing conditions</p> <p>(b) With large building contractors in regard to the utilisation of industrialised building methods</p>
18	Personnel and office accommodation	<p>(a) Make projections of personnel needs in the light of population projections and the need for supplying the above-mentioned services</p> <p>(b) Ascertain to which extent mechanisation will influence the nature and need for additional personnel</p> <p>(c) Determine the future demand for office accommodation, workshop facilities, etc. as and when services expand and additional personnel is required</p> <p>(d) Determine the most suitable sites for the provision of accommodation with a view to rendering an efficient service to the public</p>	<p>(a) With Government bodies in regard to services rendered on an agency basis (public health; Bantu affairs, motor vehicle licensing, etc.)</p> <p>(b) With manufacturers and suppliers of labour saving machines and devices</p>

No.	ONDERWERP	AKTIWITEIT	SKAKELING EN KO-ORDINASIE
16	Burgerlike Beskermingsdienste	<p><b>1. Brandbestryding en Voorkoming en Ambulansdienste</b></p> <p>(a) Bepaal, met verwysing na verwagte dorpsontwikkeling, die behoefte aan hierdie diens in woonegebiede, sakegebiede en nywerheidsgebiede.</p> <p>(b) Stel vas waar die geskikte plekke sal wees vir die hoofstasie en takstasies.</p> <p>(c) Stel vas die aard en koste van geboue, toerusting en personeel benodig.</p> <p><b>2. Verkeersbeheer en Ongelukvoorkoming</b></p> <p>(a) Doen verkeerstellings en maak verkeerstudie op deurlopende basis.</p> <p>(b) Bepaal tendense aan hand van studies.</p> <p>(c) Bepaan padnetwerke, wisselaars, parkeergebiede, ens. om verwagte verkeersprobleme die hoof te bied.</p> <p>(d) Opvoedingsprogram vir kinders en volwassenes.</p>	<p><b>1. Brandbestryding en Voorkoming en Ambulansdienste</b></p> <p>(a) Met naburige munisipaliteite ten opsigte van onderlinge hulpverlening onder normale omstandighede asook gedurende noodtoestande.</p> <p>(b) Met Suid-Afrikaanse Weermag ten opsigte van hulp gedurende noodtoestande en subsidies op toerusting.</p> <p>(c) Met plaaslike kommando-organisasie ten opsigte van gekoördineerde optrede tydens noodtoestande.</p> <p><b>2. Verkeersbeheer en Ongelukvoorkoming</b></p> <p>(a) Met Provinsiale Verkeersowerhede ten opsigte van gekoördineerde en eenvormige wetstoepassing.</p> <p>(b) Met naburige munisipaliteite met oog op samewerking.</p>
17	Behuising	<p>(a) Stel vas vir hoeveel gesinne daar jaarliks, in lig van bevolkingstoename, huisvesting met Staatsfondse voorsien moet word (onderskei tussen ekonomiese- en sub-ekonomiese huisvesting en huisvesting vir oues van dae).</p> <p>(b) Stel vas welke gebiede wat geskik is vir dorpsdigting vir behuisingsdoel-eindes benut kan word in lig van grondpryse en Staat se formule vir finansiering van huisvesting.</p> <p>(c) Verkry Staatsfondse en koop grond grond vir behuisingsdoel-eindes betyds.</p>	<p>(a) Met Departement van Gemeenskap-bou ten opsigte van aanpassings in behuisingsbeleid in lig van veranderde omstandighede.</p> <p>(b) Met groot bou-aannemers ten opsigte van gebruikmaking van montasiebou-metodes.</p>
18	Personeel en Personeelakkommodasie	<p>(a) Maak projeksie van personeelbehoefes in lig van bevolkingsprojeksie en behoefte aan bogemelde dienste.</p> <p>(b) Bepaal in welke mate meganisasie en outomatiasie die aard en omvang personeelbehoefes sal beïnvloed.</p> <p>(c) Bepaal wat die behoeftes aan kant ooraakkommodasie, werksplaasgeriewe, ens. sal wees soos en wanneer dienste uitbrei en personeelbenodig word.</p> <p>(d) Stel vas waar die mees geskikte terreine is vir die plasing van huisvesting ten einde doeltreffende diens aan die publiek te bevorder.</p>	<p>(a) Met owerheidsinstansies ten opsigte van dienste op 'n agentskapsbasis gelewer (gesondheid, Bantoesake, motorvoertuiglisensies, ens.).</p> <p>(b) Met vervaardigers en leweransiers van arbeidsbesparende outomate en masjiene.</p>



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No.	ONDERWERP	AKTIVITEIT	SKAKELING EN KO-ORDINASIE
19		<p>(a) Bereken die uitgawes verbonde aan die verskillende uitbreidingskemas ten opsigte van elke boekjaar van die beplanningstermyn.</p> <p>(b) Bepaal op welke wyse die uitgawes gefinansier kan word (inkomste, lenings of beide).</p> <p>(c) Bereken die jaarlikse belastingslas met inagnome van stygende lopende koste plus addisionele leningskoste.</p> <p>(d) Bereken verwagte inkomste uit verskillende inkomstebronne.</p> <p>(e) Bespoedig of verleng uitvoeringstydperke van projekte in lig van beskikbare fondse.</p> <p>(f) Stel finansieringsplan op en hersien jaarliks in lig van lersiene projekte of programme.</p>	<p>(a) Stadtesourier skakel voortdurend met departementshoofde wat vooruitskattings maak.</p> <p>(b) Skakel ook met owerheidsinstansies (Staatstesourie) ten opsigte van beleidsaangeleenthede (beperkings op lenings of werke, rentekoerse, ens.).</p>

No.	SUBJECT	ACTIVITY	LIAISON AND CO-ORDINATION
19	Finance	<p>(a) Determine the expenditure to be incurred in connection with the implementation of various departmental schemes for each fiscal year of the period covered by the plan</p> <p>(b) Determine in which way the expenditure will be financed (revenue, loans or both)</p> <p>(c) Calculate the annual tax burden having due regard to increase in current costs as well as additional capital charges</p> <p>(d) Calculate expected revenue from various sources</p> <p>(e) Speed-up or delay the implementation of projects in relation to available funds</p> <p>(f) Prepare financial plan and revue annually in the light of amended projects and programmes</p>	<p>(a) Treasurer continually liaise with heads of departments in connection with their forecasts</p> <p>(b) Liaise also with Government bodies (State Treasury) in regard to policy matters (restrictions on loan works, rates of interests, etc.)</p>

## ANNEXURE B

### JOB DESCRIPTION : PERSONNEL MANAGER

#### 1. Goal

To look after the welfare of the personnel and with the guidance of the Town Clerk promote good personnel relations and by means of personnel development and planning create a labour climate in which the workers can render maximum work performance.

#### 2. Tasks

- 2.1 Is responsible to draft and submit the Council's agendas and minutes concerning all staff matters and to carry out the resolutions in this regard.
- 2.2 Is responsible for the recruiting of all staff, Whites as well as Non-whites.
- 2.3 Helps with the selection of staff and the administering of aptitude and competency tests.
- 2.4 Helps with the placing of personnel.
- 2.5 Helps with the induction and training of personnel in human relations and management techniques.
- 2.6 To give information and guidance with merit rating assessments and to act as moderator of assessments made by departments.
- 2.7 Keep performance and personal files.
- 2.8 To draft and keep up to date a realistic work performance for every post in co-operation with the heads of departments.
- 2.9 Help with the drafting of staff policy, its implementation and carrying out.
- 2.10 Must listen to and give attention to real problems of staff by investigating possible causes of frustration and wrong relations.
- 2.11 Operational tasks such as leave arrangements, etc.
- 2.12 Be well informed with the labour market and advise the Town Clerk about tendencies which appear so that salaries are such, that where possible, suitable personnel can be recruited and good staff can be obtained.

#### 3. Responsibilities.

- 3.1 Responsible for drafting and maintaining uniform staff policy and to make recommendations in this regard.
- 3.2 See that personnel are properly informed about the Council's staff policy.
- 3.3 See that the Council's staff policy is properly interpreted, enforced and carried out.

## AANHANGSEL B

### TAAKBESKRYWING : PERSONEELBESTUURDER

#### 1. Doelwit

Om onder leiding van die Stadsklerk na dit welsyn van al die personeel om te sien en deur middel van goeie personeelverhoudings asook deur personeelontwikkeling en -beplanning 'n arbeidsklimaat te help skep waarin werkers maksimale werksprestasie lewer.

#### 2. Take

- 2.1 Is verantwoordelik vir die opstel en voorlegging van Raadsagendas en -notules van alle personeel-aangeleenthede asook die uitvoer van besluite in die verband.
  - 2.2 Is verantwoordelik vir werwing van alle personeel, blankes sowel as Bantoes.
  - 2.3 Help met keuring van personeel en afneem van aanleg- en bevoegdheidstoetse.
  - 2.4 Help met plasing van personeel.
  - 2.5 Help met induksie (inlywing) en opleiding van personeel in menseverhoudings en bestuurtegnieke.
  - 2.6 Gee voorligting by maak van meriete-aanslae en tree op as moderator van aanslae gemaak deur departemente.
  - 2.7 Hou van prestasie-lêers en persoonlike lêers.
  - 2.8 Opstel en byhou van 'n realistiese werks-spesifikasie vir elke pos in samewerking met hoofde.
  - 2.9 Help met opstel van personeelbeleid en sorg vir uitvoering daarvan.
  - 2.10 Moet luister en aandag gee aan werklike probleme van die personeel deur moontlike oorsake van frustrasies en wanverhoudings na te speur.
  - 2.11 Operasionele pligte soos verlofreëlings, ens.
  - 2.12 Bly voortdurend op hoogte met die arbeidsmark en lig die Stadsklerk in omtrent tendense wat hulleself openbaar maak ten einde sorg te dra dat salarisse sodanig is dat, indien moontlik, geskikte personeel gewerf kan word en goeie personeel bekom kan word.
- #### 3. Verantwoordelikhede
- 3.1 Verantwoordelik vir die opstel en handhawing van gesonde eenvormige personeelbeleid, doen aanbevelings daaromtrent.
  - 3.2 Sorg dat personeel behoorlik omtrent die Raad se personeelbeleid ingelig is.
  - 3.3 Sorg dat die Raad se personeelbeleid behoorlik vertolk, afgedwing en uitgevoer word.

#### 4. Authority.

- 4.1 Staff authority : give advice to all who ask but take the initiative sometimes with suggestions.
- 4.2 Line authority : in own department only.
- 4.3 Functional authority : in all other departments and where heads are helpful.

#### 5. Liaison.

Communicate with all personnel at a horizontal as well as vertical level but does not interfere with the organisational aspect of a department's activities. He refers misgivings in connection with a particular organisational set-up to the Town Clerk who in turn can refer it to the O. & M. Officer.

#### 6. Requirements:

##### 6.1 Academic qualifications

- (a) at least a university degree with psychology or industrial psychology as a major subject.
- (b) specialised study or knowledge of work study or work measurement.
- (c) study and/or experience in the psychometric testing of personnel.

##### 6.2 Personal qualifications

Must be an agreeable person, be interested in people and their problems and should be just, trustworthy and firm with a sound judgement over people in connection with their work. A sound knowledge of the municipal labour sphere is also essential.

##### 6.3 Experience

At least 10 years. In addition to the handling of personnel he should have practical experience in local Government so that suggested solutions can keep pace with practice and be implementable.

#### 4. Gesag

- 4.1 Stafgesag : gee advies aan almal wat daarom vra maar neem soms die inisiatief met wenke.
- 4.2 Lyngesag : net in sy eie afdeling.
- 4.3 Funksionele gesag : in alle ander departemente waarby hoofde behulpsaam is.

#### 5. Skakeling

Skakel met alle personeel sowel horisontaal as vertikaal maar meng self nie in met organisatoriese aspek van 'n departement se werksaambede nie. Hy verwys bedenkinge in verband met 'n bepaalde organisatoriese opset na die Stadsklerk wat die O. en M.-beampte kan inspan.

#### 6. Vereistes

##### 6.1 Akademiese Kwalifikasies

- (a) Minstens 'n universiteitsgraad met Sielkunde of Bedryfsielkunde as 'n hoofvak.
- (b) Gespesialiseerde studie of kennis van werkmeting of werkstudie.
- (c) Studie en/of ondervinding in die psigometrie se toetsing van personeel.

##### 6.2 Persoonlike Kwalifikasies

Moet 'n genaakbare persoon wees, in mense en hulle probleme belangstel en regverdig, eerbaar en standvastig wees met rype oordeel oor mense in hulle werksverband. Verder moet hy 'n goeie insig hê van die munisipale arbeidsveld.

##### 6.3 Ondervinding

Minstens 10 jaar. Die ondervindingsveld moet be- nuens die hantering van personeel ook praktiese ervaring van plaaslike bestuurswese behels sodat die oplossings wat hy aan die hand doen met die piaktyk rekening sal hou en dus geïmplementeer kan word.

## ANNEXTURE C

### MOTIVATION STUDY

#### 1. The problem

- 1.1 It is a known fact that even while he is on duty the worker strives after the satisfaction of needs. Basically the official is motivated towards certain actions because he wants to satisfy particular needs.
- 1.2 In the smaller circle of the work situation the worker's work-attitude and functioning are precipitated **primarily** by his motives. Because of the complex nature of these motives their relative importance is difficult to determine and periodical motivation studies are essential to enable manage-

## BYLAE C

### MOTIVERINGSTUDIE

#### 1. Probleemstelling

- 1.1 Dit is 'n bekende feit dat 'n werknemer ook in sy dagtaak steeds behoeftebevrediging nastreef. Die amptenaar word tot sekere werksaktiwiteite aangespoor uitsluitlik deur sekere behoeftes wat hy wil bevredig.
- 1.2 In die nouer werksituasie word die werker se werksbetragtning en -funksionering hoofsaaklik deur sy motiewe gepresipeiteer. As gevolg van die komplekse aard van hierdie motiewe is hulle relatiewe belangrikheid moeilik bepaalbaar en is periodieke motiveringopnames noodsaaklik ten einde bestuur



ment to integrate dominant drives into the wider programme of work-motivation.

- 1.3 The problem, therefore, is to gain insight into the hierarchy of the worker's motives (senior officials may be included) and to identify dominant drives if any.
- 1.4 Motivation forms (supplement A) were sent to heads of departments for distribution. These forms were completed by officials and returned to the Personnel department. The form does not identify the person concerned.
- 1.5 The information has, to some extent, been analysed for every department as well as for the service as a whole.

## 2. Analysis

### 2.1 Per Department

2.1.1 Some interesting aspects came to light in this section. It appears firstly that there is no fixed pattern regarding the seven factors as a whole — indicative of the changing motives of the officials. Secondly the three dominant motives in practically all departments are quite apparent although the degree of dominance differs from department to department.

These three motives are:

- Good salary;
- Pleasant working conditions and,
- Security. (See histograms in fig. I, II and III).

If the department of the Administrative Manager the emphasis is rather on "opportunity for advancement" than on "good salary" (fig. III) while figure I also indicates "acknowledgement for good work."

2.1.2 This analysis is advantageous in the fact that the head of department concerned can take note of the position in his department and integrate it into his management function of motivation. Activities in the department are then aimed at satisfying these particular needs. Periodical studies are, however, necessary for dominant motives vary among others because of labour turnover and a change in supervisors (or supervision).

### 2.2 The service as a whole

2.2.1 The result shows the following total percentage votes with respect to every positioning in the hierarchy of the given motives: (See histograms in fig. IV).

in staat te stel om algemeen dominerende motiewe te integreer in die wyer program van werksmotivering.

- 1.3 Die probleem is dus om 'n aanduiding te kry van die behoeftehiërargie van werknemers (wat bestuurslede mag insluit) en dominerende motiewe, indien enige, te identifiseer.
- 1.4 Verskeie motiveringsvorme (Aanhangsel A) is aan departementshoofde gestuur vir verspreiding. Die vorms is deur amptenare ingevul en die departement se vo.ms terruggestuur aan die Personeel-departement. Die vorm identifiseer nie die amptenaar nie.
- 1.5 Die inligting is departementsgewys asook dienswyd in 'n mate ontleed.

## 2. Ontleding

### 2.1 Departementsgewys

2.1.1 Hier het interessante aspekte na vore gekom. Dit blyk eerstens dat daar geen vaste patroon is wat die sewe faktore in die geheel betref nie — 'n aanduiding van die wisselende motiewe van die amptenare. Tweedens kom dit sterk na vore dat daar veral drie behoeftes is wat in feitlik elke departement dominerend is — die graad van dominasie verskil egter van departement tot departement.

Hierdie drie motiewe is:

- Goeie salaris;
- Aangename Werksomstandighede en
- Sekuriteit. (Kyk histogramme in figure I, II en III.)

In die geval van die Departement van die Administratiewe Bestuurder is die klem egter eerder op geleentheid vir bevordering as op goeie salaris (figuur III) terwyl figuur I ook 'n behoefte aan erkenning vir goeie werk aandui.

2.1.2 Hierdie oppervlakkige beskouing het die voordeel dat die departementshoof kennis kan neem van die posisie in sy departement en kan hy dit integreer in sy bestuursfunksie van aktiverende leidinggewing. Departementsaktiwiteite kan dan gemik word om sodanige behoeftes te bevredig. Periodieke studies is egter noodsaaklik, want die dominerende motiewe wissel onder andere as gevolg van arbeidsomset en ander beheervoerende amptenare.

### 2.2 Dienswyd

2.2.1 Die resultaat toon die volgende totale persentasiestemmings ten opsigte van elke plekplasing in die hiërargie van die gestelde behoeftes. (Kyk ook histogram in figuur IV).

- 1st : Good salary 46% (20% for 2nd place)
- 2nd : Pleasant working conditions 20% (20% for 1st place).
- 3rd : Opportunity for advancement 25% (19% for 2nd place).
- 4.h : Security 31% (23% for 1st, 13% for 2nd and 8% for 3rd place).
- 5th : Acknowledgement for good work 22% (20% for 3rd place).
- 6th : Benefits 26%
- 7th : A just controlling officer 32%

- 1e : Goeie salaris 46% (20% vir 2e plek)
- 2e : Aangename werksomstandighede 20% (20% vir 1e plek)
- 3e : Geleentheid vir bevordering 25% (19% vir 2e plek)
- 4e : Sekuriteit 13% (23% vir 1e, 13% vir 2e en 8% vir 3e plek)
- 5e : Erkenning vir goeie werk 22% (20% vir 3e plek)
- 6e : Diensvoordele 26%
- 7e : Regverdige beheervoerende beampte 32%

2.2.2 Interesting is that "good salary" gains less than half of the possible votes for 1st place. It nevertheless indicates a reasonably strong motive at this stage. A study conducted just after a general salary increase will make some interesting comparisons possible.

2.2.3 The first three motives can readily be satisfied by management and will undoubtedly contribute to the morale of the officials and have positive effects on general production.

2.2.4 The service-wide data was also divided into two salary groups, viz.:

- (i) Officials with a yearly salary of R5000 and more;
- (ii) Officials with a salary of less than R5000 (See figure V and VI for first choice).

### 3. General

- 3.1 From the foregoing it is apparent that certain motives are dominant. Management should note this and take appropriate steps.
- 3.2 Follow-up studies — per department and in the service as a whole — should be conducted every six months to evaluate the success of projects based on knowledge gained from previous studies.
- 3.3 As far as the individual worker is concerned, such a study may easily show possible frustrations that are experienced in the work situation. If, for instance, it is found in a small group, that the need for "a just controlling officer" is rather high, the head of the department should note for it may indicate a factor that has an adverse effect on production.
- 3.4 Frequently an applicant has no definite and clear motivation as to his interest in a particular position. During the employment/interview it is then unclear what the applicant's reasons are for apply-

2.2.2 Interessant is dat die motief goeie salaris, minder as helfte van die stemming vir 1e plek gekry het. Dit dui nogtans 'n redelik sterk behoefte in hierdie stadium aan. 'n Opname net na 'n algemene salarisverhoging behoort insiggewende vergelykings moontlik te maak.

2.2.3 Die eerste drie motiewe kan geredelik deur die organisasieoewerheid bevredig word en behoort veel by te dra tot die werkestevredenheid van die amptenare wat weer weerklank sal vind in die algemene produksie.

2.2.4 Die dienswye gegewens is ook in twee salarisgroepe verdeel, naamlik:

- (i) die amptenare met 'n jaarlikse salaris van meer as R5 000 per jaar.
  - (ii) amptenare met 'n salaris van minder as R5.000 per jaar.
- (Kyk figuur V en VI wat eerste keuses betref)

### 3. Algemeen

- 3.1 Uit voorgaande blyk dit dat sekere van die gestelde motiewe bepaald dominerend is. Die organisasieoewerheid behoort hiervan kennis te neem en pogings aan te wend om sodanige behoeftes te bevredig.
- 3.2 Opvolgstudies — departementsgewys en dienswyd — behoort halfjaarliks onderneem te word ten einde die sukses van projekte, gebaseer op die voorgaande kennisname, te evalueer.
- 3.3 Ten opsigte van 'n bepaalde persoon kan so 'n studie heelwat lig werp op die moontlik frustrasies wat hy in die werksituasie ervaar. Indien dit 'n kleiner werksgroep byvoorbeeld gevind word dat die behoefte aan 'n regverdige beheervoerende beampte abnormaal hoog is, moet die departementshoof kennis neem daarvan omdat dit kan dui op toestande wat produksie benadeel.
- 3.4 Dikwels het 'n aplikant om 'n betrekking geen duidelike of in elke geval 'n vrae motiverende hoekom hy om 'n bepaalde betrekking aansoek doen. Die onderhoudvoerder(s) is dan ook nie op hoogte van

ing and what his ultimate aim is. The course of and the general report needed in the interview is hampered in this way.

3.5 The relevant study has, because of the time factor, not been conducted as one would have wished. More time should for instance have been allotted to the aspect of random sampling. On the other hand it is also not known whether the particular sequence of the motives may have had an influence. There may be other important motives that were not included in the schedule.

#### 4. Conclusion

Workers have specific motives that are dominant in the work-situation. Management must note these needs and make every endeavour to satisfy them by means of personnel and productivity projects.

die redes waarom die persoon om die betrekking aansoek doen nie en wat hy in werklikheid pogg om te bereik nie. Die gang van die onderhoud en die algemene ontplouing van die applikant se ingesteldheid word aldus bemoelijk.

3.5 Die betrokke studie is, by gebrek aan tyd, nie so sorgvuldig soos verlang, uitgevoer nie. Meer tyd behoort bestee te word aan byvoorbeeld die aspek van gelykkansige steekproefneming. Dit is ook nie bekend of die volgorde van die motiewe soos op die vorm gegee dalk 'n invloed gehad het nie. Daar mag dalk belangrike motiewe wees wat nie op die skedule verskyn nie.

#### 4. Gevolgtrekking

Werknemers het bepaalde behofes wat in die werksituasie 'n dominerende motiveringswaarde het. Bestuur moet kennis neem van hierdie motiewe en in die beplanning van personeel- en produktiwiteitsprojekte pogg om sodanige behofes te bevredig.

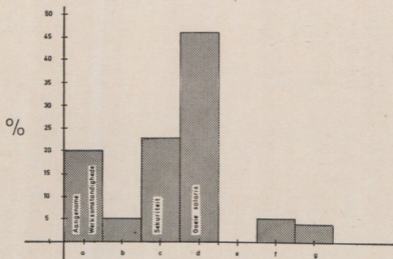


Fig. IV  
(net vir 1<sup>st</sup> plek)  
(1<sup>st</sup> place only)

**SUPPLEMENT A**

TOWN COUNCIL OF ROODEPOORT

**MOTIVATION STUDY**

Please arrange the following factors in order of your preference :

**AANHANGSEL A**

STADSRAAD VAN ROODEPOORT

**MOTIVERINGSTUDIE**

Geliewe die volgende faktore in u voorkeurvogorde te rangskik :

Your order of preference  
1st, 2nd, 3rd, etc.  
U voorkeurorde  
1e, 2e, 3e, ens.

Pleasant working conditions Aangename werksomstandighede	
Opportunity for advancement Geleentheid vir bevordering	
Security (a steady job) Sekuriteit ('n vaste werk)	
Good salary Goeie salaris	
Benefits (leave bonus, sick fund) Diensvoordele (verlofbonus, mediese fonds)	
Acknowledgement for good work Erkenning vir goeie werk	
A just controlling officer (foreman, chief clerk) Regverdigde beheervoerende beampte (voorman, hoofklerk)	

Indicate your present position by means of a cross in the appropriate block

Dui aan deur middel van 'n kruis in die betrokke blok u huidige hoedanigheid

Applicant for post Aansoker om werk	Clerk klerk	Head of Dept. or Section Dept. of Afdelingshoof	Artisan Vakman
Technical Officer (not an artisan) Tegniese amptenaar (nie vakman nie)		Councillor Raadslid	Other Ander

Your present annual salary R.....  
(officials only)

U huidige salaris per jaar R.....  
(slegs amptenare)

## ANNEXURE D

### THE PRACTICAL APPLICATION OF THE PRINCIPLE OF MANAGER BY EXCEPTION IN LOCAL GOVERNMENT SERVICE

#### 1. Secretarial Routine

##### 1.1 Disposal of incoming mail

Incoming letters are registered and thereafter marked out for disposal by Heads of Departments. A policy directive lays down which letters a departmental head can sign on behalf of the Town Clerk and which letters must be signed by the Town Clerk personally. In all cases where a letter has not been dealt with within 14 days from date of receipt thereof, the responsible head of a department is required to furnish an explanation. The Town Clerk obtains for purposes of control a schedule of all such letters containing the explanations of the heads. In cases where matters have to be dealt with by the Management Committee or the Council, the Control Officer checks that the required report is submitted for consideration within 41 days, failing which the responsible head must also furnish reasons for the delay in submitting his report.

##### 1.2 Execution of Council decisions

Heads of departments are informed of Council decisions to be given effect to by their respective departments. All decisions not being executed within 30 days are recorded on a control schedule reflecting target dates set by the responsible departmental heads. The Town Clerk familiarises himself with the reasons given for delays in execution of the relevant decisions and controls the target dates. Upon expiry of a target date, the matter is followed up and the Town Clerk is again informed if a particular matter has not been finally disposed of.

##### 1.3 Reporting and decision making

Where a large number of similar matters are referred to the Council for a decision, e.g. the approval of consent uses in terms of town planning schemes and where a whole series of conditions is being attached to such approvals, the Council can prescribe standard conditions to be made applicable to all such cases, whereafter the heads of departments only report to the Council on the necessity for imposing special conditions as a result of special circumstances.

#### 2. Approval of Building Plans

2.1 All building plans which are properly drawn up

## BYLAE D

### PRAKTIESE TOEPASSING VAN DIE UITSONDERINGSBEHEERBEGINSEL IN PLAASLIKE BESTUURDIENS

#### 1. Sekretêriële Roetine

##### 1.1 Afhandeling van inkomende briewe

Inkomende briewe word geregistreer en daarna na departementshoofde vir behandeling uitgemerk. 'n Beleidsvoorskrif bepaal welke briewe die departementshoof namens die Stadsklerk sal teken en welke briewe die Stadsklerk self sal teken. In alle geval waar 'n brief binne veertien dae na ontvangs afgehandel is nie, word die departementshoof om 'n verduideliking gevra. Die Stadsklerk kry dan vir doeleindes van beheer, 'n lys van sulke briewe met die hoofde se verduidelikings. Wanneer aangeleenthede deur die Bestuurskomitee of die Raad oorweeg moet word, kontroleer die Beheerbeampte dat die nodige verslag binne veertien dae vir oorweging voorberei word, so nie, moet die betrokke hoof oor die redes vir die vertraging verslag doen.

##### 1.2 Gee van uitvoering aan raadsbesluite

Departementshoofde word verwittig van raadsbesluite wat deur hulle onderskeie departemente uitgevoer moet word. Alle besluite wat nie binne dertig dae uitgevoer is nie, word aangeteken op 'n kontrolelys waarop die betrokke departementshoofde doeldatums verstrek wanneer die verskillende aangeleenthede afgehandel sal wees. Die Stadsklerk vergewis homself van die faktore wat die uitvoering van die betrokke besluite vertraag en kontroleer die doeldatums. By verstryking van die doeldatums word die saak opgevolg en die Stadsklerk weereens verwittig indien die werk nie afgehandel is nie.

##### 1.3 Verslaggewing en besluitneming

Waar 'n groot getal enerssoortige gevalle na die Raad vir beslissings verwys word soos bevoorebeeld die goedkeuring van vergunde gebruike onder dorpsaanlegskemas, in welke geval 'n hele reeks voorwaardes voorgeskryf word, bepaal die Stadsraad Standaard Voorwaardes wat op al sulke gevalle van toepassing is en die betrokke departementshoofde doen daarna slegs verslag aan die Stadsraad oor die noodsaaklikheid van bykomende voorwaardes wat benewens die Standaard Voorwaardes opgelê moet word as gevolg van besondere omstandighede.

##### 2. Goedkeuring van Bouplanne

2.1 Alle bouplanne wat behoorlik opgestel is en geen

and do not present any problems are speedily approved (within a week) and plans that have to be amended are dealt with subsequently. This prevents the piling up of a large number of plans whilst the problematical cases which take up a great deal of time, are being dealt with. This also encourages builders and architects to submit plans containing the minimum number of errors.

### 3. Rendering of Refuse Removal Services

- 3.1 A record is kept of all complaints. The complaints are analysed and in cases where there are no valid reasons for complaint, it can be assumed that an efficient service is being rendered. The supervisory personnel can, therefore, concentrate their attention on specific problems and rectify matters.

### 4. Construction Works

- 4.1 The various phases of the work flow of construction projects are accurately planned and target dates are set for the completion of all critical activities. If the work progresses in accordance with the programme, the responsible supervisor has nothing to report. If he is of the opinion that the programme will be completed sooner than anticipated, he reports such fact and the head of the department investigates whether or not a too low standard has been set. If it is anticipated that the work will be completed at a date later than the target date, such fact is immediately reported by the supervisor and again the head of the department ascertains the reasons therefor, investigates the responsibility of the standards set and whether or not the delay resulted from organisational problems or problems beyond the control of the workers.

### 5. General Complaints and Enquiries

- 5.1 Every member of the public is entitled to take his problems to the Town Clerk, provided the complainant first approaches the responsible head with his problems. In practice only a few complaints and problems are referred to the Town Clerk because the heads of departments or their subordinates are, in most cases, quite capable of disposing thereof. This enables the Town Clerk to give his full attention to those problems that cannot be solved by other departments on account of organisational or other reasons and which, in most cases, require a decision by the Council. The nature and scope of the problems which the complainants take to the Town Clerk, enable the latter to gain a good insight into the efficiency or otherwise of the respective departments. At the same time he is placed in a position to spot defects in a particular departmental administration and can take steps to put matters right in collaboration with the responsible head.

probleme oplewer nie word blitsvinnig) binne 'n week goedgekeur en planne wat gewysig moet word geniet later aandag. Dit verhoed dat 'n groot aantal planne ophoop terwyl die afhandeling van 'n besondere probleemgeval baie tyd in beslag neem. Dit moedig ook bouers en argitekte aan om foutlose planne in te dien.

### 3. Lowering van Reinigingsdienste

- 3.1 'n Rekord word gehou van klagtes in verband met hierdie dienste. Die klagtes word ontleed en waar daar geen gegronde klagtes voorkom nie, kan aanvaar word dat 'n goeie diens gelewer word. Die toesighoudende personeel kan derhalwe alle aandag op die probleemgevalle toespits en sake regstel.

### 4. Konstruksiewerke

- 4.1 Die presiese verloop van konstruksiewerke word in al sy stadia beplan en doeldatums vir die afhandeling van alle kritieke aktiwiteite word bepaal. Indien die werk volgens program verloop hoef die verantwoordelike toesighouer niks te rapporteer nie. Indien hy van mening is dat die program vroeër afgehandel sal wees, rapporteer hy sodanige feit en die departementshoof stel vas of die standaard wat gestel is nie te maklik is nie. Indien die werk na die betrokke doeldatum afgehandel sal word, rapporteer die onmiddellike toesighouer insgelyks sodanige feit en die departementshoof stel vas wat die aanleidende oorsaak is, ondersoek of die standaard wat gestel is redelik is en of die vertraging aan organisatoriese probleme of probleme buite die beheer van die werkers toegeskryf moet word.

### 5. Algemene Klagtes en Navrae

- 5.1 Elke lid van die publiek kan aanspraak maak op sy reg om sy probleme na die Stadsclerk te neem, mits die klaer eers by die betrokke departementshoof met sy probleme was. In die praktyk kom baie min klagtes en probleme by die Stadsclerk uit aangesien die departementshoofde, of hulle ondergeskiktes, in die meeste gevalle heeltemal in staat is om sulke sake af te handel. Dit gee die Stadsclerk die geleentheid om sy volle aandag te gee aan daardie probleme wat om organisatoriese of ander redes nie deur die ander departemente opgelos kan word nie en wat in die meeste gevalle 'n beslissing van die Stadsraad verg. Die aard en omvang van die probleme wat die klaers op appèl na die Stadsclerk neem, gee die Stadsclerk 'n goeie begrip van die bekwaamheid van die betrokke departementshoofde. Op hierdie wyse word hy ook in staat gestel om leemtes in departementele administrasies op te spoor en in samewerking met die betrokke hoofde reg te stel.

## 6. Control over Overtime Worked by Departments

6.1 Overtime that must inevitably be worked by each department is ascertained. The total amount paid monthly in the form of overtime is then expressed as a percentage of the total gross monthly salaries of each department. As and when the total monthly overtime payments exceed this normal percentage the head of a department must furnish an explanation for the deviation to the Town Clerk. In order to enable the departmental heads to submit their reports without unnecessary waste of time, a system is introduced whereby all overtime worked, is previously authorised in writing on a standard control document, which is filed for control purposes by the department concerned.

## 6. Beheer oor Oortyd gewerk deur Departemente

6.1 Ten opsigte van elke departement word bepaal welke oortyd onvermeidelik is. Die totale bedrag maandeliks aan oortyd bestee, word as 'n persentasie van die totale maandelikse brutosalarisse van elke departement bereken. Sodra die werklike totale maandelikse oortydbetalings hierdie normale persentasie oorskry, moet die hoof van die departement redes vir die afwyking aan die Stadsklerk verstrek. Ten einde die hoof in staat te stel om sonder onnodige tydverspilling sy verslag uit te bring, is 'n sisteem ingevoer waarvolgens alle oortyd vooraf skriftelik op 'n standaard kontroleform gemagtig word, welke vorm deur die hoof vir beheerdoeleindes geliasseer word.

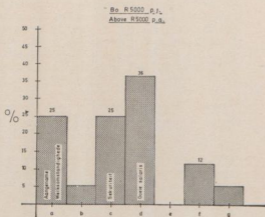


Fig. V  
(net vir 1<sup>st</sup> plek)  
(1<sup>st</sup> place only)

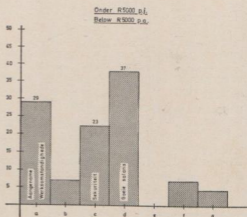
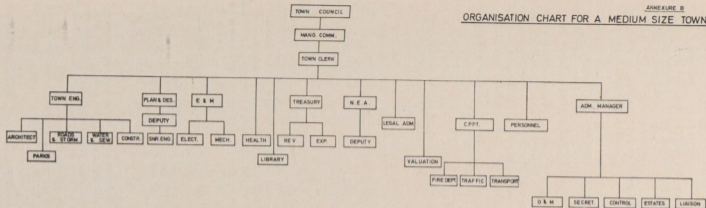


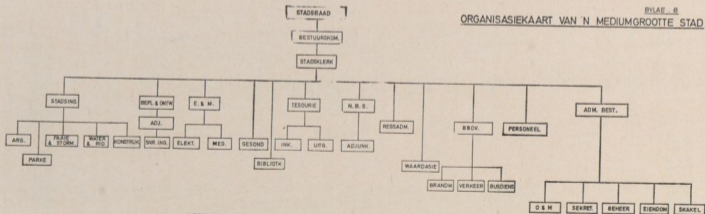
Fig. VI  
(net vir 1<sup>st</sup> plek)  
(1<sup>st</sup> place only)



LEGEND

PLANS & DES. — PLANNING AND DESIGN  
E & M — ELECTRICAL AND MECHANICAL  
N.E.A. — NON - EUROPEAN AFFAIRS

C.P.P.T. — CIVIL PROTECTION AND PUBLIC TRANSPORT  
O & M — ORGANISATION AND METHODS.  
SECRET. — SECRETARIAL SERVICE



VERWYSING

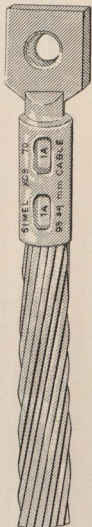
BEPL. & ONTW. — BEPLANNING EN ONTWERP  
E & M — ELEKTROTESNIES EN MESANES  
N.B.S. — NIE - BLANKESAKE

BBOV — BURGERLIKE BESKERMING EN OPENSARE VERVOER  
O & M — ORGANISASIE EN METODES  
SEKRET. — SEKRETARIELE DIENSTE

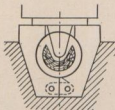
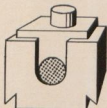


# SIMEL solves

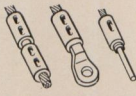
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The SIMEL method of crimping aluminium cables as illustrated opposite has been developed in France over the past twenty years. It is now used exclusively by Electricité de France for jointing low and medium voltage aluminium cables, stranded or solid, as covered by their Specification HN.68.90.

Difficulties in jointing aluminium are due to its high co-efficient of expansion, malleability and the hard insulating oxide film which covers the surface. SIMEL has overcome these problems as follows:—

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3. All SIMEL aluminium fittings are held within a steel container die while the deep indent punch is forced into the fitting under hydraulic pressure. The container die prevents elongation or flattening of the fitting during the crimping operation. This ensures that sufficient pressure is applied to rupture the film of oxide covering each strand thus making a solid electrical connection.

SIMEL fittings have been rigorously tested by a number of independent laboratories in Britain and on the Continent. Tests have been based on cycling fittings over 6,000 times with overload currents heating the cable up to 175°C. Joint resistance has always remained less than that of the same length of unbroken cable.

SIMEL fittings include bi-metallic lugs and ferrules which comprise an aluminium body pressure welded to a solid copper termination. Fittings are available for cables up to 2 sq. in. (1500 sq. mm.) in aluminium or copper.

A complete range of hydraulic tools from 6- to 40-ton capacity are available.

