

THE ASSOCIATION OF MUNICIPAL  
ELECTRICITY UNDERTAKINGS  
OF SOUTH AFRICA

DIE VERENIGING VAN MUNISIPALE  
ELEKTRISITEITSONDERNEMINGS  
VAN SUID-AFRIKA



1974

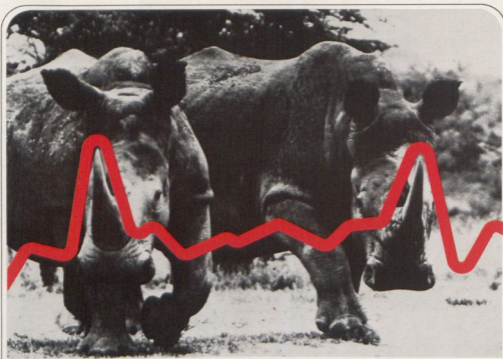
TECHNICAL MEETING PROCEEDINGS  
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ROODEPOORT

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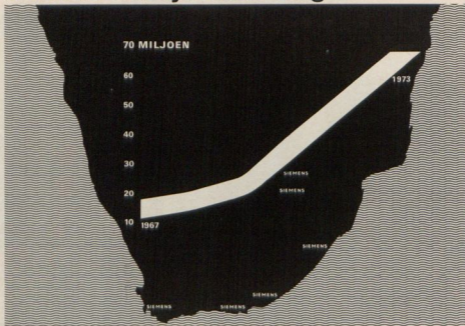
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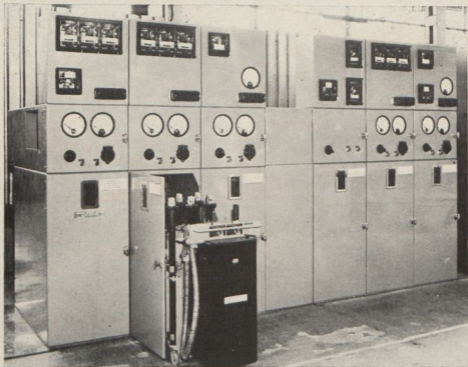
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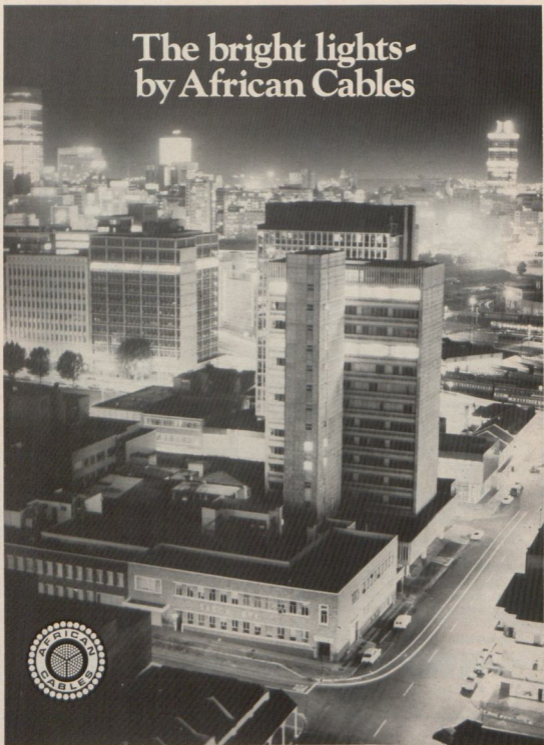
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**TECHNICAL MEETING PROCEEDINGS  
CITY HALL**

**TEGNIËSE VERGADERING -  
VERRIGTINGS STADSAAI**

**OFFICIAL PROGRAMME**

**ROODEPOORT**

**AMPTELIKE PROGRAM**

**THURSDAY, 16th MAY 1974**

8.00 a.m.	Registration
9.00 a.m.	Assembly and Welcome
9.15 a.m.	Official Opening His Worship the Deputy Mayor Councillor W.J. de Vos
9.30 a.m.	Members' Forum
10.25 a.m.	Refreshments
10.45 a.m.	Members' Forum
12.40 p.m.	Luncheon HOST: Siemens S.A. (Pty) Ltd.
2.00 p.m.	Members' Forum
3.15 p.m.	Refreshments
3.30 p.m.	Members' Forum
4.15 p.m.	Discussions of Reports
5.00 p.m.	Adjournment
from 5.30 p.m. to 8.30 p.m.	Civic Reception City Hall

**DONDERDAG, 16 MEI 1974**

Registrasie	8.00 vm.
Byeenkoms en Verwelkoming	9.00 vm.
Amptelike Opening deur sy Agbare die Onder-Burgemeester. Raadslid W.J. de Vos	9.15 vm.
Ledeforum	9.30 vm.
Verversings	10.25 vm.
Ledeforum	10.45 vm.
Midagete	12.40 nm.
<b>GASHEER:</b> Siemens S.A. (Edms.) Bpk.	
Ledeforum	2.00 nm.
Verversings	3.15 nm.
Ledeforum	3.30 nm.
Bespreking van Verslae	4.15 nm.
Verdaging	5.00 nm.
Burgemeester-onthaal Stadsaal	van 5.30nm. tot 8.30 nm.

**FRIDAY, 17TH MAY 1974**

**VRYPDAG 17 MEI 1974**

9.00 a.m.	<b>THEME:</b> "New Developments in the field of Audio Frequency Signal Transmission over power mains" <b>SPEAKER:</b> Mr. E. Bauman Vice President of Zellweger Uster Ltd. Switzerland
10.00 a.m.	Refreshments
10.30 a.m.	Discussion on Paper
11.30 a.m.	Discussion of Reports
12.30 p.m.	Luncheon HOST: Hawker Siddeley Electric ATW (Pty) Ltd.
2.00 p.m.	<b>THEME:</b> "The application of sensi- tive earth leakage protection relays to L.V. and H.V. Overhead lines." <b>SPEAKER:</b> Mr. V. Cohen Chief Designer of Fuchs Electrical Industries (Pty) Ltd.
3.00 p.m.	Refreshments
3.30 p.m.	Discussion on Paper
4.45 p.m.	Closure by President

<b>TEMA:</b> „Nuwe ontwikkelings op die ge- bied van Oudiofrekwensieintra- missie deur die kragnet.“	9.00 vm.
<b>SPREKER:</b> Mnr. E. Bauman Vise-President van Zellweger Uster Ltd. Switzerland	
Verversings	10.00 vm.
Bespreking van Referaat	10.30 vm.
Bespreking van Verslae	11.30 vm.
Midagete	12.30 nm.
<b>GASHEER:</b> Hawker Siddeley Electric ATW (Edms) Bpk	
<b>TEMA:</b> „Die aanwending van sensitiewe aardlekbeveiliging op bogronde laagspannings- en hoogspannings- geleidings.“	2.00 nm.
<b>SPREKER:</b> Mnr. V. Cohen Hoof-Ontwerper van Fuchs Elektriese Nywerhede (Edms) Beperk.	
Verversings	3.00 nm.
Bespreking van Referaat	3.30 nm.
Sluiting deur President	4.45 nm.

**LADIES PROGRAM**

**THURSDAY, 16TH MAY 1974**

**PROGRAM VIR DIE DAMES**

**DONDERDAG, 16 MEI 1974**

8.00 a.m.	Meet at the City Hall, Roodepoort.
9.00 a.m.	Attend opening ceremony.
9.30 a.m.	Leave by bus to the flower farm of Messrs. Harry de Leeuw & Co., Little Falls.
12.30 p.m.	Luncheon at City Hall
	<b>AFTERNOON FREE</b>

Ontmoeting by die Roodepoortse Stadsaal.	8.00 vm.
Woon die openingsplegtigheid by. Vertrek met 'n bus na die blomplas van mre. Harry de Leeuw en Kie, Little Falls.	9.00 vm. 9.30 vm.
Midagete by die Stadsaal	12.30 nm.

from 5.30 p.m. 8.30 p.m.	Civic Reception City Hall
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Burgemeester-onthaal Stadsaal	van 5.30 vm. tot 8.30 nm.
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**FRIDAY, 17TH MAY 1974**

**VRYPDAG, 17 MEI 1974**

9.00 a.m.	Tour Roodepoort Tea with the Mayoress at the Florida Lake.
12.30 p.m.	Luncheon at City Hall
	<b>AFTERNOON FREE</b>

Toer deur Roodepoort Burgemeestersvrou bied tee aan by die Florida Meer.	9.00 vm.
Midagete by die Stadsaal	12.30 nm.
<b>MIDDAG VRY</b>	

# The Electrical Contractors' Association

(SOUTH AFRICA)



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Honorary Members	2
Engineer Members	58
Associates	5
Associate Members	10
Affiliates	69
Councillors	7
Organisations	20
Ladies visitors	40
<b>TOTAL ATTENDANCE</b>	<b>211</b>
Apologies	30

Erelede	2
Ingenieurslede	58
Geassosieerdes	5
Assosiaatlede	10
Geaffilieerdes	69
Raadslede	7
Organisasies	20
Damesbesoekers	40
<b>TOTALE BYWONING</b>	<b>211</b>
Verskonings	30

## V.M.E.O. TEGNIESE VERGADERING: ROODEPOORT A.M.E.U. TECHNICAL MEETING : ROODEPOORT 16/17 Mei/May 1974

### Opening Session - Thursday 16th May, 1974.

The President, Mr. J.C. Waddy, opened the proceedings by extending a hearty welcome to all the delegates present.

Dr. J.G.W. Roos: Open die verrigtinge met skryflesing en gebed.  
The President: Dankie Dr. Roos. Now ladies and gentlemen in the programme that was circulated earlier it was stated that the official opening ceremony would be carried out by the then Mayor Councillor du Plessis, but he has been elected to Parliament and has now resigned as Mayor, but I'm sure we are very pleased to have with us His Worship the Deputy Mayor Councillor W.J. de Vos, and I will now ask him to perform the opening ceremony and welcome you to Roodepoort.



RDL/CLR. W.J. De Vos  
ONDER-BURGEMEESTER VAN ROODEPOORT  
DEPUTY MAYOR OF ROODEPOORT

Die Onder-Burgemeester W.J. de Vos: Mnr. die President, en lede van die Uitvoerende Bestuur, lede van die V.M.E.O., geaffilieerde lig-games, dames en here, laat my toe om 'n besondere woord van welkom namens ons dorp Roodepoort aan u almal te rig en die hoop uit te spreek dat u verbyf hier by ons baie aangenaam en die besprekings baie suksesvol sal wees. We are indeed privileged to welcome you all here and I would like to thank your Executive for the honour that this Technical Meeting is being held here in Roodepoort this year.

Laat my toe om u kortliks in te lig oor Roodepoort, u wat nie veelt weet van Roodepoort nie. Dit is 'n uitgestrekte area wat eintlik bestaan het eers uit drie dele - Roodepoort, Maraisburg en Florida, maar wat nou saamgevoeg is in wat ons eintlik noem Roodepoort, 'n myn-dorpje met 'n beskeie bestaan tot met 25 jaar gelede, beslaan vandag 'n gebied van nie minder nie as 148 vk.km en eersdaags word 'n groot deel van Honeydew ook ingelyf. Indien die huidige groeikoers gehandhaaf kan word sal Roodepoort in 1980 'n bevolking van 80 000 blankes hê, in 1990 hoort ons sowat 97 000 blankes en 117 000 blankes teen die jaar 2000 sonder die Honeydew-gebied in ag geneem is. Bogenoemde groei is feitlik verseker aangesien om myngronde beskikbaar geword het vir nywerheidsgebruik.