## ALUMINIUM CABLES, JOINTING AND ACCESSORIES

by C. T. CARTER, Pr. Eng., B.Sc. (Eng.)  
Cape Town Electricity Department

### 1. INTRODUCTION

Copper conductor cable has proved itself over many years and before a municipal electrical engineer can consider a change-over to aluminium conductor he must satisfy himself on two basic requirements:

- (i) that the aluminium cable is just as reliable in service as copper cable and is likely to remain so over the years;
- (ii) that aluminium cable is cheaper than its copper counterpart.

For many years now aluminium cable has been lower in price than copper, and it is no doubt due, partly to natural conservatism, and partly to reservations about the jointing of aluminium cable, that the change-over in South Africa to aluminium cable has not been more rapid.

### 2. HISTORICAL

Aluminium is a comparatively modern metal and it was only in 1886, when Hall in the United States of America and Heroult in France simultaneously discovered the fusion electrolytic reduction process, that aluminium could be produced at a then reasonable price.

The economic incentive to use aluminium for electrical conductors other than overhead transmission lines was not very great early in the twentieth century because aluminium continued to be more expensive than copper. During the first and second world wars aluminium was more urgently required for other purposes. The French were probably the first country to use aluminium conductors in insulated cables, more than 6000 km. of such cables being in service by 1950.

In the early 1930's Germany adopted the use of aluminium for power cables and in 1936 the first oil-filled aluminium conductor cable was manufactured in Germany and installed in Baden. During the 1960's the use of aluminium conductor cable in Great Britain increased rapidly and towards the middle of the decade the British Area Boards standardised on cables with stranded aluminium conductor for distribution at 11kV and medium voltage.

In 1946 the price of copper ingot for the first time exceeded that of aluminium and though there have been at times violent fluctuations in the price of copper, this position has remained virtually unchanged ever since. At the time of writing the cost

## ALUMINIUMKABELS, LASWEK EN TOEBEHORE

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### 1. INLEIDING

Kabels met kopergeleiers het hulself oor 'n tydperk van jare bewys en voordat 'n munisipale elektrotegniese ingenieur dit kan oorweeg om oor te skakel na aluminiumgeleiers moet hy homself in verband met twee basiese vereistes tevrede stel, nl.:

- (i) dat die aluminiumkabel in sy dienslewering net so betroubaar as koperkabel is en waarskynlik oor die jare net so sal bly;
- (ii) dat aluminiumkabel goedkoper as sy kopereweknie is.

Aluminiumkabel is jarelank reeds goedkoper as koper en dit is ongetwyfeld gedeeltelik aan natuurlike konserwatisme en gedeeltelik aan twaaf omtrent die lasmetodes vir aluminiumkabel te wyte dat die oorskakeling na aluminiumkabel in Suid-Afrika nie gouer plaasgevind het nie.

### 2. HISTORIESE OORSIG

Aluminium is 'n betreklik moderne metaal en dit was slegs in 1886, toe Hall in die Verenigde State van Amerika en Heroult in Frankryk gelyktydig die elektrolitiese smeltreduksieproses ontdek het, dat aluminium geproduseer kon word teen wat indertyd 'n redelike prys was.

Vroeg in die twintigste eeu was daar nie 'n sterk ekonomiese aanspooring om aluminium vir elektriese geleiers, behalwe vir bogronde transmissielyn, te gebruik nie, aangesien aluminium toe nog steeds duurder as koper was. Gedurende die eerste en tweede wêreloorloë was aluminium meer dringend nodig vir ander doeleindes. Die Franse was waarskynlik die eerste land wat aluminiumgeleiers in geïsoleerde kabels gebruik het, en teen 1950 was daar meer as 6000 km. van hierdie soort kabel in diens.

Vroeg in die dertigerjare het Duitsland aluminium vir kragkabels begin gebruik en in 1936 is die eerste olie-gevulde aluminiumgeleierkabel in Duitsland vervaardig en in Baden geïnstalleer. Gedurende die sestigjarige het die gebruik van aluminiumgeleierkabel in Groot Brittanje vinnig toegeneem en teen die einde van die dekade het die Britse Gebedsrade kabels met gevlegte aluminiumgeleiers vir distribusie teen 11 kV en mediumsroomspanning as standaard aanvaar.

In 1946 het die prys van kopergetblokke vir die eerste keer hoër as die van aluminium gestyg en, alhoewel daar van tyd tot tyd geweldige skommeling in die prys van koper voorgekom het, het hierdie toestand sedert 1946 feitlik onveranderd gebly. Toe

per ton of copper ingot is approximately 1,5 times that of aluminium; after conversion into wire form this results in aluminium wire of similar conductivity to copper costing per unit length half to one third of the price of copper wire.

The variations in the prices of aluminium and copper ingots from 1936 to present date are shown in Figure 1. This, however, is not the full picture as the larger conductor required for an aluminium cable increases the overall size of the cable, thus pushing up the cost of insulation, sheathing, armouring, etc. A comparison of actual cable costs will be commented on in more detail later.

hierdie referaat geskryf is, was die prys per ton van koper-gietblok ongeveer 1,5 keer soveel as dié van aluminium; na verwerking in die vorm van draad het dit tot gevolg dat aluminiumdraad met 'n soortgelyke geleidingsvermoë as dié van koper van die helfte tot eenderde soveel per lengte-eenheid as koperdraad kos.

Die wisselinge in die pryse van aluminium- en koper-gietblokke vanaf 1936 tot vandag word in Figuur 1 aangetoon. Dit skep egter nie die volle beeld nie, aangesien die groter geleiers wat vir 'n aluminium kabel nodig is, die totale groote van die kabel vermeerder, waardeur die koste van isolasie, omhulsels, bewapening, en so meer, ook vermeerder word. Daar sal later in meer besonderhede oor 'n vergelyking van werklike kabelkoste kommentaar gelever word.

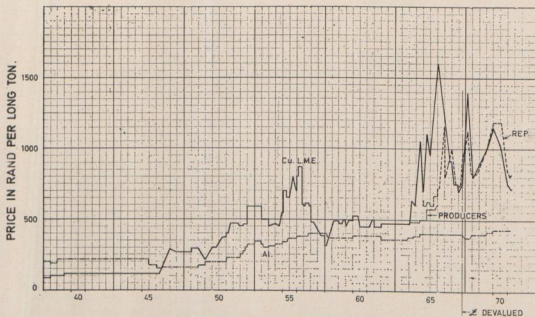


FIG. 1. COPPER & ALUMINIUM PRICE VARIATIONS.

### 3. PROPERTIES OF ALUMINIUM

#### 3.1 General

Aluminium is compatible with all paper, plastic and rubber dielectrics and impregnants used in cable making. It can be wire drawn and extruded as readily as copper.

#### 3.2 Electrical

Aluminium used in cable manufacture is based on publications Nos. 111 and 121 of the International Electrotechnical Commission applying to draw and annealed materials respectively, and has

### 3. EIENSKAPPE VAN ALUMINIUM

#### 3.1 Algemeen

Aluminium is aanpasbaar by alle papier-, plastiek- en rubber-dielektrika en impregneermiddels wat by die vervaardiging van kabel gebruik word.

#### 3.2 Elektries

Aluminium wat by die vervaardiging van kabel gebruik word, is gebaseer op publikasies nr. 111 en 121 van die Internasionale Elektrotegniese Kommissie wat onderskeidelik op getrekte en uit-

a purity of not less than 99,5 per unit and respective resistivities of 28,264 and 28,03 ohm-mm<sup>2</sup>/km.

The conductivity of aluminium is 61,0 per cent for drawn wires and 61,5 per cent for annealed conductors, of the international annealed copper standard. This means that to achieve the same voltage drop as a copper conductor for similar load conditions, the cross section of an aluminium conductor must be 1,64 times that of its copper counterpart.

### 3.3 Mechanical

The density of aluminium at 2,703 g/cm<sup>3</sup> compares with that of 8,89 g/cm<sup>3</sup> for copper, to give a density ratio of 0,304. Aluminium wire is normally drawn from rod of a hardness selected so that the aluminium wire ends up in the  $\frac{3}{4}$  H or H condition after fabrication, though there is a tendency amongst South African cable manufacturers to limit the hardness to  $\frac{3}{4}$  H. Solid Aluminium conductor in the O or M condition is considerably softer to assist flexibility.

### 3.4 Chemical

Aluminium is covered with an oxide film which is very tenacious and stable. This natural oxide film is only about 130 Å thick, but as soon as it is removed to expose the metal to the air, a fresh film begins to form immediately. This film, which has considerable electrical resistance, must be removed to permit good electrical contact in joints and it was the difficulty in achieving this in the early days of aluminium cable which mitigated against the universal acceptance of aluminium as a cable conductor material.

The oxide film is susceptible to attack by both acids and alkalis and adequate anti-corrosion protection is essential for all aluminium sheathed cable and aluminium strip or wire armoured cable.

## 4. CURRENT RATINGS

- 4.1 Current ratings of cables, whether copper or aluminium, are based on:
- (i) the maximum permissible temperature at which the component materials may safely operate,
  - (ii) the heat dissipating properties of the cable,
  - (iii) the installation, operating and temperature conditions.

gegloede materiaal betrekking het, en besit 'n suiwerheid van nie minder nie as 99,5 per eenheid en onderskeie spesifieke weerstande van 28,264 en 28,03 ohm-mm<sup>2</sup>/km.

Die geleivermoë van aluminium is in die geval van getrekte drade 61,0 persent en in die geval van uitgegloede geleiers, 61,5 persent van die internasionale standaard vir uitgegloede koper. Dit beteken dat, om dieselfde spanningsval as by 'n kopergeleier onder soortgelyke vragtoestande te verkry, die deursnee van 'n aluminiumgeleier 1,64 keer so groot as dié van sy kopereweknie moet wees.

### 3.3 Meganies

Die digtheid van aluminium, nl. 2,703 gm/cm<sup>3</sup>, vergelyk met dié van koper, nl. 8,89 gm/cm<sup>3</sup>, wat 'n digtheidsverhouding van 0,304 gee. Aluminiumdraad word gewoonlik getrek uit 'n staaf met 'n hardheid wat so uitgesoek is dat die draad, na vervaardiging, 'n hardheid van  $\frac{3}{4}$  H of H het, alhoewel daar by Suid-Afrikaanse kabelvervaardigers 'n neiging bestaan om die hardheid tot  $\frac{3}{4}$  H te beperk. Soleide aluminiumgeleiers in die O of M toestand is aansienlik sagter ten einde groter buigbaarheid te verseker.

### 3.4 Chemies

Aluminium word bedek deur 'n oksiedfilm wat baie taai en stabiel is. Hierdie natuurlike oksiedfilm is slegs sowat 130 Å dik, dog so gou as dit verwyder word om die metaal aan die lug bloot te stel, begin 'n nuwe film onmiddellik weer vorm. Hierdie film, wat buitengewoon hoë elektriese weerstand het, moet verwyder word om goeie elektriese kontak in lasse te verkry, en dit was die moeite wat in die vroeë dae van aluminiumkabel ondervind is om dit te bewerkstellig wat meegebring het dat aluminium nie gereedelik en algemeen as 'n geskikte materiaal vir kabelgeleiers aanvaar is nie.

Die oksiedfilm kan deur sowel sure as alkalië aangeval word, en voldoende beskerming teen verwerking is noodsaaklik vir alle aluminiumomhulde kabel of kabel wat met aluminiumstroke of draad bewapen is.

## 4. STROOMAANSLAE

- 4.1 Die stroomaanslag van kables, hetsy van koper of van aluminium, is gebaseer op:
- (i) die maksimum toelaatbare temperatuur waarteen die samestellende materiale met veiligheid kan werk,
  - (ii) die hitte-kwytrakende eienskappe van die kabel.
  - (iii) die installasie-, werk- en temperatuurtoestande.

**Table 1 : A.C. CURRENT RATINGS FOR CABLE IN GROUND**

**Tabel 1 : W.S. STROOMAANSLAE VIR KABELS IN GROND**

Imperial size sq. inch Imperiale grootte vk. duim	Equivalent size sq. mm. Ekwivalente grootte vk. mm.	New Metric Standard size sq. mm. Nuwe Metrieke Standard grootte vk. mm.	600/1000 Volt PVC Insulated PVC-geïsoleer		600/1000 Volt Paper Insulated Papier-geïsoleer		6,35/11 kV Paper Insulated Screened Papier-geïsoleer afgeskerm		6,35/11 kV Paper Insulated Belted Papier-geïsoleer gord konstruksie	
			Cu	Al	Cu	Al	Cu	Al	Cu	Al
0,0225	14,52		85	66	92	72	84	66	76	59
		16	88	68	97	74	90	71	79	62
0,04	25,81		115	90	130	100	115	89	105	82
		25	115	87	125	97	115	89	100	79
0,06	38,71		150	115	160	125	150	115	130	100
		35	140	105	155	115	135	105	125	98
		50	165	125	180	140	160	125	145	115
0,1	64,52		200	155	220	170	195	150	185	145
		70	205	155	220	170	200	155	180	140
0,15	96,77		250	200	265	210	240	185	225	175
		95	245	185	265	210	240	185	215	170
0,2	129,0		295	230	315	250	285	220	260	200
		120	280	210	310	235	270	210	250	195
0,25	161,3		335	260	365	285	320	250	300	230
		150	310	240	345	270	305	240	280	220
0,3	193,6		365	290	410	325	355	280	330	260
		185	350	270	390	305	340	270	315	250
0,4	258,1		430	340	480	380	415	330	385	300
		240	410	315	450	350	390	310	365	290
0,5	322,6		480	380	520	415	450	360	425	330
		300	460	355	510	395	435	350	410	325
		400			570	460	495	400	465	370

Ground temperature : 25°C

Grond temperatuur : 25°C

Soil thermal resistivity (g) : 1,2 deg C m/w

Termiese grondweerstand (g) : 1,2 grade C m/w

In order to make a comparison of the current carrying capacities of aluminium and copper based on the same permissible operating temperature, which is a function of the  $I^2R$  losses, consider an aluminium and a copper conductor of equal cross sectional area, the aluminium having resistance of  $R_{al}$  ohms and carrying a load of  $I_{al}$  amps, the copper resistance being  $R_{cu}$  and its load  $I_{cu}$ :

For equal losses:—

$$\begin{aligned} I_{al}^2 R_{al} &= I_{cu}^2 R_{cu} \\ I_{al}^2 &= I_{cu}^2 \frac{R_{cu}}{R_{al}} \end{aligned}$$

As the ratio of <sup>Copper</sup> aluminium resistance to that of copper is 0,61:

$$I_{al} = \sqrt{0,61} I_{cu} = 0,78 I_{cu}$$

This theoretical figure of 78% for the rating of an aluminium cable as compared with a copper one is true for direct current, but can vary marginally by a percent or two for alternating current duty depending on the size and construction of the cable. ERA reports F/T183 and ERA 69-30 Parts 1 and 2 (metric sizes) give details of current ratings of paper and PVC insulated distribution cable at ground and air temperatures of 15°C and 25°C respectively. By using the relevant rating factors, these can be converted to the generally accepted South African parameters of 25°C ground temperature and 30°C ambient.

- 4.2 The current ratings of distribution cables laid direct in the ground at 25°C are given for both copper and aluminium conductor in Table 1. These ratings are for four core 600/1000 volt PVC and paper insulated cables and for screened and belted 6,35/11kV cable manufactured to the appropriate South African and British Standards.

TABLE 1

- 4.3 Both prior to and after metrication of cable sizes, it has been the practice for aluminium cables to be manufactured in the same sizes as copper. For low voltage duty, volt drop considerations are often of primary importance and with the conductivity of aluminium being 0,61 that of copper, the cross sectional area of an aluminium conductor cable should theoretically be 1,64 times that of a copper one in order that the same voltage drop will apply.

For the smaller imperial sizes of PVC in-

Ten einde 'n vergelyking te kan tref tussen die stroomdraende hoedanighede van koper en aluminium, gebaseer op dieselfde toelaatbare werkteperatuur, wat 'n funksie van die  $I^2R$  verliese is, oorweeg ons 'n aluminium- en 'n kopergeleier van dieselfde deursnee. Die aluminium het 'n weerstand van  $R_{al}$  ohms en dra 'n vrag van  $I_{al}$  ampere, terwyl die weerstand van die koper  $R_{cu}$  en sy vrag  $I_{cu}$  is.

Vir gelyke verliese:—

$$\begin{aligned} I_{al}^2 R_{al} &= I_{cu}^2 R_{cu} \\ I_{al}^2 &= I_{cu}^2 \frac{R_{cu}}{R_{al}} \end{aligned}$$

Aangesien die verhouding van die weerstand van aluminium tot die van koper 0,61 is:

$$I_{al} = \sqrt{0,61} I_{cu} = 0,78 I_{cu}$$

Hierdie teoretiese syfer van 78% vir die aanslag van 'n aluminiumkabel soos vergeleke by een van koper is korrek vir direkte stroom, dog kan met een of twee persent wissel in die geval van wisselstroom, afhange van die grootte en konstruksie van die kabel. ERA verslae F/T183 en ERA 69-30 Gedeeltes 1 en 2 (metriek groottes) gee besonderhede van die stroomaanslae van papier en PVC-geïsoleerde distribusiekabel teen grond- en lugtemperatuur van 15°C en 25°C onderskeidelik. Deur gebruik te maak van die betrokke aanslagfaktore kan hulle omgewerk word tot die algemeen aanvaarde Suid-Afrikaanse parameters van 25°C en 30°C ten opsigte van grond- en omgewingstemperatuur onderskeidelik.

- 4.2 In Tabel 1 word die stroomaanslae van sowel koper as aluminiumgeleiers wat direk teen 25°C in die grond gelê is, aangegee. Hierdie aanslae geld ten opsigte van vier-aar, 600/1000 volt, PVC- en papier-geïsoleerde kables en vir afgeskermd en gordkables van 6,35/11kV, wat ooreenkomstig die geldende Suid-Afrikaanse en Britse Standaard vervaardig is.

TABEL 1

- 4.3 Sowel vóór as ná die metrisering van kabelgroottes was dit die gebruik om aluminiumkables in dieselfde groottes as koperkables te vervaardig. Bylaagspanningsdiens word daar dikwels groot waarde geheg aan die kwessie van spanningsval en, as in gedagte gehou word dat die geleivermoë van aluminium 0,61 van dié van koper is, moet die deursnee van 'n aluminiumgeleierkabel teoreties 1,64 keer dié van 'n koperkabel wees ten einde te verseker dat dieselfde spannings van toepassing sal wees.

Ten opsigte van die kleiner imperiale groottes

ulated copper cables up to 0,1 sq. in. it has hitherto been the normal rule of thumb in Cape Town to select the next highest standard size of cable as being the aluminium equivalent. In such cases the area factor would range from 1,50 to 1,77. For sizes of PVC and paper insulated cable above 0,1 sq. in. copper, it has been the practice in Cape Town to select the next but one larger standard size of cable as being the aluminium equivalent.

## 5. OVERLOAD AND CYCLIC RATING

Though applicable to both copper and aluminium conductor cables alike, it is considered that the question of overload and cyclic ratings of cables would be of interest to many municipal electrical engineers. Cable ratings are based on continuous loading and in most municipalities the shape of the system load curve is such that cables for certain periods of the day or night are running at light or reduced loads. The ratings for PVC and 11kV paper insulated screened cable are, in terms of ERA reports 69-30, based on a maximum conductor temperature of 70°C, for 11kV paper insulated belted cable on 65°C and for medium voltage paper insulated cable on 80°C.

A great deal of experimental work has been carried out at the Woodlands Laboratory of the Eastern Electricity Board, Great Britain, where lengths of copper and aluminium cables with different kinds of insulation were laid underground, jointed together in a closed loop and then subjected to continually increasing cyclic loads, 8 hours on, 16 hours off. The PVC insulation and sheath showed no visible signs of deterioration up to approximately 140°C conductor temperature, while medium voltage paper insulated cable showed no sign of deterioration at 170 per cent of rated load, at a conductor temperature of 175°C.

While time combined with temperature plays a dominant role in the deterioration of cable insulation, and the tests were carried out under more favourable ground temperature and soil thermal resistivity conditions than would apply in South Africa, these results indicate that cable dielectrics can accommodate a degree of thermal abuse.

The ERA publication F/T186 details methods for the calculation of cyclic rating factors and emergency loading for cables laid direct in the ground or in ducts. Figure 2 illustrates load curves, taken at last year's peak, of representative stepdown substations in different areas of Cape Town, on each of which has been indicated the cyclic loading factor calculated in accordance with ERA F/T186. This loading factor for a particular load curve gives the ratio of

PVC-geïsoleerde koperkabels tot by 0,1 vk. dm. is daar tot duver in Kaapstad die lukrake reël gevolg om die volgende hoogste standaardgrootte as die ekwivalente grootte aluminiumkabel te kies. In sulke gevalle het die deursnee faktor van 1,50 tot 1,77 gewissel. Vir PVC- en papier-geïsoleerde kabels van groter as 0,1 vk. dm. koper, is in Kaapstad die beleid gevolg om die volgende grootste standaardgrootte kabel as die aluminium-ekwivalent te beskou en te gebruik.

## 5. OORBELADING en SIKLUSAANSLAE

Alhoewel dit eweneens op sowel koper- as aluminiumkabels van toepassing is, word die mening gehuldig dat die kwessie van die oorbelading en die siklusaanslae van kabels vir baie munisipale elektrotegniese ingenieurs van wesentlike belang sal wees. Kabelaanslae word op deurlopende belading gebaseer en in meeste munisipaliteite is die vorm van die vragkurwe van die stelsel sodanig dat kabels gedurende sekere ure van die dag of nag 'n ligte of 'n verminderde vrag dra. Die aanslae vir PVC- en 11kV papier-geïsoleerde afgeskermdes kabels is, ingevolge ERA-verslae 69-30, gebaseer op 'n maksimum-geleiertemperatuur van 70°C, vir 11kV-papier-geïsoleerde gordkabel op 65°C en vir mediumspanning papier-geïsoleerde kabel op 80°C.

'n Groot hoeveelheid proefondervindelijke werk is by die Woodlandslaboratorium van die Oostelike Elektrisiteitsraad in Groot-Brittanje uitgevoer, waar lengtes koper- en aluminiumkabel met verskillende soorte isolasie ondergronds gelê is, in 'n geslote baan aanmeekaar gekoppel is en toe aan steeds toenemende siklusaanslae, 8 ure aan en 16 ure af, onderwerp is. Die PVC-isolasie en -omhulsel het geen merkbare tekens van verslegting getoon tot by ongeveer 140°C geleiertemperatuur nie, terwyl die mediumspanning papier-geïsoleerde kabel geen tekens van verslegting getoon het tot by 170 persent van die aangeslane vrag teen 'n geleiertemperatuur van 175°C nie.

Terwyl dit so is dat tyd, gekombineer met temperatuur, 'n oorheersende rol in die verslegting van kabel-isolasie speel, en dat die toets uitgevoer is teen meer gunstige toestande ten opsigte van grondtemperatuur en die termiese weerstand van die grond as wat in Suid-Afrika die geval sou wees, dui hierdie uitslae daarop dat die dielektrika in die kabels 'n mate van termiese misbruik kan weerstaan.

Die ERA publikasie F/T186 gee besonderhede van metodes vir die berekening van sikliese aanslag-faktore en die noodbelading vir kabels wat direk in die grond of in kanale gelê word. Figuur 2 illustreer vragkurwes, wat teen verlede jaar se spits geneem is, van verteenwoordigende verlagingssubstasies in verskillende gebiede van Kaapstad, op elkeen waarvan die sikliese beladingfaktor, wat in ooreenstemming met ERA F/186 bereken is, aangedui word. Hierdie

permissible peak load to the sustained load rating given in the relevant ERA tables.

beladingsfaktor vir 'n besondere vragkurwe gee die verhouding van die toelaatbare spitsvrag tot die gehoude vraagslag wat in die betrokke ERA- tabelle aangegee word.

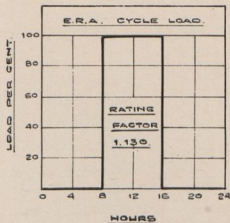
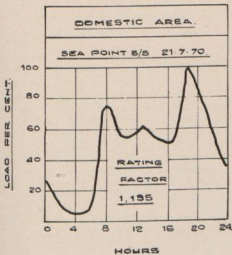
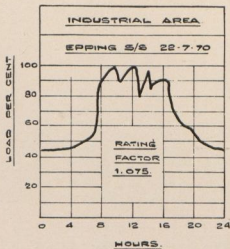
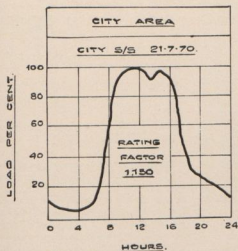


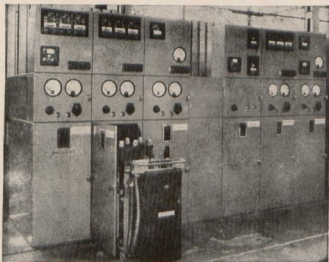
Figure 2

Figure 2

Despite the increasing use of air conditioning in summer, especially in the central business districts, the majority of peak loads on distribution cable systems in South Africa still occur during the winter months when the ground temperature will normally

Ten spyte van die toenemende gebruik van lugreëling in die somer, veral in die sentrale sakegebiede, kom die meerderheid spitsvragte op distribusiekabelstelsels in Suid-Afrika nog gedurende die wintermaande voor, wanneer die grondtemperatuur normaalweg





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be well below 25°C. If the ground temperature were 15°C, there would be an additional rating factor of between 1,09 and 1,12 depending on the type of cable.

Cables laid in the ground or ducts heat and cool much more slowly than cables laid in air and theoretically the cyclic rating of a cable laid direct in the ground with terminations in air should be governed by the portion in air. In general, however, operating and testing experience indicates that the ratings of both aluminium and copper cables are on the conservative side.

## 6. SHORT CIRCUIT RATING

The short circuit rating of a cable may be governed by any of three limiting conditions viz.

### 6.1.1 Permissible conductor temperature :

In order to prevent the buckling of joints due to longitudinal expansion of the conductors, this temperature for paper insulated stranded conductors is taken in ERA Report F/T195 to be 160°C, which is below the approximate 170°C melting point of aluminium solder and 185°C for tin-lead solder. For cable with solid aluminium conductor, which has different thermo-mechanical characteristics to stranded conductors, the maximum conductor temperature is 130°C for both paper and PVC insulated cable.

*New standard 160°C*

### 6.1.2 Damage to lead sheath :

The limiting temperature to avoid longitudinal circumferential cracking of the lead sheath of a cable is taken as 250°C. For a single wire armoured cable, the wire armour is assumed to share the fault current with the lead, not necessarily in exact proportion to their relative resistances. For steel tape armoured cable all the earth fault current is assumed to be taken by the lead sheath only, and in certain types of steel tape armoured cable a derating of the short circuit figures for wire armoured cables might be necessary. In many municipal supply undertakings the 11kV system neutral is earthed through a current limiting device, in which case the overheating of the lead sheath will not be a factor as far as short circuit rating is concerned.

### 6.1.3 Bursting of Sheath :

Formulae for calculating the limits for bursting have been established by Gosland and Parr and these formulae have been verified experimentally. Bursting limits are a function of the

heelwat onder 25°C is. Indien die grondtemperatuur 15°C sou wees, sal daar 'n bykomstige aanslagfaktor van tussen 1,09 en 1,12 wees, afhangende van die tipe kabel

Kabels wat in die grond of in kanale gelê is, word baie stadiger warm of koud as kabels wat in die lug is en teoreties behoort die sikliese aanslag van 'n kabel wat direk in die grond gelê is, met sy punte in die lug, deur die gedeelte wat in die lug is, beheer te word. Oor die algemeen dui werks- en toets-ondervinding daarop dat die aanslae van sowel aluminium- as koperkabel aan die konserwatiewe kant is.

## 6. KORTSLUITINGSAANSLAG

Die kortsluitingsaanslag van 'n kabel kan deur enigeen van drie beperkende toestande beheer word, nl.

### 6.1.1. Toelaatbare geleiertemperatuur :

Ten einde die verbuiging of kromtrek van lasse as gevolg van die oorlangse uitsetting van geleiers te verhoed, word hierdie temperatuur in die geval van papier-geïsoleerde, gevlegte geleiers in ERA-verslag F/T195 as 160°C geneem, wat laer is as die smeltpunt van ongeveer 170°C in die geval van aluminiumsoldeersel en 185°C vir tin/loodsoldeersel. Vir kabel met soliede aluminium-geleier, waarvan die termomeganiese eienskappe verskil van dié van gevlegte geleiers, is die maksimumgeleiertemperatuur 130°C vir sowel papier- as PVC-geïsoleerde kabel.

### 6.1.2. Bekadiging van lood-omhulsel :

Die beperkende temperatuur om oorlangse of omtrekbaarste in die lood-omhulsel van 'n kabel te verhoed, word as 250°C geneem. In die geval van 'n enkeldraad-gepantserde kabel word aanvaar dat die draadpantsering die foutstroom met die lood deel, dog nie in presiese verhouding tot hulle relatiewe weerstande nie. In die geval van staalband-gepantserde kabel word aanvaar dat die volle aardfoutstroom slegs deur die lood-omhulsel opgeneem word, en in sekere tipes staalband-gepantserde kabel mag dit nodig wees om die kortsluitingsstroom vir draad-gepantserde kabels jetwat te verlaag. In verskeie munisipale voorsieningsondernemings word die neutrale geleier van die 11 kV-stelsel deur bemiddeling van 'n stroombeperkende toestel geaard, in welke geval die oorverhitting van die lood-omhulsel nie 'n rol sal speel insoverre dit die kortsluitingsstroom-aanslag aanbetref nie.

### 6.1.3. Bars van die Lood-omhulsel :

Formules vir die berekening van die perke vir die bars van omhulsels is deur Gosland en Parr daargestel, en hierdie formules is proefondervindelik gekontroleer. Barsperke is 'n funksie van

**Table 2: SHORT CIRCUIT CURRENT RATINGS**

**Table 2: KORTSLUITINGSTROOMAANSLAE**

Conductor size — sq. in. Geleiersgrootte — vk. mm.		Short circuit rating, one second fault duration, kA Kortsluitingsaanlag, foutduur van een sekonde, kA										Safe Bursting Currents 11 kV P.I. Cu or Al Cable Veilige Barsstrome 11 kV-P.-G. Cu of Al Kabel	
		PVC-Geisoleer PVC Insulated		Paper insulated single-wire armoured Papier-geisoleer enkeldraad gepantser				Screened Afgeskerm 11 kV		Belted Gordkonstruksie 11 kV			
		Up to Tot by 3 300 V		Up to Tot by 1,1 kV		3,3 — 6,6 kV							
Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Belted Gord	Afgeskerm Screened		
16	1,5	1,0	1,8	1,2	1,8	1,2	1,9	1,2	1,9	1,2			
25	2,4	1,5	2,8	1,8	2,8	1,8	2,9	1,9	3,0	1,9			
35	3,3	2,1	3,9	2,5	3,9	2,5	4,1	2,6	4,2	2,7	33	17	
50	4,6	2,8	5,1	3,2	5,1	3,2	5,9	3,8	6,0	3,9	35	18	
70	6,5	4,0	7,5	4,8	7,5	4,8	8,2	5,3	8,3	5,4	36	19	
95	9,0	5,6	11,0	6,5	11,0	6,5	11,0	7,2	11,0	7,3	38	20	
120	12,0	7,0	14,0	8,4	14,0	8,4	14,0	9,0	14,0	9,3	41	21	
150	15,0	8,6	16,0	11,0	16,0	11,0	18,0	11,0	18,0	12,0	43	22	
185	18,0	11,0	20,0	14,0	20,0	14,0	22,0	14,0	22,0	14,0	44	22	
240	23,0	15,0	26,0	17,0	26,0	17,0	28,0	18,0	29,0	18,0	47	24	
300	29,0	17,0	33,0	22,0	33,0	22,0	35,0	23,0	36,0	23,0	50	24	
400	38,0	22,0	42,0	27,0	42,0	27,0	47,0	30,0	48,0	31,0			
Temperature Rise 70-130°C		80-160°C		80-160°C		70-160°C		65-160°C					
Temperatuurstyging													
Faktore vir verskillende foutduurtes Factors for different fault durations													
Sekondes Seconds	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0	2,0	3,0		
Faktor Factor	2,24	1,82	1,58	1,41	1,29	1,19	1,12	1,05	1,0	0,71	0,58		

construction of the cable and are thus independent of the conductor material.

6.2 Considering the longitudinal expansion that occurs with a rise in temperature and which tends to make the conductor ends enter the joint boxes and cause buckling, the coefficient of expansion of aluminium in 34 per cent greater than that of copper. This might appear to be detrimental to the short circuit properties of aluminium but this is not the full picture. As the conductors are not free but are restrained, it is necessary to take into account the modulus of elasticity to determine the relative forces set up. As a simplification, these forces can be considered to be proportional to the product of the coefficient of expansion and the modulus of elasticity. The modulus of elasticity of aluminium is only 58 per cent of that of copper and this difference offsets the higher expansion rate of aluminium.

6.3 The short circuit rating of an aluminium cable is about 64 per cent that of a copper cable of the same size and for an aluminium cable of similar resistance to a copper cable, the short circuit rating can be taken to be the same in each case.

Table 2 gives comparative details of the short circuit ratings and safe bursting currents for both aluminium and copper cables. For screened 11kV cable the figures given for the safe bursting currents are for unarmoured cable, these being the only ones available. For armoured cable, corresponding values could be higher.

TABLE 2

The 11kV distribution system in Cape Town makes use of both belted and screened cables, with the 11kV neutral earthed at each step-down substation by means of an 800 or 1,600 amp resistor. The smallest size of 11kV cable installed many years ago was 0,022 5 sq. in. copper conductor of belted construction and despite the fact that the system short circuit capacity has since risen to approx. 250 MVA (12,50 kiloamps), no damage to any cable due to short circuit conditions has yet occurred although reference to short circuit rating tables might give cause for concern.

Short circuit ratings are based on the assumption that the short circuit takes place when the conductor is at its maximum operating temperature and that the short circuit current stays constant during its duration instead of falling as it normally does. Short

die konstruksie van die kabel en is gevolglik onafhanklik van die materiaal waarvan die geleier gemaak is.

6.2 Met die oog op die oorlangse uitsetting wat met 'n styging van die temperatuur gepaard gaan en wat veroorsaak dat die punte van die geleiers die laskaste binnedring en verbuiging veroorsaak, word aanvaar dat die uitsettingskoeffisiënt van aluminium 34 persent hoër is as dié van koper. Dit mag skynbaar die kortsluitingseienskappe van aluminium in 'n swak lig stel, dog dit wys nog nie die volle prentjie nie. Aangesien die geleiers nie vry is nie, dog onder beperkings verkeer, is dit nodig dat rekening gehou word met die elastisiteitsmodulus ten einde die relatiewe kragte wat vrygestel word, te bepaal. Om dit eenvoudig te stel, kan hierdie kragte beskou word as proporsioneel tot die produk van die uitsettingskoeffisiënt en die elastisiteitsmodulus. Die elastisiteitsmodulus van aluminium is slegs 58% van dié van koper en hierdie verskil weeg op teen die hoër uitsettingskoers van aluminium.

6.3 Die kortsluitingsaanslag van 'n aluminiumkabel is ongeveer 64% van dié van 'n koperkabel van dieselfde grootte en vir 'n aluminiumkabel met 'n soortgelyke weerstand as 'n koperkabel kan die kortsluitingsaanslag as dieffelde in elke geval beskou word.

In tabel 2 word vergelykende besonderhede van die kortsluitingsaanslae en veilige barsstrome vir sowel aluminium- as koperkabels aangegee. In die geval van afgeskermd kabel is die syfers wat ten opsigte van die veilige barsstrome aangegee word, dié vir ongepanserde kabel, aangesien dit die enigste is wat beskikbaar is. In die geval van gepanserde kabel kan die ooreenstemmende waardes hoër wees.

TABEL 2

Die 11kV-distribusiestelsel in Kaapstad maak gebruik van sowel gord- as afgeskermd kabel, met die 11kV-nulgeleier by elke verlagingsstasie deur middel van 'n 800 of 1600-ampere weerstand geaard. Die kleinste grootte 11kV-kabel wat baie jare gelede geïnstalleer is, was 0,022 5 vk. dm. kopergeleier met gordkonstruksie en, ten spyte van die feit dat die kortsluitingsvermoë van die stelsel serdertdien tot ongeveer 250 MVA (12,50 kilo-ampere) gestyg het, het daar geen skade aan enige kabel wat aan kortsluitings-toestande te wyte is, voorgekom nie, alhoewel daar rede tot kommer mag bestaan as ons na die kortsluitingsaanslagtable verwys.

Kortsluitingsaanslae word gebaseer op die veronderstelling dat die kortsluiting plaasvind wanneer die geleier by sy maksimum-werktemperatuur is en dat die kortsluitingstroom solank as wat, dit duur, konstant by instede daarvan om te val, soos wat

circuit ratings of both copper and aluminium cables therefore tend in actual operation to be on the conservative side.

## 7. TYPES OF ALUMINIUM DISTRIBUTION CABLE

### 7.1 General :

Aluminium is very much more ductile than copper and it is practicable to use conductors of solid as well as stranded aluminium. The use of solid conductor with PVC insulation results in a more compact and a corresponding cost saving which in certain sizes can be considerable; for instance there is an approximate 14% saving by using solid instead of stranded conductor for 0,04 sq. in. two core medium voltage cable.

Solid aluminium conductors cannot be pre-spliced to reduce mechanical stress during the laying up process, and are not used for 11kV cables where the integrity of the dielectric is more important than for medium voltage cables. In addition the short circuit rating of a solid conductor paper insulated cable is lower than that of a stranded one.

### 7.2 South African Standards :

Until recently the use of aluminium as a cable conductor was covered only by the South African Bureau of Standards Specification No. 97-1967 for paper insulated cable. The new metrication standard for PVC insulated cable, SABS 150-1970, now provides for both stranded and solid aluminium conductors as well as concentric neutral cable with copper conductors only.

### 7.3 Medium Voltage 4 Core Cables :

The four core solid aluminium conductor cables to SABS 150-1970 are PVC insulated with an extruded PVC bedding, single galvanised steel wire armour and an extruded PVC sheath. There are two variations of this construction used in Great Britain and the continent.

One employs a helically lapped PVC tape bedding with aluminium strip armour and PVC sheath. In this design the bedding and armouring operations can take place in one run through the machines, which results in a cheaper cable than the conventional SABS design. The rival merits of wire armour as against aluminium strip armour are sometimes hotly debated, but in the author's opinion, these are of technical interest only. The armour is fundamentally meant to protect the cable

gewoonlik die geval is. Die kortsluitingsaanslae van sowel koper- as aluminiumkabels is dus onder werklike werksomstandighede geneig om aan die konserwatiewe kant te wees.