Roodepoort is ook besonder gunstig geleë ten opsigte van dienste terwyl die Suid/Westelike Bantoe-dorpe 'n onontreflike arbeidsbron is. I believe that your Association was formed to promote the interest of Municipal Electrical Undertakings of South Africa and to collaborate with other technical bodies. To bring together Municipal Councillors, Electrical Engineers and all persons interested in the advancement and development of undertakings, to promote wider contact and exchange of views, to arrange and hold conventions and technical meetings for the reading of papers and the discussion of subjects appertaining to undertakings and to make recommendations and matters requiring common action. To form branches consisting of member undertakings with common interest. To take such action as may be lawful and expedient for the protection and promotion of the rights and interests of member undertakings and members. These gentlemen, are very high ideals you have set yourself and I trust that today's and tomorrow's deliberations will help to further these aims.

Ek verstaan dat die Vereniging van Munisipale Elektriesiteitsonder-nemings van Suidelike Afrika normaalweg elke tweede jaar 'n kongres en die jaar tussenin 'n tegniese vergadering hou.

Daar vanjaar se twee dae in beslag geneem gaan word met tegniese aspekte sal die eerste dag aan die lede-forum gewy word waar wesenlike probleme met elektrisiteitsvoorsiening bespreek word. Die vroeë is reeds vooraf aan u geskik, vorderingsverslae van die verskillende sub-komitees soos bv. die opstel van standaardspesifikasies en oor die opleiding van personeel, ens. word vandag gehoor. Mnr. Baumann die vise-President van Zellwegger-Uster in Switserland gaan more-oggend 'n referaat lewer. Die firma Zellwegger het ondermeer die apparaat vir die afskakeling van warmwaterverhitters aan Roodepoort verskaf. Hierdie toerusting het die mandaatlike vraagfaktor van Roodepoort, wat uitsluitlik oor huishoudelike gebruik beskik met  $\pm 10\%$  verhoog. Ek verstaan dat dit 'n besparing op die Evkom-rekening meegebring het. Die firma het nou die toerusting so verbeter dat alarmering vanaf enige plek in die netwerk na die hoofstasie terug-gesien kan word. Ons sal graag na hierdie referaat wil luister. Mnr. Cohen, hoof-ontwerper van Fuchs Elektriese Nywerhede, 'n baie bekende firma in Suid-Afrika, gaan 'n referaat oor die beveiliging van bognronde geleidings lewer. Mnr. Waddy, die Stadsselektrotegniese Ingenieur van Pietermaritzburg wat in 1973 op Pietermaritzburg President van u Vereniging geword het, is veral besonder welkom by ons aangesien mevr. Waddy se familie in Roodepoort woon en hulle dus nie vreemdelinge hier is nie. Die elektrisiteitsafdeling van Roodepoort wat reeds  $\pm 72$  km van 33kV kabels in die netwerk het, gaan eersdaags 'n 88-kV leiding gebruik om tevoer deur die bestaande dorp na die noordelike nuwe gebiede oor te stuur om  $\pm 25$  000 nuwe erwe te bedien, en binnekort word 'n geafofiseerde sentrale beheerstelsel in werking gestel om die verskillende spanningsverlagingssubstansies te beheer. During the past financial year the electricity unit consumption increased by 13.35% whilst the average annual increase of the past ten years was only 10.25%.

This year tenders for the main supply of the northern areas are being called for. This main supply consists of two 88 000 volt cables through the centre of Roodepoort to Kloofdam, from there the distribution will be taken further at 33 000 volts. In 1973, 299 109 258 units were brought while the maximum demand was 60 117 kv. Meneer die President, dames en here, met die paar woorde is dit nu inderdaad my voorreg om die Tegniese Vergadering van die V.M.E.O. as amptelik open te

verklar. Mr. President, ladies and gentlemen, it is my pleasure to declare this meeting formally opened.

**The President:** Thank you Your Worship for those kind and very interesting introductory remarks. I would also like to welcome the Town Clerk of Rooledoort Mr. du Toit. He is well known to all of us because he contributed to one of our recent gatherings by reading a paper. Very nice to have you with us Mr. du Toit. Also we have two honorary members with us and we're very pleased to have them - there is Mr. Rossier who is now living in Pretoria, and Mr. Simpson of Durban, very welcome.

Our first Quizmaster for today is Mr. Fortmann of the Highveld Branch and I'll hand you over to him.



CHAIRMAN: A.H.L. FORTMANN: VOORSITTER

#### QUESTIONS:- HIGHVELD BRANCH

**Mr. Fortmann:** Thank you Mr. President and good morning gentlemen.

Die eerste vraag wat ons het, is van mnr. Eugene Pretorius (Potchefstroom) en dit gaan oor die toets van juistheid van meters, ek sal dit lees -

#### TESTING THE ACCURACY OF METERS

1.1 Sub-section 9(2) of the (Tvl.) "Standard Electricity Regulations" reads as follows:-

"The engineer's finding as to the accuracy of a meter after the test referred to in subsection (1) has been carried out shall be final and a meter shall be deemed to be registering correctly if it is shown by that test to be over- or under-registering by not more than an average of five per cent when tested in accordance with the code of practice of the South African Bureau of Standards for the testing of electricity meters or in accordance with procedure laid down by the engineer."

1.2 My department test meters at unity power factor and 100%, 50%, and 5% of the rating of the meter, as well as at 0.5 power factor and 100% rating, which complies with the relevant S.A.B.S. code of practice.

1.3 In order to determine the "average" fault, the average of the four fault values thus obtained, is taken.

1.4 Personally I feel that greater weight should be attached to the fault value at unity power factor and 50% rating, because, in my opinion, the largest consumption takes place at these load conditions, certainly as far as domestic consumers are concerned.

1.5 I regard the test at 0.5 power factor as unrealistic and the lowest weight should be attached to the corresponding fault value.

1.6 I should like to know how other suppliers who are members of our Branch, determine the "average" fault.

1.7 What do members think of the following "fault weights"?

(a) Unity power factor: 100% rating: 3

(b) 50% rating: 4

(c) 5% rating: 2

(d) 0.5 power factor : 100% rating: 1

1.8 Let us assume that the fault values are as follows:-

(a) + 1.2%; (b) - 1.0%; (c) - 2.3%; (d) + 5.0% (most unlikely!)

According to the method described in 1.3 above, the "average" fault will be  $(1.2 - 1.0 - 2.3 + 5.0) \div 4 = 0.73\%$ . According to the method described in 1.7 the "average" fault would, however be  $(3 \times 1.2 - 4 \times 1.0 - 2 \times 2.3 + 1 \times 5) \div 10 = 0\%$ .

**Mr. E. de C. Pretorius:** This sub-section 92, I think is peculiar to the Transvaal Standard Electricity By-laws. I don't know if this appears in any other Standard Supply By-laws of any other province. Ek weet die S.A.B.S. mense gaan my, soos hulle in engels se, „shoot me down in flames“, want die betrokke gebruikskodes vir die toets van elektrisiteitsmeters van die Buro van Standaarde lê meer dat die persentasie fout van 'n meter by enige een van hierdie waardes waarby dit getoets word mag nie 2.5% oorskry nie. Dit is so aan die een kant, aan die anderkant is daardie bepaling in hierdie Standaard Elektrisiteitsverordeninge. Ek noem dit maar net om my kant van die saak skoon te hou, ek wil nie graag met die Buro van Standaarde in omni leef nie en ek het verder niks by te voeg in wat hier in die agenda is, ek het niks om hier by te voeg nie.

**Mr. W. Barnard (Johannesburg):** I think at the outset I should make the point that this 5% probably originated from the Johannesburg by-laws and when the Transvaal province attempted to draw up standard by-laws the 5% was carried forward into the standard by-laws.

The question posed was: what was our opinion of the weighting factors which has been proposed by Mr. Pretorius, and quite candidly we can't see any value in these weighting factors.

As far as I can see the only purpose is in order to arrive at an acceptable accuracy. In Johannesburg the meters purchased are purchased to a specification which lays down a .5% accuracy on full load,  $\frac{1}{2}$ -load and  $\frac{1}{4}$ -load, and a .8% accuracy on 1/80th load.

The reason for this is the fact that we have today standardised on a 80 Amp meter and we feel that it is essential that small consumers should not suffer and have inaccurate meter recordings at very low loads.

Referring to the power factor test, we have taken a number of tests of domestic consumer installations and we find that it is becoming more and more common to have a power factor of .5 and less. This is probably the result of the large number of swimming pool motors, air-conditioners, refrigerators and other type of industrial loads being installed in domestic premises these days.

In actual fact, in testing meters, we have never had any problems in getting accuracies of .5% and less over the full range of tests that have been laid down. For this purpose we find very little value in trying to either lower your accuracy figures or to try and accept an accuracy beyond 5%.

**Mr. I.H. Hess:** (Cape Town): The procedure we have in Cape Town we find somewhat different to this, we work to our own supply of regulations on a normal basis of + and - 2 1/2% accuracy when we're dealing with meters which are faulty. We test new meters in accordance with the S.A.B.S. requirements, but when it comes to disputed or rather faulty meters where the consumer disputes the reading, firstly, we're not the final authority, the consumer has the right to have this meter tested at his cost by an independent authority. When it comes to testing the meter we just do the normal tests of  $\frac{1}{4}$ ,  $\frac{1}{2}$  and full-load and provides within + and - 2 1/2%, then it complies with our wiring regulations.

I must sound rather surprised to hear Mr. Barnard say that they find that the power factor in domestic consumers installations can be as low as 0.5. We, as far as I know, we haven't taken an actual survey, work on the basis that its pretty near unity power factor, in fact one of our problems on the system in the whole is leaning power factor because of the long cable installations, but we find that the power factor generally is so close to unity that I will agree with Mr. Barnard there that we don't see any merit in trying to have a loaded method of testing.

**Mr. D.H. Fraser (Durban):** In Durban we also work to a 2 1/2% accuracy limit and the consumer is refunded the test fee and adjustment made to the account if the accuracy goes outside those limits. In Durban we go about in a different way I think from what has been described previously because we installed a checked meter which has been previously tested and calibrated and this is to an accuracy of about 0.5%, we install this for a period of about a month in series with the meter that is suspected, so that the consumption recorded there is under actual operating conditions and takes the count of the consumer's power factor and his load characteristics, then independently the

meter after it is returned is subjected to the normal tests that's been described by Mr. Hess and Mr. Barnard.

It might be interesting to note that in a 12-month period, this is from September 1972 to October 1973, there were 255 tests carried out and only three of these were outside the 2½% limit, two were under, registering, one to the extent of 7,14% and another to the extent of 3,15%, the one that was over-registering was to the extent of 130% and was obviously subjected to lightning.

Mr. Chairman, I too was surprised to hear that power factor as low as 0,5% are found in Johannesburg and I think we'll need to subject some of our consumers with higher air-conditioning installations to similar tests and I think if we find those down the front level we'll have to get them to do something about their power factor, so we don't in fact use the 0,5% power factor test in deciding whether the meter is registering correctly or not.

I have reservations about the advisability of applying weightings to the different readings taken at unity power factor, and the statement that the 50% lowered unity power factor value represented the largest consumption is open to question, because the average domestic user correctly operates for the majority of the town at very low load value.

Of course the percentage consumption is not related to the town, but I do not think that this suggestion of a loading factor really warrants adoption, I think correct testing procedures and testing under actual operating conditions as we do is sufficient safeguard. Thank you.

The Chairman: Thank you Mr. Fraser. I don't think you mentioned what your findings were with regard to testing the meter in series with the good one and then testing it afterwards, what were your findings there, and did they compare favourably?

Mr. D.H. Fraser: Mr. Chairman, certainly to the extent of confirming the limits, as I say there were only three that were outside of the 2½% limit in this period that I mentioned, and the test results confirmed what was found on the checked meter. Thank you.

The Chairman: Thank you Mr. Fraser. I think actually Mr. Pretorius's problem is also the legality of this testing method. I don't know if the S.A.B.S. can throw some light on the subject.

Mr. van der Walt (S.A.B.S.): Mr. Chairman, the question of the average value on any of these meters, one must remember that a kilowatt-hour meter is a recording meter, it only gives you the end value, so any fault or percentage error figure that you got for these various points on the scale is of no use to you because you can't work back on it, you got no indication what the power factor was over this period or between what limit it varies, the loading factor, etc., so I would suggest that one view this 5% a top limit, that none of these values at any point should go beyond the 5%. Further, I would like to say the 2½% which is laid down in the code, I should think is fairly adequate, one could get oneself in grave danger with this averaging, e.g., you know 10 minus 10 is 0.

Mr. H. Barnard (Brakpan): By my is daar net twee vrae wat opduik as gevolg van hierdie toets, die eerste een is - na aanleiding van ons geval waar daar na baie meters getoets word, nie, word alle nuwe meters ook getoets voor hulle geïnstalleer word, en die tweede vraag is - hoe word hierdie meters gehanteer om te verseker nadat hulle so akkuraat ingestel is by die tyd dat hulle geïnstalleer is, of hulle akkuraatheid nog so hoog is soos hierdie toets wat hulle daarvoor stel.

Mr. J.A. Loubser (Benoni): Mnr. die Voorsitter, in Benoni het ons nog nooit soveel moete gedoen om soveel aandoing aan 'n onderwerp te gee wat vir ons so min probleme gee nie. Ek wil nou sê, in die jaar wat ek aan meters, metertoets, toetsresultate moes waarnaem was daar slegs wat buitenaardig die perke was soos neergelê deur die S.A.B.S., gewoonlik bekommer ek my nie veel daaroor of ons gewone rekenkundige gemiddeldes moet vat of kenwaars daaraan moet heg nie, verdere ondervinding het ons geleer dat die akkuraatheid van die meters selfs na baie jare diens nog sodanig is dat dit vir ons eintlik heeltemal onnodig is om dit te toets, jy weet die gewone verbruiker kla gewoonlik nie na die wintermaande, kla hulle hulle meters is foutief en dan het 'n mens 'n stapel van die meters wat jy moet laat toets en hulle is gewoonlik almal reg, as gevolg daarvan het ons ons metertoets-fooi onlangs opgeskaf vir 'n minimale R2-per meter na R10 per meter, en glo vir my ek doen dit doeltreffend om die mense te probeer afskrak, want hulle meters is akkuraat, en ek glo werklik nie ons hoef ons te veel te bekommer oor kenwaars aan daardie verskil in fout te heg nie.

Voorsitter: Mnr. Loubser, ja, ek wonder, ek dink dit is maklik om te sê ons moet ons nie daaraan steur nie, ek wonder net hoe die wetlike aspek van so-iets is, mits daar nou 'n persoon is wat 'n klage het oor sy meter wat foutief is en nou word die meter getoets, en dan pas ons hierdie waardes van 5% gemiddeld, ek dink dit is eintlik 'n klein Pretorius se groot probleem. Is die legality of our testing methods. I wonder if any one could throw some light on this aspect?

Mr. I.H. Hess (Cape Town): I'm very much in agreement with Mr. Loubser. Over the years we've been keeping very accurate records on the faults we find in meters, we found that there are so few that we really now have come to the conclusion that if we just take sample testing, we are thinking in terms of testing 10% of each sample of new meters, and if we find no fault in those, then we are going to accept the rest as being in accordance with the standards.

As far as the meters in consumers' premises are concerned, we have a fee of R5 which the consumer has to pay if he wants his meter tested. Now we are finding, because of change of tariff, that we in the last few years, we have had a terrific number of complaints and requests for this test we made. We will barely be able to keep up with this. For the

reasons we change our tariff, the domestic tariff to a state unit tariff, not even a block tariff. Now obviously when it gets to the winter and as the consumer's consumption doubles, his account now doubles, where as previously the room charge tended to delay at a certain extent. But where the meter's been in for a period of ten years or more then we do not make any charge for testing the meter. We just replace the meter as a matter of course, and then of course test the old meter.

Mnr. E. de C. Pretorius (Potchefstroom): Mnr. Barnard van Johannesburg het gesê dat hierdie sub-artikel in die Transvaalse Standaardelektreïteitsverordeninge is eintlik Johannesburg se skuld dat dit daar gekom het. Ek het al lankal toe die gevolgtrekking gekom dat hierdie bepaling in die Transvaalse verordeninge eg wettenskaplik is. Die enigste wettenskaplike manier om 'n meter te toets, is soos mnr. v.d. Walt gesê het.

Mnr. P.J. Botes (Roodepoort): Dit wil vir my voorkom asof ons iets wil ingewikkeld maak dan moet ons dit vir mnr. Pretorius gee. Dan sal ons dit alleen met 'n rekenoutomat kan uitwerk. Ek vind baie min meters is foutief, gedurende die jaar. As ek nou rofweg noem, dan noem ek 'n syfer van sê op die uiterste 2 meters 'n jaar. By ons is daar sowat 25 000 aansluitings. So ek weet nie of dit moeties werd is om so 'n laawaai op te skop nie, maar ek stem saam dat die beste toets wat 'n mens kan kry is om dit by die volrag te neem. Ek wil net noem, die geval waar ons 'n meter gehad het wat omtrent + 15% fout gehad het op volrag en by die laevrag was dit omtrent minus 15% gewas. So die gemiddelde was dus 0 gewas.

So daardie geval word gekry maar ek voel dat die tout is so klein by jou laevrag, dat mens lievers maar 'n jou hoëvrag moet toets. Maar ons moet 'n besluit kry oor die ding dat ons almal dieselfde kan toets. Dit help nie dat die een so toets en die ander een dit anders doen nie. Kan ons miskien 'n vaste besluit kry of rigting kry wat ons in die toekoms gaan doen in Transvaal?

Voorsitter: Dankie Mnr. Botes. Ek wil net sê ek moet toe 'n mate saamstem dat tot sover het dit darem goed gewas. Ek glo nie een van ons ingenieurs hier, het nog ooit eintlik 'n probleem gehad nie. Ek sê nie dat dit nie kan kom nie, en ons doen dit natuurlik binne die perke van die wet al is die wet nie baie doeltreffend miskien nie.

Mr. E.H. Surtees (Boksburg): I feel I can understand Mr. Pretorius's problem there; you have a by-law that says that you have to test a meter within a certain accuracy. You got to relate this accuracy to something and there seem to be so many variables. So what I think he feels that you should do this and relate it to the most practical condition. However, the chance of a meter altering is so remote that this is not really a tremendous problem. When you consider a meter, what is there really to go wrong. I mean firstly, you probably have problems with your potential coil or problems with bearings which are likely to cause probably the greatest causes of inaccuracy and in this case what actual load are you going to affect. So really to try and relate an inaccuracy to any particular load is a very difficult thing. The margin given of 5% would take care of most problems I feel. So if in the first instance the meter was actually tested correctly this figure of 5% would more than cover any inaccuracy that would be caused in meters except perhaps in extreme cases where we have actually found meters to be inaccurate for example the magnet in some cases; for some reasons unknown to myself the demagnetisation cause a meter to run exceptionally fast. But here you have a clause in your by-laws which allows you to compensate the consumer for an inaccuracy in a meter which is actually a reality so the thing is, you have to have some clause to go by which states a figure for example of 5% but to try and bring it down to any specific little item for example fractions of load is really not a great problem.

Chairman: Thank you Mr. Surtees. Well, I think the suggestion made by Mr. Botes that we ask for or get a decision on this is referred to the Highveld Branch.

## 2

### PROBLEMS ENCOUNTERED IN THE USE OF LOW TENSION CROSS-LINKED POLYETHYLENE INSULATED CABLES

The following problems have been encountered:-

- 1 The insulation is easily damaged and perforated, even by blunt objects such as pebbles.
- 2 The last 30 meter or so on several drums of this cable have been received in a seriously damaged condition from the factories.
- 3 At any, even the smallest, perforation of the insulation, disintegration of the aluminium conductor sets in, even in relatively dry ground after barely 3 months.
- 4 Apart from discontinuing the use of this cable, can anyone offer a solution?

Mnr. E.E. de Villiers (Rustenburg): Net 'n baie vinnige woordjie ter inleiding, ter gerugvering van die fabrikante miskien. Ons het verlede week uiteindeklik 'n baie lang gesukkel verteenwoordigers daar in Rustenburg gehad wat ons saak 'n bietjie wil opneem. Ongelukkig kon ek nie hulle persoonlik te woord staan nie maar dit is vir my gesê hulle is op dié stadium eintlik ook nie baie angstig om die saak vandag hier te bespreek nie. Ek het vermoed hulle gaan dalk iemand hier hê. Lyk

my hier is nie iemand nie. As hier iemand is sal ons bly wees om te hoor wat hulle sê. Maar ek dink daar is baie ander van my kollegas wat dieselfde probleem ondervind het. Daar is ander van my kollegas wat geen simpatie met my het nie want hulle het vir my gesê, jy wil nou afwyk van die S.A.B.S. kabela. Dit is jou eie skuld. Nou dit is maklik om dit te sê. Ons het baie groot verligtings geokester van die kabel omdat dit 'n geweldige groot finansiële besparing in die hand werk, veral op die verbruikers-aansluitings se kostes. Nou ongelukkig het die ding andersom uitgewerk.

Ons gebruik 'n weer koperkabel, die P.V.C. geïnsuleerde kabel en ons het 'n geweldige klomp van die kabela alreeds weer uit die grond mees uithaal. Dit bring 'n groot verlies vir ons mee. Nou het die fabrikante gesê hulle gaan die saak ondersoek, maar hulle het in dieselfde asem vir ons te kenne gegee daar is geen ander verbruiker of gebruiker van die kabel wat dieselfde probleem het nie. Nou wil ek baie graag weet of daar wel so iemand is, of hulle enige oplossings gevind het, want al wat ons kon doen op hierdie stadium was om in sekere gevalle waar die roete van die kabel nie moeilik met baie draaie is nie, om dit in 'n plastiese pyp te lê. Nou weet ek nie of iemand anders al dit probeer het nie. Ek wil net byvoeg dat eintlik twee groottes kabel wat ons die meeste probleme mee het, is die 35 mm<sup>2</sup> wat ons vir huis-houelike aansluitings gebruik en dan 'n groter grootte wat ons 'n paar plekke by klein fabriek gebruik het was 150 mm<sup>2</sup>. Die eerste was 2-aar en die laaste was 4-aar. Nou dit was vir my gesê, die dikker kabel behoort geen moeilikheid te gee nie, en tog het ons dit daar ook ondervind. Ek sal baie bly wees as iemand vir my kan inligting gee of hulle enige ondervinding van die kabel het en of hulle 'n oplossing gekry het.

**Voorsitter:** Dankie mnr. de Villiers. Ek het hierdie monsters van Mnr. de Villiers gesien - hy het hulle vernou na die Takvergadering gebring en ek was eintlik nie verbaas om dit te sien nie. Ek persoonlik was bang om hierdie kabel te gebruik en het ook nooit daarvan gekoop nie. Dis die kabel sonder pantsering.