## 7. Tipes ALUMINIUM-DISTRIBUSIEKABEL

### 7.1 Algemeen :

Aluminium is baie meer rekbaar as koper en dit is prakties moontlik om geleiers van sowel soliede as gevlegte aluminium te gebruik. Die gebruik van 'n soliede geleier met PVC-isolasie het tot gevolg 'n meer kompakte kabel en 'n ooreenstemmende kostebesparing, wat in sommige gevalle nogal aansienlik kan wees; daar is bv. 'n besparing van ongeveer 14% deur die gebruik van 'n soliede in plaas van 'n gevlegte geleier vir 'n 0,04 vk. dm., twee-aar mediumspanningsgeleier.

Soliede aluminiumgeleiers kan nie vooraf spiraalvormig gedraai word om meganiese streming gedurende die opbouproses te verminder nie, en hulle word nie vir 11kV-kabels gebruik waar die integriteit van die dielektrikum meer belangrik is as by mediumspanningskabels nie. Boonop is die kortsluitingsaanslag van 'n papiergeïsoleerde kabel met 'n soliede geleier laer as dié van een met 'n gevlegte geleier.

### 7.2 Suid-Afrikaanse Standaarde :

Tot onlangs is die gebruik van aluminium as 'n kabelgeleier slegs deur die Suid-Afrikaanse Buro vir Standaarde se spesifikasie nr. 97-1967 vir papier-geïsoleerde kabels gedek. Die nuwe gemetriseerde standaard vir PVC-geïsoleerde kabel, SABS 150-1970, maak egter nou voorsiening vir sowel gevlegte as soliede aluminiumgeleiers sowel as vir konsentriese neutrale kabels met slegs kopergeleiers.

### 7.3 4-aar-kabels vir mediumspanning :

Die 4-aar soliede aluminiumgeleierkabels wat aan SABS-spesifikasie nr. 150-1970 voldoen, is PVC-geïsoleer met 'n deurgeperste PVC-onderlaag, 'n enkele galvalvaniseerde staaldraadpantsering en 'n deurgeperste PVC-omhulsel. Daar is twee variasies van hierdie konstruksie wat in Groot-Brittanje en die Vasteland gebruik word.

Een maak gebruik van 'n onderlaag van helies-gedraaide PVC-band, gepantser met aluminiumstroke en 'n omhulsel van PVC buiteom. In hierdie ontwerp kan die onderlaag en die pantsering gedurende één lopie deur die masjiene aangebring word, wat 'n goedkoper kabel tot gevolg het as die konvensionele SABS-ontwerp. Die onderskeie voordele van draadbewapening soos vergeleke by pantsering van aluminiumband lok soms warm bespreking uit, dog, na die skrywer

against damage during installation and both strip or wire will be of very limited, if any assistance, against a direct blow from a pick of other mechanical device.

A second design employs the use of three PVC insulated solid aluminium conductors with a round aluminium neutral conductor with an extruded lead covering, the four conductors, being armoured with two corrosion protected steel tapes with a PVC sheath overall.

#### 7.4 Concentric neutral cables :

On protective multiple earthing (PME) systems the consumers earth is connected to the earthed neutral of the distribution system, and no independent cable earth connection is required. This has focused attention, both in South Africa and overseas, on the saving in medium voltage cable costs that could be achieved by employing a concentric neutral which would also act as an armour or sheath. The conductivity of such a neutral must of necessity be high, thus restricting the metal used to either copper or aluminium.

For PVC insulated cables, copper wire either in conventional lay or wavecon formation could readily be employed for the concentric neutral, but the use of aluminium strip or wire is influenced by the dangers of corrosion should the outer PVC sheath be damaged.

The problem of the corrosion of exposed aluminium in underground installations is a complicated one, but depends mainly on the galvanic chemistry of the soil. This can lead to inconsistent results. The aluminium armoured wires of 33kV cables laid across a tidal estuary in Northern Ireland were in almost perfect condition after 29 years of service, even though the hessian covering over the wire had virtually disappeared and the cables were exposed to the air daily at low tide. On the other hand, there have been instances when aluminium wire or strip concentric neutrals have corroded away to powder within a year of installation, due to the ingress of water through a perforation of the PVC sheath.

It is widely accepted that in the event of the conventional extruded PVC anti-corrosive sheath over an aluminium strip or wire concentric neutral being punctured, moisture can readily migrate along the strips/wires and by corrosion cause the

se mening, is hierdie oorwegings van bloot tegniese belang. Die fundamentele doel van die pantsering is om die kabel teen skade tydens installasie te beskerm en sowel draad- as bandpantsering sal baie beperkte, indien enige, beskerming bied teen 'n direkte hou van 'n pik of enige ander meganiese toestel.

'n Tweede ontwerp maak gebruik van drie soliede aluminiumgeleiers wat met PVC geïsoleer is, tesame met 'n ronde nul-geleier van aluminium met 'n deurgeperste loodomhulsel, terwyl alhier die geleiers met twee verweringsbestande staalbande gepantser en buite-om met 'n PVC-omhulsel bedek is.

#### 7.4 Kables met Konsentriese nulgeleiers :

In stelsels met beskermde veelvoudige aarding word die verbruiker se aardgeleiding aan die geaarde nulgeleier van die distribusiestelsel gekoppel, en geen onafhanklike kabel-aardkonneksie is gevolglik nodig nie. Dit het die aandag, sowel in S.A. as oorsee, gevestig op die besparing wat in die koste van mediumsenningskabel tweeweggebring kan word deur gebruik te maak van 'n konsentriese nulgeleier wat ook as pantsering of omhulsel kan dien. Die geleibaarheid van so 'n nulgeleier moet noodwendig hoog wees, met die gevolg dat die materiaal wat gebruik kan word, tot óf koper óf aluminium beperk is.

In die geval van PVC-geïsoleerde kables sal koperdraad, óf op die konvensionele wyse gelê óf in gegolfde formasie, gereedlik vir die konsentriese nulgeleier gebruik kan word, maar die gebruik van aluminiumband of -draad sal beïnvloed word deur die gevaar van verwering indien die buitenste PVC-omhulsel beskadig sou word.

Die probleem van die verwerking van ontblote aluminium in ondergrondse installasies is gekompliseerd, dog dit hang hoofsaaklik van die galvaniese chemie van die grond af. Dit kan inkonsekwente resultate tot gevolg hê. Die aluminium-pantserderade van 33kV-kables wat oor 'n vloedmunding in Noord-Ierland gelê is, was na 29 jaar diens nog in 'n byna perfekte toestand, alhoewel die going-omhulsel van die drade feitlik verdwyn het en die kables tweekeer per dag by laagwater aan die lug blootgestel is. Aan die ander kant het daar gevalle voorgekom waar konsentriese nulgeleiers van aluminiumdraad of -band binne 'n jaar na installasie tot poeier verweer het, weens die binnedringing van water deur 'n perforasie in die PVC-omhulsel.

Daar word algemeen aanvaar dat, indien daar 'n lekplek in die konvensionele deurgeperste, anti-verweringsomhulsel van PVC óm 'n nulgeleier van aluminiumband of -draad sou voorkom, die voligheid gereedlik langs die band of draad

loss of the neutral and earth concentric conductor. For this reason it is the custom in France to use for the concentric neutral, aluminium wires embedded in a soft uncured rubber bedding, into which the wires partially sink. In Germany it is considered that the requirement for good contact between the concentric wires and contact tape is incompatible with having the wires and contact tape properly protected against corrosion, and the use of an aluminium concentric neutral conductor is therefore specifically outlawed in Germany. Apart from an experimental PVC sheathed concentric neutral installation at Worcester some nine years ago, this type of cable construction using an aluminium wire or strip neutral is not accepted by the Area Boards in Great Britain.

As far as paper insulated concentric neutral cable is concerned, designs having three paper insulated solid or stranded aluminium cores and an extruded aluminium sheath concentric neutral have been in successful operation for some time. This type of cable called CONSAC in Great Britain, has solid aluminium conductors and a PVC over-sheath extruded over a corrosion inhibiting compound covering and is approximately 30% cheaper than a 4 core lead sheathed aluminium conductor cable of conventional design. The German counterpart normally has stranded conductors and an anti-corrosion protection consisting of bitumen compound covered with polyisobutylene tapes longitudinally applied underneath an extruded PVC sheath.

While it can be argued that an extruded aluminium sheath is also liable to corrosion in the event of external damage to the anti-corrosion sheath, the compound over the aluminium prevents the migration of moisture along the cable sheath and the corrosion effect is localised. If such corrosion of the sheath takes place moisture can enter through pin holes in the sheath, into the cable core(s) which being paper insulated and sensitive to moisture, fails to safety. This failure mechanism does not occur when the cable has plastic or elastomeric insulation which is not sensitive to water. In this case the fault is not noticed and partial or complete corrosion of the concentric neutral can occur.

kan deurdring en deur verwerking die verlies van die konsentriese nul- en aardgeleier kan veroorsaak. Om hierdie rede word daar in Frankryk vir die konsentriese nulgeleier gebruik gemaak van aluminiumdrade wat in 'n sagte, ongevulkaniseerde rubber-onderlaag ingelê is, sodat die drade gedeeltelik in die rubber wegsink. In Duitsland word die mening gehuldig dat dit nie moontlik is om die drade en die kontakband doeltreffend teen verwerking te beskerm en nogtans die gewenste goeie kontak tussen die konsentriese drade en die kontakband te behou nie, en die gebruik van 'n konsentriese nulgeleier van aluminium word gevolglik in Duitsland uitdruklik by wetgewing verbied. Behalwe vir 'n eksperimentele installasie van PVC-omhulde konsentriese nulgeleier te Worcester ongeveer nege jaar gelede, word hierdie tipe kabelkonstruksie wat van 'n nulgeleier van aluminiumdraad of -lint gebruik maak, ook nie deur die Gebiedsrade in Groot-Brittanje aanvaar nie.

Sover dit papier-geïsoleerde kables met konsentriese nulgeleiers aanbetref, is ontwerp met drie papier-geïsoleerde, soliede of gevlegte aluminium-are en 'n konsentriese nulgeleier met 'n deurgeperse aluminiumomhulsel, reeds geruime tyd met sukses in gebruik. Hierdie soort kabel, wat in Groot-Brittanje CONSAC genoem word, bestaan uit soliede aluminiumgeleiers en 'n PVC-omhulsel wat oor 'n verwerkingstremmende seël-mengselbedekking deurgepers is, en is ongeveer 40% goedkoper as 'n 4-aarkabel met lood-omhulde aluminiumgeleiers en 'n konvensionele ontwerp. Die Duitse teenhanger hiervan bestaan normaalweg uit gevlegde geleiers en beskerming teen verwerking bestaande uit 'n bitumenmengsel, gedek met poli-isobutileen-bande wat oorlangs aangebring en met 'n deurgeperse PVC-omhulsel bedek is.

Terwyl daar geargumenteer kan word dat 'n deurgeperse aluminium-omhulsel ook aan verwerking blootgestel sal word indien die anti-verweringsomhulsel van buite af beskuldig sou word, is dit tog so dat die mengsel oor die aluminium die deurdring van vog langs die kabelomhulsel verhoed en dat die verweringsuitwerking dan gelokaliseer is. Indien sodanige verwerking van die omhulsel plaasvind kan vog deur die klein gaatjies in die omhulsel binnedring tot binne-in die kabelkern, wat, omdat hulle papiergeïsoleer en dus gevoelig vir vog is, na-veiligheid deurbrand. Hierdie deurbrandmeganisme vind nie plaas wanneer die kabel plasties of elastomeries geïsoleer is nie, aangesien hierdie isolering nie vir water vatbaar is nie. In hierdie geval word die fout nie opgemerk nie en die gedeeltelike of algehele verwerking van die konsentriese nulgeleier kan dus voorkom.

## 8. JOINTING OF ALUMINIUM CONDUCTORS

At this stage it is opportune to survey the various means available for jointing aluminium conductors, all of which have to deal with a common problem, i.e. how to overcome the tenacious oxide film on the aluminium. The methods used are in the main, soldering, welding and compression.

### 8.1 Soldering

#### 8.1.1 Abrasion Soldering

In the abrasion soldering method, which uses no flux, the oxide layer is removed by friction. The conductor is heated until a stick of abrasion solder held against it begins to melt. Abrasion solder is a tin-zinc alloy, and rubbing the conductor with the solder stick causes zinc particles, which melt less readily than the bulk of the solder, to abrade the oxide film thus enabling the aluminium underneath the solder blanket to become tinned. It is important that the solder should be heated indirectly and not by the flame. After tinning a conventional tin-lead solder can be used to complete the jointing process.

Abrasion soldering is particularly suitable for solid aluminium conductors; in the case of stranded conductors, it is a painstaking job to effectively tin each individual strand, though this method is used.

#### 8.1.2 Soldering fluxes, general

For all other methods of soldering, whether on copper or aluminium conductors, the use of a flux is essential. In order to enable the solder to alloy with the metal which has to be joined, both the molten solder and the joint surface must be free from dirt or oxide, and it is the function of the flux to clean the joint before soldering and to protect it from oxidation while soldering is in progress.

The normal fluxes used for copper cable are unsuitable for use with aluminium and it was only after special fluxes for aluminium jointing had been successfully developed that the prejudice against aluminium conductor cable began to wane in many countries.

There are two basic types of flux used for jointing aluminium viz. organic and inorganic (reaction). Organic fluxes are normally liquid compounds of the amine/fluorine type which decompose at approximately 250°C to affect loosening and removal of the oxide film, and to assist the spreading of the molten solder, which immediately tins the de-oxidised surface.

## 8 DIE LAS VAN ALUMINIUMGELEIERS

Dit is in hierdie stadium gepas om 'n oorsig te gee van die verskillende beskikbare metodes om aluminiumgeleiers te las, welke metodes almal met 'n gemeenskaplike probleem te kampe het, nl. hoe om die taai oksiedfilm op die aluminium te bowe te kom. Die metodes wat gebruik word, is hoofsaaklik soldering, sweising en saampersing.

### 8.1 Soldering :

#### 8.1.1 Skuursoldering :

In die skuursolderingsmetode, waar geen vloei-middel gebruik word nie, word die oksiedlaag deur middel van wrywing verwyder. Die geleier word verhit totdat 'n staaf skuursoldeerseel wat daarteen gehou word, begin smelt. Skuursoldeerseel is 'n tin-sink-allooi en wanneer die soldeerstaaf teen die geleier gevryf word, veroorsaak dit dat klein deeltjies sink, wat minder gereedlik smelt as die grootste gedeelte van die soldeerseel, die oksiedfilm wegskuur, met die gevolg dat die aluminium onder die laag soldeerseel vertin word. Dit is belangrik dat die soldeerseel indirek verhit moet word en nie deur die vlam nie. Na vertinning kan 'n konvensionele tin-lood-soldeerseel gebruik word om die lasproses te voltooi.

Skuursoldering is besonder geskik vir soliede aluminiumgeleiers. In die geval van gevlegde geleiers is dit 'n nougesette taak om elke afsonderlike draadjie doeltreffend te vertin, dog hierdie metode word nogtans gebruik.

#### 8.1.2 Soldeervloei-middels, algemeen :

Vir alle ander soldeermetodes, hetsy op koper of aluminiumgeleiers, is die gebruik van 'n vloei-middel noodsaaklik. Ten einde die soldeerseel in staat te stel om 'n allooi te vorm met die materiaal wat gelas moet word, moet sowel die gesmelte soldeerseel as die lasoppervlakte vry wees van enige vuiligheid of oksied, en dit is die taak van die vloei-middel om die lasplek vóór soldering skoon te maak en om dit teen oksidasie te beskerm terwyl die soldeerproses aan die gang is.

Die normale vloei-middels wat vir koperkabel gebruik word, is ongeskik vir gebruik met aluminium, en dit was eers nadat spesiale vloei-middels vir die las van aluminium met sukses ontwikkel is, dat die vooroordeel teen kabels met aluminiumgeleiers in baie lande begin afneem het.

Daar is twee basiese soorte vloei-middels wat vir die las van aluminium gebruik word, nl. organies en onorganieses (reaksie). Organiese vloei-middels is gewoonlik vloei-bare samestellings van die amino/fluoried-tipe wat teen ongeveer 250°C begin ontbind en die oksiedfilm losmaak en verwyder en die verspreiding van die gesmelte soldeerseel aan help, waardeur die gedooksiede oppervlakte onmiddellik vertin word.



Inorganic or reaction fluxes are generally mixtures of chlorides of heavy metals such as tin, zinc, lead and cadmium. When applied to aluminium the salts react at temperatures between 250°C and 350°C to form aluminium halides, which effectively remove the oxide film. A secondary reaction then takes place whereby the heavy metals deposit and alloy with the oxide free aluminium surface.

### 8.1.3. Soldering with organic fluxes

In the case of organic fluxes, the jointing procedure for aluminium conductors is not dissimilar to that for copper, but more care and attention to detail are required. The following aspects of the jointing procedure must be carefully followed:—

- The wires of the stranded conductor must be opened in such a way that no two adjacent ends are touching, though full separation of wires is not required. The object of this is to ensure full penetration of the flux to the centre wires.
- Flux must not be applied to a cold conductor, which should be preheated by liberal basting with special molten solder, usually of a tin/lead/zinc alloy composition.
- The pot temperature must be within the correct working range recommended by the manufacturer, to ensure avoidance of the flux and consequently, poor tinning. This temperature range is between 300°C and 340°C.

For straight joints, standard copper weak-back ferrules are used and these must be pot tinned if not supplied in a tinned condition.

Up to a few years ago the flux used by the Area Boards of Great Britain had the drawback that physical contact with the flux and the fumes emitted by this flux could, in the case of a small number of the jointing establishment more allergic than others, cause dermatitis, eye trouble or respiratory disorders such as bronchitis over a period of time.

In 1968 a new flux, which has no toxic medical side effects, was developed by a leading British cable manufacturer, and since then another similar flux has come on the market.

### 8.1.4 Soldering with inorganic fluxes

While British practice favours aluminium

Anorganiese of reaksie-vloeimiddels is gewoonlik mengsels van die kloriedes van swaar metale soos tin, sink, lood en kadmium. Wanneer dit met aluminium in aanraking kom, reageer die soute teen temperature tussen 250°C en 350°C om aluminiumhalides te vorm, wat die oksiedfilm doeltreffend verwyder. Daarna vind 'n sekondêre reaksie plaas waardeur die swaarder metale neerslaan en 'n alloor met die oksiedvrye aluminium-opervlaktes vorm.

### 8.1.3 Soldering met organiese vloeimiddels:

In die geval van organiese vloeimiddels is die lasprosedure soortgelyk aan dié vir koper, dog meer sorg en meer aandag aan detail is nodig. Die volgende aspekte van die lasprosedure moet sorgvuldig in ag geneem word:

- Die drade van die gevlegde geleier moet op so 'n wyse oopgemaak word dat geen twee lamsmekaarliggende punte aan mekaar raak nie, alhoewel dit nie nodig is om die drade heeltemal van mekaar te skei nie. Die doel hiervan is om te verseker dat die vloeimiddel ten volle die binne drade deurdring.
- Die vloeimiddel moet nie aan 'n koue geleier aangebring word nie, dog laasgenoemde moet vooraf verwarm word deur 'n ruime bedruiping met spesiale gesmelte soldeersel, gewoonlik 'n samestelling van tin/lood/sink-alloor.
- Die kroestemperatuur moet binne die regte werksgrense, soos deur die vervaardiger aanbeveel, wees, ten einde die verkoring van die vloeimiddel en gevolglike swak vertinning te verhoed. Hierdie grense is gewoonlik tussen 300°C en 340°C.

Vir reguit lasse word standaard gekepte koperbeslagringe gebruik en hulle moet in die kroes vertin word as hulle nie in 'n vertinde toestand voorsien word nie.

Tot 'n paar jaar gelede het die vloeimiddel wat deur die Gebiedsrade in Groot-Brittanje gebruik is, die nadeel gehad dat fisiese aanraking van die vloeimiddel self of van die dampe wat daardeur vrygelaat word, in die geval van 'n klein aantal van die personeel wat meer allergies as die ander is, oor 'n lang tydperk dermatitis, oor-aandoeninge of asemhalings siektes soos bv. bronchitis, kon veroorsaak.

In 1968 is 'n nuwe vloeimiddel, wat geen toksiese mediese sy-effekte het nie, deur 'n voorraastande Britse kabelvervaardiger ontwikkel, en sedertdien het nog 'n ander soortgelyke vloeimiddel op die mark gekom.

### 8.1.4 Soldering met anorganiese vloeimiddels:

Terwyl daar in Brittanje in die praktyk voor-

soldering with an organic flux because of the somewhat lower temperatures obtained, soldering using an inorganic or reaction flux is used on the Continent. The latter method differs from the organic flux technique in that it is not a basting method. A solder stick is applied to the conductor inside the heated up ferrule after reaction of the flux has taken place; this is indicated by the emission of white fumes. Solders of the zinc-tin type with high flowability are normally used. This type of solder is difficult to wipe and it is usual to top up the ferrule with a low melting point "wiping" solder. In the absence of a basting action, flux residues and charred compound cannot be washed away, and it is therefore necessary to take certain precautions to avoid entrapment of these residues.

## 8.2 Welding

The welding of aluminium conductors has been carried out successfully for many years in Germany. A method used by one of the leading cable manufacturers is illustrated in Figure 3.

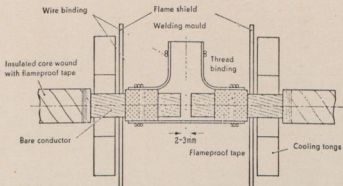


Figure 3 : Arrangement for aluminium welding.

The black iron welding mould, coated inside with diluted ingot mould, is suitably clamped around the conductors to be joined, and flame shields and cooling tongs fitted to the conductor on each side of the mould. The mould is heated by means of an oxy-acetylene welding torch until it glows red and aluminium rod thinly coated with flux is then melted into the mould. When cooled, the mould and other attachments are removed, the riser sawn off and the joint filed and smoothed.

keur gegee word aan aluminiumsoldering met 'n organiese vloeimiddel vanweë die ietwat laer temperatuur wat nodig is, word daar op die Vasteland gebruik gemaak van soldering met 'n anorganiese of reaksievloeimiddel. Laasgenoemde verskil van die organiese vloeimiddeltegning daarin dat dit nie 'n bedruipingsmetode is nie. Die soldeerstaaf word binne in die verwarmede beslagring aan die geleier aangebring nadat die reaksie van die vloeimiddel plaasgevind het: dit word deur die afgee van wit dampe aangedui. Soldeersels van die sink-tin-tipe met hoë vloeibaarheid word gewoonlik gebruik. Hierdie soort soldeersel is moeilik om te veeg en die beslagring word gewoonlik volgemaak met "afveeg"-soldeersel wat 'n lae smeltpunt het. In die afwesigheid van bedruiping kan vloeimiddelreste en verkoold mengseloortblyfselfs nie weggespoel word nie, en dit is gevolglik nodig om sekere voorsorgmaatreëls te tref om te verhoed hierdie reste in die soldeersel vasgevang word.

## 8.2 Sweising

Die sweising van aluminiumgeleiers word baie jare lank al met sukses in Duitsland uitgevoer. Die metode wat deur een van die vooraanstaande kabelvervaardigers toegepas word, word in Figuur 3 geïllustreer.

Die swart yster-sweisgietsvorm, van binne bedek met 'n verdunde blokvormsmeerlaag, word om die geleiers wat gelas moet word, vasgeklamp, en vlamskerms en verkoelingstange word aan weerskante van die gietvorm aan die geleier aangebring. Die gietvorm word deur middel van 'n oksiasietileenblaasvlam verhit totdat dit gloei, en dan word 'n aluminiumstaaf, met 'n dun laag vloeimiddel bedek, in die gietvorm gesmelt. Na afkoeling word die gietvorm en die ander aanhegtings verwyder,

The Sydney County Council has introduced a number of refinements to this basic method and excellent results, especially as regards heat limitation, have been obtained.

### 8.3 Compression

The successful use of compression jointing on copper conductors is well established, and it has been the ultimate aim of electrical engineers to extend this quick and easy method of jointing to aluminium conductors.

For the compression jointing of aluminium, an aluminium ferrule is used to ensure that the expansion and contraction characteristics of the ferrule and conductors are matched. When two aluminium surfaces are pressed together, the oxide film must be ruptured by the force of the meeting pressure points before intimate metal to metal joining takes place. When oxide film is removed by the inter-action of the surfaces during compression such that aluminium flows into the exposed spaces, contact areas are formed which can initially be stable and satisfactory.

The British Electricity Board's Report, A.C.E. Report No. 17 (1967), on the testing of connectors and terminations for aluminium conductors of insulated power cables, lays down the following acceptance criteria :—

- (i) The graph of connector resistance to number of cycles in the course of an accelerated duty test, shall demonstrate with reasonable probability that the rise of resistance over the last 1000 cycles of a series of 2000 load cycles is not more than 15% of the average resistance over the same period.
- (ii) Likewise, the connector resistance over the last 1000 cycles shall not exceed the conductor resistance by more than 50% or 5 micro ohms whichever is the greater.
- (iii) The connector temperature shall not exceed that of the conductor.
- (iv) The connector shall have a tensile strength of not less than 60% of the unjointed conductor.

For tests (i) to (iii) the load cycling is arranged so that the control conductor is raised to a temperature of at least 105°C above ambient.

There are numerous types and makes of compression jointing equipment for aluminium conductors, such as those employing circumferen-

die stygstuk afgesaag en die las word met 'n vyl afgewerk.

Die graafkapsraad van Sydney het 'n aantal verfyngs aan hierdie basiese metode aangebring en uitstekende resultate is behaal, veral sover dit die beperking van hitte betref.

### 8.3 Saampersing

Die suksesvolle gebruik van saampersinglasie by kopergeleiers is reeds goed gevestig, en dit was nog altyd die einddoel van elektrotegniese ingenieurs om hierdie vinnige en maklike las-metode ook op aluminiumgeleiers toe te pas.

Vir 'n saampersinglasie by aluminium word 'n aluminiumbeslagring gebruik, ten einde te verseker dat die uitsettings- en inkringingseienskappe van die beslagring en die geleier dieselfde is. Wanneer twee aluminium-oppervlaktes teen mekaar gedruk word, moet die oksiedfilm deur die krag van die twee ontmoetende drukpunte gebreek word voordat direkte metaal-tot-metaal-aansluiting kan plaasvind. Wanneer die oksiedfilm deur die interaksie van die oppervlaktes tydens saampersing dermate verwyder word dat aluminium in die ontblote ruimtes kan invloei, word kontakgebiede gevorm wat aanvanklik stabiel en bevredigend kan wees.

Die Britse Elektrisiteitsraad se verslag (A.C. E.-verslag nr. 17 van 1967) oor die toets van verbinders en afsluiters vir die aluminiumgeleiers van geïsoleerde kragkabels bepaal die volgende aanvaardingsmaatstawwe :—

- (i) Die grafiek van verbinderweerstand tot die aantal siklusse in die loop van 'n versnelde dienstoets moet met redelike waarskynlikheid aandui dat die verhoging van weerstand gedurende die laaste 1000 siklusse van 'n reeks van 2000 vrag siklusse nie meer as 15% van die gemiddelde weerstand oor dieselfde tydperk is nie.
- (ii) Eweneens moet die verbinderweerstand oor die laaste 1000 siklusse nie die geleierweerstand met meer as 50% of 5 mikro-ohms, watter een ookal die grootste is, oorskry nie.
- (iii) Die temperatuur van die verbinder moet nie dié van die geleier oorskry nie.
- (iv) Die verbinder moet 'n treksterkte van tenminste 60% van dié van die ongelaste geleier hê.

Vir toetse (i) tot (iii) word die vrag siklusse so gereël dat die kontrole geleier tot 'n temperatuur van tenminste 105°C bokant die omgewings-temperatuur verhit word.

Daar is 'n groot aantal tipes en fabrikate saampersinglasietoerusting vir aluminiumgeleiers, soos bv. dié wat gebruik maak van omtrek-of inkeep-

tial compression, indent compression either unrestricted or in an enclosed die, or wrap-around compression combined with indent using a die-less tool.

It is unfortunate that most of the load cycle tests completed on aluminium conductor compression joints have taken place in air under laboratory conditions and not in the form of complete joints buried in the ground. From tests and experience in Great Britain and Germany it is considered that compression ferruling of stranded aluminium in a buried compound filled joint is not satisfactory. Stranded aluminium connections which have successfully withstood the 2 000 cycle type test in air have failed after a few hundred cycles at normal conductor temperature when installed in a compound filled joint. The causes of the eventual thermal instability of such joints have not been fully analysed or understood, but this is partly attributed to the penetration of bitumen between the strands within the ferrule, causing relaxation of the aluminium with load cycling over the passage of time. Compression techniques for either stranded or solid medium voltage aluminium conductor terminations in air have, however, been found to be successful.

For solid aluminium PVC insulated cable, the consensus of opinion in Great Britain is that compression would be satisfactory for all joints, though this has not been field tested. The compression jointing of aluminium conductors is not used in Germany, but successful results are claimed in France.

Municipal electrical engineers and supply undertakings have to be conservative to a certain degree, and while there is no doubt that a well designed compression technique is suitable for aluminium conductor cables in industry, a certain measure of reserve should be attached to its indiscriminate use on an underground distribution system.

#### 8.4 Mechanical Jointing

There are a number of designs of mechanical tap connections for "tee" joints available for both stranded and solid aluminium conductors. These should preferably be spring-loaded. For CONSAC cable, i.e., three solid aluminium paper insulated cores and a concentric aluminium sheath neutral, an ingenious method of friction welding has been developed by the British Electricity Council Research Centre for tee jointing, which involves the friction welding of a bi-metal aluminium-copper stud to the solid aluminium core. An aluminium pin rotating at high speed is applied and causes

saampersing, óf onbeperk óf in 'n geslote matrys, óf omwikkelsaampersing gepaard met inkeping, waarby 'n matryslose gereedskapstuk gebruik word

Dit is ongelukkig dat meeste van die vragik-lustoets wat op die saampersingslaste van aluminiumgeleiers uitgevoer is, in die lug onder laboratoriumtoestande plaasgevind het, en nie in die vorm van voltooide lasse wat onder die grond begrawe is nie. Uit toetsen en ondervinding in Groot-Brittanje het geblyk dat beslagingsaampersingslaste van gevlegde aluminium in 'n mengselgevlude laskas wat ondergronds begrawe is, nie bevredigend is nie. Gevlegde aluminiumkon-neksies wat die 2000 siklustoets in die lug met sukses deurstaan het, het na 'n paar honderd sik-lusse teen normale gelieertemperatuur gefaal toe dit in 'n mengselgevlude laskas geïnstalleer is. Die oorsake van die uiteindelijke termiese onbestendigheid van sulke lasse is nog nooit ten volle geanaliseer of begryp nie, dog dit is deels te wyte aan die deurdringing van bitumen tot tussen die draadjies binne in die beslagring, wat 'n verslapping van die aluminium gedurende die kringloop-proses oor 'n langer tydperk tot gevolg het. Saampersingstegnieke vir óf gevlegde óf soliede aluminiumafsluiters vir medium-spanning in die lug is eger suksesvol bevind.

Vir soliede PVC-geïsoleerde aluminiumkabel word die mening algemeen in Groot-Brittanje gehuldig dat saampersing vir alle lasse bevredigend sal wees, alhoewel dit nog nie in die veld getoets is nie. Saampersingslaste by aluminiumgeleiers word nie in Duitsland gebruik nie, dog in Frankryk word daar op suksesvolle resultate aanspraak gemaak.

Munisipale elektrotegniese ingenieurs en voor-sienings-ondernemings moet in 'n sekere mate konserwatief wees, en terwyl daar geen twyfel bestaan dat 'n goedontwerpte saampersingstegniek geskik is vir aluminiumkabels in die nywerheid nie, moet daar tog sekere voorbehoude wees met betrekking tot die onoordeelkundige invoering daarvan in 'n ondergrondse distibusiëstelsel.

#### 8.4 Meganiese Lasse

Daar is 'n aantal ontwerpe beskikbaar ten opsigte van meganiese aftakingsverbindings vir "T"-lasse met betrekking tot sowel gevlegde as soliede aluminiumgeleiers. Hierdie verbindings moet by voorkeur veerbelaas wees. Vir CONSAC-kabel, dit wil sê drie soliede aluminium geleiers met papier geïsoleer en 'n konsentriese aluminium-omhulde nulgeleier, is 'n vindingryke metode van wrywingswulge deur die Britse Elektrisiteitsraad se navorsingsentrum vir "T"-verbindings ontwikkel, wat bestaan uit die vassweis van 'n tweemetallige aluminium-koper-kontakknop aan die soliede alu-

the metal to become plastic, at which stage a forging load is applied to the aluminium stud thus completing the welding action.

## 9. ECONOMICS

Up to this stage, the technical characteristics of aluminium cable have been examined, in the course of which it has been established that aluminium is an acceptable alternative to copper as a conductor. But what of the price structure?

The conductivity of an aluminium conductor is 61% and its thermal rating 78% of a similar sized copper conductor, and it is therefore necessary to compare prices of copper conductor cable with its larger sized aluminium equivalent.

As far as paper insulated cables are concerned the City of Cape Town has hitherto regarded the following aluminium sizes to be the copper equivalent of the standard sizes of cable used :

Cu sq. in.	Al sq. in.	Voltage
0,25	0,4	6,35/11 kV
0,1	0,15	..
0,06	0,1	..
0,3	0,5	600/1 000 volt
0,15	0,25	..

Towards the middle of 1968 when Cape Town issued specifications for its annual requirements for distribution cable, tenderers were requested to quote alternative prices for both copper and equivalent aluminium conductor paper and PVC insulated cable. Acceptance of the aluminium alternative resulted in an average saving of 20% for paper insulated cable and 16% for PVC insulated cable, the total saving amounting to R133 000.

Comparative curves of the early 1971 prices of equivalent copper and aluminium 11kV and 600/1 000 volt paper insulated cables are given in Figure 4 while Figure 5 represents these on a percentage basis.

minium-geleier. 'n Aluminiumpen wat teen 'n hoë snelheid in die rondte draai, word gebruik om die metaal sag te maak, waarna smeedrukking op die aluminiumknop toegepas word om die sweisaksie te voltooi.

## 9. EKONOMIESE ASPEKTE :

Tot in hierdie stadium het ons die tegniese eenskappe van aluminiumkabel ondersoek, en tydens hierdie ondersoek het ons vasgestel dat aluminium as 'n geleier 'n aanvaarbare plaasvervanger vir koper is. Maar wat ontrent die prysstruktuur ?

Die geleibaarheid van 'n aluminiumgeleier is 61% en sy termiese aanslag 78% van dié van 'n kopergeleier van die dieselfde grootte, en dit is gevolglik nodig om die pryse van kopergeleierkabel met sy groter aluminium-ekwivalent te vergelyk.

Sover dit papier-geïsoleerde kables betref, het die Stad Kaapstad tot dusver die volgende aluminium-groottes as die koper-ekwivalent van die standaard-kabelgroottes wat gebruik word, besou :—

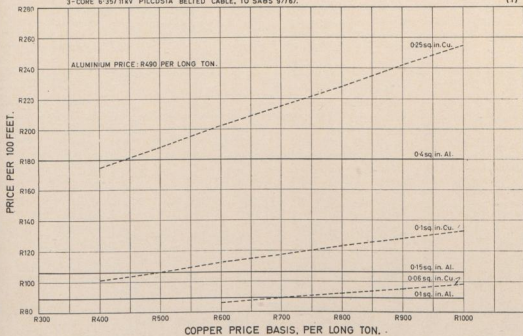
Cu. vk. dm.	Al. vk. dm.	Spanning
0,25	0,4	6,35/11 KV
0,1	0,15	..
0,06	0,1	..
0,3	0,5	600/1 000 V
0,15	0,25	..

Teen die helfte van 1968, toe Kaapstad spesifikasies vir sy jaarlikse benodighede distribusiekabel uitgereik, het, is tendersaars versoek om alternatiewe pryse vir koper sowel as vir die ekwivalente groottes papier- en PVC-geïsoleerde aluminium-geleierkabel in te dien. Die aanname van die tenders vir aluminium het 'n gemiddelde besparing van 20% ten opsigte van papier- en 16% ten opsigte van P.V.C.-geïsoleerde kabel meegebring. Die totale besparing het sowat R133 000 beloop.

Vergelykende kurwes van die vroeë 1971-pryse van ekwivalente koper- en aluminiumkabel (papier-geïsoleer) van 11 Kv en 600/1 000 volt word in figuur 4 aangegee, terwyl figuur 5 dieselfde pryse, op 'n persentasiebasis bereken, aantoon.

3-CORE 6-35/11kV PILCDSTA BELTED CABLE, TO SABS 97/67.

(1)



4-CORE 600/1100 VOLT PILCDSTA CABLE, TO SABS 97/67.

(2)

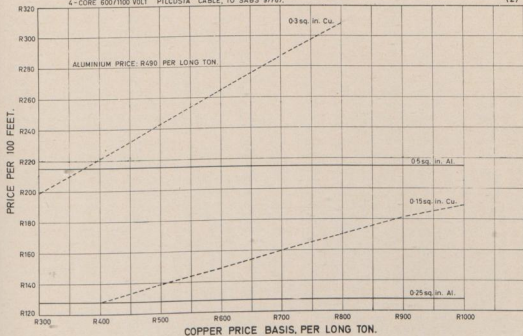
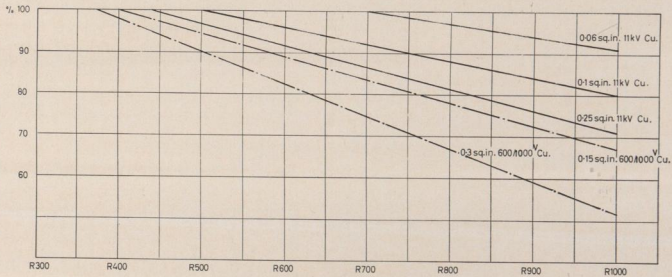


FIG. 4 COMPARATIVE PRICES OF COPPER & ALUMINIUM CABLES.

PRICE OF EQUIVALENT ALUMINIUM CABLE  
AS PERCENTAGE OF COPPER CABLE.



COPPER PRICE BASIS PER LONG TON

FIG. 5. RELATIVE PERCENTAGE PRICES OF ALUMINIUM & COPPER CABLES.