**Mnr. G.C. Theron** (Vanderbijlpark): Ons gebruik heelwat van hierdie kabel, sal ek maar sê, baie groot hoeveelhede, vir huisaansluitings, 25 mm<sup>2</sup> grootte en tot 'n mate het ons ook die probleem ondervind wat Mnr. de Villiers hier van vertel. Ek wil eers net terug kom na sy punt 2.2 toe. Ek dink dit is 'n kwesie van swak hantering van die kabel sover soos dit die aflewering aangaan en ek kan geen probleem hier sien waarvoor hy nie die koste hiervan kan verhaal van die voorsier nie. Wat die res van die probleem aangaan, beskaiding deur voorwerpe, daer stem ek met hom saam. Die kabel moet versigtig gehanteer word.

Maar mnr. die Voorsitter, die probleem van versigtige hantering van kabela berou, of gaan nie net net in opsigte van hierdie kabela nie. Dit gaan ten opsigte van alle kabela en ek dink in die verledes was ons mense heeltemal bedroef gewees deur die manier wat die kabels gehanteer is; selfs op hoogspanningskabel. Dit verbaas mens eintlik as jy sien hoe jou eie personeel somtyds 'n kabel hanteer en ek dink die oplossing in die verledes gebruik van hierdie kabel is in die regte onderrig van die personeel hoe die kabel gebruik en hanteer moet word.

Tot op die huidige stadium het ons nog nie probleme ondervind, sulke ernstige probleme dat ons van opinie is om weg te doen met die gebruik van hierdie kabel nie. Ons huisaansluitings op die oomblik, is R150 per huis en as dit nie was vir die gebruik van hierdie tipe van kabel nie, dan sou dit seker al naby aan die R180 - R200 gewees het. Ek voel dus dat die gebruik van hierdie kabel, met die nodige voorsorgmaatreëls, is nog heeltemal gereverdig.

**Voorsitter:** Dankie Mnr. Theron. Nou wil ek Mnr. de Villiers waarsku dat as hy die koste van daardie 30 meter verhaal moet hy dit op die prys baseer van die daaropvolgende kontrak.

**Mnr. H.C. Dreyer** (Paarl): Ek wil net graag bietjie meer inligting hê van Mnr. de Villiers. Hy sê ongelukkig vir ons weer water tipe kabel dit is nie, behalwe dat dit polyethilene kruisgekoppelde kabel is; blykbaar met aluminiumkern. Is dit gepantserde kabel, is dit beskerm buite om is dit die gewone enkel-aar polyethilene?

**Mnr. E.E. de Villiers** (Rustenburg): Ek wil nie graag die fabriekaat se naam op hierdie stadium sê nie, ek dink nie dit is reg nie, maar daar is net een fabriekant op die oomblik wat hierdie laagspanningskabel vervaardig, as ek dit reg het. Dit is nou laagspanningskabel aluminiumkerngeleier. Dit is geïnsuleer met kruisgekoppelde polyethilene, swart. Na my mening is dit beskerm teen swak geleide. Dit is eintlik saggter na my mening, as die standaard P.V.C. wat ons ken. Ek dink nie dit was ons gegagte oorspronklik dat die geleide daarvan nie is die standaard sal wees wat ons gedink het nie. Dit is maar my eie mening. Verder is daar geen vulling tussenin of omhulsel of pantsering hoegenaamd nie. Waar jy twee of meer kerns het, word dit eenvoudig met 'n tipe spiraal aanneembaar gevoeg en wanneer jy dit lê, dan lê jy dit net so. Die geleide was van die fabrikante dat die isolasie so taai is en doeltreffend, dat dit dien as 'n insulasie-middel en 'n omhulsel en pantsering in een en ons het hulle geloo, maar dit lyk my dit werk nie so uit nie.

**Voorsitter:** Dankie mnr. de Villiers. My concern for this cable was of course that it is a low voltage cable and such if it was damaged you're very unlikely going to get heavy or high fault current, and the result would be no tripping of any switches and the continual feeding into the ground of possibly small fault currents.

**Mnr. H.C. Dreyer** (Paarl): Nou verstaan ek die probleem. Ek dink Mnr. v.d. Berg van Krugersdorp sal vir ons meer lig op hierdie saak kan werp. As ek reg onthou het ons destyds hier tussen Roodepoort en Krugersdorp, op die Hoofrivier, 'n stuk kabel gehad, laagspanning, wat 'n aluminiumpantser gehad het, en met die kabel het ons presies dieselfde moeilikheid gehad wat mnr. de Villiers nou van

praat. Dit wil voorkom as jy jou aluminium nie behoortlik beskerm teen binnedringing van onsuiverhede uit die grond uit nie, dan kry jy die ontbinding van die aluminium. Ek dink Mnr. v.d. Berg kan dit miskien bevestig. Ek weet nie of daardie kabel nou gebruik word nie.

**Mr. E.P.E. W. Trautmann** (Ladysmith): I think that we can perhaps try to overcome the problem with tests. In Ladysmith we are living in quite a polluted area and we have to watch very carefully our cables for electrolytic deterioration. I think we apply to our normal cables sheathed with P.V.C. a test: A simple meggar test after the cable has been laid, and I think this could perhaps also be applied here, with this sort of cable to make sure that during the laying process the cable has not been damaged so that the aluminium screening or armouring cannot really now deteriorate. It might be too elaborate for every house connection, but for long stretches it might help. I don't know whether the experiences in Rustenburg were after the laying with the slow intrusion of stones into the cable which perhaps only came to light after a few weeks, a month, or whether it has been perhaps been already done during the process. I would suggest that after the coverage of the cable with soil it is easily detected with an air spike and a 1000 Volt meggar for instance whether there is any leakage down the ground.

**Mnr. A.J. v.d. Berg** (Krugersdorp): Die spesifieke kabel waarna verwys is, is 'n gewone koper-aar-kabel met 'n aluminiumomhulsel. Die kabel is reeds vervang omdat vir deur myngroende geloop het daar waarskynlik baie suure was en hy was baie gekorrodeer. Ek dink nie dit hou verband met die ander kabel wat genoem was deur Mnr. de Villiers nie, want die feit is dat 'n kabel wat 'n aluminiumhulsel het, behoortlik beskerm moet word veral hier op die Rand waar hy moontlik deur gronde loop wat sure het.

**Chairman:** Actually I think that putting this cable into a plastic pipe, which I think one or two members do, as a protective means, is about the only way of protecting the cable.

**Mnr. M.W. Odendaal** (Alberton): Ek voel heeltemal in my skik as mense nie graag hierdie kabel wil gebruik nie, vir die eenvoudige rede dat met die skaarste waarin ons nou lewe en waar 'n man moet wag vir 60 weke aflewering, ek baie gelukkig is want terwyl ek daardie kabel gebruik, kry ek nog redelike kort aflewering. Hierdie kabel is so ver ek weet, in Amerika ontwikkel en is daar gebruik. Dit is 'n groot afwyking van wat ons aan gewoond is in Suid-Afrika. Dit is 'n ongepantserde kabel en in die eerste instansie kan ek nie mnr. de Villiers saamstem dat daardie insulasie van 'n swakker gehalte is of minder taai is as P.V.C. nie. Die ondervinding wat ek het is dat dit wel meer bestand is teen beskaiding.

Tot ek die kabel die eerste keer gebruik het, het ek onmiddellik tot die gevolgtrekking gekom dat enige graaf, pik of wat ook al, as daar gegrawe moet word, die kabel sal beskaid, en ek dink dit is aan ons almal bekend dat enige aluminium wat in die grond blootgestel is, onmiddellik sal verweer. Met die gevolg is, dat waar ek dit gebruik het, het ek plastiese pype gebruik en vermaaklik met die distribusie van mini-substansies en kiosks het ons ongeveer standaardiseer op 'n 95 mm aluminiumkabel om te voer tussen die mini-substansies en die kiosks en ek dink my kollegas kan maar so 'n sommetjie maak en probeer uitwerk as hulle die koste van hierdie kabel het, en dit vergelyk met 'n kabel ingetrek in 'n plastiese pyp met 'n gewone gepantserde kabel en dan gaan ons nog een stap verder, vermaaklik om goeie grond te kry, dan trek ons nog 'n koperdraad langs die plastiese pyp in en dit versker goeie gronding by al die mini-substansies terwyl met 'n gewone kabel wat wel gepantserd is, dan word die pantsering aan albei kante gegroond, maar langs die pad verhoop ons nie die grondwaarde nie, terwyl ek in hierdie geval die kabel met 'n plastiese pyp en 'n koperdraad intrek en versker dat ek 'n goeie gronding kry of so 'n goeie gronding as wat mens maar moontlik kan kry.

**Mr. I.H. Hess** (Cape Town): We do not use this cable, and I really have no experience. But I am inclined to agree with Mr. Theron. We do use a tremendous amount of super tension cable which is aluminium cored sheathed with P.V.C. covering aluminium. Now, obviously, when you use cable of that voltage, you handle it with kid gloves. We really have no problems at all with this. We now use low voltage cables, aluminium cored and aluminium sheathed and we have no troubles either provided you train your staff to handle cables in the same manner as you would with super tension cable. I think it really comes down to a question of handling.

**Chairman:** I think Mr. Hess, that super tension cable is as a rule given far more careful handling than low voltage cable.

**Mnr. W. Barnard** (Johannesburg): Ek het nie enige oplossings vir die probleem nie, maar ek het 'n paar vrae wat ek graag aan Mnr. de Villiers wil stel. Die eerste vraaglik wou ek ask: What is the underlying purpose of using crosslinked polyethylenes? We have been looking into this problem, or I should say this application for a couple of months now, and the conclusion that we have come to, is that the only value of using crosslinked polyethelene cable, is to get a higher thermal rating out of your lower voltage cables. We go further, our investigations have shown that aluminium cored conductor or cable with P.V.C. insulation is not economical because of its limited thermal rating. Now in order to achieve the economy that we want, we are considering going to go to the crosslinker polyethelene. But I think once you decide to go to crosslinked polyethelene, you must then accept that you have to have an outer sheath of P.V.C. Now our experience with P.V.C. sheathing is that it is probably as tough and as resistant against pick damage as steel tape armouring. For the reason that it has

more resilience obviously and we have carried our test with a pick on a cable and we find that it is not easy to pierce the outer P.V.C. sheath. But my main question is this: Is Mr. de Villiers using the polyethylene in order to get a higher thermal rating or is he using it for some other reason?

**Mr. E.E. de Villiers (Rustenburg):** Before I answer Mr. Barnard's question, in regard to the handling of the cable, I think we must have a couple of roughjacks in Rustenburg, but I don't think any much more than any other place. We try to handle it as carefully as possible and even much more carefully now than we handle any other cable and we have never had this problem with P.V.C. That brings me immediately to Mr. Barnard's question. My personal experience has been too that P.V.C. is a very, very tough material for the covering of a cable. You don't damage this so easily. Regarding the thermal rating, that is correct. Our very first consideration as I mentioned was cost. You will get the higher thermal rating which is of course, also very good to have, in these expensive times which also again ties up with cost. The other point that was mentioned is that if you run a separate copper conductor with the cable, you get very good earthing. And that is also what we do and we find that also a very excellent way of working. Now regarding this running of the P.V.C. tubing, we are doing that, the P.V.C. pipe, at the present moment as far as possible. So perhaps, the stocks that we still have at the moment will be used up, but I am still rather dubious about purchasing any further stocks of this cable.

**Chairman:** I am sorry the affiliate members of this particular firm aren't here.

**Mr. H. Barnard (Brakpan):** Brakpan gebruik natuurlik ook van hierdie kabel. Ek dink ons was een van die eerste Munisipaliteite wat hierdie kabel op groot maat gebruik het. Wat betref die kabel, is dit hoofsaaklik die kleiner groottes van 70 mm<sup>2</sup> af wat hierdie probleme veroorsaak.