At the copper prices that have been prevalent over recent years, the choice of aluminium as a conductor results in, at times, substantial savings especially at the larger conductor sizes.

## 10. CAPE TOWN'S EXPERIENCE WITH ALUMINIUM CABLE

### 10.1 Cable Types :

After an intensive investigation into the merits of aluminium conductor cable, Cape Town in 1968 went over to the use of this type of cable for 11 kV and low voltage distribution. Stranded aluminium was used for 11 kV and medium voltage paper insulated cable, while solid aluminium in sizes from 0,0225 sq. in. to 0,15 sq. in. was chosen for medium voltage PVC cable. Because of the fear of corrosion, three core PVC insulated cable with a concentric aluminium wire or strip neutral was not considered. Cables with an extruded aluminium sheath such as CONSAC, were also not considered, as South African cable makers are not equipped for their manufacture.

### 10.2 Jointing :

Of the aluminium jointing methods available, soldering using a non-toxic organic flux, Bical, was chosen as it was most akin to the solder basting method used by the Department's cable jointers for copper cables. After a certain amount of practising and ferrule testing, the jointers rapidly adapted themselves to the refinements of the new jointing procedure and no difficulties or joint failures due to soldering have so far been experienced. When aluminium cable is straight jointed to a smaller copper one, the copper conductor is built up to ensure a good fit into the weak-back ferrule, and the soldering procedure as for an all aluminium joint is carried out.

Due to doubts about its long lasting effectiveness, compression-jointing of compound filled stranded aluminium conductor joints or cable end boxes was rejected. The use of heat shrinkable gloves and tubing was introduced to replace pot-ends on paper insulated and solid aluminium PVC cable terminations. The gloves and tubing are fitted over the cable cores and sheath and then shrunk to approximately half their original size, to effect a tight fitting seal to the cable.

Even before changing over to aluminium cable it was felt that jointing techniques tended to be over elaborate, and a number of experimental

Bereken teen die prys van koper wat in die jongste jare geheers het, het die keuse van aluminium as geleier soms aansienlike besparings tot gevolg, veral by die groter geleiergroottes.

## 10. KAAPSTAD SE ONDERVINDING MET ALUMINIUMKABEL :

### 10.1 Tipes Kabel

Na 'n intensiewe ondersoek na die meriete van kabel met aluminiumgeleiers het Kaapstad in 1968 oorgeslaan na die gebruik van hierdie tipe kabel vir 11 KV en laagspanningsdistribusie. Gevlegte aluminium is vir 11 KV en vir mediumspanningskabel (papier-geïsoleer) gebruik, terwyl vir mediumspanningskabel (PVC-geïsoleer) soliede aluminium in groottes vanaf 0,0225 vk. dm: tot 0,15 vk. dm. gekies is. Vanweë die vrees vir verwerwing is drie-aar, PVC-geïsoleerde kabel met 'n konsentriese nulgeleier van aluminiumdraad of —band nie oorweeg nie. Kabels met 'n deurgeperde aluminiumomhulsel soos CONSAC is ook die oorweeg nie, aangesien Suid-Afrikaanse kabelvervaardigers nie toegeger is om hulle te maak nie.

### 10.2 Lasse :

Van die beskikbare lasmetodes vir aluminium is soldering met behulp van 'n nie-toksiese organiese vloeimiddel, Bical, gekies, aangesien dit die naaste is aan die bedruipingsoldeermetode wat deur die Departement se kabellassers vir koperkabels gebruik is. Na 'n sekere mate van oefening en die toets van beslagringing het die lassers hulself geredelik by die ingewikkeldheid van die nuwe lasmetode aangepas en geen moeilikhede of die onklaarraking van lasse wat aan soldering te wyte is, is tot dusver ondervind nie. Wanneer 'n aluminiumkabel reguit aan 'n kleiner koperkabel gelas moet word, word die kopergeleier opgebou om te verseker dat dit goed in die gekepte beslagringing inpas, en dan word die soldering uitgevoer asof dit 'n volle aluminiumlas is.

Omdat daar twyfel bestaan het omtrent die effektiwiteit daarvan op die lange duur, is daar nie van die saampersingsmetode met mengselgevalde gevlegte geleierlasse of kabelentkaste gebruik gemaak nie. Daar is gebruik gemaak van hitte-krimpbare "handskoene" en buise in plaas van die gebruikelike gietyster-kabelentkaste by die afsluitings van papier-geïsoleerde en PVC-kabel met soliede aluminiumgeleiers. Die "handskoene" en buise word oor die kabelkerns geplaas en dan tot ongeveer die helfte van hul oorspronklike grootte gekrimp ten einde 'n stewig-passende seël aan die punt van die kabel daar te stel.

Selfs voor die oorskakeling na aluminiumkabel is die mening gehuldig dat die lastegniese genieë het om ooruitvoerig te wees, en 'n aantal



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11 kV joints in which the normal lead sleeve was eliminated, were put into service. In this type of joint, the cores are separated by means of suitable spreaders, and the ferrules are left uninsulated. Stress cones for the core screens are provided on each side of the joint, as well as an 11 kV PVC insulated earth bond across the joint. The cable entry holes of a cast iron box are sealed with Prtley or other suitable compound, and the box slightly heated prior to filling with A grade compound.

One of these joints similar to that photographed in Figure 6, was recently opened up and found to be in a perfectly dry condition after 4 years in service in ground which during winter is below the water table.

### 10.3 Pole terminations:

Although all new areas are reticulated entirely by means of underground cable, Cape Town has an extensive network of medium voltage copper overhead mains. For 0,5 and 0,25 sq. in. aluminium conductor paper insulated pole terminations, compound filled boxes in which PVC insulated copper tails are solder ferruled to the ends of aluminium conductors, were initially used. Subsequently heat shrinkable gloves and tubing were employed, likewise with a PVC copper tail soldered to the aluminium conductor. This makes for a neater and lighter pole and is approximately half the cost of a pole box.

For PVC insulated cables, it was found that conventional plastic pole boxes were large enough to accommodate solid aluminium cable sizes up to 0,1 sq. in. For 0,15 sq. in. cable ends, heat shrinkable components are used.

For house service connections it is normal practice in Cape Town to connect the cable end directly on to the overhead mains. The Department's only direct experience of copper to aluminium junctions was an experimental aluminium overhead mains system to which copper service conductors were connected by means of brass line line taps covered with Denso paste and tape. After more than ten years' service these copper and aluminium junctions were still in perfect condition.

For terminating the solid aluminium service conductors to the copper overhead mains, tinned parallel groove clamps were chosen. These clamps, which may be of cast aluminium alloy or extruded aluminium, give a better grip on the aluminium than line taps. The clamps are normally of the universal type suitable for any of the nor-

eksperimentele 11KV-lasse, waarby die normale loodhuls weggelaat is, is in diens geplaas. In hierdie soort las word die kerns van mekaar geskei met behulp van geskikte ooprekkers en die beslagringe word ongeïsoleer gelaat. Spanningskeëls vir die kernskerm word aan weerskante van die las aangebring, sowel as 'n PVC-geïsoleerde aardverbinding van 11kV daaroor die las. Die kabelgate van 'n gegote ysterkas word met Prtley of 'n ander geskikte stof verseël en die kas word effens verhit voordat dit met 'n graad-A-mengsel gevul word.

Een van hierdie lasse, soortgelyk aan die een waarvan 'n foto in Figuur 6 verskyn, is onlangs ooggemaak en is in 'n perfekte droë toestand gevind na 4 jaar diens in grond wat gedurende die winter onderkant die watertafel geleë is.

### 10.3 Paal-afluitings:

Alhoewel al nuwe gebiede insluitend by wyse van ondergrondse kables getrikuleer word, het Kaapstad 'n uitgebreide netwerk van oorhoofse mediumspanning-koperhoofgeleidings. Vir 0,5 en 0,25 vk. dm. paalafsluitings van papier-geïsoleerde aluminiumgeleierkabel is daar aanvanklik gebruik gemaak van mengselgevulde kaste waarin die PVC geïsoleerde koperdrade met beslagringe en soldeer aan die punte van die aluminiumgeleiers gekoppel is. Later is hitte-krimpbare "handskoene" en buise gebruik, eweneens met 'n PVC-koperdraad wat aan die aluminiumgeleier vasgesoldeer is. Dit het 'n netjieser en ligter paalafsluiting tot gevolg en kos ongeveer die helfte soveel as 'n paalkas.

Vir PVC-geïsoleerde kables is daar bevind dat konvensionele plastiek-paalkaste groot genoeg is om soliede aluminiumkabelgroottes van tot 0,1 vk. dm. te huisves. Vir kabelente van 0,15 vk. dm. word hitte-krimpbare onderdele gebruik.

In die geval van dienskonneksies na huise is dit in Kaapstad gebruiklik om die kabel-ent direk aan die oorhoofse hoofgeleiding te koppel. Die Departement se enigste direkte ondevinding van koper-na-aluminium-aansluitings was 'n eksperimentele stelsel van oorhoofse aluminiumgeleiers waaraan koperdiensgeleiers gekoppel is by wyse van geelkoper-aftakkings wat met Denso pasta en -band bedek is. Na meer as tien jaar diens verkeer hierdie koper-en-aluminiumkoppellings nog in 'n volmaakte toestand.

Om die soliede aluminiumdiensgeleiers aan die oorhoofse koperhoofgeleidings te koppel, is vertinde klampe met ewewydige groewe gekies. Hierdie klampe, wat van gegote aluminium-allooi of van deurgeperste aluminium kan wees, gee 'n beter greep op die aluminium as lyn-aftakkings. Die klampe is gewoonlik van die universele tipe

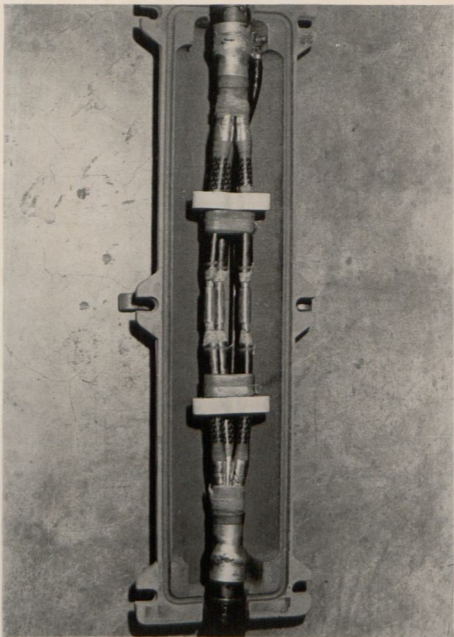


Figure 6: Compound filled joint for 0,1 sq. in. 11kV aluminium conductor screened cable.

mal sizes of copper conductor used on medium voltage mains.

After fitting the clamp the connection is covered with high melting point corrosion inhibiting Densal paste and then Denso taped as a protection against corrosion of the aluminium and copper junction. The aluminium conductor is always placed on top of the copper to avoid any possibility of corrosive copper salts being washed by rain on to a portion of the aluminium conductor which might inadvertently have been left exposed.

#### 10.4 Connections :

The cable in general use in most house connections in Cape Town is two core 0,04 sq. in. solid aluminium PVC. The conductor end of such a cable does not quite fit into the terminal block of a standard 80 amp MCCB but with a minimum of filing of the corners of the virtually semi-circular shape of the conductor, this can easily be achieved. As a precaution against corrosion the connection is smeared with Densal paste. The conductor readily fits into the connection block block of meters installed in kerb-side metering kiosks.

With the use of crimping lugs and pins, etc., no difficulty has been experienced in connecting up larger sizes of solid aluminium conductor.

#### 10.5 Installation :

It has been this Department's experience that the installation of aluminium conductor distribution cable is no more difficult nor easier than equivalent sized copper cable. A fully mobile tractor/winch/loader is used to draw the larger sizes of cable into the trench, alternatively this is done by hand.

The bending radii of both copper and aluminium conductor cable are governed by the cable overall diameter. Cable boxes and glands on existing switchgear and transformers were able to cater for the increased size of the aluminium conductor cable and no installation difficulties have been experienced with either 11 kV or 600/1 000 volt aluminium conductor cable.

When using 0,04 sq. in. 4-core PVC solid aluminium conductor cable for looping in and out of cable-entry street lighting poles it was found difficult to connect up the conductors and wires inside the pole cavity and subsequently 0,0225 sq. in. copper cable, costing approximately 7% more than the aluminium equivalent, was purchased for street lighting supplies.

wat geskik is vir eenige van die normale groottes kopergeleier wat in mediumspanningshooflyne gebruik word.

Nadat die klampe vasgesit is, word die verbinding bedek met Densal-pasta, wat 'n hoë smeltpunt het en verwerking teëwerk, en dan met Denso-band toegedraai as beskerming teen verwerking van die aluminium-en-koper-verbinding. Die aluminiumgeleier word altyd bo-op die koper geplaas ten einde enige moontlikheid te verhoed dat verwerende kopersoute deur die reën afgespoel word op 'n gedeelte van die aluminiumgeleier wat misken per ongeluk onbedek gelaat is.

#### 10.4 Aansluitings :

Die kabel wat oor die algemeen in meeste huis-aansluitings in Kaapstad gebruik word, is twee-aar 0,04 vk. dm. soliede aluminium-PVC. Die geleierpunte van so 'n kabel pas nie heeltemal in die aansluitblok van 'n standaard — 80 ampere-stroombreker met vormgegote kas nie, maar indien die hoeke van die feitlik halfsirkelvormige geleiers 'n bietjie afgeveyl word, pas hulle heeltemal goed. As 'n voorsorgmaatreeël teen verering, word die aansluiting met Densal-pasta gesmeer. Die geleier pas maklik in die aansluitings-blokke van meters wat in die meterkiosks op die sypaadjie geïnstalleer is.

Met die gebruik van geriffelde kloue en penne, ens. is daar geen probleme ondervind met die aansluiting van groter groottes soliede aluminiumgeleier nie.

#### 10.5 Installasie :

Hierdie Departement het die ondervinding gehad dat die installasie van distribusiekabel met aluminium-geleiers nie moeiliker of makliker is as wat die geval met die ekwivalente grootte koperkabel is nie. 'n Ten volle mobiele trekker/windas/laaier word gebruik om die groter groottes kabel in die slotte in te trek, of dit kan ook met die hand gedoen word.

Die buigstrale van sowel koper as aluminiumgeleierkabel word deur die buitemiddellyn van die kabel bepaal. Die kabelkaste en afdigstyk van die bestaande skakeltuig en transformatore was groot genoeg om vir die groter dikte van die aluminiumgeleierkabel voorsiening te maak en geen installasieprobleme is met óf 11kV of 660/1 000 volt-aluminiumgeleierkabel ondervind nie.

Wanneer 0,04 vk. dm., 4-aar PVC-kabel met soliede aluminiumgeleiers gebruik word om straatligpale by die kabelstelsel aan te sluit, is dit moeilik gevind om die geleiers en drade binne in die paalhoute te konnekteer en daar is gevolglik 0,0225 vk. dm. koperkabel, wat ongeveer 7% meer as die aluminium-ekwivalent kos, vir straatligvoorrade aangekoop.

## 11. ALUMINIUM SHEATHS

When considering the use of aluminium in the cable industry, a brief reference should be made to aluminium sheathing. There are two methods by which this can be achieved, viz., either by pulling the insulated conductors into an oversize pre-extruded tube or by direct extrusion over the laid-up cores. In either case the sheath can be readily corrugated.

The corrugation of the sheath, a process normally associated with supertension cables, enables the aluminium wall thickness to be considerably reduced, thus improving flexibility and reducing costs.

A characteristic of a corrugated sheathed cable is the ability of the sheath to expand and contract with the conductors without creating over-stresses at joint positions.

The high mechanical strength of aluminium coupled with its low electrical resistivity and light weight gives aluminium a number of advantages over lead as a sheathing material, the only disadvantage being the now familiar corrosion danger. The mechanical strength of aluminium makes it possible to dispense with tape reinforcement in the case of oil or gas pressure supertension cables which results in a saving of cable cost in the region of 5 to 10%. An aluminium sheath is specially suited to situations where high resistance to vibrational fatigue is required.

The use of aluminium as a sheathing material presupposes that the anticorrosion protection is satisfactory, and PVC or polythene with a corrosion inhibiting compound are both acceptable for this purpose. Each has marginal advantages over the other in certain circumstances.

## 12. ALUMINIUM CONDUCTORS IN SUPERTENSION CABLES

For supertension cables of voltage up to 132 kV, there is no doubt that the use of aluminium conductor will, at present copper prices, result in a cost saving at the higher MVA ratings. Hitherto it has always been the practice of Cape Town to specify copper conductor for oil filled cable because of reservations about the effectiveness of aluminium jointing procedures for this type of cable.

During the last few years, however, a new technique for jointing aluminium conductors in oil filled cables has been developed by a leading British cable

## 11. Aluminium-Omhulsels

Wanneer ons oorweging skenk aan die gebruik van aluminium in die kabelnyerheid, moet daar kortliks na die kwessie van aluminium-omhulsels verwys word.

Daar is twee metodes waarvolgens dit teweeggebring kan word, nl. óf deur die geïsoleerde geleiers in 'n bomaatbuis wat vooraf deurgepers is, in te trek, óf deur direkte deurpersing oor die opgeboude kerns. In albei gevalle kan die omhulsel maklik gegolf word.

Die golwing van die omhulsel, wat 'n proses is wat mens gewoonlik met superspanningskabels assosieer, maak dit moontlik om die aluminium-wanddikte aansienlik te verminder, waardeur die buigbaarheid bevorder en die koste verlaag word.

'n Eienskap van 'n kabel met 'n gegolfde omhulsel is die vermoë van die omhulsel om uit sit en te krimp saam met die geleiers sonder om oorspanning by die lasse te veroorsaak.

Die hoë meganiese sterkte van aluminium, gepaard met sy lae elektriese resistiwiteit en sy ligte gewig, verleen aan aluminium 'n aantal voordele bo lood as 'n omhulselmateriaal. Sy enigste nadeel is die nou welbekende verweringsgevaar. Die meganiese sterkte van aluminium maak dit moontlik om af te sien van versterking deur middel van lint of band in die geval van superspanningskabel met olie- of gasdrukking, wat 'n besparing in kabelkoste van sowat 5 tot 10% meebring. 'n Aluminiumomhulsel is veral gebruik in situasies waar hoë weerstand teen trillings-uitputting vereis word.

By die gebruik van aluminium as 'n omhulselmateriaal word daar vooraf aanvaar dat die beskerming teen verwering bevredigend is, en sowel PVC as politeen met 'n verweringsvertragende mengsel is vir hierdie doel aanvaarbaar. Elkeen van hierdie stowwe het in gegewe omstandighede sekere grensvordele bo die ander.

## 12. ALUMINIUMGELEIERS IN SUPERSPANNINGS-KABELS

In die geval van super-spanningskabels van tot soveel as 132 KV, ly dit geen twyfel nie dat die gebruik van aluminiumgeleiers, teen die huidige pryse van koper, tot 'n besparing van koste ten opsigte van die hoër MVA-aanslae sal lei. Tot dusver was dit nog altyd in Kaapstad gebruiklik om koper vir oliegevulde kabel te spesifiseer vanweë die mate van twyfel wat bestaan het omtrent die effektiwiteit van die lasprosedures met betrekking tot aluminium by hierdie soort kabel.

Gedurende die afgelope paar jaar is daar egter deur 'n vooraanstaande Britse kabelvervaardiger 'n nuwe tegniek vir die las van aluminiumgeleiers in

manufacturer. This is the MIG process in which the conductor joint is made by electrical welding in an inert gas atmosphere.

The metal inert gas (MIG) welding process is basically electric welding using an aluminium wire electrode in an argon atmosphere, no flux being required. The layout of the welding equipment is as shown in Figure 7.

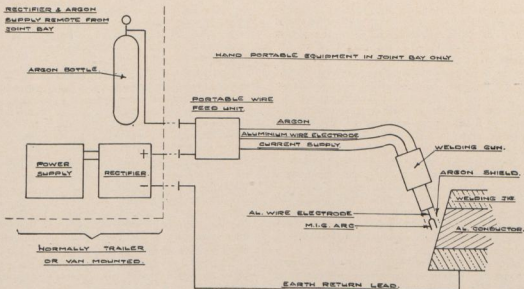


Figure 7

Two problems associated with the MIG jointing of oil filled cables are :

- (a) prevention of excessive temperature rise of the cable dielectric;
- (b) ensuring a clean and oil-free conductor surface.

These problems have been overcome by means of moulds which also act as heat sinks, and these in combination with the continuous oil flow, prevent excessive dielectric temperatures.

Oil control is by means of a vacuum acting through the mould, the residual oil on the conductor end being removed by a solvent which is drawn through the conductor end strands by the vacuum. Specially designed ferrules and plugs are used in the case of hollow single core aluminium conductors to ensure an oil-free surface for the welding operation and oil continuity for the completed joint.

oliegevulde kabels ontwikkel. Dit is die MIG-proses, whereby die geleier by wyse van elektriese sweising in 'n atmosfeer van ontkiewe gas gelas word

Die MIG-sweisproses is basies elektriese sweising met behulp van 'n aluminiumdraad-elektrode in 'n argon-atmosfeer sonder dat 'n vloemiddel nodig is. Die rangskikking van die sweistoerusting word in figuur 7 aangedui:

Figuur 7

Die twee probleme wat by MIG-lasse van oliegevulde kabels ondervind word, is :-

- (a) Om die buitensporige verhoging van die temperatuur van die kabeldiëlektrika te verhoed.
- (b) Om 'n skoon olievrye geleieroppervlakte te verseker.

Hierdie probleme is te bowe gekom deur middel van gietvorms wat ook as hitte-dissipeerders diens doen, en tesame met 'n voortdurende vloeï van olie, verhoed hulle dat oormatige dielektriese temperature ontstaan.

Oliebeheer word bewerkstellig by wyse van 'n lugleegte wat deur die gietstuk werk, terwyl die oorblywende olie op die geleierpunte deur 'n oplosmiddel verwyder en met behulp van die lugleegte deur die draadrys van die geleierpunt gesuig word. In die geval van hol enkelkern-aluminiumgeleiers word spesiaal-ontwerpte beslagringe en proppe gebruik ten einde 'n olievrye oppervlakte vir die sweiswerk en 'n on-

The MIG jointing technique for jointing aluminium conductor filled cable has been approved by the Central Electricity Generating Board of Great Britain. The process is more clearly illustrated in the film which follows this paper.

### 13. CONCLUSIONS

Provided a correct jointing procedure is chosen and precautions taken when these may be necessary, there is no reason why municipal electrical engineers should not accept the economic advantages of aluminium over copper as a conductor material.

The new metric standard specification SABS 150-1970 for PVC insulated cables makes provision for concentric neutral construction using copper conductors, and the price advantages of equivalent solid aluminium conductors as compared with this type of copper cable are not likely to be large in the smaller conductor sizes of PVC insulated cable.

For the larger sizes of PVC insulated cable and for paper insulated medium voltage and 11 kV cable, in the larger sizes of which there can be a price saving of the order of 20% if aluminium is used, the question might be posed whether the municipal electrical engineer at present-day copper prices can afford not to consider a change over to aluminium conductors.

Likewise the use of aluminium as a conductor for supertension cable and also as a sheathing material has been firmly established.

### 14. ACKNOWLEDGMENTS

The author would like to express his thanks to Mr A. C. T. Frantz, the City Electrical Engineer, Cape Town, for having been given the opportunity to write and present this paper to the Association. He is also grateful to Messrs Aberdare Cables Africa Limited, Messrs BICC (S.A.) (Pty.) Ltd, and to Messrs Scottish Cables Ltd, for information included in this paper and for the assistance rendered by his colleagues in the Electricity Department.

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onderbroke olievoorraad vir die voltooid las te versker.

Die MIG-tegniek vir die las van oliege vulde aluminiumgeleierkabel is deur die Sentrale Elektriese toewekingsraad van Groot-Brittanje goedgekeur. Die proses sal meer duidelik deur die film wat ná hierdie referaat vertoon sal word, geïllustreer word.

### 13. GEVOLGTREKKINGS

Mits die korrekte lasprosedure gevolg en die nodige voorsorgmatreëls getref word is daar geen rede waarom munisipale elektrotegniese ingenieurs nie die ekonomiese voordele van aluminium bo koper as 'n geleiermateriaal sal aanvaar nie.

Die nuwe Metrieke Standaardspesifikasie nr. SABS 150-1970 vir PVC-geïsoleerde kables maak voorsiening vir die konsentriese nulgeleierkonstruksiemetode met kopergeleiers, en die prysvoordeel van ekwivalente soliede aluminiumgeleiers, soos vergeleke by hierdie tipe koperkabel, sal waarskynlik nie baie groot wees by die kleiner groottes PVC-geïsoleerde kabel nie.

By die groter groottes PVC-geïsoleerde kabel, so-wel as by papier-geïsoleerde mediumspanning- en 11 KV-kabel, waar daar, in die geval van die groter groottes, 'n prysbesparing van tot 20% deur die gebruik van aluminium tweeweggebring kan word, kan die vraag wel gevra word of munisipale elektrotegniese ingenieurs dit kan bekostig om nie 'n oorsakelike aluminiumgeleiers te oorweeg nie.

Eweneens is die gebruik van aluminium as 'n geleier vir superspanningskabel, sowel as vir 'n omhulselmateriaal, reeds goed gevestig.

### 14. DANKBETUIGINGS :

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## WIRING REGULATIONS AND THE IMPLICATIONS OF SENSITIVE EARTH LEAKAGE PROTECTION

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### 1 INTRODUCTION

This address is intended to provoke discussion on the implications of the use of earth leakage protection particularly with regard to wiring regulations. To date the influence of this protective measure on our "Blue Book" has been minimal despite the fact that it was introduced some 15 years ago. If we are to make more use of its safety features, I feel that we should take a good look at earth leakage and convert this hardy annual into some concrete proposals. One of the first references in South Africa to this subject was Mr A. A. Middlecote's paper entitled "Earth Leakage" in 1957. This paper described the principles of earth leakage protection, as have indeed subsequent publications, therefore I do not propose to do so here; we must all be well aware of the method of operation.

Discussion in this address is limited, unless otherwise stated, to core balance or differential current operated sensitive earth leakage devices applied to domestic installations.

The international view (as expressed by the International Electrotechnical Commission in Technical Committee 64: Electrical Installations of Buildings) is that sensitive earth leakage protection can only be regarded at this stage as an additional form of protection against shock and thermal hazards. We in South Africa endorse this attitude which in effect means that there can be no relaxation of our existing protective measures, such as earthing, even when earth leakage protection is used.

It is only too easy to pick holes in any wiring regulations because advances in techniques and innovations in materials and equipment are frequent. Without any intention of belittling the work of former Wiring Regulations committees it is becoming apparent that our "Blue Book" is in need of a spring clean or better still perhaps, a completely new approach and format—a new look.

The IEC is now drawing up wiring regulations, with international agreement, therefore this is an

## BEDRADINGSREGULASIES EN DIE IMPLIKASIES VAN SENSITIEWE AARDELEKBESKERMING

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### 1. INLEIDING

Hierdie referaat het ten doel om bespreking uit te lok oor die implikasies van die gebruik van aardlekbekerming, veral met betrekking tot bedradingsregulasies. Tot dusver het hierdie beskermingsmaatreë slegs 'n minimale invloed op ons „Blouboek" uitgeoefen, ten spyte van die feit dat dit reeds sowat vyftien jaar gelede vir die eerste keer aangevoer is. Indien ons meer gebruik van die veiligheidsenskappe daarvan wil maak, is ek van mening dat ons die kwessie van aardlekkte van nadeby moet beskou en hierdie jaarlikse besprekingspunt tot seker konkrete voorstelle moet uitbou. Een van die eerste verwysings in Suid-Afrika na hierdie onderwerp was Mnr. A. A. Middlecote se referaat onder die titel „Earth Leakage" in 1957. In hierdie referaat, sowel as in sekere ander latere publikasies, is die beginsels van aardlekbekerming uiteengesit, daarom sal ek dit nie ook hier doen nie—ons is seker almal met die metode van toepassing daarvan bekend.

Tensy anders aangedui, word die bespreking in hierdie referaat beperk tot die kernbalans—of gediferensieerde, stroomaangedrewe sensitiewe aardlektostelle wat in huishoudelike installasies aangebring word.

Die internasionale standpunt (soos deur die Internasionale Elektrotegniese Kommissie in die verslag „Tegniese Komitee 64: Elektriese Installasies in Geboue" geformuleer) is dat sensitiewe aardlekbekerming in hierdie stadium slegs as 'n bykomstige vorm van beskerming teen skok- en brandgevaare beskou kan word. Ons in Suid-Afrika onderskryf hierdie standpunt, wat prakties beteken dat geen verslapping van ons bestaande beskermingsmaatreëls, soos bv. aarding, toegelaat kan word nie, selfs waar aardlekbekerming van toepassing is.

Dit is baie maklik om skuiwergate in enige stel bedradingsregulasies te vind, aangesien daar soveel vordering op die gebied van tegnieke en nuwe ontwikkelinge met betrekking tot materiaal en toerusting gemaak word. Sonder om enigsin's die werk van voormalige komitees insake bedradingsregulasies te probeer verkleineer, word dit al hoe meer duidelik dat ons „Blouboek" deeglik skoongemaak of, nog beter, miskien met 'n heeltemal nuwe benadering en in 'n nuwe formaat—d.w.s. met 'n nuwe voorkoms—hersien behoort te word.

Die IEK is tans besig om, met internasionale instemming, nuwe bedradingsregulasies op te stel en

ideal opportunity to rewrite our national regulations and to fit our new look into a similar framework as is proposed by the IEC. By keeping in line with the international approach South Africa will eventually benefit for the two main reasons of:

- (a) facilitating international exchanges that might otherwise be hampered by differences in national regulations, and
- (b) promoting compatibility between wiring regulations and other rules or standards concerning the equipment installed, where we are already following IEC recommendations wherever practicable.

A few references to earth leakage protection are to be found in the "Blue Book" but it is felt that the new approach to the regulations would allow this subject to be introduced, and dealt with fully, in a more logical manner. I therefore intend to outline briefly this proposed approach to the new regulations and to indicate where earth leakage would be introduced in the general requirements for installations.

Thereafter certain contentious aspects of earth leakage protection will be discussed, notably whether or not it should be made compulsory. Solutions to some of these problems will be suggested.

Finally, the correlation between earth leakage and wiring regulations, in the new form, will be mentioned.

## 2. WIRING REGULATIONS FROM FIRST PRINCIPLES

How often is a professional man asked for his opinion on a certain aspect of his own subject? And how often does he, when at a loss to reply immediately, work out his answer from first principles? Every schoolboy is taught to do this but unfortunately the electrical engineer has tended to overlook this simply philosophy when writing wiring regulations, and not only in this country.

Instead of merely directing a person to install a socket-outlet more than two metres from a water tap, or otherwise incur the additional cost of an earth leakage device or isolating transformer (Regulation 606(J)), would it not be better to derive this rule from first principles? Some might think the reason for this regulation is that it would not be so easy to fill a plugged-in electric kettle due to the length of flexible cord: others that it then becomes difficult to touch simultaneously both the plug and the earthed tap, or maybe even the running water. One might then be excused for thinking that the socket-outlet must be more than two metres from a metallic drain-

dit is dus nou 'n ideale geleentheid om ons regulasies te herskryf en om ons nuwe voorkoms by 'n nuwe raamwerk, soos deur die IEK voorgestel, in te pas. Deur met die internasionale bedrading tred te hou sal Suid-Afrika uiteindelik voordeel terk, hoofsaaklik om die volgende redes:

- (a) die vergemaakliking van internasionale onderhandelinge wat anders deur verskillende in nasionale regulasies in die wiede gery mag word;
- (b) die bevordering van die aanpasbaarheid tussen bedravingsregulasies en ander Standaarde of reëls insake geïnstalleerde toerusting, met inagneming van die feit dat ons alreeds, waar dit ookal prakties moontlik is, die aanbevelings van die IEK navolg.

In die „Blouboek" word 'n paar verwysings na aardlekbeskerming gevind, dog die mening word gehuldig dat die nuwe benadering tot die regulasies dit moontlik sal maak om hierdie onderwerp op 'n meer logiese wyse in te lei en te behandel. Ek is derhalwe van plan om 'n kort uiteensetting te gee van hierdie voorgestelde benadering tot die nuwe regulasies en om aan te dui waar aardlekbeskerming in die algemene vereistes vir installasies ingevoeg sal word.

Daarna sal sekere kontensieuse aspekte van aardlekbeskerming bespreek word, veral of dit verpligtend gemaak moet word, aldan nie. Daar sal voorstelle in verband met moontlike oplossings vir sekere van hierdie probleme aan die hand gedoen word.

Ten slotte sal daar melding gemaak word van die korrelasie tussen aardlekkte en die bedravingsregulasies in die nuwe vorm.

## 2. BEDRADINGSREGULASIES EN BASIESE BEGINSELS

Hoe dikwels word 'n professionele persoon om sy mening gevra aangaande 'n sekere aspek van sy eie vak? En hoe dikwels werk hy, wanneer hy nie dadelik kan antwoord nie, sy antwoord uit op die grondslag van die basiese beginsels? Elke skoolseun word geleer om dit te doen, maar ongelukkig is die elektrotegniese ingenieur verloor om hierdie eenvoudige filosofie uit die oog te verloor wanneer hy bedravingsregulasies opstel, en dit gebeur nie net in ons land nie.

In plaas daarvan om slegs te bepaal dat 'n sokkeltaal meer as twee meter vanaf 'n waterkraan geïnstalleer moet word, by gebreke waarvan daar bykomstige uitgawes aangegaan moet word om 'n aardlektoestel of 'n isolerende transformator te installeer (Regulasie 606(J)), is dit nie beter om hierdie reël aan die basiese beginsels te ontleen nie? Party mense mag miskien dink dat die rede vir hierdie regulasie is dat dit dan nie so maklik sal wees om 'n aangeskakelde elektriese ketel vol water te maak nie omdat die elektriese tou te kort is; ander mag weer dink dat dit dan moeilik word om gelyktydig aan die prop en die gearde kraan, of selfs aan die lopend water,

ing board which is earthed and liable to splashing. Is this what is intended? There is possibly some excuse for muddled thinking and different interpretations in this instance, whereas a definite requirement in general terms could have made the intention behind the regulation quite clear. It is not reasonable to provide the justification for each rule in, say, a series of footnotes or the wireman would be saddled with an encyclopedia which he would never read. But without some idea of the motivation and principles behind the regulations the wireman, the Engineer and future committees would not know how they were derived or how to interpret them under slightly different circumstances, the complexities of which could never be covered by even the most comprehensive rules.

This then is the new approach to wiring regulations: working from first principles.

The two main advantages that spring to mind are:

- (a) that it will be easier to decide whether or not a new method of wiring or new materials or apparatus, are safe to use, and
- (b) that interpretations of the regulations to cover unforeseen circumstances will be easier;

if the method or equipment complies with the first principles. Let us see how this works in practice.

Having defined the scope of the new regulations the first step would be to establish a set of **fundamental principles**, as simple as possible and yet covering all situations in general terms. The second step would be to expand the fundamental principles into **general requirements** for all types of electrical installation. The succeeding steps would be to define **supplementary requirements** for various kinds of premises and special locations such as, amongst others, domestic and industrial premises, theatres, caravan and building sites, agricultural premises, hospitals and premises with explosive atmospheres. These divisions can be built up in logical steps and have been designated:

- Part 1: Scope and definitions
- Part 2: Fundamental principles
- Part 3: General requirements for installations
- Parts 4 to 13: Supplementary requirements.

In order to follow, again, a logical sequence each of these parts has been split into sections, as follows:

te raak. 'n Mens kan dan verskoon word as hy dink dat die sok-uitlaat meer as twee meter vanaf 'n metaaldreineringsbord moet wees wat geaard is en aan die spat van water blootgestel is. Is dit wat bedoel word? Daar is seker in hierdie geval 'n goeie verskoning vir verwarde denke en verskillende vertolkings, terwyl 'n definitiewe vereiste, in algemene terme geformuleer, die bedoeling wat agter hierdie regulasie skuil, heeltemal duidelik sou gemaak het. Dit is nie wenslik om die regverdiging vir elke reël in, sê, 'n reeks voetnotas te vervat nie, aangesien die draadwerker dan opgesaal sou sit met 'n ensiklopedie wat hy nooit sal lees nie. Maar tensy hulle 'n idee het van die motivering en die beginsels wat die regulasies ten grondslag lê, sal die draadwerker, die ingenieur en toekomstige komitees nie weet waaraan die regulasies ontleen is of hoe om hulle te vertolk onder effens verskillende omstandighede, waarvan die ingewikkelhede nooit deur selfs die mees omvattende reëls gedek kan word nie.

Dit is dan die nuwe benadering tot bedradingsregulasies: daar moet van die basiese beginsels uitgegaan word.

Die twee vernaamste voordele wat by 'n mens opkom, is die volgende:

- (a) dit sal makliker wees om te besluit of 'n nuwe bedradingsmetode, of nuwe materiale of apparaat, veilig is om te gebruik; en
- (b) die vertolk van die regulasies om onvoorsiene omstandighede die hoof te bied sal makliker wees.

indien die metode of die toerusting aan die basiese beginsels beantwoord. Laat ons kyk hoe dit in die praktyk werk.

Nadat die omvang van die nuwe regulasies gedefinieer is, is die eerste stap om 'n stel **fundamentele beginsels** daar te stel, wat so eenvoudig as moontlik moet wees en tog alle situasies in algemene terme moet dek. Die tweede stap is dan om die fundamentele beginsel uit te brei na **algemene vereistes** vir alle soorte elektriese installasies. Die daaropvolgende stappe sal dan wees om aanvullende vereistes te definieer vir verskillende tipes persele en spesiale liggings, soos bv. woon- en nywerheidspersele, teaters, karavaanparke, bouperssele, landbouperssele, hospitale en persele met 'n ontplofbare atmosfeer. Hierdie afdelings kan in logiese stappe opgebou word en word aangedui as:

- Deel 1: Omvang en woordoms krywings
- Deel 2: Fundamentele beginsels
- Deel 3: Algemene vereistes vir installasies
- Dele 4 tot 13: Bykomstige vereistes.

Ten einde weereens 'n logiese volgorde te volg, is elkeen van hierdie dele weer in afdelings onderverdeel, en wel soos volg:

- Section 1: Protection rules
- Section 2: Design rules
- Section 3: Rules for selection of electrical equipment

Section 4: Rules for erection and initial testing

Section 5: Rules for maintenance and repair

Section 6: Rules for periodic inspection

The result is set out in Table 1. Although at first sight there appear to be a great number of parts and sections, these sub-divisions would assist in expanding the fundamental principles into fully detailed requirements in logical steps and in discussing sections of reasonable size. Some sections will be relatively short and at the conclusion of the work it might well be possible to combine sections with a view to producing a manageable and readable document.