Die laaste samesprekings wat ek met die vervaardigers gehad het; ek was eenkeer by die fabriek waar die goed vervaardig word in Richards-bani, en het die mense my inliging dat daardie kleiner grootte kabels wat hulle vervaardig gaan nou uitkom met dubbel die dikte isolasie. As gevolg daarvan kan ek nie sien dat ons enigens van hierdie probleme kan kry nie.

Ek sê dit want soos Mnr. Hess gesê het, het jy dieselfde toestand waar jy aluminium hoogspanningskabels insit op die 33 kV. Jy het ook geen beskerming daar nie. Nou my argument is dit: as 'n mens soveel tyd kan spandeer om 'n hoogspanningskabel in te sit en die nodige sand aan te ry om die sloot in te vul sodat daar nie klip en die klas van ding is om daardie kabel te beskadig nie, dan kan mens presies dieselfde doen op die laagspanningskabel, vir twee redes. Eerstens, ek dink dit behoort by jou persoonlike ingehamer te word om die installasie van alle kabels nie sommer net aan te pak en die kabel in die grond te gooi nie. Hulle moet gewoond word daaraan om daardie kabel baie versigtig te hanteer. Tweedens, finansiële gaan dit jou ook betaal, want as jy 'n bontjie meer tyd spandeer in die installering van daardie kabel, gaan dit vir homself dubbel en dwars betaal, wanneer jy die prys van die kabel vergelyk met die konvensionele kabels wat ons gebruik. Daar is ongelukkig op die oomblik 'n groot ommeswaai in die bestuur van daardie maatskappij met die gevolg dat 'n mens nie so maklik die inligting kry waarna jy soek nie, en ook afwesing van die tipe kabels is ook vinjig besig om langer te word. Dan net 'n laaste puntjie met verwysing na wat Mnr. Barnard van Johannesburg gesê het: The thermal ratings of a cable, I don't know, but I very seldom consider this, because there are two other problems, or two other causes which cause it not to be used, namely the voltage drops and the fault currents, then the cable would be of such a size that you would never load the cable to its maximum. In other words, it's still a much larger cable than the actual size required and this also helps where the jointing of this type of cable is considered, with the results that you can quite easily crimp-joint these cables and never come to their full thermal rating, and your heat cycle is then not so bad with the result that you have reasonable installation if you consider these points.

**Mr. E. de C. Pretorius (Potchefstroom):** In Potchefstroom we have been using this crosslinked polyethylene low voltage cable for the past two or three years, although not on a very extensive scale. We standardise in three sizes 120, 185 and 300 mm<sup>2</sup> and so far we have not any trouble.

Ek wil aansluit by wat Mnr. Barnard nou net gesê het, dat met 'n bietjie sorg behoort hierdie kabel vir mens geen probleme te gee nie; die sorg met die installering. Ons lê die kabel op 'n bed van sand, en dit word dan ook gevel met sand om dit te beskerm. Soos ons sê, ons het geen dusver geen probleme gehad nie. Die kwesing van koste en ekonomie is hier genoem. Dit lyk my hier is sommige van ons lêde wat nie beseft dat koper se prys nou or die R2000 'n ton is nie, wat hierdie kabel werklik 'n proposisie maak ten spyte van die probleme wat daarmee gepaard gaan. Hier is genoem deur vorige sprekers dat dit in pyp gelê word. Ek hoop en ek dink hulle weet van die laer stroom-draervermoë van die kabel as dit in 'n pyp gelê word – dit kan soveel as 30% minder wees.

**Mr. D.H. Fraser (Durban):** We haven't used this sort of cable in Durban, we have been over conservative perhaps, but I must say I am still concerned about the lack of an earthed screen on the outside of the cable particularly when one considers the high incidents of mechanical damage. However, just one or two points that occur to me. Mr. Barnard of Brakpan refers to the voltage drop as being the dominant consideration in the rating of the low voltage distribution cable and I would

agree with him in this, from my experience, that this in a distribution system, as distinct from an industrial application, is likely to determine the size of a low voltage cable, so if this is so, there would appear to be no advantage in having insulating material that gives you a higher thermal rating. I wonder whether with the additional care it must increase the cost of installation, the fact that you need to install this in a pipe and run a continuous copper earthwire with it, whether in the end you show any material financial advantage over the alternatives for low voltage distribution which are presently available using aluminium conductors and perhaps aluminium sheath too.

**Mr. F.J. Prins (S.A.B.S.):** I am not replying to the problem raised directly by Mr. de Villiers, but rather as result of comments made by previous speakers. Now the most important thing I would like to comment on, and it was raised by Mr. Pretorius, is his people laying these cables in piping, are playing with extra problems because they are destroying the whole thermal characteristics. It is completely different running it in the pipe as to running it in the ground. Your best one is to run it directly in the ground, and I am very glad Mr. Pretorius raised that point – it is important to remember that. Now as far as the call it the toughness of the material, is concerned our experience is that if crosslinked has been properly manufactured, it is pretty tough – you can knock it with a pick and it would probably jump away, but we do know that P.V.C. which is used all over, especially as an outer protective sheath, and especially as an anti-electrolysis sheath, you got to watch, P.V.C. will flow under any pressure at ambient and will equalise, and if you don't believe me, come and look at the samples I have in the lab. It may take a couple of years but eventually she will flow till there is nothing. So if you are burying your cables, whether it is low voltage, whether it is high voltage, with a P.V.C. outer protective sheath and especially where you got electrolysis and using it as an electrolysis protection, you got to prepare that route, because a small cable or any bit of hard that press against that P.V.C. in time, is going to go through. In the case of PEX, from what we know, that should not happen with PEX. As far as his installation problem is concerned, I think it comes back basically to the way the cable is handled, to the way it is been installed, you got to watch jointing, you got to watch termination, it is not just a job for inexperienced men, and very important too, is the quality of the cable you're putting in.

**Chairman:** Thank you, Mr. Prins for those comments. I think that is quite an important point Mr. Prins made.

**Mr. K.J. Murphy (Somerset West):** I just wanted to say, I was somewhat interested to hear Mr. Theron say, that a service connection in Vanderbijlpark was now costing R180.

We at Somerset West recently revised our connection fees and brought them up to R130 and we thought that was probably an all time record for S.A. However, that is the true cost today. The other remark I simply want to pass in this is just a thought, and that is, you know that I do get the impression at times that electrical engineers are so ready to drop their standards, provided a manufacturer or supplier could offer them a small saving or apparent saving on the products they are selling. You know civil engineers build roads, construct bridges and what have you, and it costs thousands, millions, and no-one raises an eyebrow, and then we come along and we try to save a few rands here and there, and in the process we sometimes drop standards.

**The Chairman:** Thank you Mr. Murphy. We'll leave this subject now and we'll go on to question 3 from Mr. Plowden.

### 3.

**Can satisfactory discrimination be obtained between miniature circuit breakers of thermal and magnetic types?**

**Mr. W. Barnard (Johannesburg):** I would like to briefly enlarge on this question. This arises from development that has been taken over the years. If we trace back the history, in very early days in Johannesburg, we had wire fuses, metal clad in the house and we had pole-mounted wire fuses on the pole. From this we developed to the moulded case breaker in the house. The early days we installed different size breakers, I think the maximum size was 60 amp, we still had a fairly heavy wire fuse on the pole. More recently we found it more economical to standardise on a 80 Amp service connection which includes a 80 amp meter and a 80 amp circuit breaker, irrespective of the load, unless of course the load exceeded the capacity of a single-phase 80 Amp service connection.

Later development was to replace the wire pole-mounted fuse with a moulded case breaker on the pole, and it was at that stage that certain problems arose.

Initially we used both an 80 amp in the house and the 80 amp also on the pole but with a longer time delay, a longer time delay tripping characteristic. Still more recently we found we could in the same size get a 100 Amp breaker, so today we're using a 100 amp breaker on the pole and a 80 amp breaker on the house. We still have certain misgivings about the discrimination between these two breakers. It is generally accepted that under severe fault conditions, that is, fault currents exceeding something in the order of 1500 amps, you cannot expect to get discrimination, because I think in such cases discrimination is dependent on the momentum of your moving parts, and I think it would be impossible to get discrimination between electrical mechanical devices under fault conditions. So we are really confining ourselves to the problem where the fault current exceeds, say 100 amps, which is overload conditions and something like 1500 amps, which is the type of fault one might get on a domestic installation.

Our feeling is that in general under these particular conditions we can get adequate discrimination if we use mainly a mechanical moulded case breaker on the pole, that is on the supply side, 100 amp breaking with a long time delay, and a 80 amp either electrical-mechanical or a thermal moulded case breaker on the consumer side.

**Mr. E. de C. Pretorius (Stofchefstroom):** Ek wil nie 'n bydrae maak nie, ek wil net 'n vraag stel aan mnr. Barnard van Johannesburg. Wat is die rede om twee stroombrekers in 'n serie te hê? Is dit nie voldoende om net een stroombreker by die paal te hê en dan net 'n gewone skeiding skakel-isolator by die meterkas?

**Mr. W. Barnard (Johannesburg):** In reply to Mr. Pretorius' question, we find in Johannesburg that the majority of interruptions to supply to consumers, that is domestic consumers, results from some type of limited fault on the consumer's system.

Now if in every case this type of fault had to trip out the circuit breaker on the pole, it would mean that our standby staff would be required to attend to a very large number of complaints, which can be very adequately dealt with by the consumer himself. It is our policy to give the consumer access to the circuit breaker. In his own meter cabinet, we're talking about a meter cabinet which is individual to each consumer and not the meters in a minibus-station, and we invariably ask the consumer when they phone to complain that they have had a failure of supply, we ask them to check up on that circuit breaker, and if it has tripped we ask them to reclose it, and in that way we save ourselves the cost of having to go out and having to close it for them.

**Mr. D.H. Fraser (Durban):** We feel that there is an advantage in combining on a consumer's service connection a higher operating capacity fuse at the point of connection to the main with a circuit breaker in the consumer's premises as his main protection, we don't have any difficulty in getting discrimination between those two, we specify the fusing characteristics from the characteristics of the breaker required to give us discrimination. In my view there is an advantage in the higher operating capacity fuse because you don't have any problems about high fault levels, in your distribution system you might get some situations where your volt levels perhaps are getting close to capabilities of the circuit breaker, you do have the advantage of a back-up in the form of the fuse, and the consumer, as Mr. Barnard said, has access to the circuit breaker and can deal with the majority of faults which are in his own installation.

**Mr. Van der Walt (S.A.B.S.):** Ek kan die probleem insien mnr. de Pretorius. Barnard kom dit daarop neer as 'n koutrek vir die uitklink, die uitklink kouse van 'n stroombreker verbreëk het, dan trek jy 'n kouse van die tyd wat die stroombreker neem om uit te klink teenoor 'n sekere stroom, en êrens op hierdie kouse bereik jy 'n oomblikke waarde, daarna klink die stroombreker uit min of meer oombliklik vir alle hoë strome tot by sy brekvermoë.

Nou, die probleem is dit, as die stroombreker in die huis of in die installasie, waar ons nou van 'n huis en 'n paal praat, as die oomblikke uitklink-punt van daardie stroombreker naby aannekeer is en daar is 'n fout wat bokant hierdie uitklink-punt is dan gaan altee stroombrekers uitklink, omrede dit is ongeveer in die omgewing van 10 milli-sekondes wat die stroombreker dan neem om uit te klink in 'n half siklus. Onderkant hierdie waardes kan 'n mens goeie diskriminasie kry, soos in die stroombrekers, mits jy die stroom, die kenwaarde van die stroom bietjie aanpas en kyk na die spesifieke kurwes van stroombrekers, wat daar eintlik nodig is, is om 'n kurwe te trek, die maksimum stroom wat die stroombreker kan dra vir 'n periode vir nie-uitklink, 'n mens moet 'n addisionele kurwe hê vir nie-uitklink, en jy kan hierdie twee kurwes is baie na aan mekaar vir lae strome en lang tye, maar die oomblik wat jy na die oomblikke waardes beweeg dan vind jy dat jou nie-uitklink stroom word baie, baie laag. Dit is waar die probleem ontstaan, die stroombreker sien 'n fout wat sy meganisme in aksie stel en bety die stroom later in die baan verbreëk word, by gaan nog steeds uitklink, ek sien dit basies as so 'n probleem. Die probleem is as aanstand dat hierdie kouse waarvan ek gepraat het, is nie beskikbaar nie, daar is min spesifikasies wat daarna verwysing maak, en 'n mens moet derhalwe na jou uitklinkkurwe kyk en die punt waar die stroombrekers oombliklik word moet 'n mens so aanpas in werklikheid om te verseker laal altyd diskriminasie het moet jy hierdie punt sodanig gekry het dat hy nie punt oomblikke waardes vir die stroombreker op die paal, daardie stroom moet nie kan bereik word in die huis-installasie nie, dit moet bokant die maksimum foute waarde in die huis-installasie wees, nou dit is nie altyd moontlik nie. 'n Mens het 'n beperkte lengte bakel wat jy van die paal na die huis moet bring, en jy wil nie draai daarvoor loop om jou maksimum stroom af te bring, so wil jy nie altyd moontlik nie en die probleem is wesenlik probleem, en die wesenlike probleem bestaan wel ook by skeerding. Dit is nou ongelukkig so dat in hulsgewoonte stroombrekers praat 'n mens van 24 kilo-ampere en 5 kilo-ampere en miskien 10 kilo-ampere, die rede waarom ons hier te doen het met skeerding begin 'n mens by 16 kilo-ampere brekvermoë, m.a.w. die punt vir oomblikke uitklinking is baie hoër, en as 'n mens dieselfde ding toepas by 'n stroombreker en jy ook miskien 'n stroombreker wat miskien 'n bietjie dunder is en waarvan die brekvermoë bokant die waarde is dan kan jy hierdie in alle gevalle oordoen.

**Mr. L. Read (Fuchs Electrical):** The problem as far as domestic distribution is concerned has been realised by manufacturers and considerable development has been done in this particular respect. Research which has taken place during the past few years have

culminated in a patent which was registered in 1972 which relates to improvements in, or relating to tripping means of circuit breakers. Now, the problem of discrimination is two powered, if one visualises the tripping time characteristics of the multi-case circuit breaker, you first of all have the overload zone, and secondly, instantaneous or magnetic trip. Now as far as discrimination is concerned relating to the overload zone that must be obtained and planned by using circuit breakers of different current breakers, I have seen some installations where the municipal main breaker is for e.g. a 60 Amp, and the consumer's circuit breaker also 60 amp, they may be breakers having two different overlapped tripping characteristics. But if you now examine the Buro of Standards specification for circuit breakers you will see that for a 60 amp circuit breaker, the breaker must hold its rated load and at the same time trip out at 135% overload. Hence, it says in the requirement that in order to obtain discrimination on the overload portion of the curve that you must use two breakers of different ratings and tests have indicated that the normal differential between say, the municipal incoming circuit breaker and the consumer's circuit breaker should be of the order of 20 ampere, that means that the municipal breaker should, say, be a 80 amp and the consumer's a 60 amp breaker. One also has to consider that the further discrimination is required in the instantaneous trip region. Here it is a case where the instantaneous trip values of the different circuit breakers must differ sufficiently in order to ensure that the consumer's circuit breaker will trip out before the municipal circuit breaker.

In this research which has been done during the past few years and which culminated in the registration of this patent, the disclosures in this particular patent enables a circuit breaker to be manufactured which does provide different magnetic trip ranges, for example, it is possible now to manufacture a 60 amp circuit breaker which could have three ranges of magnetic trip value, a range of say 250 to 350, 550 to 600 and 1000 to 1200 amp. Now if with this facility which is available you then superimpose the current rating differential which is required in order to ensure discrimination on the overload range, I think it can be served generally that facilities or that features are being provided in circuit breakers for domestic installations which could ensure adequate discriminations which is, what is being sought after by municipal undertakings.

**Mr. J.D. Weyers (Pretoria):** Ek sal nie sê navorsing nie, ek sal sê wel elementêre toetse. Ek het toetse uitgevoer om te bepaal of mens goeie diskriminasie kan kry tussen die magnetiese tipe en die termiese tipe. Ek het gevind dat alleenk die beste resultate verkry kan word as net magnetiese tipes gebruik word, of net termiese tipe, m.a.w. as magnetiese tipes gebruik word, die 100 ampere vertragingstipe op die paal met 'n 80 ampere gewone kurwe by die huisant, of die 100 ampere termiese-vertragingstipe op die paal met sê maar 'n 80 ampere aan die huisant. Met daardie kombinasies is die beste resultate verkry, maar wanneer mens die termiese tipe en die magnetiese tipe kombineer op so 'n installasie, is die resultate nie enipnis beduidend wat altyd verwag kan word nie, m.a.w. dit gebeur wel dat die magnetiese vertragingstipe partykeer voor die termiese tipe uitklink of andersom. Daarom het ek gevind dat dit raadsaam sal wees om net 'n termies of magnetiese tipe te gebruik.

Daar ontstaan egter 'n probleem wanneer 'n, veral by sekere, laal ek dit so stel, met 'n uitleg van 'n dorpsgebied, hang dit baie af van die stroomdra-vermoë of die foutevermoë, waarby daardie installasie betrokke is, en daar is probleme ondervind by die diskriminasie van die magnetiese tipe bo 'n sekere waarde, m.a.w. dit hang af in dorpsgebied, hoever die spesifieke huisinstallasie van sê maar die miniatursubstansie af is, want dit bepaal die foutevermoë dravermoë, en ek sal graag wil hoor van die ander lede of hulle enige probleme ondervind het met die diskriminasie in daardie gebied.

**Mr. H.C. Dreyer (Paarl):** Jy weet dat baie dorpe deesdae die praktyk het om stroombrekers te gebruik vir tariewedoeleindes. Die Paarl doen dit ook. Ons vind dit baie handig om die gewone stroombreker wat in die huis op die meterbord gemeenter word eenvoudig te vervang met 'n stroombreker. Nou, dit is nie aan my bekend wat die uitklinkarakteristiek van 'n stroombreker is in verhouding met die stroombreker wat byvoorbeld op die paal gemeenter word vir beskeringsdoeleindes nie. Ek sal baie graag meer inligting in hierdie verband wil hê, as een van ons gae-affilieerde vervaardigers vir ons net 'n aanleiding kan gee van hoe daardie uitklinkienskappe verkry.

**Mr. L. Read (Fuchs Electrical):** With regards to the question asked by the last speaker, I would just like to mention that being associated with both the manufacturer of hydraulic magnetics and thermal magnetic circuit breakers, that I could probably answer his question.

The tripping characteristics, I won't call them current limiters because current limiters really is the incorrect name for that type of breaker it should be load limiter. A current limiter as far as I am concerned is normally related to fusing appliances where you have current limiting being affected by the rupturing of the fuse.

If you take a hydraulic magnetic circuit breaker and you take say an associated load limiter, the only difference in operating characteristics between the two is that the tripping characteristics of the load limiter is much faster than that of the normal hydraulic magnetic circuit breaker. The instantaneous tripping of both types are similar. So even if you use say, a current limiter as a consumer circuit breaker and you have the normal type of breaker as far as the municipal incoming breaker is concerned you will not obtain discrimination with faults close to the instantaneous trip range of the two breakers. I would just



like to make a few remarks relating to what Mr. Weyers has said. I actually saw the results of tests that were undertaken, as a matter of fact, I witnessed certain of the tests, and I can't quite completely agree with the conclusions that were drawn from the test results. I haven't the figures in front of me, but talking from memory, I would say that as far as the thermal magnetic circuit breaker is concerned, that very adequate discrimination was indicated between the discriminating breaker as an incoming breaker and the other breakers which would then be the consumer's circuit breaker. It did show very high level of discrimination, I think the figure went up to something like 1800 ampere. As far as the other type of breaker is concerned, adequate discrimination was also indicated between similar brochures of that type, although the discrimination level was somewhat lower than that of the thermal magnetic circuit breaker. With the test which was then subsequently done with a mixture of the two, I think quite reasonable discrimination results were obtained and I would not go so far as to say that, having to form a conclusion from those results, that discrimination is not possible between breakers of the thermal magnetic and the hydraulic magnetic.

#### 4.

### THE PROVISION OF SINGLE PHASE SUPPLY OR THREE PHASE SUPPLY TO DOMESTIC INSTALLATIONS.

It is probably true to say that in this country it is an established practice that the vast majority of domestic installations are supplied with electricity at single phase.

In Boksburg and presumably in most other Undertakings there is an ever increasing electricity demand. Homes with more than one hot water cylinder, more than one stove and the installation of under-floor heating or the use of air conditioning units is becoming a frequent occurrence and more often than not a request for a three phase supply is made, and justifiably so. This trend is also on the increase.

The fact that the reticulation is done on the basis that single phase supply is made available to individual installations, and some of these installations require three phase supply, is cause for real concern.

The question is, should serious consideration not be given to the complete abolition of single phase supply to domestic installations and only three phase supply made available?

**Die Voorsitter:** Die bewering dat die oorgrote meerderheid van huis-houdelike kragverbruikers in ons land van enkelfasige krag voorsien word, is moontlik heeltemal waar.

In Boksburg, en ons neem aan in meeste ander ondernemings, is daar 'n steeds toenemende aanvraag om elektriese krag. Huis met meer as een waterverwarmingstelsel, met meer as een stoof, met 'n vloer-verwarmingstelsel of lugreeling word nou meer alledaags en heel dikwels word toegeë om driefasige krag aansoek gedoen. Die neiging neem steeds toe.

The fact that the reticulation is done on the basis that single phase supply is made available to individual installations, and some of these installations require three phase supply, is cause for real concern.

The question is, should serious consideration not be given to the complete abolition of single phase supply to domestic installations and only three phase supply made available?

**Mnr. H. Barnard (Brakpan):** Mnr. die Voorsitter, die vraag wat u daar vra is 'n wesenlike probleem. Ek dink ons moet meer driefasige aansluitings gee veral vir Rooipoort se stadsaal sodat hulle ondersoek-verwarmers kan insit. Die punt wat u daar noem is miskien 'n goeie een, maar ek kan nie heeltemal daarmee saamstem nie. Die rede waarom ek dit sê is dat, met die verspreidingsnetwerke wat mens nou se dae uitwerk, kan jy 'n baie groot vraag op 'n enkelfasie-kabel oordra na 'n huis vir buite toe. As u sou werk op 'n grootte van ongeveer 18 kW, daar rond, vir 'n huis, ek praai nou nie van die werklike probleem-huis waar jy miskien 50 of meer kW nodig het, ek praai van 'n redelike gemiddelde huis wat jy nou se dae kry, dan kos 'n enkelfasie aansluiting jou ongeveer, as hy 'n gemiddelde lengte van 50 Meters het, so R10 vir die 50 M x 16 mm kabel plus 'n stroombreker, en die meter, die hele totaal van die materiaal kos jou ongeveer R80.