It should be mentioned that the idea of stating basic principles, and then requirements which comply with these basic principles is not altogether new. This approach has been used, although not in such a comprehensive way, by some countries overseas: in this respect I would like to refer you to:

- (a) Regulations for the electrical Equipment of Buildings: IEE, London. Part 1: Requirements for Safety, and
- (b) Wiring Rules: Standards Association of Australia: Section 1: General Requirements, and
- (c) Canadian Electrical Code, Part 1: Canadian Standards Association: Section 2: General Rules.

### 3. PROTECTION RULES

A brief summary of protection rules (Section 1) as regards fundamental principles (Part 2) and general requirements for installations (Part 3) is given in Table 2.

Amplification of these rules is necessary for full understanding but for our purposes here the intention behind them is sufficiently self-explanatory, with the exception of those rules mentioned specifically below.

The terms direct contact and indirect contact require some elaboration. They have been adopted by the IEC to denote shocks received through contact with live or current-carrying parts (direct contact) and, on the other hand, shocks received through contact with conducting parts which have become alive

Afdeling 1: Beskermingsreëls

Afdeling 2: Ontwerpreëls

Afdeling 3: Reëls vir die keuring van elektriese toerusting

Afdeling 4: Reëls vir oprigting en aanvanlike toetsing

Afdeling 5: Reëls vir instandhouding en herstelwerk

Afdeling 6: Reëls vir periodieke inspeksie.

Die resultate word in Tabel 1 uiteengesit. Alhoewel dit op die oog af wou voorkom asof daar 'n groot aantal dele en afdelings is, help hierdie onderverdelings om die fundamentele beginsels uit te brei na volle gedetailleerde vereistes wat in logiese stappe uiteengesit is, asook om afdelings van 'n redelike grootte te bespreek. Sommige afdelings sal betreklik kort wees, en, na ahandeling van die werk, mag dit miskien moontlik wees om sekere afdelings te kombineer ten einde 'n hanteerbare en leesbare dokument daar te stel.

Daar moet gemeld word dat die idee om basiese beginsels daar te stel en dan vereistes te formuleer wat aan hierdie beginsels voldoen, nie heeltemaal nuut is nie. Hierdie benadering is, alhoewel nie op so 'n omvattende wyse nie, deur sommige oorsese lande gebruik.

In hierdie verband kan ek verwys na:

- (a) Regulasies vir die elektriese uitrusting van geboue: IEK, Londen. Gedeelte I: Veiligheidsvereistes;
- (b) Bedradingsreëls: Standaardvereniging van Australië: Gedeelte I: Algemene Vereistes; en
- (c) Kanadese Elektrotegniese Kode, Deel I: Standaardvereniging van Kanada: Afdeling 2: Algemene Reëls.

### 3. BESKERMINGSREËLS

'n Kort opsomming van beskermingsreëls (Afdeling 1) soos dit betrekking het op fundamentele beginsels (Deel 2) en algemene vereistes vir installasies (Deel 3), word in Tabel 2 aangegee.

Om hierdie reëls ten volle te kan verstaan, is dit nodig om heelwat daarop uit te brei, maar vir ons doeleindes in hierdie referaat kan die bedoeling daaragter as vanselfsprekend genoeg aanvaar word, met die uitsondering van die reëls wat spesifiek hieronder vermeld word. Die terme direkte kontak en indirekte kontak het verdere verduideliking nodig. Hulle is deur die IEK aanvaar om aan te dui emersyds skokke wat ontvang word as gevolg van die aanraking van lewendige of stroomdraende dele (direkte kontak) en, aan die ander kant, skokke wat opgedoen word as gevolg van aanraking van dele wat na die ontstaan

or current-carrying on the occurrence of a fault (indirect contact). It will be appreciated that these two aspects may require different approaches in order to provide overall protection from shock. Usually at least one protective measure against direct contact and at least one against indirect contact are necessary but in some cases both contingencies can be covered by one measure, e.g., safety extra-low voltage.

The information in the tables is condensed from the draft documentation of IEC Technical Committee 64: the fundamental principles have already been agreed, by the IEC, but the general requirements are to be discussed this year. Being of an international nature, the information is intended to cover all the contingencies which may be encountered in practice throughout the world. Some of the provisions may be rejected by our wiring regulations committee because they are not applicable to local conditions. One example is the earth-free domestic room which is accepted as a normal location in Norway (and other countries) where timber construction is widespread: no earth conductor may be introduced into these rooms as it could constitute an additional hazard. I do feel, however, that all these contingencies must be included for discussion at this preliminary stage.

Earth leakage protection will be introduced in the general requirements in Table 2 under Subclauses 1.2.3, 2.3.1, and 3.1: further explanations will be given in Clause 7 of this paper.

#### **4. FUNDAMENTAL PRINCIPLES: PART 2, SECTION 2 to 6**

As a matter of general interest and not for discussion in this paper, I have completed the overall picture of the fundamental principles by including Table 3 which covers the remaining Section 2 to 6 as listed in Clause 2 of the paper. Time permitting I will be pleased to answer any questions on Table 3.

#### **5. EARTH LEAKAGE CURRENTS**

Much has been said over the years about making earth leakage protection compulsory but before going further it will be as well to take a look at the data available on the leakage currents likely to be encountered in domestic installations.

The Bureau carried out a short survey in 1970 at Durban, Edenvale, Springs and Witbank. Random domestic installations were chosen, ranging up to 50 years old: stoves, geysers and refrigerators were tested when encountered. The following were among the conclusions reached:

van 'n fout lewendig of stroomdraend geword het (indirekte kontak). Daar sal besef word dat hierdie twee aspekte verskillende benaderings vereis ten einde omvattende beskerming teen skok te verseker. Gewoonlik is minstens één beskermende matreël teen direkte kontak en minstens één teen indirekte kontak nodig, dog in sekere gevalle kan abei gebeurlikhede deur een matreël, soos bv. veilige ekstralae stroomspanning, gedek word.

Die inligting in die tabelle vervat is gekondenseer uit die konsepdokumentasie van die IEK te Teg-niese Komitee No. 64. Die IEK het reeds die fundamentele beginsels aanvaar, dog die algemene vereistes word vanjaar oorweeg. Omdat dit internasionaal van woord vanjaar oorweeg. Omdat die internasionaal van likhede wat in die praktyk dwarsdeur die wêreld ondervind mag word, te dek. Party van die bepalinge mag miskien deur ons komitee insake bedradings-regulasies verwerp word omdat dit nie op plaaslike toestande van toepassing is nie. Een voorbeeld is die aardvrye woonkamer wat as normaal aanvaar word in Noorweë en in ander lande waar houthuise algemeen voorkom; geen aardgeleier mag in hierdie kamers geïnstalleer word nie, aangesien dit 'n bykomstige bron van gevaar mag wees. Ek is egter van mening dat, in hierdie voorlopige stadium, al hierdie gebeurlikhede in die bespreking ingesluit behoort te word.

Aardlekbeskerming sal by die algemene vereistes in Tabel 2 onder subklousules 1.2.3, 2.3.1 en 3.1 ingesluit word, terwyl verdede verduidelikings in klousule 7 van hierdie referaat gegee sal word.

#### **4. FUNDAMENTELE BEGINSELS: DEEL 2, AFDELINGS 2 tot 6**

As 'n saak van algemene belang, dog nie vir bespreking in hierdie referaat nie, het ek die volle prentjie van die fundamentele beginsels probeer voltooi deur die insluiting van Tabel 3, wat die oorblywende afdelings 2 tot 6, soos in die lys in klousule 2 van hierdie referaat vervat, dek. Indien die tyd dit toelaat, sal ek met graagte vrae in verband met Tabel 3 beantwoord.

#### **5. AARDLEKSTROME**

Daar is oor die jare heen veel gesê omtrent die wenslikheid daarvan om aardlekbeskerming verpligtend te maak, dog, voordat ons voortgaan, sal dit 'n goeie doel dien om te kyk na die beskikbare gegewens omtrent die aardlekstrome wat waarskynlik in huishoudelike installasies teëgekomp sal word.

Gedurende 1970 het die Buro 'n kort opname in Durban, Edenvale, Springs en Witbank gemaak. Huishoudelike installasies, sommige tot 50 jaar oud, is luktak gekies: stowe, warmwatertoestelle en yskaste is getoets soos en waar hulle teëgekomp is. Die gevolg-trekkings waartoe gekom is, was o.a. die volgende:

(a) Earth leakage devices, complying with SABS 767, would have tripped out at over 25 mA leakage current on about one quarter of the installations tested, and

(b) the major cause of tripping is stoves (17 per cent) otherwise it is refrigerators and geysers (other portable plug-in appliances were not tested), and

(c) decreasing the sensitivity to a point beyond our present opinion of safety, say 50 mA threshold tripping current, would reduce this figure to about one-fifth of the installations tested, and

(d) the standing leakage currents on complete fixed wiring installations were all in the range of 0 to 5 mA except three in Durban (2 at 9 mA and 1 at 14 mA). About 89 per cent were measured at 1 mA or less.

We cannot claim that these values are completely valid without more confirmatory tests but the trends indicated have been confirmed by independent tests conducted by some of the larger municipalities. The question of nuisance tripping is dealt with later, with reference to this section of the paper.

## 6. SENSITIVE EARTH LEAKAGE PROTECTION

Under this section it is proposed to examine some of the problems associated with sensitive earth leakage protection and offer some possible solutions.

**6.1 General.** It is probably well known that differential current operated earth leakage protection is being more widely used every year overseas. The standard threshold tripping currents in use are 30 mA in France; 100 mA in Austria; 5 mA in the USA and Canada, but only on each final subcircuit and 30 mA in Germany. It will be seen that there is quite a wide range of opinion but that our standard 20 mA unit (plus/minus 25%) is closely related to the German unit, for instance, which must trip between 50 and 100 percent of the rated current, i.e., 15 to 30 mA, according to the VDE specification.

In this paper I am not discussing the theory of what the body can tolerate over certain periods of time but the practical aspects of using earth leakage. The above tripping values are, however, of interest when related to the information in the following sub-clause.

**6.2 Compulsory Earth Leakage Protection.** Earth leakage protection, as an additional protective measure, has been made nationally compulsory in the following instances:

(a) Aardlektoestelle wat aan SABS 767 voldoen, sou by ongeveer een-kwart van die installasies wat getoets is, teen meer as 25 mA-lekstroom uitgeklink het.

(b) Die hoof-oorsaak van uitklinking is stowe (17 persent) gevolg deur yskaste en warmwatertoestelle (ander verskuifbare inprop-toestelle is nie getoets nie).

(c) Om die sensitiwiteit te verlaag na 'n punt onderkant ons huidige idee van veiligheid, sê 50 mA — drumpeluitklinkstroom, sal die uitklinksyfer na ongeveer een-vyfde van die getoetste installasies verminder, en

(d) Die staande lekstrome in voltooide vaste bedradinginstallasies was almal tussen 0 en 5 mA, behalwe drie in Durban (2 teen 9 mA en een teen 14 mA). Omtrent 89 per sent is gemeet teen 1 mA of minder.

Ons kan nie daarop aanspraak maak dat hierdie waardes heeltemal geldig is sonder meer bevestigende toetse nie, dog die neigings wat getoon is, word bevestig deur die uitslae van onafhanklike toetse wat deur sommige van die groter munisipaliteite uitgevoer is. Die Kwessie van lastige uitklinking sal later, met verwysing na hierdie afdeling van die referaat, behandel word.

## 6. SENSITIEWE AARDLEKBESKERMING

Onder hierdie afdeling gaan ons sommige van die probleme wat met sensitiewe aardlekbekskerming verband hou, van naderby ondersoek en enkele moontlike oplossings aan die hand doen.

**6.1 Algemeen.** Dit is waarskynlik welbekend dat geïntensifiseerde stroomaangedrewe aardlekbekskerming elke jaar meer en meer in oorsese lande gebruik word. Die standaard-dumpeluitklinkstrome in gebruik is 30 mA in Frankryk, 100 mA in Oostenryk, 5 mA in die Verenigde State en Kanada, dog slegs op elke finale substroombaan, en 30 mA in Duitsland. Dit blyk dus dat daar 'n heel groot verskil van menings is, dog dat ons standaard 20 mA-eenheid (plus/minus 25 per sent, in noue verband staan met bv. die Duitse eenheid, wat moet uitklink tussen 50 en 100 persent van die aangeslane stroom, d.w.s. 15 tot 30 mA, ooreenkomstig die VDE-spesifikasie.

Ek gaan nie in hierdie referaat bespreking wy aan die teorie oor wat die liggaam oor sekere tydperke kan verduur nie, maar wel aan die praktiese aspekte van die gebruik van aardlekbekskerming. Bogenelde uitklinkwaardes is egter van belang wanneer dit met die inligting in die hieropvolgende subklousule in verband gebring word.

**6.2 Verpligte Aardlekbekskerming.** Aardlekbekskerming, as 'n bykomstige beskermende maatregel, is in die volgende gevalle landswyd verpligtend gemaak:

(a) In Canada, but not the USA, their 5 mA rated device is used on all new swimming pool lighting fixtures installed below or within ten feet of the pool surface. The maximum voltage permitted is 150 volts. Some nuisance tripping is being experienced with this high sensitivity.

(b) In Germany, where the VDE regulations for the earthing of domestic electricity supplies cannot be met due to poor soil conditions, every consumer affected must install earth leakage protection in addition to the normal earthing of exposed conductive parts. A sensitive device operating at 30 mA is used on the socket-outlet circuits only: less sensitive devices, for the protection of equipment rather than life, are used on lighting circuits (300 mA) and on stoves and heaters (500 mA). The 30 mA unit is also mandatory on certain agricultural premises.

(c) In France the whole domestic installation is protected by a device rated at 30 mA and experience is said to be satisfactory.

In South Africa there is no national ruling for compulsory earth leakage protection on domestic wiring although some municipalities have done just this for complete installations. We have had evidence of positive interference with the earth leakage devices in such cases whereby they have been rendered inoperative, therefore it would appear doubtful that this measure should be mandatory at this stage. Perhaps the approach should rather be to protect part of the installation and aim at protecting the whole installation at a later date. This aspect will be examined in the next subclause.

One must bear in mind that the percentage of domestic accidents due to electricity is relatively low when compared with other causes such as accidents on the roads or due to falls. This has been mainly due to the care and attention taken by electricity supply authorities in the field of safety. However, electricity is dangerous and it is surely advisable to tighten up rather than relax our safety precautions provided this can be done without hitting the householder's pocket too hard and provided we do not run into more problems by doing so. As regards economics, the cost of an earth leakage device on a new installation should not be a hardship when considering the total building cost (except perhaps on subeconomic housing) and the additional safety thus provided. Some of the problems to be met are being discussed in this paper.

(a) In Kanada, dog nie in die V.S.A. nie, word hulle 5 mA aangeslane toestel gebruik vir alle nuwe ligtoebehore wat onder of binne 10 voet vanaf die oppervlakte van 'n swembad geïnstalleer word. Die hoogste spanning wat toegelaat word, is 150 volt. 'n Mate van lastige uitklinking word met hierdie hoë sensitiviteit ondervind.

(b) In Duitsland, waar dit weens swak grondtoestande nie moontlik is om aan die vereistes van die VDE-regulasies insake die aarding van huishoudelike elektrisiteitstoelers te voldoen nie, moet elke verbruiker wat daarby betrokke is, aardlekbeskerming installeer bo en behalwe die normale aarding van ontblote geleiers. 'n Sensitiewe toestel wat teen 30 mA werk, word slegs in die sokkitaalstroombane voorsien: minder sensitiewe toestelle, wat bedoel is om toerusting liewer as lewens te beskerm, word op ligstroombane gebruik (300 mA) sowel as by stowe en verwarmers (500 mA). Die 30 mA-eenheid is ook op sekere landboupersele verpligtend.

(c) In Frankryk word die hele huishoudelike installasie beskerm deur 'n toestel van 30 mA, en daar word verneem dat dit bevredigend werk.

In Suid-Afrika is daar geen landswye reël vir verpligte aardlekbeskerming in die bedrading van huise nie, alhoewel sommige munisipaliteite dit wel vir voltooide installasies ingestel het. In sulke gevalle is gevind dat daar beslis met die aardlektoestelle gepeuter is, wat daartoe gelei het dat hulle opgehou het om te funksioneer, as gevolg waarvan dit te betwyfel val of so 'n reëling in hierdie stadium verpligtend gemaak moet word. Miskien moet die benadering liewers wees om 'n gedeelte van die installasie nou te beskerm, en die oogmerk om die hele installasie in 'n latere stadium te beskerm. Hierdie aspek sal in die volgende subklousule van naderby ondersoek word.

Ons moet in gedagte hou dat die persentasie huishoudelike ongelukke wat aan elektrisiteit te wyte is, relatief laag is wanneer dit vergelyk word met ander oorsake soos bv. ongelukke op die paaië of gevalle waar mense val. Dit is hoofsaaklik te danke aan die sorg en aandag wat deur elektrisiteitsvoorsieningsowerhede aan die kwessie van veiligheid bestee word. Elektrisiteit is egter gevaarlik en dit is sekerlik raadzaam om ons veiligheidsmaatreëls liewer te verskerp as te verslap, mits dit gedoen kan word sonder om die verbruiker se sak te hard aan te spreek en mits ons natuurlik nie, deur dit te doen, meer probleme vir onself skep nie. Sover dit die ekonomie van die saak betref, behoort die koste van 'n aardlektoestel in 'n nuwe installasie nie 'n ontbering te wees as die totale boukoste (behalwe in die geval van sub-economiese behuising) en die bykomstige beskerming wat aldus verkry word, in aanmerking geneem word nie. Sommige van die probleme wat teëgekem kan word, word in hierdie referaat bespreek.

### 6.3 Protection of the Whole or a Part of the Installation. Let us examine a few points.

(a) **Stoves.** From Clause 6 of this paper it would seem that stoves will cause a good deal of nuisance tripping. Furthermore, if a stove does trip the earth leakage device it is not possible to "bake out" the fault.

In spite of some reports of sensations of shock from stoves we have examined all the records at our disposal and cannot trace a fatality due to a faulty stove. These appliances can therefore be assumed to be fixed and reliably earthed.

For these reasons we suggest that the stove should be excluded from any compulsory earth leakage protection at present.

One small point arises from this suggestion. It could no longer be permitted to supply one socket outlet on the same final subcircuit as the stove (Regulation 1202: Exemption (i)).

(b) **Geysers.** In our records we cannot trace any fatalities due to electric geysers. They are fixed and reliably earthed and could for these reasons be omitted from earth leakage protection without sacrificing safety.

If included in leakage protection some nuisance tripping would occur but as these appliances are now controlled by a double-pole switch and are on a separate circuit (Regulation 1219) it is likely that any leakage on the neutral conductor could be isolated and the earth leakage device then reclosed, thus restoring power to other circuits. Otherwise, there would be no harm in including this item with the protected circuits.

In this instance it is suggested that, in order to avoid introducing any new problems, e.g., nuisance tripping and loss of water heating, geysers are excluded from earth leakage protection.

(c) **Lights:** Further study of our records for the years 1968 to 1970 show that out of 32 fatal electrical domestic accidents 28 were due to extension leads. Of these, 27 were connected to socket-outlet circuits and one was connected to a bayonet lighting fitting: in the latter case an electric drill was being used, the earth conductor being left unconnected. To say the least, it is extremely bad practice to connect any appliance provided with an earthing conductor and not use that conductor. As long as bayonet-cap adaptors are available to the public we will be faced with hazardous extensions from lighting points, particularly on old houses with insufficient socket-outlets.

### 6.3 Beskerming van die hele installasie of slegs 'n gedeelte daarvan. Laat ons 'n paar punte van naderby beskou:

(a) **Stowe:** Uit klousule 6 van hierdie referaat wou dit voorkom asof stowe die oorsaak van 'n groot mate van lastige uitklinking kan wees. Voorts is dit duidelik dat, as 'n stoof die aardlektoestel laat uitklink, dit nie moontlik is om die fout „uit te bak" nie.

Ten spyte van verslae van gevalle waar 'n gevoel van skok by stowe ondervind is, het ons al die rekords wat tot ons beskikking is, ondersoek en kon ons geen noodlottige voorval waarby 'n stoof betrokke is, opspoor nie. Daar kan dus aanvaar word dat hierdie aparate vasstaande en betroubaar geaard is.

Om hierdie redes doen ons aan die hand dat stowe in die huidige stadium van enige verpligte aardlekbekerming uitgesluit word.

Uit hierdie voorstel vloei daar egter een punt voort: daar kan nie langer toegelaat word dat een sokkuitlaat op dieselfde finale substroombaan geïnstalleer word nie (Regulasie 1202: Vrystelling (i)).

(b) **Warmwatertoestelle:** In ons rekord kon ons geen noodlottige voorvalle wat aan warmwatertoestelle toegeskryf kan word, opspoor nie. Hulle is vasstaande en betroubaar geaard en kan dus van verpligte aardlekbekerming uitgesluit word sonder om enigiets aan veiligheid in te boet.

Indien die warmwatertoestel by die lekbekerming ingesluit sou word, sou 'n mate van lastige uitklinking voorkom, dog, aangesien hierdie toestelle tans deur 'n tweepoolskakelaar beheer word en boonop 'n aparte stroombaan geïnstalleer word (Regulasie 1219), is dit waarskynlik dat enige lekkasie op die neutrale geleier geïsoleer en die aardlektoestel dan weer gesluit kan word om sodoende weer krag aan die ander stroombane te verskaf. Andersins sal daar geen skade gedoen word indien hierdie toestelle by die ander beskermdes stroombane ingesluit word nie.

In hierdie geval word daar aan die hand gedoen dat, ten einde die invoering van ander probleme, soos bv. lastige uitklinking en 'n verlies aan waterverwarming te verhoed, warmwatertoestelle van aardlekbekerming uitgesluit word.

(c) **Ligte:** 'n Verdere studie van ons rekords vir die jare 1968 tot 1970 toon dat, uit die 32 noodlottige huishoudelike ongelukke waarby elektrisiteit betrokke was, 28 deur verlengingsgeleiers veroorsaak is. Hier van was 27 aan sok-uitlate gekonnekteer en een aan 'n bajonet-tipe ligprop. In laasgenoemde geval is 'n elektriese boor gebruik, met die aardeleier nie gekonnekteer nie. Om die minste daarvan te sê, is dit 'n baie swak beleid om enige apparaat wat van 'n aardeleier voorsien is, te gebruik sonder om daardie geleier te gebruik. So lank as wat die bajonet-tipe passtukke vir die publiek beskikbaar is, sal ons te kamp hê met gevaarlike verlengings vanaf ligproppe, veral



fire. Sensitive earth leakage protection could assist in the prevention of fires caused by leakages from current-carrying conductors to earth. We have covered this aspect for plugged-in appliances and flexible cords but it is difficult to determine the incidence of fires, due to electricity, on lighting or other circuits. Once more, statistics of fires could prove this, enabling us to take suitable steps in future but the hazard of "no lights" will always exist where one leakage device protects the lighting and socket-outlet circuits.

Lastly, if compulsory earth leakage protection was accepted, I suggest that it should be applied to new installations only. If considered desirable, complete rewiring of installations could be included in this category.

**6.4 Nuisance Tripping.** With stoves, in particular, excluded from earth leakage protection this problem is simplified. Of the other semi-permanent plug-in appliances one can expect trouble from a small number of refrigerators and deep-freeze units: mention is made of these later.

Where nuisance tripping does occur the only practical method of dealing with it appears to be to display a notice on the distribution board explaining simply how a fault can be located and eliminated and if the fault cannot be cleared that a competent person must be called in. Contractors and inspectors could be asked to bring the consumer's attention to this notice and offer their advice to him.

**6.5 Desensitizing.** If an earth leakage device is provided on a voluntary basis, desensitizing might be acceptable. On a compulsory basis, however, I consider that a householder should not be able to desensitize or bypass the device in any way because there is no certain method of ensuring that it is reset. Thus, the safety measure can be nullified. Here we come up against the tripping out of the freezer during holidays or even week-ends. Some of the solutions are impractical, e.g., allowing the earth leakage relay to be switched off but only with the approval of a responsible authority—and this means the ubiquitous Engineer, poor fellow.

Our suggestion is to provide one final subcircuit to the freezer, not controlled by earth leakage. To ensure good earthing let us treat the freezer in a similar manner as the stove, because it is moved occasionally for cleaning purposes. We could provide

van brande. Sensitiewe aardlekbeskerming kan bydra tot die voorkoming van brande wat veroorsaak word deur lekkes vanaf stroomdraende geleiers na die aarde toe. Ons het hierdie aspek behandel vir sover dit ingepropte apparaat en buigbare koorde betref, dog dit is moeilik om te bepaal hoeveel brande deur elektrisiteit in lig- of ander stroombane veroorsaak word. Ook hier kan statistiek in verband met brande die nodige bewys lewer en ons sodoende in staat stel om gepaste stappe in die toekoms te doen, dog die gevaar van „geen ligte" sal nog altyd bestaan waar een toestel sowel die lig- as die sok-uitlaatstroombane beskerm.

Ten laaste, as aardlekbeskerming verpligtend gemaak sou word, sou ek aan die hand doen dat dit net op nuwe installasies van toepassing gemaak word. Indien dit as wenslik beskou word, kan gevalle waar persele geheel-en-al herbedraad word, by hierdie kategorie ingesluit word.

**6.4 Lastige uitklinking.** Indien veral stowe van aardlekbeskerming uitgesluit sou word, sou hierdie probleem baie vereenvoudig word. Wat die ander semi-permanente inprop-apparaat betref, kan 'n mens moeilikheid verwag van 'n klein aantal ys- en vrieskaste. Hulle word egter later behandel.

Waar lastige uitklinking wel voorkom, skyn die enigste praktiese manier om dit te bekamp, te wees om 'n kennisgewing op die distribusieboard te plaas waarin in eenvoudige taal verduidelik word hoe om 'n fout op te spoor en uit te skakel en, indien die fout nie reggestel kan word nie, dat 'n deskundige persoon ingeroep moet word. Kontraakteurs en inspekteurs kan versoek word om hierdie kennisgewing onder die aandag van die verbruiker te bring en hulle raad aan hom te bied.

**6.5 Desensitiserings.** Indien 'n aardlektoestel op 'n vrywillige grondslag voorsien word, kan desensitering wel aanvaarbaar wees. Indien dit egter verpligtend is, is ek van mening dat die verbruiker nie in staat behoort te wees om die toestel op enige wyse te desentiteer of te omsel nie, aangesien daar geen sekere metode bestaan om te verseker dat dit herset word nie, met die gevolg dat die waarde van die veiligheidsmaatregel tot niet gemaak kan word. Hier kom ons weer te staan voor die probleem van die vrieskas wat gedurende 'n vakansie of 'n naweek uitklink. Sommige van die oplossings wat aan die hand gedoen is, is onprakties, soos bv om toe te laat dat die aardlektoestel afgeskakel word, dog dan slegs met die toestemming van 'n verantwoordelike owerheidspersoon — en dit beteken die alomteenwoordige ingenier, arme kêrel.

Ons voorstel is om een finale substroombaan vir die vrieskas te voorsien wat nie deur die aardlektoestel beheer word nie. Om goeie aarding te verseker, laat ons die vrieskas behandel soos die stoof, aangesien dit ook nou en dan vir skoonmaakdoeleindes

Notwithstanding the above remarks, it is usually more convenient to make use of a socket-outlet than a lighting point and the former will be used to a much greater extent even when both are available in the same area of a house as might be expected in a new building.

Unfortunately, the records previous to 1968 are not detailed enough to provide the same type of information, but one can perhaps assume that some three per cent of domestic fatalities are due to extension leads from lighting points. A number of these will also be unauthorised wiring, e.g., taking ripcord from the house to light the garage. I do feel that as the older houses are demolished or rewired and more socket-outlets are provided the percentage of this type of accident could diminish.

Turning now to the biggest bone of contention on this matter, many consider it dangerous for a dwelling to be plunged into darkness if a fault develops at night. If this feeling is strong enough, why not also eliminate the lighting circuits from earth leakage protection and apply it only to socket-outlets? The degree of overall safety is being increased and on the small proportion of lighting circuit accidents the safety level is at least unchanged. Protection is greatly enhanced against the biggest (by far) factor, i.e., socket-outlets, and the secondary hazard of losing the lights at night is eliminated. Thereafter, statistics will show whether or not lighting circuits should be protected as well.

(d) **General.** Taking the above comments into consideration, it appears that compulsory earth leakage protection should be applied, at this stage, to socket-outlet circuits only. One or two further points in this respect are now mentioned.

The "clever" man will discover that he can still use his faulty pop-up toaster on a lighting circuit whereas it will trip the earth leakage device when plugged in to a socket-outlet. This foolishness might be minimised by better publicity on the advantages of earth leakage protection, perhaps through the medium of advice from municipal engineers and through the Press. We cannot afford to continue indefinitely to legislate for fools unless there are too many for us to do otherwise. As already mentioned, statistics of fatalities due to shocks could determine how necessary it would be to include lighting circuits in this method of protection.

So far I have made little mention of the risk of

in die ouer huise waar daar nie genoeg sok-uitlate beskikbaar is nie.

Nieteenstaande bostaande opmerkings, is dit gewoonlik veel gemakliker om 'n sok-uitlaat te gebruik as 'n ligpunt en eersgenoemde sal altyd meer gebruik word, selfs waar albei in dieselfde gedelte van 'n huis beskikbaar is, soos wat mens in 'n nuwe gebou kan verwag.

Ongelukkig is ons rekords van vóór 1968 nie volledig genoeg om dieselfde soort inligting te verskaf nie, maar mens kan miskien aanvaar dat sowat 3 per sent van noodlottige huishoudelike ongelukke aan verlengingsgeleiers vanaf ligpunte toegekryf kan word. Hiervan sal 'n aantal ook nog te wyte wees aan ongemagtigde bedrading, soos bv. om 'n draad vanaf die huis te neem om die motorhuis te verlig. Ek is van mening dat, namate die ouer huise gesloop of herbedraad en meer sok-uitlate voorsien word, die persentasie van hierdie soort ongeluk behoort te verminder.

Laat ons ons nou tot die grootste geskilpunt in hierdie verband wend, nl. die mening wat baie mense daarop nahoo dat dit gevaarlik is om 'n huis in duisternis te doppel as daar gedurende die nag 'n fout ontstaan. Indien hierdie mening sterk genoeg is, waarom sluit ons dan nie ligstroombane van aardlekbeskerming uit en pas laasgenoemde slegs op sok-uitlate toe nie? Die graad van totale veiligheid word verhoog en wat betref die klein persentasie van ongelukke waarby ligstroombane betrokke is, bly die veiligheidspeil minstens onveranderd. Beskerming teen die heel grootste faktor, nl. sok-uitlate, word aansienlik verhoog, en die sekondêre gevaar van die verlies aan verligting gedurende die nag word heeltemal uitgeskakel. Daarna sal die statistiek wel toon of ligstroombane ook beskerm behoort te word of nie.

(d) **Algemeen.** Met inagneming van die voorgaande kommentaar, wou dit voorkom asof aardlekbeskerming in hierdie stadium slegs op sok-uitlate van toepassing gemaak moet word. Een of twee verdere punte moet nog in hierdie verband genoem word.

Die „slim" man sal gou genoeg agterkom dat hy nog sy foutieve broodrooster op 'n ligstroombaan kan gebruik, terwyl dit die aardlektoestel sal laat uitklink indien dit by 'n sok-uitlaat ingeplug word. Hierdie dwaasheid kan miskien verminder word deur beter reklamering van die voordele van aardlekbeskerming, miskien deur middel van advies deur munisipale ingenieurs en deur die Pers. Ons kan nie bekostig om onbepaald voort te gaan met wette maak vir gekke nie, tensy daar soveel van hulle is dat ons nie anders kan nie. Soos reeds gesê, sal die statistiek omtrent noodlottige elektriese skokke bepaal hoe noodsaaklik dit is om ligstroombane by hierdie metode van beskerming in te sluit.

Toe dusver het ek min te sê gehad oor die gevaar

a suitable switched wall outlet point with a flexible connection to the freezer through flexible conduit or would tough rubber sheathed cable be sufficient without further mechanical protection? Alternatively, and more conveniently, the wall outlet point could have a socket-outlet of special configuration with a matching plug for the freezer. If desired, a double wall outlet could be used for the refrigerator as well, if it is adjacent. The extra cost would not, I feel, be unduly onerous in a new house of a standard which caters for freezers when compared with the possible loss of valuable perishables. Costs could be reduced by using, for the freezer, a 10 ampere circuit-breaker protecting one square millimetre conductor (13 ampere rating) in 16 millimetre ( $\frac{5}{8}$ -in) conduit: this would also provide better over-current protection than existing methods.

There are admittedly snags to this proposal. An individual may wish to locate the freezer elsewhere: he could lose his meat but not, we hope, his life. Or he could use the special socket outlet for another appliance, not then protected against leakage: would it be sufficient to display a notice on this outlet, e.g., "Deep-freeze units only"?

This is a knotty problem and any alternative suggestions would be welcome. Perhaps the real answer is to wash our hands of it and advise the householder to insure his perishables against this contingency!

#### 6.6 Periodic Checking of Earth Leakage Relays.

Until these devices have been proved consistent and reliable over very long periods, occasional checks on their operation are advisable. Here again, we think the practical solution is a notice on the board giving the necessary instructions.

One municipality has gone to a good deal of trouble in making periodical checks on these devices. It would certainly be of great help in compiling statistics if other municipalities could find the time to do the same. Only by statistics can we judge the long term accuracy of these devices.

### 7. THE IMPLICATIONS OF SENSITIVE EARTH LEAKAGE PROTECTION ON WIRING REGULATIONS

**7.1 General.** Although I have suggested that only socket-outlets need be protected by sensitive earth leakage devices this does not affect the broad implications of introducing this form of protection as a

verskuif word. Ons kan 'n geskikte muur-uitlaatlamp met 'n skakelaar en 'n buigbare konneksie na die vrieskas deur 'n buigbare geleibuis voorsien, of sal 'n taai, rubber-omhulde kabel genoegsaam wees sonder verdere meganiese beskerming? Alternatiewelik, en meer gerieflik ook, kan die muur-uitlaatlamp 'n sok-uitlaat met 'n spesiale vorm hê en 'n daarby passende prop vir die vrieskas. Indien verlang, kan 'n dubbele muur-uitlaat voorsien word om die yskas ook bedien, indien dit langsaan staan. Ek is van mening dat die ekstra koste nie onnodig swaar sal weeg in die geval van 'n nuwe huis wat van so 'n standaard is dat dit vir 'n vrieskas voorsiening maak nie, veral as dit vergelyk word met die waarde van bederfbare goedere wat dalk verlore kan gaan nie. Die koste kan verminder word deur bv. vir die vrieskas 'n stroombreker van 10 ampere te gebruik, wat 'n geleier van een vierkante millimeter (13 ampere-aanslag) in 'n 16 mm ( $\frac{5}{8}$  dm.) geleibuis beskerm: dit sal ook beter beskerming teen oorstroming bied as die bestaande metode.

Toegegee, hierdie voorstel hou sekere probleme in. 'n Besondere persoon mag miskien sy vrieskas op 'n ander plek wil plaas; hy kan sy vleis verloor dog, hoop ons, nie sy lewe nie. Of hy kan die spesiale sok vir 'n ander apparaat gebruik, wat dan nie teen aardlekke beskerm sal wees nie: sou dit dan genoegsaam wees om op hierdie uitlaat 'n kennisgewing aan te bring: „Slegs vrieskaste”? Dit is 'n knoperige probleem en enige alternatiewe voorstelle sal verwelkom word. Miskien is die beste antwoord om ons hande in onskuld te was en die verbruiker aan te raai om sy bederfbare produkte teen so 'n gebeurlikheid te verseker!

**6.6 Periodieke nasien van Aardlekrelê's.** Tot tyd en wyl daar bewys gelewer word dat hierdie toestelle oor baie lang tydperke konsekwent en betroubaar funksioneer, is dit wenslik om van tyd tot tyd die funksionering daarvan te kontroleer. Hier is ek ook van mening dat die praktiese oplossing is om 'n kennisgewing met die nodige aanwysings op die bord aan te bring.

Een minisipaliteit het baie moeite gedoen om periodiek die werking van hierdie toestelle na te sien. Dit sal ongetwyfeld van groot hulp by die samestelling van statistiek wees indien ander munisipaliteite die tyd kon vind om dieselfde te doen. Slegs met behulp van statistiek kan ons die akkuraatheid van hierdie toestelle oor 'n lang tydperk beoordeel.

### 7. DIE IMPLIKASIES VAN SENSITIEWE AARDLEKBESKERMING VIR BEDRADINGSREGULASIES

**7.1 Algemeen.** Alhoewel ek voorgestel het dat slegs sok-uitlate deur sensitiewe aardlektoestelle beskerm hoef te word, raak dit nie die breë implikasies van inwring van hierdie vorm van beskerming in die bedra-

general requirement for installations in wiring regulations.

Assuming that this protective measure is accepted in principle, as it is now in South Africa, it must be included in Part 3: General requirements for installations. We have already seen that this has been done, in Table 2, in Subclauses 1.2.3, 2.3.1, and 3.1 which we can now consider.

Subclause 1.2.3. (additional protection—by an earth leakage device) has been discussed at some length and no further explanations are necessary.

Subclause 3.1 (detailed requirements for protection against thermal effects, e.g., fires and burns) will be concerned mostly with regulations dealing with the types of material used for enclosures or for supporting electrical apparatus, and related to the temperatures likely to be attained during normal or abnormal service, so as to avoid burns or fires. Apart from these rules it will be mentioned that earth leakage protection can be used as an additional protective measure against these hazards. Disconnecting devices for overload and fault currents are, of course, dealt with for all installations in Subclause 4.1 of Table 2 which will also indicate the correlation with thermal effects.

Subclause 2.3.1 (detailed requirements for automatic disconnection of the supply on the occurrence of a fault) deserves a closer examination. It will deal with the type of supply system and earthing methods, also with suitable devices for adequate protection, as shown in Subclause 7.2 below.

**7.2 Automatic Disconnection of the Supply on the Occurrence of a Fault.** Closely allied to earth leakage is the question of earthing. Let us suppose that all the exposed conductive parts of an electrical installation are bonded together and to earth: an overload or short-circuit between phase and neutral will be dealt with by the overcurrent device, e.g., circuit-breaker. Now consider these alternatives:

(a) If the transformer neutral is earthed, and there exists an earth continuity conductor between the transformer neutral and the installation earth, we have a good earth loop return path for leakage currents to earth, which means that an earth leakage device can be used (optionally) to detect them. Large leakages to earth can also be interrupted by the overcurrent devices. This system is the one commonly encountered in South Africa.

(b) If the supply transformer is earthed but there is no direct connection between the transformer and installation earth electrodes, except through the

dingsregulasies as 'n algemene vereiste vir installasies nie.

As ons aanneem dat hierdie beskermingsmatreël in beginsel aanvaar word, soos dit inderdaad nou in Suid-Afrika die geval is, moet dit ingesluit word by Deel 3: Algemene vereistes vir installasies.

Ons het reeds gesien dat dit gedoen is in Tabel 2, subklousules 1.2.3, 2.3.1 en 3.1, wat ons nou van naderby kan beskou.

Subklousule 1.2.3 (bykomstige beskerming deur 'n aardlektoestel) is breedvoerig bespreek en het geen verdere verduideliking nodig nie.

Subklousule 3.1 (gedetailleerde vereistes vir beskerming teen termiese uitwerking soos bv. brande en brandwonde) sal hoofsaaklik te doen hê met regulasies wat handel oor die soorte materiaal wat vir omheinings of vir die stut van elektriese apparaat gebruik word, gesien in verhouding tot die temperatuur wat waarskynlik gedurende normale of abnormale werking bereik sal word, met die oog daarop om brande of brandwonde te verhoed. Afgesien van hierdie reëls sal daar genoem word dat aardlekbeskerming as 'n bykomstige beskermingsmatreël teen hierdie gevare gebruik kan word. Ontkoppelingstoestelle vir oorvrug en foutstrome ten opsigte van alle installasies word natuurlik in subklousule 4.1 van Tabel 2 behandel, wat ook die korrelasie met die termiese uitwerking aantoon.

Subklousule 2.3.1 (gedetailleerde vereistes vir outomatiese afskakeling van die toevoer wanneer 'n fout ontstaan) verdien nader aandag. Dit sal handel oor die tipe toevoerstelsel en aardingsmetodes, sowel as oor geskikte toestelle vir voldoende beskerming, soos in subklousule 7.2 hieronder aangetoon.

**7.2 Outomatiese afskakeling van die toevoer wanneer 'n fout ontstaan.** Die kwessie van aarding staan in noue verband met aardlekbeskerming. Laat ons aanvaar dat al die ontblote geleidende dele van 'n elektriese installasie behoortlik aan mekaar en aan die aarde verbind is; enige oorbelading of kortsluiting tussen fase en neutraal sal deur die oorstroomtoestel, d.w.s. die stroombreker, gehanteer word. Kyk egter na die volgende alternatiewe:

(a) As die neutrale geleier van die transformator geaard is en daar bestaan 'n aardkontinuiteitsgeleier tussen die neutrale pool van die transformator en die aardedraad van die installasie, het ons 'n goeie lusbaan vir lekstrome om terug te vloei aarde toe, wat beteken dat 'n aardlektoestel (opsioneel) gebruik kan word om hulle op te spoor. Groot aardlekke kan ook deur die oorstroomtoestelle onderbreek word. Hierdie is die stelsel wat algemeen in Suid-Afrika aangetref word.

(b) As die toevoertransformator geaard is dog daar is geen direkte verbinding tussen die transformator en die aardelektrodes van die installasie nie, behalwe

ground, then the earth loop return path is likely to be of considerably higher resistance, and an over-current device will not be so positive in operation on a large leakage to earth. In order to limit the shock voltage which could appear on the conductive parts of the installation, it might be necessary to use an earth leakage device, depending on the values of earth loop resistance.

(c) If the secondary of the supply transformer is entirely free from an earth connection or electrode there is no earth loop return path and an earth leakage device could not detect one fault on an otherwise healthy circuit. In this case it might be preferable to prohibit the use of earth leakage devices but to detect leakages to earth by means of insulation monitoring devices. Large earth leakages can be interrupted by the usual overcurrent device but only on the occurrence of two faults. This system is commonly used in hospital operating theatres.

From the three instances quoted it can be seen that earth leakage can technically be optional, compulsory or prohibited, depending on the supply system and earthing conditions. However, if compulsory earth leakage is required in the optional case (a), a separate supplementary requirement would be introduced, e.g., in Part 4 Section 1 for domestic installations.

**7.3 Special Applications.** In difficult locations earth leakage can be a very useful additional means of protection against shock and some fire hazards, e.g., at caravan parks, building sites and fun-fairs. Where it is considered necessary to make this protection compulsory the appropriate regulations can be introduced in the relevant Part of Section 1: Protection rules, e.g., Part 12 for caravan sites.

A number of these special applications are covered by other regulations, e.g., portable electric hand tools are mentioned in Clause C.59 of the Factories, Machinery and Building Work Act, 1941. There must obviously be close co-ordination in such cases with the wiring regulations which, if they are to be comprehensive, should also cover the instances commonly encountered in practice.

## 8. CONCLUSIONS

**8.1** I hope that this brief survey of the proposed approach to wiring regulations has been of interest. Working from fundamental principles will result in logical requirements for installations which are less liable to misinterpretation and which can be used to assess the safety of innovations in methods and equipment.

**8.2** By following IEC recommendations, although not necessarily in every detail, we will eventually benefit

deur die grond, dan het die terugvloei-lusbaan waarskynlik 'n aansienlik hoër weerstand en sal 'n oorstroomtoestel nie so positief in sy inwerking op 'n groot aardlek wees nie. Ten einde die skokspanning wat op die geleënde gedeeltes van die installasie mag voorkom, te beperk, mag dit nodig wees om 'n aardlektoestel te gebruik, afhange van die waarde van die weerstand van die aard-lusbaan.

(c) As die sekondêre pool van die toevoertransformator heeltemal sonder 'n verbinding na die aarde of na 'n elektrode is, is daar geen terugvloei-baan nie en sal 'n aardlektoestel nie 'n allenstaande fout in 'n origens gesonde stroombaan kan opspoor nie. In hierdie geval mag dit verkieslik wees om die gebruik van aardlektoestelle te verbied, dog om lekkasie na die aarde by wyse van isolasie-montortoestelle op te spoor. Groot aardlekke kan deur die gewone oorstroomtoestelle onderbreek word, dog dan slegs wanneer daar twee foute voorkom. Hierdie stelsel word algemeen in die operasiesale van hospitale gebruik.

Van die drie gevalle wat hierbo genoem is, kan afgelei word dat aardlekbeskerming tegnies opsioneel, verplig of verbode kan wees, afhange van die toevoerstelsel en aardingstoestand. Indien verpligte aardlekbeskerming eger in die opsionele geval (a) verlang word, sal 'n aparte aanvullende vereiste vir huishoudelike installasies ingestel moet word, bv. in Deel 4, Afdeling 1.

**7.3 Spesiale aanwendinge.** Waar die ligging moeilik is, kan aardlektoestelle 'n baie nuttige bykomstige beskermingsmaatregel teen skok en sommige brandgevaare uitmaak, bv. by woonwaparke, boupersone en vermaaklikheidsparke. Waar dit as nodig beskou word om hierdie beskerming verpligtend te maak, kan 'n geskikte regulasie ingevoer word in die betrokke Deel van Afdeling 1: Beskermingsreëls, bv. Deel 12 vir woonwaparke.

'n Aantal van hierdie spesiale aanwendinge word deur ander regulasies gedek, bv. draagbare elektriese handgereedskap word in Klousule C.59 van die Wet op Fabriek, Masjinerie en Bouwerk, 1941 genoem. Daar moet klaarblyklik in sulke gevalle noue ko-ördinasie wees met die bedradingregulasies, wat, ten einde omvattend te wees, ook die gevalle wat normaalweg in die praktyk teëgekóm word, moet dek.

## 8. GEVOLGTREKKINGS

**8.1** Ek vertrou dat hierdie kort oorsig van die voorgestelde benadering tot bedradingregulasies interessant was. As daar van die fundamentele beginsels uitgegaan word, sal dit lei tot logiese vereistes vir installasies wat minder vatbaar vir wanvertolking sal wees en wat gebruik kan word om die veiligheid van nuwigheide in metodes en toerusting te beoordeel.

**8.2** Deur die aanbevelings van die IEC te volg, alhoewel nie in die fynste besonderhede nie, sal ons uit-

through facilitating international exchanges and promoting compatibility between wiring regulations and the installed equipment. In order that you may appreciate the extent of the work of TC64 and the co-operation which exists with other IEC committees I have reproduced the draft agenda for the meeting of TC64 in September, this year, in Appendix A. Item 4 of the agenda is in respect of the installation of the equipment concerned: the individual technical committees prepare recommendations for the equipment itself.

**8.3.** Regarding sensitive earth leakage protection I feel that, if it is to be compulsory, the simplest approach should be chosen, i.e., protecting socket-outlets only in the first instance, on new domestic installations. By doing this we avoid most of the problems involved in taking such a step and at the same time we provide the additional protection where it is most needed—on portable apparatus where earth continuity conductors are more prone to damage.

**8.4.** Statistical evidence will determine in which areas further coverage by earth leakage protection in domestic premises is required, if any. This information is being supplied to the Bureau by the Department of Labour.

**8.5** In order to assess the long term reliability of earth leakage devices, we should start tests on selected installations and repeat these periodically. Your assistance in this respect would be of immense value.

## 9. ACKNOWLEDGEMENTS

I should like to acknowledge my indebtedness to the authors and organisations listed in the references: to the Department of Labour for statistics on electrical accidents; to the Director General of the South African Bureau of Standards for permission to deliver this paper and finally to the President and Executive of the AMEU for doing me the honour of allowing me to address this convention.

## 10. REFERENCES

1. Earth Leakage by A. A. Middlecote, 31st Convention of the AMEU at Margate, 1957.
2. Earth Leakage Protection in Relation to Human Safety by R. K. Jooste, CSIR Symposium on Earthing, March, 1970.
3. Standard Regulations for the Wiring of Premises: The South African Institute of Electrical Engineers.
4. Regulations for the Electrical Equipment of Buildings: The Institution of Electrical Engineers, London.
5. SAA Wiring Rules: Standards Association of Australia.
6. Canadian Electrical Code: Canadian Standards Assn.
7. Factories, Machinery and Building Work Act, 1941.

eindelik voordeel trek deur die vergemakliking van internasionale onderhandelinge en die bevordering van die aanpasbaarheid tussen bedradingsregulasies en die geïnstalleerde toerusting. Ten einde u in staat te stel om 'n idee te kry van die omvang van die werk van TK 64 en die samewerking wat daar met ander IEK-komitees bestaan, het ek, in Bylae A, 'n weergawe gegee van die sakelyst vir die vergadering van TK 64 wat in September vanjaar gehou sal word. Item 4 van die sakelyst handel oor die installasie van die betrokke toerusting. Die individuele tegniese komitees berei aanbevelings vir die toerusting self voor.

**8.3** In verband met sensitiewe aardlekbeskerming is ek van mening dat, indien dit verpligtend gemaak sou word, die eenvoudigste benadering gekies behoort te word, d.w.s. slegs sok-uitlaters in nuwe huishoudelike installasies behoort in die eerste plek beskerm te word. Deur dit te doen sal ons die meeste van die probleme wat aan so 'n stap verbonde is, uitskakel, en terselfdertyd voorsien ons die bykomende beskermings waar dit nie nodigste is—by draagbare apparaat waar die aardkontinuiteitsgeleiers die maklikste beskadig kan word.

**8.4** Statistiese getuigenis sal bepaal in welke gebiede verdere dekking deur aardlekbeskerming in huishoudelike persele nodig is, indien dit wél is. Hierdie inligting word deur die Departement Arbeid aan die Buro verskaf.

**8.5** Ten einde die betroubaarheid van aardlekbeskermingstoestelle oor 'n lang tydperk te beoordeel, moet ons begin met toeste op uitgesoekte installasies en hierdie toetse periodiek herhaal. U hulp in hierdie verband sal van onskatbare waarde wees.

## 9. BEDANKINGS

Ek sou graag my dank wou betuig aan die ouers en organisasies wat in die verwysingslys genoem word: aan die Departement Arbeid vir die statistiek insake ongelukke waarby elektrisiteit betrokke is; aan die Direkteur-Generaal van die Suid-Afrikaanse Buro van Standaarde vir die vergunning om hierdie referaat te kan lewer en, ten slotte, aan die President en die Uitvoerende Raad van die V.M.E.O. vir die eer wat hulle my aangedoen het deur my toe te laat om hierdie konvensie toe te spreek.

## 10. VERWYSINGS

1. "Earth Leakage" deur A. A. Middlecote, 31ste Konvensie van die V.M.E.O. te Margate, 1957.
2. Aardlekbeskerming met betrekking tot die beskerming van die Mens, deur R. K. Jooste, W.N.N.R.-simposium insake Aarding, Maart 1970.
3. Standaardregulasies vir die Bedrading van Persele: Die S.A. Instituut van Elektrotegniese Ingenieurs.
4. Regulasies vir die Elektriese Toerusting van Geboue: Die Instituut van Elektrotegniese Ingenieurs, Londen.
5. S.A.A.-bedradingsreëls: Standaardvereniging van Australië.
6. Kanadese Elektrotegniese Kode: Standaardvereniging van Kanada.
7. Wet op Fabriek, Masjinerie en Bouwerk, 1941.

Table 1—WIRING REGULATIONS PARTS AND SECTIONS

1	2	3	4	5	6	7	8
PART :		SECTION :					
		1	2	3	4	5	6
No.	Title	Pro ection rules	Design rules	Rules for selection of electrical equipment	Rules for erection and initial testing	Rules for maintenance and repair	Rules for periodic inspection
1	Scope and definitions						
2	Fundamental principles	2—1	2—2	2—3	2—4	2—5	2—6
3	General requirements for installations	3—1	3—2	3—3	3—4	3—5	3—6
4	Supplementary requirements for residential and commercial premises	4—1	4—2	4—3	4—4	4—5	4—6
5	Supplementary requirements for public premises						
6	Supplementary requirements for industrial premises						
7	Supplementary requirements for passenger and goods lifts, hoisting equipment						
8	Supplementary requirements for installations in explosive atmospheres						
9	Supplementary requirements for building sites						
10	Supplementary requirements for prefabricated houses						
11	Supplementary requirements for agricultural premises						
12	Supplementary requirements for temporary installations+) other than building sites						
13	Supplementary requirements for rooms in which electro-medical equipment is used	13—1	13—2	13—3	13—4	13—5	13—6

+) E.g. caravans and caravan sites

Tafel 1—BEDRADINGSREGULASIES DELE EN AFDELINGS

1	2	3	4	5	6	7	8
DEEL :		AFDELING :					
		1	2	3	4	5	6
Nr.	Titel	Beskermings-reëls	Ontwerp-reëls	Reëls vir keuring van elektriese toerusting	Reëls vir oprigting en aanvanklike toetsing	Reëls vir instandhouding en herstelwerk	Reëls vir periodieke inspeksie
1	Ontvang en woordomskrywings						
2	Fundamentele beginsels	2—1	2—2	2—3	2—4	2—5	2—6
3	Algemene vereistes vir ins allasies	3—1	3—2	3—3	3—4	3—5	3—6
4	Aanvullende vereistes vir woon- en handelspersele	4—1	4—2	4—3	4—4	4—5	4—6
5	Aanvullende vereistes vir openbare persele						
6	Aanvullende vereistes vir nywerheidspersele						
7	Aanvullende vereistes vir passasiers- en goedere-hysbakke en hystoerusting						
8	Aanvullende vereistes vir installasies in ontplofbare atmosfeer						
9	Aanvullende vereistes vir bouppersele						
10	Aanvullende vereistes vir voorafvervaardigde huise						
11	Aanvullende vereistes vir landbouppersele						
12	Aanvullende vereistes vir tydelike installasies* behalwe bouppersele						
13	Aanvullende vereistes vir kamers waarin elektromediese toerusting gebruik word	13—1	13—2	13—3	13—4	13—5	13—6

\* Bv. Karavane en Karavaanpersele



Tafel 2—BESKERMINGSREËLS: Dele 2 en 3, Afdeling 1

1	2	3
Fundamentele Beginsels: Deel 2, Afdeling 1		Algemene Vereistes vir Installasies: Deel 3, Afdeling 1
1. Beskerming teen DIREKTE kontak (met stroomdraende dele)	<p>1.1 Voorkom dat enige stroom deur die liggaam van enige persoon of dier gaan</p> <p>1.2 Beperk die maksimumstroom wat deur 'n liggaam kan gaan</p>	<p>1.1.1 Voorsien bele sels, bv. deksels, omheining, deure, kanale, geleibuisie ens.</p> <p>1.1.2 Iscleer stroomdraende dele (verwyderbaar slegs)</p> <p>1.1.3 Voorsien plaaslike isolasie (van mure, vloere en ander geleidende dele)</p> <p>1.1.4 Beperkte beskerming a) deur ruimtes na en tussen stroomdraende geleiers en b) deur versperrings, bv. handrelings</p> <p>1.2.1 Gebruik veilige ekstra lae spanning</p> <p>1.2.2 Beperk die ontladingsenergie van die stroombaan</p> <p>1.2.3 Bykomstige beskerming—deur 'n aardlektotoestel</p>
2. Beskerming teen INDIREKTE kontak (met nie-stroomdraende dele)	<p>2.1 Voorkom dat enige foutstroom deur die liggaam van enige persoon of dier gaan</p> <p>2.2 Beperk die maksimumfoutstroom wat deur 'n liggaam kan gaan</p> <p>2.3 Outomatiese ont koppeling van die toevoer wanneer 'n fout ontstaan</p>	<p>2.1.1 Plaaslike rangskikking van ontblote geleidende dele (bv. deur spasiering of deur geïsoleerde inlasstukke, of deur deurverbinding van hierdie dele)</p> <p>2.1.2 Die gebruik van intrinsiek veilige (Klas II) toerusting</p> <p>2.1.3 Isolasie van geleidende dele (bykomstig tot die funksionele isolasie)</p> <p>2.1.4 Veilige skeiding van stroombane, bv. deur middel van 'n isolerende transformator</p> <p>2.2.1 Gebruik veilige ekstra lae spanning</p> <p>2.2.2 Beperk die ontladingsenergie van die stroombaan</p> <p>2.3.1 Gedetailleerde vereistes vir 2.3</p>
3. Beskerming teen termiese uitwerking in normale diens		<p>3.1 Gedetailleerde vereistes vir kables, aansluitings, toerusting ens. vir beskerming teen brande en brandwonde</p>
4. Beskerming teen oorstrom		<p>4.1 Gedetailleerde vereistes vir oorbelading, kortsluitings en die beperking van oorstrom.</p>
5. Beskerming teen oorspanning		<p>5.1 Besonderhede van beskerming teen oorspanning (bv. weerligstuwings) en foute tussen stroomdraende gedeeltes van stroombane wat teen verskillende spannings voorsien word.</p>

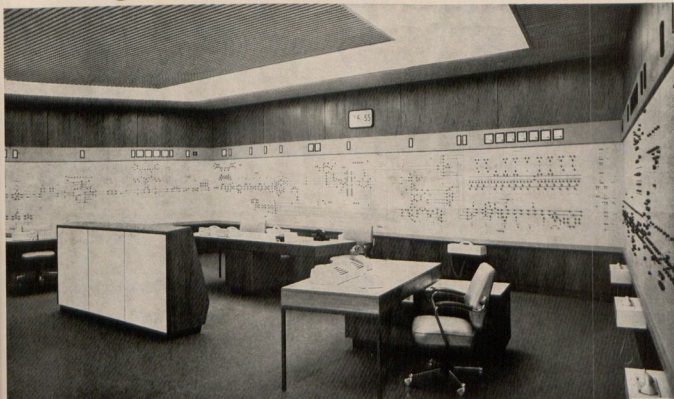




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Tafel 3—FUNDAMENTELE BEGINSELS : Deel 2, Afdeling 2 tot 6

1	2	3
AFDELING		ONDERHOOFDE VAN AFDELINGS
No.	Titel	
2	Ontwerpreeëls	2.1 Eienskappe van die toevoer 2.2 Aard van die aanvraag 2.3 Noodtcevoer 2.4 Omgewingstoestande 2.5 Deursnee van geleiers 2.6 Tipe bedradingsstelsel 2.7 Beskerrende toerusting 2.8 Noodbeheer 2.9 On koppelingstoestelle 2.10 Voorkoming van nadelige uitwerking op ander stelsels 2.11 Toeganklikheid van elektriese toerusting
3	Reëls vir die keuring van elektriese toerusting	3.1 Voldoening aan die Standaard 3.2 Geskikte eienskappe of aanslae 3.3 Installasietoestande (spanning en omgewing) 3.4 Voorkoming van nadelinge uitwerking op ander stelsels
4	Reëls vir oprigting en aanvanklike toetsing	4.1 Goeie vakmanskap: gebruik van regte materiaal en gereedskap 4.2 Aardkontinuiteits- en neutrale geleiers moet geïdentifiseer word 4.3 Aansluitings moet veilig en betroubaar wees 4.4 Oprigting moet nie die eienskappe van die toerusting of die ontwerpe verkoelingstoestande belemmer nie 4.5 Rangskik toerusting om brande of brandwonde te voorkom 4.6 Laat toe vir toegang vir nodige aandag tydens gebruik 4.7 Toets voor eerste ingebruikneming en na enige belangrike verandering
5	Reëls vir instandhouding en reparasie	5.1 Let op veiligheidsprosedures 5.2 Isoleer toevoer 5.3 Laat in veilige toestand
6	Reëls vir periodieke inspeksie	6.1 Gespesifiseerde tydperke in verhouding tot 6.2 en 6.3 6.2 Tipe installasie 6.3 Toestande van installasie of omgewing

INTERNATIONAL ELECTROTECHNICAL  
COMMISSIONTechnical Committee No. 64: Electrical Installations  
of Buildings

Draft Agenda for the meeting to be held in London  
from September 13 to 17, 1971

1. Opening of the meeting.
2. Confirmation of the minutes of the meeting held in Baden-Baden in July, 1970—RM 1314/TC64.
3. Report on the meeting of the Advisory Committee on Safety (ACOS) held in Brussels in June, 1971.
4. Co-ordination of the work undertaken in TC 64 with the activities of other Technical Committees.
  - 4.1 TC 16: Terminal markings and identifications. (Among others Document 16 (Secretariat) 231).
  - 4.2 TC 17, Subcommittee 17D: Protective measures for factory-built assemblies of switch gear and control gear.
  - 4.3 TC 20: Cables (in connection with the work of Working Group 2 of TC 64, see item 12).
  - 4.4 TC 23, Subcommittee 23C: World-wide plug and socket outlet system (see also item 6).
  - 4.5 TC 27: Electro-heating (safety in installations).
  - 4.6 TC 28: Insulation co-ordination (including replies to Questionnaire 64(Secretariat)32).
  - 4.7 TC 31: Electrical apparatus for explosive atmospheres (safety in installations).
  - 4.8 TC 62: Electrical equipment in medical practice (safety in installations).
  - 4.9 TC 70: Protective enclosures (in connection with the work to be undertaken eventually by Working Group 3 of TC 64).
  - 4.10 TC 71: Open-cast mines (safety in installations).
  - 4.11 Others.
5. Activity of TC 64 in connection with requests expressed by other organisations.
  - 5.1 UNO/Economic Commission for Europe.
  - 5.2 ISO, in particular safety of electric lifts.
  - 5.3 FICC, caravans.
  - 5.4 Other organisations.

INTERNASIONALE ELEKTROTEGNIESE  
KOMMISSIETegniese Komitee No. 64: Elektriese Installasie in  
Geboue

Konsep-agenda vir die vergadering wat vanaf 13 tot  
17 September 1971 in Londen gehou sal word

1. Opening van die vergadering.
2. Bekragtiging van die notule van die vergadering wat in Julie 1970 te Baden-Baden gehou is —RM 1314/TC64.
3. Verslag oor die vergadering van die Adviserende Komitee insake Veiligheid (ACOS) gehou in Brussels gedurende Junie 1971.
4. Ko-ordinasie van die werk wat in TK64 onderneem word met die bedrywighede van ander Tegniese Komitees.
  - 4.1 TK 16: Merk op eindpunte en identifikasie (onder andere Dokument 16(Sekretariaat) 231).
  - 4.2 TK 17: Subkomitee 17D: Beskermende maatreëls vir fabriekvervaardigde montasies van skakel- en beheertuig.
  - 4.3 TK 20: Kabels (in verband met die werk van Werkgroep 2 van TK 64, sien item 12).
  - 4.4 TK 23: Subkomitee 23C: Wêreldwye stelsel vir proppe en sok-uitlate (sien ook item 6).
  - 4.5 TK 27: Elektriese verwarming (veiligheid in installasies).
  - 4.6 TK 28: Ko-ordinasie van isolasie (insluitende antwoorde op Vraagbrief 64 (Sekretariaat) 32).
  - 4.7 TK 31: Elektriese apparaat vir ontplofbare atmosfeer (veiligheid in installasies).
  - 4.8 TK 62: Elektriese toerusting in die mediese praktyk (veiligheid in installasies).
  - 4.9 TK 70: Beskermende omheinings (in verband met die werk wat uiteindelik deur werkgroep 3 van TK 64 onderneem sal word).
  - 4.10 TK 71: Oop myne (veiligheid van installasies).
  - 4.11 Ander.
5. Bedrywighede van TK 64 in verband met versoeke van ander organisasies.
  - 5.1 V.V.O. se Ekonomiese Kommissie vir Europa.
  - 5.2 O.I.V., in die besonder die veiligheid van elektriese hysbakke.
  - 5.3 F.I.C.C., karavane.
  - 5.4 Ander organisasies.

6. Plug and socket outlets, Questionnaire 64(Secretariat)26, result 64(Secretariat)39.
7. Neutral and protective conductor, Questionnaire 64(Secretariat)28, result 64(Secretariat)41.
8. Definitions, Document 64(Secretariat)34\* including the results of work in WG 1.
9. Discussion of Part 3, Chapter one, Section 1, Document 64(Secretariat)35.\*
10. Discussion of Part 3, Chapter One, Section 2, Document 64(Secretariat)36.\*
11. Discussion of Part 3, Chapter One, Section 3, Document 64(Secretariat)37\* including Questionnaire 64(Secretariat)27, results 64(Secretariat)33.
12. Report on the state of work in WG 2 (Current-carrying capacity of conductors) taking into account the Questionnaire 64(Secretariat)31.
13. Discussion of Part 3, Chapter one, Section 4, 5, 6, and 7, Documents 64(Secretariat)38\* and 40.\*
14. Report on the state of work in WG 4 (Effects of current passing through a body) including Documents 64(Secretariat)29.
15. Report on the state of work in WG 5(Voltage bands) including Document 64(Secretariat)30.
16. Programme of future work.
17. Any other business.
18. Close of the meeting.
6. Proppe en sok-uitlate, Vraagbrief 64(Sekretariaat)26, resultate 64(Sekretariaat)39.
7. Neutrale en beskermende geleier, Vraagbrief 64(Sekretariaat)28, resultate 64(Sekretariaat)41.
8. Definisies, Dokument 64(Sekretariaat)34,\* insluitende die resultate van die werk van Werks-groep 1.
9. Bespreking van Deel 3, Hoofstuk een, Afdeling 1, Dokument 64(Sekretariaat)35.\*
10. Bespreking van Deel 3, Hoofstuk een, Afdeling 2, Dokument 64(Sekretariaat)36.\*
11. Bespreking van Deel 3, Hoofstuk een Afdeling 3, Dokument 64(Sekretariaat)37\* insluitende Vraagbrief 64(Sekretariaat)27, resultate 64(Sekretariaat)33.
12. Verslag oor die stand van die werk in Werks-groep 2 (stroomdraende vermoë van geleiers) met inagneming van Vraagbrief 64(Sekretariaat)31.
13. Bespreking van Deel 3, Hoofstuk een, Afdelings 4, 5, 6 en 7, Dokumente 64(Sekretariaat)38\* en 40.\*
14. Verslag oor die stand van die werk in Werks-groep 4 (uitwerking van stroom wat deur 'n liggaam gaan) met inbegrip van Dokument 64 (Sekretariaat) 29.
15. Verslag oor die stand van die werk in Werks-groep 5 (Spanningsbande) met inbegrip van Dokument 64(Sekretariaat)30.
16. Program van toekomstige werk.
17. Enige ander sake.
18. Afsluiting van die vergadering.

\* Explanations on some of the Clauses of these documents as well as parts of a later Application Guide are contained in Documents 64(Secretariat)34A up to 64(Secretariat)38A and 64(Secretariat)40A which will be circulated later.

\* Verduidelikings van sommige klousules van hierdie dokumente sowel as gedeeltes van 'n latere Gebruiksgids word vervat in Dokumente 64(Sekretariaat)34A tot en met 64(Sekretariaat)38A en 64(Sekretariaat)40A wat later omgestuur sal word.

**ANNUAL REPORT FOR 1970**

**ELECTRICAL WIREMEN'S REGISTRATION BOARD**

The Board was constituted as follows for 1970 :

Chairman : Mr J. G. Wannenburg;  
 Members : Messrs J. M. Fraser, F. Meemans,  
 A. H. M. Drysdale, J. K. von Ahlften.

In an advisory capacity, Mr Hare of the Central Organisation for Trade Testing, Olifantsfontein, attended the meetings of the Board.

Before submitting the report for 1970, I wish to place the Association's appreciation on record for the valuable work done over the past years up to then end of 1969 by Mr C. Lombard as the A.M.E.U.'s representative on the Board.

During 1970 the Electrical Wiremen's Registration Board held 12 meetings and considered 1 153 new application for registration. Of these, 1 147 persons were either accepted for the examinations or exempted from them in part or in full. The applications of 6 persons were refused. The Board also granted provisional registration certificates or approved renewal of such certificates in respect of 1 586 applicants.

**Examinations**

Four written examinations were held at 43 examination centres and 1 618 candidates were entered. The results were as follows :

Failed Part 1 (on the Wiring Regulations) .....	405
Passed Part 1 .....	240
Failed Part 2 (Electrical Theory—NTC II level) .....	472
Passed Part 2 .....	132
Absent from the examinations .....	369
	<hr/>
	1618
	<hr/>

A number of candidates who, for various reasons, were unable to undergo or pass the written examinations, were allowed to undergo oral tests.

During the year under review 147 practical examinations were held in the ten principal centres. Test arrangements were made in respect of 1 567 candidates of which 274 passed while 267 were absent. Of the 1 026 who failed quite a number of them passed in some of the tasks and they were granted exemption from these in subsequent tests. The pass marks for each task is 60%.

The abovementioned totals of 1 618 and 1 567 include candidates who failed in previous years.

**JAARVERSLAG VIR 1970**

**REGISTRASIERAAD OP ELEKTROTEGNIESE DRAADWERKERS**

Die Raad was vir 1970 soos volg saamgestel :

Voorsitter : Mnr. J. G. Wannenberg;  
 Lede : Mnr. J. M. Fraser, F. Meemans, A. H. M. Drysdale, J. K. von Ahlften.

Mnr. Hare van die Sentrale Organisasie vir Beoepstoets, Olifantsfontein, het die vergaderings van die Raad in 'n raadgewende hoedanigheid bygewoon.

Voordat ek die verslag vir 1970 indien, wil ek graag die Vereniging se waardering boekstaaf vir die waardevolle werk wat oor die jare, tot aan die einde van 1969, deur Mnr. C. Lombard as die Vereniging se verteenwoordiger in die Raad gedoen is.

Die Registrasieraad op Elektrotegniese Draadwerkers het gedurende 1970 12 vergaderings gehou en oorweging verleen aan 1.153 nuwe aansoeke om registrasie. Hiervan is 1 147 persone óf tot die eksamens toegelaat óf geheel of gedeeltelik daarvan vrygestel. Die aansoeke van 6 persone is geweier. Die Raad het ook voorlopige registrasiesertifikate of die hernuwing van sulke sertifikate ten opsigte van 1 586 applikante toegeken of goedgekeur.

**Eksamens**

Vier skriftelike eksamens is by 43 eksamensentra gehou en 1 618 kandidate het daarvoor ingeskryf. Die uitslae was soos volg :

Gedeelte 1 gedruip (Bedradingsregulasies) .....	405
Gedeelte 1 geslaag .....	240
Gedeelte 2 gedruip (Elektrotegniese teorie—NTS II standaard) .....	472
Gedeelte 2 geslaag .....	132
Afswig van die eksamen .....	369
	<hr/>
	1618
	<hr/>

'n Aantal kandidate wat om verskillende redes nie die skriftelike eksamens kon aflê of slaag nie, is toegelaat om mondelike toetse te ondergaan.

Gedurende die verslagjaar is 147 praktiese eksamens in die tien vernaamste sentra gehou. Toetsreëlings is ten opsigte van 1 567 kandidate getref, van wie 274 geslaag het en 267 nie opgedaag het nie. Van die 1 026 wat gedruip het, het 'n hele aantal in sommige van die take wat aan hulle gestel is, geslaag en hulle is in die daaropvolgende toetse van hierdie take vrygestel. Die slaagpunte vir elke taak is 60%.

Die bogenoemde totale van 1 657 en 1 567 sluit kandidate wat in die vorige jare gedruip het, in.

## Registration Certificates

Particulars of registration certificates issued since the Act came into operation are reflected hereunder:

Year	To applicants exempted from the examinations	To applicants who passed the examinations during 1970 or in previous years	Totals
1940-65	2 553	6 668	9 221
1966	64	269	333
1967	34	218	252
1968	50	169	219
1969	74	293	367
1970	89	371	460
Totals	2 864	7 988	10 852

Because the Board is aware that a large percentage of practising wiremen are not licenced, and in an effort to get these persons to undergo the examinations, it was decided that, as a special concession for 1970, provisional registration would be granted to them if they submit satisfactory proof of:

- (i) A completed contract of apprenticeship and at least five years' acceptable subsequent experience, or
- (ii) At least ten years' acceptable experience in the case of persons who had not served an apprenticeship.

The concession was also extended to persons who received training in the trades of Electrician, Millwright (Electro-mechanical) and Lift Mechanic. Persons with five years' experience who possess certain of various additional qualifications which would exempt them any part of the Board's examinations, also qualify for provisional registration.

The certificates are granted on condition that the holders thereof regularly enter for and attempt the examinations, and that they are not to be absent from examinations for which they have entered.

Previously provisional registration certificates were only granted to those persons who had passed part of the Board's examinations.

When, during the latter half of the year, it appeared that not as many applications as would have been expected had been received, all the organisations concerned were reminded of the concession and advised that after the 31st January, 1971, efforts would be made to ensure that no electrical wiring is done by persons other than those mentioned in section 20 of the Act.

## Registrasiesertifikate

Besonderhede van registrasiesertifikate wat sedert die inwerkingtreding van die Wet uitgereik is, word hieronder weergegee:

Jaar	Aan applikante wat van die eksamens vrygestel is	Aan applikante wat gedurende 1970 of in vorige jare in die eksamens geslaag het	Totale
1940-65	2 553	6 668	9 221
1966	64	269	333
1967	34	218	252
1968	50	169	219
1969	74	293	367
1970	89	371	460
Totale	2 864	7 988	10 852

Omdat die Raad daarvan bewus is dat 'n groot persentasie van die praktiserende draadwerkers nie gelisen sieer is nie, en in 'n poging om die persone aan te moedig om die eksamens af te lê, is daar besluit om, by wyse van 'n spesiale toegewing vir 1970, voorlopige registrasie aan hulle toe te ken, mits hulle bevredigende bewys kan lewer van:

- (i) 'n voltooide vakleeringskontrak en ten minste 5 jaar aanvaarbare ondervinding daarna; of
- (ii) ten minste tien jaar aanvaarbare ondervinding in die geval van persone wat nie 'n vlakleeringskap uitgedien het nie.

Hierdie toegewing is ook gemaak aan persone wat opleiding in die ambagte van elektrisïen, masjienmonteur (elektro-meganies) en hysbakwerktuigkundige ontvang het. Persone met vyf jaar ondervinding en wat in besit is van sekere van verskeie ander kwalifikasies wat hulle op vrystelling van enige gedeelte van die Raad se eksamens geregtig maak, kwalifiseer ook vir voorlopige registrasie.

Die sertifikate word toegeken op voorwaarde dat die houders daarvan gereeld vir die eksamens moet inskryf en dit moet aflê en dat hulle nie van eksamens waarvoor hulle ingeskryf het, moet wegby nie.

Vroeër is voorlopige registrasiesertifikate slegs aan persone wat in sekere gedeeltes van die Raad se eksamens geslaag het, toegeken.

Toe dit gedurende die tweede helfte van die jaar duidelik geword het dat daar nie soveel aansoeke ontvang is as wat redelikerwys verwag kon word nie, is al die betrokke organisasies se aandag op die toewings gevestig en is hulle meegedeel dat daar ná 31 Januarie 1971 pogings aangewend sou word om te verseker dat geen bedragingswerk deur ander persone as dié wat in Artikel 20 van die Wet genoem word, uitgevoer word nie.



As reported to the last meeting of the Executive, the concession to grant provisional registration to the persons mentioned in items (i) and (ii) above (on their experience only), was later extended to the 31st December, 1971, and it was also decided to exempt such persons from the written examinations. Unlicensed wiremen have, however, not been given grace to carry on with the work until that date, and the Department's own Inspectors will also be assisting to enforce the Act.

To assist the Board in its efforts to register as many unlicensed practising wiremen as possible, the co-operation of all Municipal Electricity Supply Authorities is requested to ensure that no unlicensed wiremen do wiring work and attention is again drawn to the requirements of section 20 of the Act.

Proposed amendments to the Act are still under consideration and as these have not yet been finalised it is therefore premature to report anything at this stage.

An additional advisory committee was established in East London in addition to those in Cape Town, Durban and Bloemfontein, who have held regular meetings during the past year and given valuable assistance.

In conclusion I wish to thank the Board for the information provided in this report and for permission to submit it to the Convention.

J. VON AHLFTEN,  
Representative.

#### REPORT OF THE RECOMMENDATIONS COMMITTEE FOR NEW ELECTRICAL COMMODITIES

During the year 1970 three meetings were held and 39 new electrical commodities were considered. Twenty-three were recommended for use and member supply authorities were notified accordingly through the medium of news bulletins.

Representation on the Wiring Regulations Committee has fallen away with the transfer of the latter's functions to the South African Bureau of Standards. However, Mr. J. T. Williams and Mr. R. A. Leigh remain on the committee on behalf of the South African Institute of Electrical Engineers.