'n driefasie aansluiting wat dieselfde hoeveelheid energie kan oordra, kan 'n mens wegkom met 'n 4 mm<sup>2</sup> x 4 ar kabel, wat jou binne daardie selfde spanningsval hou, maar dit gaan jou heelwat meer kos, alhoewel die kabel as sulks, goedkooper is, kos 'n driefasie meter jou 'n R50 in pleks van die R10 van 'n enkelfasie meter, en jou stroombreker is R9,30 in plaas van jou R1,60. As 'n mens dit op hierdie basis werk, dan kry jy dat 'n aansluiting soos hierdie is ongeveer, suur dit die materiaal aangaan, 22% duurder as 'n enkelfasie-aansluiting.

As ek nou net dink aan Brakpan vervang ons bogronde lyne, diens-lyne, elke jaar ter waarde van ongeveer R35 000, waarvan die materiaal-inhoud ongeveer R20 000 is, dan kos so 'n driefasie-stelsel teenoor 'n enkelfasie-stelsel ongeveer R5 000 'n jaar meer.

Waar jy verpligte aardlekbeveiliging het, soos bv. in Brakpan, vind jy dat die koste van die aardlekke 30% duurder is as dié van 'n enkel-fase.

Verder moet die huseisenaar 'n groter verdeelbord insit sodat jou kragverspreiding oor jou driefase gebalanseer kan word, in die geval van 'n los nul-geleier kan dit veroorsaak word dat as jy bv. 'n warm-waterstelsel bo in die dak het en die neutraal is los op hom dat jy bv. 380 volt spanning oor 'n paar gloeilampe kan kry wat baie nadelig is vir jou verbruiker.

Verdere nadele is die risiko van ernstige skokke, is heelwat hoër, van 'n dorpsbevoorrings-ogpunt moedig 'n mens natuurlik met 'n driefase-toevoer, moedig jy 'n werkswink in die agterplaas aan, en iets wat 'n mens nie maklik uit gedagte moet verloor nie en wat baie maklik gebeur is dat as jy 'n driefasie-aansluiting vir 'n perseel gegee het, dan is die eienaar of die verbruiker gewoonlik geneig om een of ander driefase apparaat daaraan te sit, en sou jy in die oewerling instandhouding doen, dan sal jy vind dat partymaal word daar aan te lyne geverk. Dan moet jy altyd daardie ekstra moeite doen om te verseker dat daardie toestel wat jy gebruik se rigting is nog dieselfde as voordat jy daar gaan werk het.

Laastens, maar ek dink nie die minste nie, sal 'n mens vind dat, soos ek netnou gesê het die kabel wat jy gebruik op 'n enkelfase om daardie stroom oor te dra is 16 mm<sup>2</sup>, terwyl as jy 'n 3-fase x 4 ar het, dit 'n 4 mm<sup>2</sup> is. Nou, dit gaan van die onderstelling af uit dat die 3-fase 4 ar kabel se las op die einde is beoorlik oor die 3-fase versprei, m.a.w. hy is goed gebalanseer, maar die oomblik as jy jou vrag nie gebalanseer het nie dan vind jy dat jou spanningsval op daardie 4mm kabeltjies tussen 'n fase en die neutraal is gans en al te hoog, m.a.w. omdat jy die onbalans daar bet, sit jy nou met 'n kabeltjie wat te dun is vir die werk wat hy moet verrig.

**Die Voorsitter:** Dankie mnr. Barnard. Ek wil natuurlik die voorspelling hier wag dat ons oor 'n klompie jare, nie 'n keuse sal bê nie maar om wel net 3-fase te voorsien, want die aanvraag vir krag styg al meer en meer, ek dink pieklike soos Johannesburg het verbruikers wat seker 50 en 100-kVA elk trek, miskien ander stede ook, die groter stede in besonder.

We actually decided to purchase our distribution pillars, that we place on the pavements, we've planned them in such a way that they can take either a single-phase or a three-phase meter, so that when we will still continue to use single-phase probably depending, and should a consumer require a three-phase, then it is a simple matter to then install a three-phase meter, it will mean replacing the cable though, but at least at the meter end it will be a simple matter.

**Mr. I.H. Hess (Cape Town):** You say it's a matter of some concern about continuing with giving single-phase connection. Mr. Barnard seems to have exactly the opposite worry about the three-phase connection. Most distribution systems surely are based on three-phase. I know Johannesburg some years ago had a single-phase installation with single-phase transformers and minisubs. I don't know if they still carry on with this or whether that has been followed by any others.

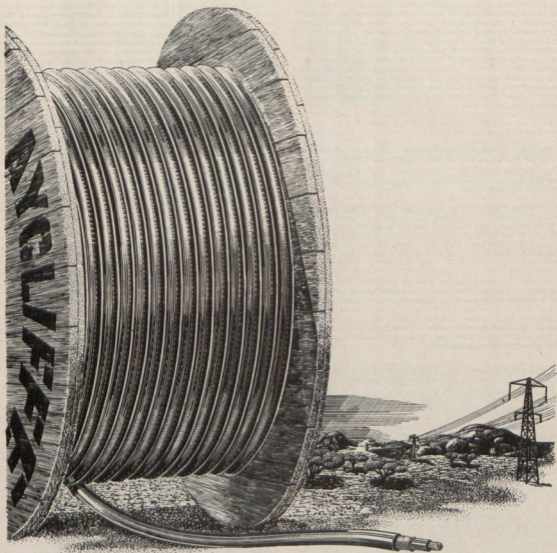
Although our whole distribution system in Cape Town is based on a three-phase system so we have 3-phase available everywhere and we normally give single-phase connections to household consumers, provided that the demand based on a fairly simple formula, does not exceed 13 kVA. This formula generally is just to assume that there can be 40 lighting points of 60 watts each, with our 6 kVA for socket-outlets, 10 kVA for rail socket, on that we apply a 50% diversity giving us about 9 kVA, we allow for a 2 kVA hot-water cylinder giving us an estimated load of 11 or 12 kVA.

This does permit for a slightly bigger stove or in most cases of a second hot water cylinder, but if it exceeds this we have no objection to giving him a three-phase connection. Now, your last remark Sir, all our new consumers we use metering kiosks on the pavements so that we have the meters right outside the premises. These kiosks allow for 8 single-phase miniature circuit breakers plus single-phase meters, plus it makes provision for two three-phase meters with the corresponding multicase circuit breakers. This we have up to now found completely adequate, we seldom find more than one house in every ten that by virtue of a swimming bath, air-conditioners and so on, requires more than a single-phase connection.

I personally can't see why there should be any worry about if you can give both, I think one should do so.

**Mr. K.G. Robson (East London):** I thought I might just tell you some of the things we do in East London. I agree with Mr. Hess that provided your distribution system makes provision for either single-phase or three-phase connections, you don't really have a problem, and I would find it difficult to accept that every installation should be provided with a 3-phase connection. I was interested also in Mr. Hess's connected load in terms with the wiring regulations, I assume more or less, to be 13 kVA. Perhaps Mr. Dawson might care to comment in connection with this experience in Uitenhage. I understand that there they are safely providing single-phase connections for connected loads of the order of 20 kVA. We are providing an underground system to meter pillars using only two connections from each meter pillar, they are placed on the boundaries between the two houses, and it is comparatively a simple matter to provide either a single-phase or a three-phase connection.

You may be interested to know what we charge for a single-phase connection at the boundary, we are charging R75, providing for a single-phase connection, one would say up to 15 kVA, and for a three-phase connection from perhaps the same point for a load between 15 and 50 kVA - R120, which perhaps gives some idea of the difference in cost to which the consumer would be put for the three-phase connec-



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tion as compared with the single-phase. But the important thing is, I believe, to provide a system where the changeover which the consumer would have to do is as simple as possible on your distribution system.

**The Chairman:** Thank you Mr. Robson. The immediate solution anyway is to put in a system where this changeover is easily done.

**Mr. E.E. de Villiers**, (Rustenburg): Ek het miskien nie mooi geluister nie, maar ek dink nie enige van die sprekers het spesifiek melding gemaak van die basiese rede waarom daar oorgegaan is 'n klompie jare gelede deur meeste munisipaliteite vir alleenk enkel-fases aansluitings nie. Dit is natuurlik om die balans oor moontlik op jou toevoer reg te hou op die laagspanningtak. Nou kan ek meld dat vroeër jare toe die eerste maal in die munisipale diens gekom het in Witbank was meeste van die grootste gedeelte van die ou dorp met drie-fase aansluitings bedien. Ek kan u verseker dat dit vir ons jare geneem het om die verbruikers te installeer sodat die drie-fases in elke installasie sodanig gekoppel is by eels huis, dat jy 'n mate van balans kon kry. Op enkel-fase het jy as voorsiener, tot 'n baie groot mate die hef in die hand om jou balans reg te hou. Wat ons nou wel ook doen, en ek dink dit is die beste praktyk op hierdie stadium, is dan ook om soks reeds hier gesê was, jou voorsienings-stelsel so in te rig dat jy enige verbruiker enige van drie-fase kan gees sonder veel moeite of koste. Alleenk die uitsondering is in die geval van drie-fase draag, nie in die gevalle van persone wat om spesifieke redes drie-fase draag wil hê, nie om spesifiek om hulle vragdoelendes nie, maar om drie-fase toevoering aan te dryf, motore, dan word die drie-fase na die huis voorsien, maar alleenk die spesifieke fase vir daardie woning, word in die huis versprei, en al die ander drie-fase dan in die betrokke toerusting of dit nou swembadtoerusting is of 'n werkswinkeljie of wat ook al. Ek was genteresseerd teeswee vanogend om te hoor dat Johannesburg nou van hulle 80 ampere toevoer, of stroombreker by die paal gaan nou 'n 100 ampere maar tog nou die 80 ampere in die huis behou. As ek reg onthou is dit seker nou 'n hele klompie jare alreeds dat hulle 80 ampere gebruik en dit nog groot genoeg vind vir normale doelendes. Ek sal baie graag wil hoor wat die Johannesburgse ingenieur in daardie versand op die oomblik doen en wat hulle in die toekoms beoog en of hulle enige planne voorsien, want dit is tog 'n feit dat jou stedeling die persoon is wat maar die toon aangee vir die gebruik van 'n kommoditeit soos elektrisiteit.

**Mr. W. Barnard** (Johannesburg): First of all, we had taken out statistics, and of the 85 000 domestic consumers in Johannesburg only 5% require more than a single phase 80 amp. supply. Now I think that in fact you must put me concluding that it would be highly uneconomical to go and put in three phase supply to every consumer. You yourself do remark about the fact that we have some very large consumers, and in actual fact, we have domestic consumers taking something like 300 kVA, and for those consumers we have put in a high voltage supply, but we would be the last people to suggest that every consumer must have a high voltage supply. What we are in actual fact doing, we finding in some of the wealthier suburbs, in actual fact we dont like you to find it as wealthier suburbs, I consider it in townships where the standard of housing is of a very high standard and you normally find that the stand is fairly large as well. In those cases we find that there is a large percentage of the consumers requiring a three phase supply and applies for a single phase supply we parallel two cores so that they only have one meter and they only have to provide a metering cabinet to accommodate one meter. But we can then very easily at some future date convert this to three phase supply without having to lay a new service cable, merely by fitting a new meter board. Reference is also made to our original thinking and development at Montgomery Park where we put in single phase, I think today, Montgomery Park, this was in 1956 that we reticulated Montgomery Park, and as far as I can remember there was of the order of 500 stands, and I think today that we have probably got no more than half a dozen of those consumers who have asked for, and have received a three phase supply. There we had to of course, take very special measures, to give them a three phase supply from a transformer substation, the main supply substation.