Sincere appreciation is expressed to the members of the committee for their invaluable efforts and to the South African Bureau of Standards for carrying out tests on various commodities.

R. W. BARTON,  
Convener

Soos aan die vorige vergadering van die Uitvoerende Raad gerapporteer, is die toegewing om voorlopige registrasie aan die persone in items (i) en (ii) hierbo genoem (op grond van hul ondervinding alleen) te verleen, is later tot 31 Desember 1971 verleng en daar is ook besluit om sodanige persone van die skriftelike eksamens vry te stel. Ongelisensieerde draadwerkers is egter nie toestemming verleen om tot laasgenoemde datum met hul werk voort te gaan nie, en die Departement se eie inspekteurs sal ook help om die Wet toe te pas.

Ten einde die Raad behulpsaam te wees in sy poginge om soveel ongelisensieerde draadwerkers as moontlik te registreer, word die samewerking van alle munisipale elektrisiteitsvoorsieningsowerhede gevra om te verseker dat geen ongelisensieerde draadwerkers bedradingswerk uitvoer nie, en die aandag word nog eens die vereistes van Artikel 20 van die Wet gestig.

Voorgestelde wysiginge van die Wet word tans nog oorweeg en, aangesien dit nog nie gefinaliseer is nie, sal dit voorbarig wees om in hierdie stadium iets daaromtrent te rapporteer.

'n Bykomstige advieskomitee is in Oos-Londen in die lewe geroep, bo en behalwe dié in Kaapstad, Durban en Bloemfontein. Gereëde vergaderings is gedurende die jaar gehou en waardevolle hulp is verleen.

Ten slotte wil ek graag die Raad bedank vir die inligting wat in hierdie verslag raak is, sowel as vir die nodige toestemming om dit aan die Konvensie voor te lê.

J. VON AHLFTEN,  
Verteenwoordiger.

#### VERSLAG VAN DIE KOMITEE VIR AANBEVELINGS INSAKE NUWE ELEKTRIESE WARE

Gedurende die jaar 1970 is daar drie vergaderings gehou en nege-en-dertig nuwe elektriese apparate is oorweeg. Drie-en-twintig is as geskik vir gebruik aanbeveel en lid-ondernemings is by wyse van nuusbull-etins dienooreenkomstiglik in kennis gestel.

Met die oorplasing van die werksaamhede van die Komitee insake Bedradingsregulasies na die S.A.B.S. het die verteenwoordiging van die Komitee vir Aanbevelings insake Nuwe Elektriese Ware op die Komitee insake Bedradingsregulasies weggeval. Mnr. J. T. Williams en R. A. Leigh bly egter in die Komitee aan namens die Suid-Afrikaanse Instituut van Elektrotegniese Ingenieurs.

Ek wil graag my opregte waardering boekstaaf vir die uiters waardevolle werk van die lede van die Komitee sowel as my dank aan die Suid-Afrikaanse Buro van Standaard vir die toetse wat hulle op verskillende kommoditeite uitgevoer het.

R. W. BARTON  
Sameroeper.

## REPORT ON THE WORLD ENERGY CONFERENCE

The annual meeting of the South African National Committee of the World Energy Conference took place at Escom Centre, Johannesburg, on the 18th February, 1971, under the chairmanship of Dr R. L. Straszacker.

The following bodies were represented: Electricity Supply Commission, Atomic Energy Board, Department of Labour, Department of Mines, Fuel Research Institute, C.S.I.R., South African Institute of Electrical Engineers, South African Institute of Mechanical Engineers, South African Railways, S.A.S.O.L., Chamber of Mines, South African National Committee on Large Dams, and the Association of Municipal Electricity Undertaking of Southern Africa.

Numerous matters were discussed, including the following:

### Survey of Energy Resources:

Arising out of the minutes of the previous meeting it was noted that the survey of energy resources, to be undertaken as a preliminary to the formulation of an energy policy for South Africa, had been delayed owing to the difficulty of finding a body suitably staffed and equipped for the work. However, it was agreed that the matter be actively pursued. It was noted that the Department of Mines was busy with a survey of coal resources.

### Questionnaire on Pollution:

A detailed questionnaire on pollution arising from energy production facilities was replied to by the Committee at the request of the World Energy Conference, which has set up an ad hoc committee to study the problem.

### Meeting of the International Executive Council—Rio de Janeiro

A meeting of the International Executive Council was held in Rio de Janeiro, Brazil, during May, 1970. The South African National Committee was represented by the Chairman, Dr Straszacker and the Honorary Secretary, Mr H. J. de Villiers.

Matters dealt with were mainly administrative, including preparations for the Ninth World Energy Conference to be held in Detroit, U.S.A., in 1974.

A session was also devoted to the energy resources, and their utilisation, of the host country, Brazil.

## VERSLAG OOR DIE WERELDKONFERENSIE INSAKE ENERGIE

Die jaarvergadering van die Suid-Afrikaanse Nasionale Komitee van die Wêreldkonferensie insake Energie is op 18 Februarie 1971 in die Evkomsentrum, Johannesburg, onder die voorsitterskap van dr. R. L. Straszacker gehou.

Die volgende liggame was verteenwoordig: Die Elektrisiteitsvoorsieningskommissie, die Raad op Atoomkrag, die Departement van Arbeid, die Departement van Mynwese, die Brandstofnavorsingsinstituut, die W.N.N.R., die Suid-Afrikaanse Instituut van Elektrotegniese Ingenieurs, die Suid-Afrikaanse Instituut van Meganiese Ingenieurs, die Suid-Afrikaanse Spoorweë, S.A.S.O.L., die Kamer van Mynwese, die Suid-Afrikaanse Nasionale Komitee insake Groot Damme, en die Vereniging van Munisipale Elektrisiteitsondernemings van Suidelike Afrika.

'n Groot aantal sake is bespreek, waaronder die volgende:

### Opname van Energie-hulpbronne:

Voortspruitende uit die notule van die vorige vergadering word daar kennis geneem van die feit dat die opname van energie-hulpbronne wat onderneem sou word as 'n voorafgaande matreël tot die formulering van 'n energiebeleid vir Suid-Afrika, vertaag is, aangesien daar nie 'n liggaam gevind kon word wat die nodige toerusting en personeel tot sy beskikking het om die werk te onderneem nie. Daar word egter ooreengekom dat die saak daadwerklik verder gevoer word. Daar word ook kennis geneem van die feit dat die Departement van Mynwese besig is met 'n opname van steenkool-hulpbronne.

### Vraagbrief insake Besoedeling:

'n Gedetailleerde vraagbrief insake besoedeling wat as gevolg van energie-opwekkende bedrywighede ontstaan, is deur die Komitee beantwoord op versoek van die Wêreldkonferensie insake Energie, deur wie 'n ad hoc-komitee benoem is om die probleem te bestudeer.

### Vergadering van die Internasionale Uitvoerende Raad—Rio de Janeiro:

'n Vergadering van die Internasionale Uitvoerende Raad is gedurende Mei 1970 in Rio de Janeiro, Brasilië, gehou. Die Suid-Afrikaanse Nasionale Komitee is deur die Voorsitter, dr. Straszacker, en die Ere-Sekretaris, mnr. H. J. de Villiers, verteenwoordig.

Die sake wat oorweeg is, was hoofsaaklik administratief van aard, insluitende die voorbereidings vir die Negende Wêreldkonferensie insake Energie wat in 1974 in Detroit, V.S.A., gehou sal word.

En sitting is ook gewy aan die energie-hulpbronne van die gasheerland, Brasilië, en die benutting daarvan.

Dr Straszacker emphasised that the personal contact and exchange of ideas and information between delegates was very valuable. South Africa has many friends in the organisation.

#### **Eighth Plenary Meeting of the World Energy Conference**

The Eighth Plenary Meeting of the World Energy Conference was to be held in Bucharest, Romania, from the 28th June until the 2nd July, 1971. Although the host country has refused to issue visas to enable South African delegates to attend, the S.A. National Committee had sponsored three technical papers and it was presumed that these would appear in the proceedings of the Plenary Meeting. These papers are:

- (a) "An approach to the problem of optimising the location of electricity generating plants in South Africa" by E. J. Maunders and J. D. Roode of the S.A. Atomic Energy Board.
- (b) "The development of an integrated electric power supply system in South Africa based on a combination of available fossil fuel, hydro and nuclear resources" by M. J. Lay and N. Troost of Escom, and
- (c) "The use of low grade coal for the production of oil, gas, fertilisers and chemicals" by C. W. Schutte and J. H. Govaarts of SASOL.

#### **Annual Report for 1969**

The annual report of the World Energy Conference for 1969 was tabled. Reference was made to the work of various Committees such as the Standardisation of terminology, Standardisation of units, pollution, the large scale transportation of heat over long distances, etc.

Administrative details were given, such as new members admitted, and financial data.

#### **Meeting of the International Executive Council 1972**

The next meeting of the International Executive Council will take place at Wairakei, New Zealand, in September, 1972.

#### **Resignation of Honorary Secretary**

Leave was taken of Mr H. J. de Villiers who resigned as Honorary Secretary of the S.A. National Committee in anticipation of his retirement from the post of General Manager of Escom. Tribute was paid to his excellent services for the Committee. Mr Jan H. Smith, General Manager-designate of Escom was elected Honorary Secretary.

R. W. BARTON,  
Representative.

Dr. Straszacker het beklemtoon dat die persoonlike kontak en die uitruiling van inligting en idees deur die afgevaardigdes van groot waarde is. Suid-Afrika het baie vriende in hierdie organisasie.

#### **Agste Voltallige Vergadering van die Wêreldkonferensie insake Energie :**

Die Agste Voltallige Vergadering van die Wêreldkonferensie insake Energie sou vanaf 28 Junie tot 2 Julie 1971 te Boekarest, Roemenië, gehou word. Alhoewel die gasheerland geweier het om visums uit te reik ten einde die Suid-Afrikaanse afgevaardigdes in staat te stel om die vergadering by te woon, het die Suid-Afrikaanse Nasionale Komitee drie tegniese referate geborg, en daar is aanvaar dat hulle in die verrigtinge van die Voltallige Vergadering sal verskyn. Hierdie referate is die volgende :

- (a) „'n Benadering to die probleem van die mees gunstigste plasing van elektrisiteitsopwekkingsinstallasies in Suid-Afrika", deur E. J. Maunders en J. D. Roode van die Suid-Afrikaanse Raad op Atoomkrag;
- (b) „Die ontwikkeling van 'n geïntegreerde elektriese kragvoorsieningstelsel in Suid-Afrika, gebaseer op 'n kombinasie van die beskikbare fossielbrandstof, water en kernhulpbronne" deur M. J. Lay en N. Troost van Evkom; en
- (c) „Die gebruik van laagrade steenkool vir die produksie van olie, gas, kunsmisstowwe en chemikalieë" deur C. W. Schutte en J. H. Govaarts van SASOL.

#### **Jaarverslag 1969 :**

Die jaarverslag van die Wêreldkongres insake Energie vir 1969 is ter tafel gelê. Melding is gemaak van die werk van verskillende komitees, soos byvoorbeeld die standaardisasie van die terminologie, die standaardisasie van eenhede, besoedeling, die groot-skaalse vervoer van hitte oor lang afstande, ens.

Administratiewe besonderhede is aangegee, soos byvoorbeeld nuwe lede wat toegelaat is, en finansiële besonderhede.

#### **Vergadering van die Internasionale Uitvoerende Raad, 1972 :**

Die volgende vergadering van die Internasionale uitvoerende Raad sal in September 1972 in Wairakei, Nieu-Seeland, plaasvind.

#### **Bedanking van Ere-Sekretaris :**

Daar is afskeid geneem van mnr. H. J. de Villiers, wat as Ere-Sekretaris van die S.A. Nasionale Komitee bedank het met die oog op sy uittrede uit die pos van Algemene Bestuurder van Evkom. Daar is hulde gebring aan die uitstekende dienste wat hy aan die Komitee gelewer het.

Mnr. Jan H. Smith, Aangewese Algemene Bestuurder van Evkom, is tot Ere-Sekretaris verkies.

R. W. BARTON,  
Verteenwoordiger.

## REPORT ON SOUTH AFRICAN NATIONAL COMMITTEE ON ILLUMINATION CONGRESS 1970

The 17th Annual General Meeting and Congress of S.A.N.C.I. was held in the Stewarts and Lloyds Recreation Club Hall, Vereeniging, from the 29th April to the 1st May, 1970. Seventy delegates attended.

His Worship the Mayor of Vereeniging, Councillor Combrink, opened the Congress. In his address he expressed appreciation to S.A.N.C.I. and other bodies for their efforts to promote good lighting.

### Presidential Address

In his Presidential address, Dr W. H. M. Rennhackkamp said that since its birth in 1953, S.A.N.C.I. by the efforts of its experts and correspondents on the various C.I.E. Committees had become fairly well-known internationally. However, in South Africa, in spite of its various publications and codes of practice, to the broad mass of the public it was still largely unknown. He considered that it was time to cultivate and educate the man in the street to be interested in this one requirement which can increase his productivity, assist in his safe travelling from place to place, make his leisure hours worthwhile, and thus help him to be a better citizen.

The President mentioned that two guides had been prepared, one on soccer field lighting and one on rugby field lighting. The second part of the code of practice for street and highway lighting, covering lighting of roundabouts, complex interchanges, on and off ramps, etc., had been completed. The first part of the code of practice for interior lighting, dealing with levels of illuminations, glare prediction, etc., had also been completed.

Dealing with C.I.E. matters, Dr Rennhackkamp mentioned that S.A.N.C.I. members had taken part in an international lamp comparison programme. The code committee on streetlighting was engaged on a survey of streetlighting installations as requested by the chairman of the C.I.E. committee.

Numerous other committees were active in C.I.E. matters. A summary is available for perusal by A.M.E.U. members.

### Election of Executive Committee :

Dr Rennhackkamp was re-elected President. Two A.M.E.U. members, Messrs K. G. Robson and R. W. Barton were elected as country members.

## VERSLAG OOR DIE 1970-KONGRES VAN DIE SUID-AFRIKAANSE NASIONALE KOMITEE INSAKE VERLICHTING

Die Sewentiende Algemene Jaarvergadering en Kongres van die S.A.N.K.V. is vanaf 29 April tot 1 Mei 1970 in die Ontspanningsklubsaal van Stewarts en Lloyds, Vereeniging, gehou. Sewentig afgevaardigdes was teenwoordig.

Sy Agbare di Beugreemeester van Vereeniging, Raadslid Combrink, het die kongres geopen. In sy toespraak het hy sy waardering teenoor die S.A.N.K.V. en ander liggame uitgespreek vir hul pogings om goeie verligting te bevorder.

### Presidentsrede :

In sy presidentsrede het dr. W. H. M. Rennhackkamp gesê dat die S.A.N.K.V., sedert sy totstandkoming in 1953, deur middel van sy deskundiges en korrespondente in die verskillende C.I.E.-komitees, internasionaal redelik goed bekend geraak het. In Suid-Afrika is hy egter, ten spyte van sy verskillende publikasies en gebruikskodes, by die breë massa van die publiek nog feitlik onbekend. Hy spreek die mening uit dat die tyd aangebreek het om die gewone burger op te voed en aan te moedig om belang te stel in hierdie één vereiste wat sy produktiwiteit kan verhoog, hom kan help om met veiligheid van plek tot plek te reis, sy vrytyd meer aangenaam kan maak en hom sodoende kan help om 'n beter burger van die land te wees.

Die President sê dat twee handleidings voorberei is, een vir die verligting van sokkervelde en die ander een vir die verligting van rugbyvelde. Die tweede gedeelte van die gebruikskode vir die verligting van strate en hoofpaie, wat die verligting van verkeersilande, komplekse wisselaars, op- en afdritte, ens. dek, is ook voltooi. Die eerste gedeelte van die gebruikskode vir binnenshuise verligting, wat oor verligtingsvlakke, skitteringsvoorspelling ens. handel, is eweneens voltooi.

Met betrekking tot C.I.E.-sake, meld dr. Benschackkamp dat lede van die S.A.N.K.V. aan 'n internasionale lampvergelykingsprogram deelgeneem het. Die gebruikskodekomitee insake straatverligting het homself besig gehou met 'n opname van straatverligtinginstallasies soos versoek deur die voorsitter van die C.I.E.-komitee.

Talryke ander komitees het aktief aan C.I.E.-sake deelgeneem. 'n Opsomming van hierdie bedrywighede is beskikbaar vir insae deur lede van die V.M.E.O.

### Verkieping van Uitvoerende Komitee :

Dr. Rennhackkamp is as President herkies. Twee lede van die V.M.E.O., mnr. K. G. Robson en R. W. Barton, is as plattelandse lede verkies.

## Papers

Ten papers were presented, two by speakers from overseas, in the persons of Mr H. Hewitt from the United Kingdom and Mr J. Lindsay from the United States of America.

(a) **"Lighting in the Visual and Thermal Environment"** by H. Hewitt.

The paper reviewed work done on the environmental factors of lighting, namely thermal, aural and spatial and shows how progress is being made in the integration of building services. An interesting feature was the completion of an appraisal form (on the environmental properties of the conference hall) by delegates and a discussion of the results.

(b) **"Control Gear for Modern Discharge Lamps"** by H. Silbermann.

The paper surveys the important technical aspects of control gear for fluorescent lamps. Explanations are given for switch start, instant start and rapid start circuits. With the aid of circuit diagrams, advantages and disadvantages based on technical or economic consideration are discussed. The construction of ballasts and capacitors is reviewed.

The conclusion is reached that it would be in the best interests of the lighting industry if control gear for fluorescent lamps was made solely to the specifications of the South African Bureau of Standards.

(c) **"Lighting for Inspection"** by M. A. Riley.

The use of artificial light in inspection processes in various industries, trades and professions is examined. The suitability of different light sources and light fittings is discussed and recommendations made. An historical treatment of the subject adds to the interest of the paper.

(d) **"Trends in high intensity discharge lighting"** by J. S. Lindsay.

This very interesting talk was delivered with the aid of a large number of coloured slides. The need for higher light levels, lower maintenance costs, attractive appearance and lower operating expenses was shown to have stimulated the production and use of high intensity discharge light sources in the fields of roadway lighting, highway lighting, flood lighting and industrial lighting.

(e) **"High bay lighting"** by D. H. Piekma.

This type of lighting is applied mostly in factories where the height from the floor to roof trusses is at least 7,50 metres. The paper discusses the suit-

## Referate :

Tien referate is voorgelê, waaronder twee deur oorsese sprekers, naamlik mnr. H. Hewitt van die Verenigde Koninkryk en mnr. J. Lindsay van die Verenigde State van Amerika.

(a) **"Verligting in die Visuele en Termiese Omgeving"** deur H. Hewitt.

In hierdie referaat is 'n oorsig gegee van die omgewingsfaktore met betrekking tot verligting, naamlik die termiese, die gehoor- en die ruimte-aspekte, en daar word aangetoon watter vordering in verband met die integrasie van boudienste gemaak word. 'n Interessante glanspunt was die voltooiing van 'n skattingsvorm (aangaande die omgewingseienskappe van die Konferensiesaal) deur die afgevaardigdes en die bespreking van die resultate daarvan.

(b) **"Beheertuig vir moderne ontladingslampe"** deur H. Silbermann.

In hierdie referaat is 'n oorsig gegee van die belangrike tegniese aspekte van beheertuig vir fluoresserende lampe. Verduidelikings is gegee van skakelaar-, oombliklike en snelle aansitterstroombane. Met behulp van stroombaandiagramme is die voor- en nadele, wat op tegniese en ekonomiese oorwegings gegrond is, bespreek, en 'n oorsig is gegee van die konstruksie van ballas en kapasitore.

Daar is tot die gevolgtrekking gekom dat dit tot die grootste voordeel vir die verligtingsnywerheid sou wees indien die beheertuig vir fluoresserende lampe slegs in ooreenstemming met die spesifikasies van die Suid-Afrikaanse Buro vir Standaard vervaardig sou word.

(c) **"Verligting vir Inspeksie"** deur M. A. Riley.

Die gebruik van kunsmatige lig by inspeksieprosesse in verskillende nywerhede, ambagte en professies word ondersoek. Die geskiktheid van verskillende ligbronne en ligtoebehoore word bespreek en aanbevelings word gemaak. 'n Historiese oorsig van die onderwerp dra tot die interessantheid van die referaat by.

(d) **"Tendense in hoë-intensiteitontladingsverligting"** deur J. S. Lindsay.

Hierdie baie interessante praatjie is met behulp van 'n groot aantal kleurskryfies gelewer. Daar is aangetoon dat die behoefte aan hoër verligtingspeile, laer instandhoudingskoste, aantrekklike voorkoms en laer bedryfsuitgawes die produksie en gebruik van hoë-intensiteit-ontladingsverligtingsbronne op die gebied van straatverligting, hoofpadverligting, vloedbeligting en verligting in die nywerheid gestimuleer het.

(e) **"Verligting van hoë lokale"** deur D. H. Piekma.

Hierdie soort verligting word hoofsaaklik in fabriek gebruik waar die hoogte vanaf die vloer tot by die dakkappe minstens 7,50 meter is. In die referaat

ability of various light sources and luminaires. A detailed comparison of annual costs in a specific project, using as alternatives very high output fluorescent, colour-corrected mercury and colour-corrected mercury reflector lamps, is given.

- (f) **"A guide to the planned lighting of offices"** by D. W. Young.

The contribution planned lighting should make to ergonomics in the various types of offices found in modern business concerns is discussed. General design, quality, quantity and colour of light, types of lamps and luminaires, luminance and lighting levels, glare, are all dealt with.

- (g) **"Daylighting of buildings"** by W. Rennhackkamp and C. Krause.

The use of large window areas in countries having a large percentage of sunlight hours can lead to overheating of buildings. The paper discusses this problem in detail for South African conditions and concludes that in many instances it would be more realistic to reduce window areas and supplement daylight with artificial light.

- (h) **"Underground lighting in the Mining Industry"** by C. H. van Graan.

In order to be able to conduct valid vision and colour-blindness tests of mine labourers at the levels of illumination existing in the mines, a survey of light intensities was conducted in 19 mines. The average level of illumination in the South African Mining Industry compares favourably with those reported in the literature, although inter- and intra-mine variations were found. These variations can be eliminated by standardising lighting conditions underground.

- (i) **"The Artifacts of Lighting"** by P. Whitworth.

In this light-hearted presentation the author traces the development of domestic light sources and fittings from the "first bunch of twigs thrust into the fire" right up to the projected "atomic" light source. He discusses the need for highly skilled designers and postulates that the real problem, once the technical requirements have been met, is to produce a design that is socially acceptable in this day and age.

- (j) **"Lighting as a positive factor in Architectural Design"** by R. van der Walt.

The author, who is a practising architect, develops the theme that in the positive design of lighting three main conditions should be fulfilled — firstly

word die geskiktheid van verskillende ligbronne en armature bespreek. Daar word 'n gedetailleerde vergelyking gegee van die jaarlikse koste van 'n spesifieke projek waarin daar om die beurt fluoëssende lampe met baie hoë lewering, kleurekorriseerde kwik- en kleurgekorriseerde kwikweerkatserlampe gebruik is.

- (f) **"'n Gids tot die beplande verligting van kantore"** deur D. W. Young.

Die bydrae wat beplande verligting tot die ergonomie in die verskillende tipes kantore in moderne sakeondernemings behoort te lewer, is bespreek. Algemene ontwerp, gehalte, hoeveelheid en kleur van die lig, die tipes lampe en armature, luminasie en verligtingspele, skittering ens. word almal behandel.

- (g) **"Die dagverligting van geboue"** deur W. Rennhackkamp en C. Krause.

Die gebruik van groot vensteroppervlaktes in lande wat 'n hoë persentasie sonlig-ure het, kan tot die oorverhitting van geboue lei. In die referaat word hierdie probleem vir sover dit op Suid-Afrikaanse toestande betrekking het, in detail bespreek en daar word tot die gevolgtrekking gekom dat dit in baie gevalle meer realities sal wees om vensteroppervlaktes kleiner te maak en om daglig met kunsmatige lig aan te vul.

- (h) **"Ondergrondse Verligting in die Mynbedryf"** deur C. H. van Graan.

Ten einde in staat te wees om geldige gesig- en kleurblindheidstoetse op mynwerkers uit te voer teen die verligtingspele wat in die myne bestaan, is 'n opname van die lig-intensiteit in 19 myne gemaak. Die gemiddelde verligtingspeil in die Suid-Afrikaanse mynnywerheid vergelyk gunstig met wat in die beskikbare lektuur beskryf word, dog verskille tussen myne en tussen gedeeltes van dieselfde myn is gevind. Hierdie verskille kan uitgeskakel word deur die ondergrondse verligtingstoestande te standaardiseer.

- (i) **"Die kunsprodukte van verligting"** deur P. Whitworth.

In hierdie lughartige voordrag gee die skrywer 'n oorsig van huishoudelike ligbronne en toe behore vanaf „die eerste bondel takkies wat in die vuur gedruk is" tot by die beoogde „atomiese" ligbronne. Hy bespreek die behoefte aan hoogs bekwame ontwerpers en gaan van die veronderstelling uit dat die werklike probleem, nadat daar aan die tegniese vereistes voldoen is, is om 'n ontwerp daar te stel wat in hierdie tydsvak sosiaal aanvaarbaar sal wees.

- (j) **"Verligting as 'n positiewe faktor in argitektoniese ontwerp"** deur R. van der Walt.

Die skrywer, wat 'n praktiserende argitek is, bespreek die stelling dat, in die positiewe ontwerp van verligting, daar drie hoof-vereistes is waaraan voldoen

its practicality, that is does it meet with the physical and psychological requirements of the users; secondly, its functionality, that is, does it have a sound technology? and thirdly, impact—does it induce the desired emotions and create the appropriate character?

(k) **“Orientated Lighting”** by H. D. Einhorn.

A new design concept, “orientated lighting”, (more precisely “general orientated asymmetric lighting”) can enhance the quality of lighting by reducing reflected glare and by improving modelling. Its potentialities and limitations are explained with the aid of practical examples. Opportunities for light fittings development become apparent.

**General**

The Congress was a great success and met fully the high standards which we have learned to expect from S.A.N.C.I.

R. W. BARTON,  
Representative

**REVISION OF THE STANDARD REGULATIONS  
FOR THE WIRING OF PREMISES**

Messrs D. C. Plowden (Johannesburg) and E. E. de Villiers (Rustenburg) represented the A.M.E.U. on the newly constituted S.A.B.S. Committee for the revision of the Standard Regulations for the Wiring of Premises.

The first meeting of the Committee was held on 8th December, 1970. At this meeting the metrication of all units were finalised as well as a new system of tables of current-carrying capacity of cables, voltage drop, conduit capacities, etc. The final results have been published by the S.A.B.S. as Addendum No. 1.

A further meeting was held on 11th May, 1971, primarily to consider suggestions received from various persons and bodies concerning revision of a number of paragraphs of the present Regulations. It is anticipated that the revisions decided upon will be published soon.

At this second meeting the Committee was reconstituted as the South African Technical Sub-Committee of the Technical Committee No. 64 (Electrical Installation of Buildings) of the International Electro-technical Commission to discuss and comment on Documents 34, 35, 36, 37 and 38 of the Secretariat, to be used as a basis for the revision of Publication 364-1. Representatives will pose these comments at the meeting of Committee No. 64 to be held in Lon-

doon—eerstens die uitvoerbaarheid daarvan, d.w.s. of dit aan die fisiese en sielkundige vereistes van die gebruikers voldoen; tweedens die funksionaliteit daarvan d.w.s. is dit tegnies gesond?; en derdens die trekkrag daarvan—waker dit die verlangde emosies aan en skep dit die gewenste atmosfeer?

(k) **„Georiënteerde Verligting”** deur H. D. Einhorn.

’n Nuwe begrip in ontwerp, „georiënteerde verligting” (of, meer korrekgestel, „algemene georiënteerde asimmetriese verligting”) kan die gehalte van verligting verhoog deur weerkaatste skittering te verminder en deur modellering te verbeter. Daar is ’n uiteensetting gegee van die moontlikhede en die beperkinge hiervan, met behulp van praktiese voorbeelde. Die moontlikhede vir die ontwikkeling van ligtoebehore word verduidelik.

**Algemeen :**

Die kongres was ’n groot sukses en daar is ten volle voldoen aan die hoë standaarde wat ons gewoon geraak het om van die S.A.N.K.V. te verwag.

R. W. BARTON,  
Verteenwoordiger.

**HERSIENING VAN DIE STANDAARD  
REGULASIES VIR DIE BEDRADING VAN  
PERSELE**

Mnr. D. C. Plowden (Johannesburg) en E. E. de Villiers (Rustenburg) het die V.M.E.O. verteenwoordig op die nuutgestigte S.A.B.S.-komitee vir die hersiening van die Standaard Regulasies vir die Bedrading van Persele.

Die eerste vergadering van die Komitee is gehou op 8 Desember 1970. By hierdie vergadering is die metrisering van alle eenhede afgehandel sowel as ’n stelsel van tabelle van stroomvermoë van kables, spanningsverlies, geleierpypvermoë, ens. Die eindresultaat is reeds deur die S.A.B.S. gedruk as „Addendum No. 1”. (Die Afrikaanse weergawe sal mettertyd verskyn).

’n Verdere vergadering is gehou op 11 Mei 1971, hoofsaaklik om voorgestelde wysigings van ’n aantal persone en instansies, te oorweg. Na verwagting sal die hersiening waarop besluit is binnekort gepubliseer word.

By hierdie tweede vergadering is die Komitee geherkonstitueer as die Suid-Afrikaanse Tegniese Komitee van die Tegniese Komitee Nr. 64 (Elektriese Installasies van Geboue) van die Internasionale Elektrotegniese Kommissie om bespreking te voer oor en kommentaar te lewer op dokumente 34, 35, 36, 37 en 38 van die Sekretariaat, vir gebruik as basis tot hersiening van Publikasie 364-1. Verteenwoordiger sal hierdie kommentaar voorlê aan ’n vergadering van

don from the 13th to 17th September, 1971. It is anticipated that the revised Publication 364-1 of the I.E.C. will be a valuable guide to mould the South African wiring Regulations to conform to International Standards.

E. E. de VILLIERS,  
Representative

#### S.A. ELECTROLYTIC CORROSION MAIN COMMITTEE

The fifth meeting of this Committee was held in the offices of the South African Railways in Paul Kruger Building, Johannesburg, on the 9th June, 1971.

In terms of the Constitution it was necessary to elect a Chairman and Deputy Chairman for the new two-year term and Messrs L. H. James, Deputy Chief Engineer, Rand Water Board, and Mr G. B. Jack, Assistant Chief Electrical Engineer (Maintenance), S.A.R., were respectively elected to these positions.

#### Regional Field Committees

The four Regional Field Committees are healthily active and their deliberations are proving mutually beneficial to all parties concerned.

From time to time Regional Field Committees refer technical problems to the Main Committee. Because the latter Committee only meets once a year and because its functions are administrative rather than technical, it was decided to request Field Committees to address their problems to the Secretary of the Main Committee who, in turn, would refer them to each of the other Field Committees for consideration. All comments received would then be passed back to the originating Field Committee and, if of common interest, be published in Technical Bulletins.

On occasion, Regional Field Committees become involved in legal considerations. Since these considerations do not fall within the scope of activity of either the Main Committee or the Field Committees, it was decided to instruct the latter Committees to avoid such involvement. The policy of confining activities to technical considerations only constituted one of the basic concepts in the establishment of the Main and Regional Field Committees and is covered in the Constitutions of these Committees.

The question of apportionment of costs for installation of protective systems was raised by one of the Regional Field Committees. The Main Committee resolved to inform Field Committees that this matter does not fall within their terms of reference, which essentially cover consideration of technical problems.

Komitee Nr. 64 wat vanaf 13 tot 17 September 1971 in Londen gehou word.

Die verwagting is dat die hersiene Publikasie 364-1 van die I.E.K. as 'n waardevolle gids sal dien om die Suid-Afrikaanse Bedradingsregulasies in 'n vorm te giet wat sal voldoen aan Internasionale Standaarde.

E. E. de VILLIERS,  
Verteenwoordiger.

#### S.A. ELEKTROLITIESE KORROSIE HOOF KOMITEE

Die vyfde vergadering van hierdie Komitee was in die kantore van die Suid Afrikaanse Spoorweë in Paul Kruger gebou, Johannesburg, gehou op 6 Junie 1971.

Volgens die Konstitusie was dit nodig om 'n Voorsitter en Ondervoorsitter vir die nuwe tweejarige termyn te kies, en mnr. L. H. James, adjunk Hoofingenieur, Randse Waterraad, en G. B. Jack, Assistant Hoof Elektrotegniese Ingenieur (Onderhoud), S.A.S., is onderskeidelik vir die twee poste gekies.

#### Streeksgebiedskomitees

Die vier Streeksgebiedskomitees is werksaam op 'n gesonde grondslag en hulle oorwegings blyk onderling voordelig te wees vir alle onderhawige instansies.

Elke nou en dan verwys Streekskomitees tegniese probleme na die Hoof Komitee. Aangesien die laasgenoemde Komitee slegs eenmaal per jaar saamkom en omdat sy funksies meer administratief dan tegniese is, is dit besluit om die Gebiedskomitees te versoek om hulle probleme te rig aan die Sekretaris van die Hoof Komitee wat, op sy beurt, hulle sal verwys na elk van die ander Gebiedskomitees vir oorweging. Alle opmerkings ontvang sal dan teruggestuur word na die oorspronklike Gebiedskomitee en, indien van gemeenskaplike belang, vir publikasie in Tegniese Bulletins.

Somtyds word Streeksgebiedskomitees gemoed in wetsaspekte. Aangesien sulke oorwegings buite die bestek van die werksaamhede van beide die Hoof Komitee en die Gebiedskomitees val, is dit besluit om die laasgenoemde Komitees te beveel om nie betrokke te raak in sulke aangeleenthede nie. Die belied om werksaamhede te beperk tot slegs tegniese aangeleenthede was een van die basiese oorwegings by die samestelling van die Hoof en Streeksgebiedskomitees en word gedek in die konstitusies van daardie komitees.

Die vraag van indeling van onkoste vir installeering van beveiligingsstelsels is geopper deur een van die Streeksgebiedskomitees. Die Hoof Komitee het besluit om Gebiedskomitees aan te sê dat die saak buite hulle bevoegdheidsgrense, wat hoofsaaklik tegniese oorwegings behels, val. Tog was die opinie van die Hoof



However, the opinion of the Main Committee was that, because costs are generally small, each party should meet its own costs in the installation of a protective system, regardless of whose equipment was of older establishment. This policy is covered in the Constitution of the Main Committee.

#### Colour Codes for Master Plans

No progress has been made in the establishment of a standard colour code for distinguishing the various services recorded on master plans. The value of such a standard appears debatable and the Main Committee decided to suggest to the Field Committees that, when renewing their master plans, they give consideration to adopting the colour code used by the Witwatersrand and O.F.S. Regional Field Committee, whose area is the most complex. The representative of this Committee informed the meeting that his Committee was in the process of introducing coded plastic ferrules for wiring connections based on vehicle registration letters for municipal installations, e.g., "TJ" for Johannesburg and initial letters for other organisations such as "RWB" and "SAR" followed by the applicable circuit number.

#### Codes of Practice

(a) While carrying out the second revision of the of the Code of Practice For Cables and Pipe-lines Crossing Beneath Railway Tracks (No. SAECC/1), which was originally issued in November, 1967, the opportunity was taken to metricate the document which, in its revised form, was approved for issue.

(b) Since the S.A.B.S. has established committees to draft Codes of Practice covering the subjects listed below, the Main Committee decided to discontinue drafting its own codes and to request the S.A.B.S. for representation on its relevant committees:

- (i) Catholic protection of buried structures in the Republic of South Africa.
- (ii) Anti-electrolysis measures for underground services crossing or in close proximity to pipelines in the Republic of South Africa.

The interests of all bodies represented on the Main Committee will be borne in mind when approaching the S.A.B.S.

D. C. PLOWDEN,  
Representative.

#### CO-ORDINATING COMMITTEE FOR HIGH VOLTAGE RESEARCH FACILITIES

The fourth meeting of the Committee was held at the C.S.I.R., Pretoria, on 22nd October, 1970, and the following are the main points arising from the

Komitee dat, aangesien kostes gewoonlik laag is, elke party sy eie onkoste in die installing van die beveiligingsstelsel behoort te dra, ongeag wie se toerusting eerste bestaan het. Hierdie beleid word gedek in die konstitusie van die Hoof Komitee.

#### Kleurkode vir Hoofplanne

Geen vordering is gemaak in die vasstelling van 'n standaard kleurkode om die verskillende diensfunksies, aangeteken op hoofplanne, te onderskei nie. Die waarde van so 'n standaard kan betwis word en die Hoof Komitee het besluit om aan die Gebiedskomitees voor te stel dat, wanneer hulle hoofplanne hernuwe word, hulle dit sal oorweeg om die kleurkode aan te neem soos gebruik deur die Witwatersrandse en O.V.S. Streeksgebiedskomitees, wat die mees ingewikkelde gebiede het. Die verteenwoordiger van die Komitee het die vergadering meegedeel dat sy Komitee besig is om gekodeerde plastiese beslagringe, gebaseer op voertuig registrasieletters, in te voer vir bedragnings aansluitings vir munisipale installasies, bv. „TJ” vir Johannesburg en eerste letters vir ander instansies soos „RWB” en „SAR”, wat dan gevolg word deur die toepaslike stroombaan nommer.

#### Gebruikskodes

(a) Onderwyl besig was met die tweede hersiening van die Gebruikskode vir kables en Pypleidings wat onder spoorlyne deurgaan (No. SAECC/1), wat oorspronklik in November 1967 uitgegee is, is van die geleentheid gebruik gemaak om die uitgawe te metriseer, wat, in die hersiene vorm, goedgekeur is vir uitgawe.

(b) Aangesien die S.A.B.S. Komitees saamgestel het om konsep gebruikskodes op te stel oor die ondergelede onderwerpe, het die Hoof Komitee besluit om op te hou om sy eie kodes op te stel en om aansoek by die S.A.B.S. te doen vir verteenwoordiging op sy onderhawige komitees:

- (i) Katodiese beskerming van bedekte strukture in die Republiek van S.A.
- (ii) Elektrolisewerende maatreëls vir ondergrondse dienste wat pypleidings kruis of aansluitend is, in die Republiek van S.A.

Die belange van alle instansies verteenwoordig op die Hoof Komitees sal in gedagte gehou word wanneer die S.A.B.S. genader word.

D. C. PLOWDEN,  
Verteenwoordiger.

#### KO-ORDINERENDE KOMITEE VIR HOOGSPANNINGS NAVORSINGSFASILITEITE

Die vierde vergadering van die Komitee is by die W.N.N.R., Pretoria gehou op 27 Oktober 1970 en die volgende is die belangrikste onderwerpe wat uit die verhandelinge voorgevloei het:

#### (1) Lightning Research

The Chairman, Dr F. J. Hewitt, reported that the University of the Witwatersrand had been approached in regard to the continuation of lightning research by the Bernard Price Institute and gave the assurance that he would encourage more research in the physics of lightning.

#### (2) Specialised Field of Insulation

Professor R. A. Hellawell emphasised that more detail was required in future on the progress of research being undertaken. He also referred to the steps taken to secure greater support from the manufacturing industry.

He further reported on the progress achieved in particular by the University of the Witwatersrand and jointly by the Rand Water Board and the C.S.I.R. into the life of motor insulation. Professor Hellawell reported on the work on external insulation, special reference to environmental conditions in South Africa and the mechanism of breakdown over solid insulation surfaces especially under polluted conditions.

#### (3) Symposium on Earthing (January, 1970)

Professor Hellawell reported that this had been a great success but that it had revealed that a great deal more research and investigation was required than had been realised. The need to establish a Co-ordinating Committee was discussed and Mr A. A. Middlecote offered to undertake the task of co-ordinator and to determine the role which such a committee should assume.

#### (4) Specialised Field of Lightning and Surges

Mr R. B. Anderson reported a serious shortage of research staff but considered that co-operative research was progressing satisfactorily. Reference was also made and tribute paid to the work of the late Professor D. J. Malan.

#### (5) Specialised Field of Corona

Professor F. G. Heymann reported on the progress of Corona measurement at the University of Pretoria. He went on to describe work on arcs conducted by the N.P.R.L. and emphasised the need to study the mechanics of long sparks to determine those properties conducive to self-propagation.

#### (6) A National E.H.V. Research and Test Facility

It was announced that Escom was to establish a research centre at Apollo Distribution Station where the following facilities would be provided:

#### (1) Weerlignavorsing

Die Voorsitter, Dr. F. J. Hewitt, het berig dat die Witwatersrandse Universiteit deur die Bernard Price Instituut genader is in verband met voorstelling van weerlignavorsing en hy het onderneem dat hy meer navorsing in die fisika van weerlig sal aanmoedig.

#### (2) Gespesialiseerde Veld van Isolering

Professor R. A. Hellawell het dit benadruk dat in die toekoms meer besonderhede benodig sal word oor die vordering van die navorsing wat gedoen word. Hy het ook verwys na die maatreëls wat geneem word om groter samewerking te verkry van die vervaardigingsindustrie.

Hy het verder verslag gedoen oor die vooruitgang wat bereik is, in besonder aan die Witwatersrandse Universiteit en gesamentlik deur die Randse Waterraad en die W.N.N.R., aangaande die lewensduur van motorisolering. Professor Hellawell het verslag gedoen oor die werk in verband met eksterne isolering, met besondere verwysing na omgewings-toestande in Suid-Afrika en die meganisme van deurslag oor soliede isoleringsoppervlakte, in besonder onder besoedelde omstandighede.

#### (3) Simposium oor Aarding (Januarie 1970)

Professor Hellawell het berig dat die baie suksesvol was maar dat dit geblyk het dat heelwat meer navorsing en ondersoek nodig is, as wat besef word. Die behoefte om 'n koördinerende komitee te stig is bespreek en Mnr. A. A. Middlecote het aangebied om die werk van koördinator te onderneem en om die rol wat so 'n komitee moet speel, vas te stel.

#### (4) Gespesialiseerde Veld van Weerlig en Stuwings

Mnr. R. B. Anderson het 'n ernstige tekort aan navorsings staf gerapporteer, maar is die opinie toegedaan dat samewerkende navorsing bevredigend vorder. Daar is ook verwys na en 'n huldeblyk gebring aan, die werk van oorlede Professor D. J. Malan.

#### (5) Gespesialiseerde Veld van Korona

Professor F. G. Heymann het verslag gedoen oor die vordering gemaak in die meting van korona, aan die Universiteit van Pretoria. Hy het voortgegaan om die werk oor boë, gedoen deur die „N.P.R.L.“, te beskryf en het die noodsaaklikheid benadruk van die studie oor die meganika van lang boë, om die eienskappe wat aansporing tot self-voortplanting gee, te bepaal.

#### (6) 'n Nasionale E.H.S. Navorsings- en Toets Fasiliteit

Dit is bekend gemaak dat Evkom 'n navorsings-sentrum by Apollo Verspreidingsstasie sou oprig waar die volgende fasiliteite voorsien sou word:

- (a) A high voltage research testing laboratory for transmission voltages up to 1 500 kV;
- (b) High voltage test line for A.C. and D.C. transmission is planned for the near future.

It is intended that all facilities at the research centre shall be used as a national asset and an advisory board is to be established to control this centre.

#### **(7) High Voltage Research Facilities available in the Republic**

The Co-ordinators recommended that in order to avoid duplication of high voltage facilities, the C.S.I.R. consider using the Escom and Bureau of Standard's facilities.

#### **(8) Information and Research Services**

It was suggested that a scheme be organised for the storage of information and retrieval in respect of research fields covered by the committee. Mr Anderson stated that at present the list of publications, theses and reports did not include those currently published by the South African Learned Societies and it was agreed that select papers pertaining to the high voltage field should in future be included.

The A.M.E.U. representative pointed out that there were many organisations, notably municipal electricity undertakings, who did not undertake research themselves and did not have research facilities but confined their work to applied research and development. They were nevertheless in a good position to note where problem areas lie and could suggest avenues for future research. It was suggested that these organisations should submit such projects to the committee for compiling and allocation to research organisations.

It was agreed that the co-ordinators in specialised fields investigate this matter.

#### **(9) Additional Meetings**

The Committee agreed to meet early each year to report progress and matters arising from the previous year's formal meeting.

#### **10 Summary of Schedule 1**

- (a) Basic research in progress — 19 projects.
- (b) Applied research and testing progress — 17 projects.
- (c) Research and Testing plans — 5 projects.
- (d) Proposed future research and testing — 31 projects.

(a) 'n Hoogspannings navorsings toetslaboratorium vir oorbrennings spanninge tot by 1 500 kV.

(b) Hoogspannings toetsleiding vir W.S. en G.S. oorbrenning word beplan vir die nabye toekoms.

Die bedoeling is dat al die fasiliteite by die sentrum as 'n nasionale bate gebruik sal word en 'n raad, gewende liggaam sal saamgestel word om beheer oor die sentrum uit te oefen.

#### **(7) Hoogspannings Navorsingsfasiliteite in die Republiek**

Die koördineerders beveel aan dat die W.N.N.R. dit oorweeg om die fasiliteite van Evkom en die Buro van Standaarde te gebruik om sodoende die duplisering van hoogspannings fasiliteite te vermy.

#### **(8) Inligtings- en Navorsingsdienste**

Dit is voorgestel dat 'n skema georganiseer word vir die opgaar van inligting en herwinning met betrekking tot navorsingsgebiede wat deur die komitee gedek word. Mnr. Anderson het gesê dat vir die huidige, die lys van publikasies, tesisse en verslae nie die insluit wat huidige deur die Suid-Afrikaanse Vereniging van Geleerdes uitgegee word nie, en daar is saamgestem dat uitgesoekte verhandelinge wat betrekking het op die hoogspanningsveld, in die toekoms ingesluit moet word.

Die V.M.E.O. verteenwoordiger het daarop gewys dat daar baie organisasies was, in besonder munisipale elektrisiteitsondernemings, wat nie self navorsing gedoen het nie en geen navorsings geriewe gehad het nie, maar wat hulle werk beperk het tot ondersoek en ontwikkeling. Hulle was desnieteenstaande in 'n voordelige posisie om te let waar probleemterreine geleë was en kon rigtings vir toekomstige navorsing voorstel. Dit is aan die hand gedoen dat daardie organisasies sulke projekte aan die komitees sal voorlê vir opstelling en toewysing aan navorsingsorganisasies.

Daar is besluit dat die koördinatore in gespesialiseerde rigting hierdie saak sal ondersoek.

#### **(9) Bykomende Vergaderings**

Die komitee het besluit om vroeg elke jaar byeën te kom om verslag te doen oor vordering en oor sake wat voortgespruit het uit die vorige jaar se formele vergadering.

#### **(10) Opsomming van Bylae 1**

- (a) Basiese navorsing aan die gang — 19 projekte.
- (b) Toegepaste navorsing en toetse aan die gang — 17 projekte.
- (c) Navorsings en Toetsplanne — 5 projekte.
- (d) Voorgestelde toekomstige navorsing en toetse — 31 projekte.

(c) Research completed during 1969/70—Nil.

### Summary of Schedule 2

High Voltage Facilities at the University of the Witwatersrand, Pretoria, Cape Town and Natal, C.S.I.R., S.A.B.S., Escom, S.A.R., City of Johannesburg Electricity Department, were updated.

### Summary of Schedule 3

Five additional publications were added to the list of publications, theses and reports.

In pursuance of item (9) above, the Committee met on the 22nd April, 1971, and the following are the main points arising from this meeting:

- (1) There was some discussion on the University of Witwatersrand's decision to discontinue lightning research—no reason being given—and the Chairman expressed his regret that as South Africa had been a leader in this field, it should virtually cease because of the death of Dr Malan.
- (2) Mr A. A. Middlecote described his proposals for a special sub-committee on Earthing and the headings under which the subject had been divided. He referred to the inclusion of the section on earth leakage protection.
- (3) Various speakers reported on other items on the agenda but in general there had been little significant progress over the past six months.
- (4) In the afternoon a visit to the C.S.I.R. research station at Apollo Distribution Station where C.S.I.R. researchers explained the method of measuring surges on the Hendrina/Apollo 400 kV lines.

D. C. PLOWDEN,  
Representative.

### COMMON SERVICE FACILITIES

This committee, consisting of three A.M.E.U. members and G.P.O. representatives, was constituted at Umthali to investigate the practicability of co-ordinating the installation of power and telecommunication reticulation systems with the object of ensuring mutual benefit to the parties concerned and ultimately the consumers. The work of the committee was mostly done by correspondence and satisfactory progress can be reported.

The U.M.E. considered the matter in February, 1971, and decided to support the project in principle

(c) Navorsing voltooi gedurende 1969/70—Geen.

### Opsomming van Bylae 2

Hoogspanningsfasiliteite aan die Universiteit van die Witwatersrand, Pretoria, Kaapstad en Natal, aan die W.N.N.R., S.A.B.S., Etkom, S.A.S., Stad Johannesburg, Elektrisiteitsafdeling is aangevul.

### Opsomming van Bylae 3

Vyf bykomende uitgawes is toegevoeg tot die lys van publikasies, tesse en rapporte.

In voortsetting van item (9) hierbo, het die komitee op 22 April 1971 saamgekom en die volgende is die vernaamste kwessies wat voortspruit uit die vergadering:

- (1) Daar was 'n mate van bespreking oor die besluit van die Witwatersrandse Universiteit om navorsing oor weerlig te staak—waarvoor geen rede gegee is nie—en die Voorzitter het sy spyt te kenne gegee dat, aangesien Suid-Afrika 'n voorloper in hierdie gebied was, dit feitlik tot stilstand moet kom omrede die afsterwe van Dr. Malan.
- (2) Mnr. A. A. Middlecote het sy voorstelle vir 'n spesiale sub-komitee oor aarding beskryf en die hoofde waaronder die onderwerp verdeel is. Hy het verwys na die insluiting van die afdeling oor aardlekbeveiliging.
- (3) Verskillende sprekers het verslag gedoen oor ander items op die sakelys maar in die algemeen was daar weinig vordering van enige betekenis gedurende die afgelope ses maande.
- (4) Na die middag is 'n besoek gebring aan die W.N.N.R. se navorsingsstasie te Apollo Verspreidingsstasie waar die W.N.N.R. navorsers die metode van stuwingsmeting op die Hendrina/Apollo 400 kV leidings verduidelik het.

D. C. PLOWDEN  
Verteenwoordiger.

### GESAMENTLIKE DIENSFASILITEITTE

Hierdie komitee, bestaande uit drie V.M.E.O. lede en H.P.K. verteenwoordigers, was in Umthali samegestel om die praktiese moontlikhede vir die gesamentlike installering van krag- en telekommunikasiebetenningstelsels te ondersoek te einde wedesydse voordele vir albei partye en uiteindelik die verbruikers, daaruit te put.

Die V.M.B. het in Februarie 1971 die aangeleentheid oorweeg en besluit om die saak in beginsel te

on the basis of mutual co-operation and provided no monetary or other burden is placed on the local authorities. The compilation of a code of practice as a guide to local authorities was also authorised by the U.M.E. on the recommendation of your Executive Council.

A number of pilot schemes have been launched in the Republic in order to gain experience on this work and gather information on which to base the code of practice.

It is expected that the code of practice based on the practical experience gathered from the pilot schemes and in accordance with the principles approved by the A.M.E.U. and the U.M.E. will be available at the convention in Cape Town.

G. C. THERON  
Convenor

#### C.S.I.R. ADVISORY COMMITTEE FOR ELECTRICAL ENGINEERING

This committee, under the chairmanship of the vice-president of the C.S.I.R., is constituted from representatives from a number of national bodies. It meets once per year in Pretoria to consider reports from the C.S.I.R. and make recommendations to the Council on proposed research projects.

Much of the work of this Institute is for defence purposes and thus confidential. There is, however, a very active power engineering department under the leadership of Mr R. B. Anderson. They are working on earthing problems, soil thermal conductivity, surge voltages and corona on E.H.V. lines; protection on 11 kV lines and lightning. Mr Anderson is at present Chairman of the C.I.G.R.E. working group No. 33 on lightning and lightning counters.

Many enquiries for assistance and information are dealt with by telephone or correspondence as the answers are readily available. The institute would welcome suggestions for future research programmes and these could be forwarded to your representative.

Due to a shortage of research personnel at the C.S.I.R. a number of projects had to be temporarily shelved.

We also wish to record and add our congratulations to Mr J. D. N. van Wyk, well known to members for his outstanding contributions at A.M.E.U. conventions, with his appointment as Director of the National Electrical Engineering Research Institute.

G. C. THERON  
Representative.

steun op die voorwaardes van onderlinge samewerking en dat geen geldelike of ander las op die plaaslike besture geplaas word nie. Volgens aanbeveling van u Uitvoerende Raad, het die V.M.B. ook die opstel van 'n gebruikskode om as leiding vir plaaslike besture te dien, gematig.

'n Aantal proefskemas is in die Republiek van stapel gestuur ten einde ondervinding op te doen en inligting in te samel vir die samstelling van die gebruikskode.

Daar word verwag dat die gebruikskode gegrond op die praktiese ondervinding gehaal uit die proefskemas en in ooreenstemming met die beginsels deur die V.M.E.O. en die V.M.B. goedgekeur, by die konvensie in Kaapstad beskikbaar sal wees.

G. C. THERON  
Sameroeper.

#### W.N.N.R. ADVIESKOMITEE VIR ELEKTRIESE INGENIEURSWESE

Hierdie komitee, onder die voorsitterskap van die vise-president van die W.N.N.R., is saamgestel uit verteenwoordigers van 'n aantal nasionale organisasies. Die komitee vergader een keer per jaar in Pretoria om verslae van die W.N.N.R. te oorweeg en aan die Raad aanbevelings ten opsigte van beoogde navorsingsprojekte te maak.

Baie van die werk van die Instituut is vir verdedigingsdoeleindes en derhalwe op die geheime-lyne. Die departement vir swaarstroom-ingenieurswese, onder leiding van mnr. R. B. Anderson, is egter baie aktief. Daar word gewerk aanaardingsprobleme, termiese geleiding van grond, stootspanning en straling op ekstra hoëspanningslyne, beskerming van 11 kV lyne en weerlig. Mnr. Anderson is tans voorsitter van die C.I.G.R.E. werkende groep Nr. 33 opweerlig en weerligtellere.

Baie navrae om hulp en inligting word per telefoon of brief afgehandel aangesien die oplossings maklik beskikbaar is. Die Instituut sal voorstelle vir toekomstige navorsingsprojekte verwelkom en dié kan aan u verteenwoordiger gestuur word.

Weens 'n tekort aan personeel vir navorsing by die W.N.N.R. moes 'n aantal projekte tydelik agterweê gehou word.

Ons wil dit aanteken en ook mnr. J. D. N. van Wyk, wat aan lede bekend is vir sy uitstaande bydrae by V.M.E.O. konvensies, gelukwens met sy aanstelling as Direkteur van die Nasionale Navorsingsinstituut vir elektriese ingenieurswese.

G. C. THERON  
Verteenwoordiger.

## STANDING ADVISORY COMMITTEE ON ELECTRICAL SAFETY

This committee, under the chairmanship of Mr Middlecote, meets from time to time to deal with various aspects of electrical safety such as the application of earth leakage relays, fatalities due to electricity and other safety matters.

Under the chairmanship of Mr N. W. W. Bennett of the S.A.B.S., the committee is also closely associated with I.E.C. committee TC 61—safety of household electrical appliances, which was one of the largest and most active committees at the I.E.C. Brussels meeting, 1971.

It is in South Africa's interest to follow as closely as local conditions will permit, in our own National safety specifications, the recommendations of I.E.C. Manufacturers are well represented at these meetings and it is important that consumer organisations and particularly the A.M.E.U. must take an active part in the discussions and keep well informed on these requirements and specifications.

These new safety specifications will be in two parts: Part I—general requirements and Part II—additional requirements for specific appliances.

The existing compulsory specifications will ultimately be withdrawn and replaced by the new safety specifications.

G. C. THERON  
Representative.

## SOUTH AFRICAN BUREAU OF STANDARDS

### A. NATIONAL STANDARDISATION

During the period under review the following committees, on which representatives of the A.M.E.U. serve, were active:

**Ceramic and glass insulators for overhead lines with a nominal voltage greater than 1000 V.:**

C. Lombard and F. J. Sulter—Document finalised by the committee and being prepared for submission to the Council of the S.A.B.S.

**Code of practice for the control of electrostatic hazards in anaesthetizing and similar locations and Code of Practice for the installation, wiring and use of electrical equipment in anaesthetizing and similar locations:**

C. A. Anderson and L. Fletcher—Document being prepared for submission to the Council of the S.A.B.S.

**Compact transformer substations for use in public areas:**

P. J. Botes, N. I. Boyack, E. de C. Pretorius and

## VASTE RAADEWENDE KOMITEE VIR ELEKTRIESE VEILIGHEID

Hierdie komitee, onder die voorsitterskap van mnr. Middlecote, vergader periodiek om aandag te skenk aan verskillende aangeleenthede van elektriese veiligheid soos byvoorbeeld, toepassing van aardlekrelés, noodlottige ongelukke weens die gebruik van elektrisiteit en ander veiligheidsfaktore.

Met mnr. N. W. W. Bennett van die S.A.B.S. as voorsitter, werk die komitee ook nou saam met die I.E.K. komitee TC 61—veiligheid van huishoudelike elektriese toestelle—wat een van die grootste en mees aktiewe komitees op die I.E.K. vergadering in Brussels 1971, was.

Dit is in Suid-Afrikaanse belang om sover plaaslike toestande dit moontlik maak, die aanbevelings van die I.E.K. in ons eie nasionale veiligheidsspesifikasies na te volg. Vervaardigers word sterk by hierdie vergaderings verteenwoordig en dit is belangrik dat verbruikorganisasies en die V.M.E.O. in besonder, aktief aan die besprekings sal deelneem en op hoogte moet bly van die vereistes en die spesifikasies.

Die nuwe veiligheidsspesifikasies sal in twee dele verskyn: Deel I—algemene vereistes en Deel II—bykomstige vereistes vir besondere toestelle.

Die bestaande verpligte spesifikasies sal uiteindelik onttrek en deur die nuwe veiligheidsspesifikasies vervang word.

G. C. THERON  
Verteenwoordiger.

## SUID-AFRIKAANSE BURO VIR STANDAARDE

### A. NASIONALE STANDAARDISASIE

Gedurende die verslagtydperk was die volgende komitees waarop verteenwoordigers van die V.M.E.O. dien, aktief:

**Keramiek- en glisolatore vir bogronde lyne met 'n kernspanning groter as 1000 V:**

C. Lombard en F. J. Sulter—Dokument is deur die komitee voltooi en word voorberei vir voorlegging aan die Raad van die S.A.B.S.

**Gebruikskode vir die beheer van elektrostatiese gevare in narkose- en soortgeleke lokale en gebruikskode vir die installering, bedrading en gebruik van toerusting in narkose- en soortgeleke lokale.**

C. A. Anderson en L. Fletcher—Dokument word voorberei vir voorlegging aan die Raad van die S.A.B.S.

**Kompakte transformatorsustasies vir gebruik in openbare gebied:**

P. J. Botes, N. I. Boyack, E. de C. Pretorius en

R. M. O. Simpson — Document being prepared for comment.

**Compulsory specification for flexible cords :**

G. C. Theron and F. Turnbull — Document finalised by committee and being prepared for gazetting.

**Contactors :**

E. van Jaarsveld — A further meeting to be held.

**Copper products for electrical conductors :**

G. C. Theron and A. F. Turnbull — The project has been split into three specifications; the first dealing with busbars, the second with winding wires and the third with overhead conductors and has been expanded to include aluminium. New documents are being prepared.

**Distribution transformers :**

I. Boyack and F. L. Knobel — further meetings to be held.

**Electric stoves and hotplates :**

W. F. Cronje — A further meeting to be held.

**Fixed electric storage water heaters :**

A. J. Myburg — Document being prepared for comment.

**General requirements for the safety of electrical appliances :**

G. C. Theron — Part 1, dealing with the general requirements for all types of electrical appliances, has been finalised by the committee.

**Immersion heaters :**

A. J. van den Berg — A further meeting to be held.

**Immersion type thermostats for electric storage water heaters :**

A. Gerber — A further meeting to be held.

**Impregnated paper insulated electric cables :**

G. C. Theron and A. F. Turnbull — The documents were finalised and printed. The new specification combines the original two specifications for paper insulated cables.

**Insulation co-ordination :**

I. Boyack — Document being prepared for comment.

**Light dimmers :**

J. E. Heydenrych — A further meeting to be held.

R. M. O. Simpson — Dokument word voorberei vir kommentaar.

**Verpligte spesifikasie vir buigsame koorde :**

G. C. Theron en F. Turnbull — Dokument deur komitee afgehandel en word vir afkondiging voorberei.

**Kontaktors :**

E. van Jaarsveld — Nog 'n vergadering moet belê word.

**Koper-produkte vir elektriese geleiers :**

G. C. Theron en A. F. Turnbull — Die projek is in drie spesifikasies verdeel; die eerste handel met stroomgeleiers, die tweede met winddraad en die derde met bogronde geleiers, wat uitgebrei is om aluminium in te sluit. Nuwe dokumente word voorberei.

**Verspreidingstransformators :**

I. Boyack en F. L. Knobel — Nog vergaderings sal gehou word.

**Elektriese stowe en warmplate :**

W. F. Cronje — Nog 'n vergadering moet gehou word.

**Vaste elektriese opgaarwaterverwarmers :**

A. J. Myburgh — Dokument word vir kommentaar voorberei.

**Algemene vereistes vir die veiligheid van Elektriese toestelle :**

G. C. Theron — Deel 1, wat handel oor die algemene vereistes vir alle tipes elektriese toestelle, is deur die komitee afgehandel.

**Dompelverwarmers :**

A. J. van den Berg — Nog 'n vergadering moet gehou word.

**Dompeltipe-termostate vir elektriese opgaarwaterverwarmers :**

A. Gerber — Nog 'n vergadering moet gehou word.

**Deurdrekte papier-geïsoleerde elektriese kables :**

G. C. Theron en A. F. Turnbull — Die dokumente is voltooi en gedruk. Die nuwe spesifikasie kombineer die oorspronklike twee spesifikasies vir papier-geïsoleerde kables.

**Ko-ordinasie van isolering :**

I. Boyack — Dokument word vir kommentaar voorberei.

**Ligdempskakerare :**

J. E. Heydenrych — Nog 'n vergadering word belê.

**Non-current-carrying line fittings for overhead power lines :**

A. H. L. Fortman—Amendment for approval by Council of S.A.B.S.

**Oven thermostats for electric stoves :**

W. F. Cronje—A further meeting to be held.

**Part 2 of the code of practice for public lighting :**

F. Turnbull—Document being prepared for comment.

**PVC insulate electric cables and flexible cords :**

G. C. Theron and F. Turnbull—Document finalised and printed.

**Standard specification for non-sparking electrical equipment for use in class 1 division 2 locations :**

J. J. Barrie and A. H. L. Fortman—Project completed and approved by the Council of the S.A.B.S.

**Storage batteries for use in motor vehicles :**

J. Kriel—A further meeting to be held.

**The installation and maintenance of electrical equipment used in explosive atmospheres :**

L. B. Cumming and M. M. Sinclair—The committee decided to recommend to the Council of the S.A.B.S. that a further code of practice, i.e., "The Reduction of Explosive Hazards by Segregation, Ventilation and Pressurisation of Electrical Equipment" be drawn up. Approval for this has been granted.

It will be noticed that the S.A.B.S. was exceptionally active during the past year and the Association had to call on the help of numerous engineer members in order to man all the technical committees. The existing specifications had to be metricated and in many cases the opportunity was utilised to bring the specifications up to date in accordance with the latest techniques and materials. Whenever possible the assistance of members in the more distant centres are utilised but due to practical limitations, the greatest burden does fall on the members near the S.A.B.S. headquarters.

One exception here worthy of mention, is the rewrite of the Standard Regulations where the bureau personnel has regular meetings with regional committees throughout the country and only the co-ordinating work is done at headquarters. (D. C. Plowden and E. E. de Villiers—headquarters representatives).

**B. INTERNATIONAL ELECTROTECHNICAL COMMISSION**

Since the South African Bureau of Standards is the member body for South Africa of the International

**Nie-stroomdraende lyntoebehore vir bogronde kraglyne :**

A. H. L. Fortman—Wysiging gaan vir goedkeuring van die S.A.B.S.-Raad.

**Oondtermstate vir elektriese stowe :**

W. F. Cronje—Nog 'n vergadering word belê.

**Deel 2 van die gebruikskode vir openbare verligting :**

F. Turnbull—Dokument word vir kommentaar voorberei.

**PVC-geïsoleerde elektriese kables en buigsame koorde :**

G. C. Theron en F. Turnbull—Dokument voltooi en gedruk.

**Standaard spesifikasies vir nie-vonkende elektriese toerusting vir gebruik in Klas 1, Groep 2 gebiede :**

J. J. Barrie en A. H. L. Fortman—Projek afgehandel en deur die Raad van die S.A.B.S. goedgekeur.

**Opgaarbatterye vir gebruik in motorvoertuie :**

J. Kriel—Nog 'n vergadering word belê.

**Die installering en onderhoud van elektriese toerusting wat in plofbare lugmengsels gebruik word :**

L. B. Cumming en M. M. Sinclair—Die vergadering het besluit om by die Raad van die S.A.B.S. aan te beveel dat nog 'n gebruikskode opgestel word, naamlik „die vermindering van ontplofingsgevaar deur afsondering, belugting en drukvermeerdering van elektriese toerusting”.

Dit moet beklemtoon word dat die S.A.B.S. in die afgelope jaar besonder aktief was en die Vereniging moes die hulp van baie ingenieurslede inroep ten einde al die tegniese komitees te beman. Die bestaande spesifikasies moes gemetriseer word en in baie gevalle is daar van die geleentheid gebruik gemaak om die spesifikasies volgens die jongste gebruike en materiale op datum te bring. Waar moontlik word gebruik gemaak van die hulp van lede in die meer afgeleë sentrums, maar weens praktiese beperkinge val die grootste las op die skouers van die lede naby die S.A.B.S.-hoofkantoor.

Een uitsondering wat genoem moet word, is die herskrywe van die Standaardregulasies, waar die personeel van die buro gereeld vergadering met streekskomitees dwarsdeur die land hou en net die koördinerende werk op die hoofkantoor gedoen word. (Hoofkantoorvertegenwoordigers—D. C. Plowden en E. E. de Villiers).

**B. INTERNASIONALE ELEKTROTEGNIESE KOMMISSIE**

Aangesien die S.A.B.S. die Suid-Afrikaanse verteenwoordiger op die I.E.K. is en derhalwe moet



Electrotechnical Commission and per se reliant on the support of organisations such as the A.M.E.U. for successful participation the following short summary of participation since the last convention would be of interest.

1. The **35th Annual Meeting** held in Washington during the period 18 to 30 May, 1970, was attended by five delegates from South Africa. This meeting was attended by 1 322 delegates from 34 countries. There were altogether 509 half-day sessions for 60 different technical committees, sub-committees and working group meetings. South Africa participated in 12 different committees.

At the Council Meeting held during this gathering, South Africa had the honour, along with France and USSR, of being elected from 12 nominees to the Committee of Action, the technical executive committee of the I.E.C.

Mr A. A. Middlecote was also elected as Chairman of TC 64: Electrical Installations of Buildings, to replace Mr S. E. Goodall who had been elected President of the I.E.C. He automatically also became a member of the Advisory Committee on Safety (A.C.O.S.). This is an overall committee assigned the task of advising on co-ordination of the principles of safety in all the technical committees.

2. The meeting of TC 64: Electrical Installations of Buildings, held in Baden-Baden during September, 1970, was attended by Mr J. V. Grant.

3. The **36th Annual General Meeting** of the I.E.C. held in Brussels during the period 9 to 19th June, 1971, was attended by 11 delegates under the leadership of Mr A. A. Middlecote, Director, Electrical Engineering of the S.A.B.S.

At this stage, it may be useful to sketch what the I.E.C. is.

The I.E.C. exists to promote the harmonisation and, where possible, the unification of national electrical standards. Through its technical committees, it seeks to establish common standards for every kind of electrical and electronic product. 41 countries at present have I.E.C. National Committees which is represented in South Africa by the S.A.B.S. The commission is administered by a council on which all the National Committees are represented.

The Council delegates certain problems to a **Committee of Action** composed of **nine** National Committees, elected by the Council for a term of six years each. South Africa is at present a member of the Committee of Action.

Due to the large number of items on the agenda

staatmaak op die ondersteuning van organisasies soos die V.M.E.O. vir doeltreffende deelname, sal die volgende kort oorsig van werksaamhede sedert die laaste konvensie seker interessant wees.

1. Die **35ste jaarlikse vergadering** wat in Washington gedurende die tyd 18 to 30 Mei 1970 gehou is, is deur vyf afgevaardigdes uit Suid-Afrika bygewoon. 1 322 afgevaardigdes uit 34 lande was teenwoordig. Daar was altesame 509 halfdag-sessies vir 60 verskillende tegniese komitees, sub-komitees en vergaderings van die werkende groepe. Suid-Afrika het aan 12 verskillende komitees deelgeneem.

Op die Raadsvergadering wat gedurende die byeenkoms gehou is, het Suid-Afrika die eer te beurt geval om saam met Frankryk en Rusland uit 12 genomineerde lande tot die aksiekomitee verkies te word. Die aksiekomitee is die tegniese uitvoerende komitee van die I.E.K.

Mnr. A. A. Middlecote is ook tot voorsitter van TC 64: „Elektriese Installasies in Geboue“, verkies om mnr. S. E. Goodall wat as president van die I.E.K. benoem is, te vervang. Hy het ook outomatieslid van die raadgewende komitee vir veiligheid (A.C.O.S.). Hierdie is 'n oorkoepelende komitee wat die taak het om raad te gee insake die koördinasie van die beginsels van veiligheid in al die tegniese komitees.

2. Die vergadering van TC 64: „Elektriese Installasies in geboue“, wat gedurende September 1970 in Baden-Baden gehou is, is deur mnr. J. V. Grant bygewoon.

3. Die **36ste jaarlikse aalgemene vergadering** van die I.E.C. is gedurende 9 tot 19 Junie 1971 in Brussel gehou en deur 11 afgevaardigdes onder die leierskap van mnr. A. A. Middlecote, Direkteur Elektriese Ingenieurswese van die S.A.B.S., bygewoon.

Dit mag nou wenslik wees om te skets wat die I.E.K. eintlik behels.

Die I.E.K. bestaan om die aanpassing en waar moontlik die samesnoering van nasionale elektriese standaarde te bevorder. Deur sy tegniese komitees word gepoeg om gemeenskaplike standaarde vir alle moontlike elektriese en elektroniese produkte daar te stel. Die I.E.K. het tans nasionale komitees in 41 lande en word in Suid-Afrika deur die S.A.B.S. verteenwoordig. Die kommissie word geadmireer deur 'n Raad waarop al die nasionale komitees verteenwoordig is.

Die Raad deleger sekere probleme aan die **Aksiekomitee** bestaande uit **nege** nasionale komitees en word deur die Raad geskies vir 'n periode van ses jaar. Suid-Afrika is tans lid van die Aksiekomitee.

Weens die groot getal items op die sakelyst van

of the Brussels meeting which were of direct interest to consumers particularly the safety aspect, the Executive Council decided to send an A.M.E.U. representative with the South African contingent. The group, consisted of three S.A.B.S. members, one from the S.A.B.C., six representatives from manufacturers and the A.M.E.U. delegate.

The General Meeting was attended by 1 016 delegates from 32 countries.

There were altogether 194 half-day sessions for 41 different technical committees, sub-committees and working group meetings.

South Africa was active in 20 of the meetings as well as in those of A.C.O.S., the Council and the Committee of Action.

I.E.C. specifications are very important for international trade and particularly so for South Africa who is struggling to build up export markets. These specifications also effect the quality of imported articles and thus very directly the local consumer and his safety. The S.A.B.S. is very much alive to both sides of the picture, but in the face of the very strong manufacturers' delegations at these meetings, the A.M.E.U. should endeavour to support the S.A.B.S. as much as possible.

We also want to place on record, the sterling work done by the leader of the delegation, Mr Middlecote of the S.A.B.S. As a result of hard work over many years, he has secured for South Africa a seat on the Committee of Action as well as the secretariatship of a number of technical committees. Only by this means can South Africa hope to influence the formulation of international specifications which are vital for our export trade. Mr Middlecote's opinions are often called for in meetings and he has established for South Africa a status at the I.E.C. not to be underestimated. We want to thank him for his leadership and personal sacrifices.

G. C. THERON  
Co-ordinating Representative.

van die Brusselvergadering wat van direkte belang vir verbruikers was, in besonder die veiligheidsaspek, het die Uitvoerende Raad besluit om 'n V.M.E.O. verteenwoordiger saam met die Suid-Afrikaanse afvaardiging te stuur. Die groep het bestaan uit drie S.A.B.S. lede, een van die S.A.U.K., ses verteenwoordigers van vervaardigers en die V.M.E.O. verteenwoordiger.

Die algemene vergadering was bygewoon deur 1 016 afgevaardigdes uit 32 lande. Daar was altesame 194 halfdag-sessies vir 41 verskillende tegniese komitees, sub-komitees en werkende groepvergaderings.

Suid-Afrika was bedrywig in twintig vergaderings, sowel as die van die A.C.O.S. (Raadgewende Veiligheidskomitee), die Raad en die Aksiekomitee.

I.E.K. spesifikasies is baie belangrik vir internasionale handel en in besonder so vir Suid-Afrika wat veg om uitvoermarkte op te bou. Hierdie spesifikasies raak ook die kwaliteit van ingevoerde artikels en dus direk ook die plaaslike verbruiker en sy veiligheid. Die S.A.B.S. stel 'n lewendige belang in albei kante van die prentjie maar het die werklike steun van die V.M.E.O. nodig in die vergaderings waar vervaardigers sterk verteenwoordig word.

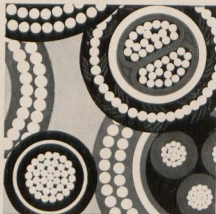
Ons wil ook die uitstekende werk deur mnr. Middlecote van die S.A.B.S., wat die afvaardiging geleidelik aanteek.

Deur harde werk oor baie jare, het hy vir Suid-Afrika 'n plek op die Aksiekomitee, sowel as die sekretarisskap van 'n aantal tegniese komitees, verower. Net deur hierdie kanale kan Suid-Afrika hoop om die opstel van internasionale spesifikasies wat vir ons uitvoerhandel so lewensbelangrik is, te beïnvloed.

Mnr. Middlecote se mening word dikwels in komitees gesoek en hy het vir Suid-Afrika 'n status by die I.E.K. opgebou wat nie onderskat moet word nie. Ons wil hom vir sy leierskap en persoonlike opoffering bedank.

G. C. THERON  
Koördinerende Verteenwoordiger.

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## STANDARD VOLTAGES

Discussion on the following memorandum will be introduced by a representative of the South African Bureau of Standards.

The primary requirement for a rational approach to the manufacture of electrical equipment is reduction in variety. This gives the manufacturer an opportunity of taking advantage of longer production runs and the classic volume-cost relation gives rise to better quality at a lower price.

There are also obvious advantages to the supply industry particularly as regards replacement, maintenance and reduction of stocks of spares. This in addition to design advantages.

The fundamental requirement for reduction in variety is the acceptance of standard voltages. It is therefore proposed that, in the interests of the power supply industry as well as the manufacturing industries of the Republic, the following be accepted as the standard voltages in the Republic and be so declared by the South African Bureau of Standards.

**1.0 Standard Low Voltage.** 38/220 V three-phase. (This is declared in the Electricity Act).

### 2.0 Standard High Voltages.

Highest voltage kV r.m.s.	3,6	7,2	12	24	36	52
Nominal voltage kV r.m.s.	3,3	6,6	11	22*	33	44†
Highest voltage kV r.m.s.	72,5	100	145	245	300	400
Nominal voltage kV r.m.s.	66	88†	132	220	275	400

\* Non-preferred standards to be phased out in the future.

† Preferred for rural distribution only.

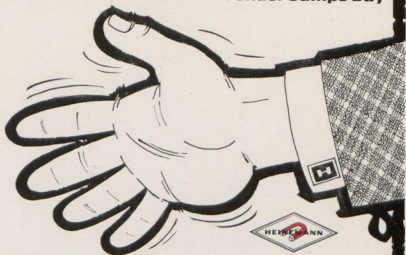
It is further recommended that a concerted effort be made to bring supply systems, particularly low voltage supply systems, in line with the abovementioned standard voltages.

# HEINEMANN

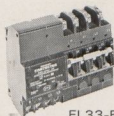
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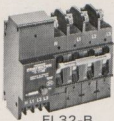
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EL32-B



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EP12-S

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