So coming back to the question, our policy is at the moment to put in single phase supply, is to reticulate all townships on three phase, but where we anticipate that in the very near future consumers are going to require three phase supplies, we put in a four core cable in order to be able to cater for their needs.

**Mr. H.C. Dreyer** (Paarl): Die kwessie van drie- of enkel-fase versal vir woonhuise word baie maklik opgelos deur daardie instansies wat tariewe het gebaseer op stroombrekers. Ek wil nou nie graag hier die kwessie van tariewe gebaseer op stroombrekers propageer nie, maar ek dink dit is baie maklik om in te sien dat as jy 'n stroombreker-tarief het, dan het jy geen probleem met verbruikers wat vir jou kom viraan vir 'n drie-fase-aansluiting nie. Die ding is eenvoudig outomaties. Ons het byvoorbeeld 'n geometriese reeks wat ons toesig; jy begin met 'n 10 ampere grootte, die volgende stap is 'n 30, dan 'n 60, dan 'n 90, dan 'n 120, daarnaas het jy 'n drie-fase-aansluiting; drie van 30 en drie van 60. Dit is vir gewone gebruikers onderkant laagspanningsmassa. Dit is die gebruiker se ope keuse wat hy wil hê, en daarvolgens betaal hy. Ek kan u verseker daar is geen probleem nie, want die tarief wat jy betaal, is volgens sy stroombreker, en as jy drie 30-ampere stroombrekers in 'n huis het en jy vergelyk dit met 'n 90 ampere enkel-fase, dan het die enkel-fasegebruiker die voordeel van sy eie diversiteit op sy eie apparaat wat die man met die drie-fase-aansluiting nie het nie. Dit los baie netjies die hele probleem op.

## S.A.B.S. COMMITTEE FOR STANDARD SPECIFICATION

### Dual specifications.

It is sometimes necessary to have dual standards during the changeover period from the values specified by an old specification to those specified by a new revised one. Generally, the S.A.B.S. tends to prefer having one specification at all times, which view is supported.

**Mr. A.A. Middlecote** (S.A.B.S.): I am talking first just to clarify the matter, because I think there might be some misunderstanding. There is only one specification. The minute a specification is published in the Gazette, that is the only specification. But I can see the problem; the problem is, shall we take a simple case of a P.V.C. cable. If one revises the specification and the thicknesses of insulation or the copper conductors, the metrication is a good example, demand a new specification. That specification is worked up to its finality and on a due day after being passed by a Council, it is published in the Gazette and from that day there is only one specification. The other one ceases to exist and is eradicated from the lists. But now this is a practical problem, because you can't suddenly go to an industry, and say, alright, from Monday you make the new. Now when it comes to products that bear our mark, this is easily dealt with because we negotiate with the industry, discuss existing stocks, they have got components which we can't expect them to throw away, and a time is decided, shall we say six months, a year, depends upon the product and after that due date, during that period, manufacturers supply the product with the mark, whether it is the old or to the new. This is the only way it can be done. So it is covered for a markholder. For anyone who doesn't make to our mark, is it a matter of private agreement between a purchase and a manufacturer, if he says, look here, I can supply you with this, but I can't supply you to the new specification - you buy it at your own risk. It can't be made a national rule. Where we hit a case, and one will come up a very interesting one, where we going to really change dramatically something, and the best example I can give you would be the new world wide plug-in socket. If we accept it, I don't be misled - we haven't accepted it yet. But what will happen then, a completely new specification will be drawn up. It is not the old specification. If the old specification is a S.A.B.S. 180, it will continue and the new type of plug-in socket would be given a completely new number and a new title. This would mean that for 10 years you will be able to order to the old, to suit the old house, and the new, to suit the new house. So the answer really is, there is no dual specification with the same number, it ceases as soon as the new one is published in the Gazette. The only case where there could be parallel general usage, is where there are two different specifications, even if they appear to cover the same commodity.

**Mr. P.J. Botes** (Roodepoort): Let me just explain the problem as Mr. Barnard has put it. It is actually where you get, we got at the moment, or we don't have a specification for a certain commodity or we do have an old specification which was based on the S.A.B.S. specification. Now when we revise, we only change over to the I.E.C. specifications. Now you get some certain series especially in the current ratings and fuse ratings in the I.E.C. which didn't fall in with the S.A.B.S. Now some of the specifications do allow, I think in both series at a certain time limit to it. I think that is what Mr. Barnard wants clarified, but the real problem is that you can't have two series. You must have only one series. You would either drop out a certain rating. Now, that rating for instance in the case of Johannesburg and most other cases in these cartridge fuse type links, for low tension and medium voltage electric fuses, have used a certain type of cartridge fuse for years. It has been supplied in great quantities, it is available on the market, I think most of us do use it, but the new specification, this doesn't fall in with the new specification. Now will the supplier still supply those fuses in future or not. That is one of the problems, I think what Mr. Barnard wants to get solved.

**Mr. A.A. Middlecote** (S.A.B.S.): This is slightly different - this is where the preferred number or a preferred rating is changed or a dimensional, something within a specification. Well there are two answers to this; one is, remember our specifications are voluntarily accepted. You can still as an individual, negotiate for the supply of a particular type. This is undesirable, because it is not good for the country, it means that you make small production runs for certain, shall we say, sizes, which we wish to phase out. But the normal way of dealing with a matter like this, is to prefer over a period of years. You might have two different size fuses, dimensionally different ones, say based on Continental practice, one on British Practice, and you might allow both those within the specification, but you might indicate the one is preferred as by preference you indicate that you hope that everyone will go over towards that, so that after a few years you can, shall we say, standardise on the one type only. There are various ways of dealing with it and you put it as an appendix until we found some order in which case they are very far and few between, they have to be, shall we say, two different series within the specification and I think this is a point that really at issue, that you might have a series based on one, sometimes in the I.E.C. itself the other two series. They give a series for American practice and one for European practice, Common Market versus the rest. We have to try and decide here, do we allow both.

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which is usually bad, means our maintenance point of view its not good and from the manufacturer's point of view it is not good, so usually we might start by allowing both, if both have been used, or are being used, but we always try and indicate over a period of years the one is preferred so that after a few years, we can nationalise and say, this is the one from now on.

**Mr. H. Barnard (Brakpan):** I wasn't going to say anything on this one, but so many people said things that they thought I thought, so I have to say something that I think I think. Firstly, when Mr. Middlecote started off, I was quite happy - I was not going to say a word, but now we are back to where we started off. Referring again to this dual specifications of the fuses, I feel and I mentioned this before the Maritzburg Convention and also at the Highveld Branch, I feel that the word "preferred values" should not appear in a standard specification. The specification should cover only those values that the standards for the country is aimed at. Anything beyond that, will still be available on the market and as Mr. Middlecote said, anybody that wants to buy it, can do so by private discussions on it or buying it out of the specifications. I say this, because if anybody specifies take for example, a range of fuses, according to S.A.B.S. call it S.A.B.S. 200, you don't want to specify and say I want a range of fuses in accordance with SABS but the preferred values. We just want one set of values there. I feel very strong about this and I cannot agree with Mr. Middlecote that we can only hope that the people would go over to the preferred values rather than sticking to the old values. To me it doesn't make sense, because as long as he gives somebody a chance to keep on manufacturing on the trend they are now, you will get all this different non-standard sizes and your preferred values will never come into operation.

**Chairman:** Thank you Mr. Barnard. I am inclined to agree with you, but I think in this society we live in, we got to accept this for a while anyway regarded by the S.A.B.S.

6.

**Is the "Drycol" type breather really effective and how can the user ascertain that the breather is still operating after some time?**

**Mr. D.C. Plowden (Johannesburg):** Mr. Chairman, we have tried "Drycol" breathers in Johannesburg not to a very large extent; we have fitted them to some old transformers, 80 kV, 40 mW. At the outlet we tried to determine whether the manufacturer's claim was right to this extent that the manufacturer claims that the "Drycol" breather will get rid of moisture which collects in the conservator above the oil level. To try and determine this, we put a "Drycol" breather on one of these transformers, and we coupled with it a large Silica-gel breather and then on the adjacent transformer the same rating, we just had the "Drycol" breather alone and we then measured the amount of water that was collected over periods and it does seem to indicate from our own tests that the "Drycol" breather does do what the manufacturer asks us to do. The other question, how do we check that the "Drycol" breather is still functioning? The way we are doing this, is that we have put a counter on the "Drycol" breather to count the number of cycles of thawing and freezing.

**Mr. D.H. Fraser (Durban):** Mr. Chairman, we have used quite a lot of "Drycol" breathers on transformers uprating at 132 kV generally 45 or 100 mVA capacity. We have found them to be reasonably effective and measure up to the manufacturer's claims as far as keeping the transformers dry and concerned. We have, however, found that they require quite a lot of looking after, maintenance, and I think we have come to the conclusion that in the size and voltage range that I have mentioned, that there isn't really a material advantage in the "Drycol" over the Silica-gel breather provided the Silica-gel breather is maintained and inspected at regular intervals it will do the job. I know in the United Kingdom that is standard practice, I think on the larger transformers higher voltage range, 275 and 400 kV to fit the "Drycol".

The problem of detecting the failure of the device as Mr. Plowden has mentioned, can be overcome by having the counter to make sure that it goes through the process of freezing and defrosting. We do have an alarm monitoring which also gives a signal if the thing is not working properly, so I think that doesn't present a problem, but the question of the relative advantage of this device over the Silica-gel is an important one and we come to the conclusion that Silica-gel, for our application, will be satisfactory.

**Chairman:** Thank you Mr. Fraser. Nou here, ons het aan die einde gekom van my gedeelte van hierdie forum en ek sê vir u dankie, en ek hoop dat ons darem iets hier geleer het.

**The President:** Thank you Mr. Fortmann that was very well handled indeed and I now call on the chairman of the Natal Branch, Mr. Bozyczko, to put over his questions.

#### QUESTIONS:- NATAL BRANCH

1.

**In snelgroeiende gebiede word baie geboue gesloop om vir nuwe komplekse plek te maak.**

**Die gewone prosedure is soos volg:-**

Die eienaar don, deur bemiddeling van die Raad, by die Dept. van Gemeenskapsbou aansoek om die gebou te mag sloop en stuur die Raad se kommentaar saam met die aansoek. Die Dept. van Gemeenskapsbou staan 'n permit toe, die Raad neem kennis daarvan en stuur dit aan die eienaar met die opdrag om die Raad in kennis te stel van die datum van die beoogde sloping, sodat die

Raad die geleentheid kan kry om die dienste te verwyder. Omdat die permit eger dikwels maande vóór die sloping uitgereik word, laat die eienaar dikwels na om die Raad in kennis te stel, met die gevolg dat lewendige kabels en toerusting tussen die rommel gevind word. Ons sou graag ongelukke wou vermy.

**Wat is die prosedure in ander dorpe?**



MR. W. BOZYCZKO  
CHAIRMAN OF THE NATAL BRANCH

**Mr. J.A. Loubser (Benoni):** Mnr. die Voorsitter, ek het dieselfde probleem gehad in Benoni, maar ons het dit maklik opgelos deur eenduidig by die toestemming wat die Raad aan die Kontrakteur gee dat hy mag sloop, net 'n klousule in te sluit dat voordat daar met enige sloping begin word, moet daar 'n sertifikaat verkry word vanaf die Elektriesiteitsafdeling dat die dienste verwyder word. Dit was al wat ons gedoen het.

**Mr. E.P.E.W. Trautmann (Ladysmith):** Daardie antwoord is goed en reg as dit onder die Raad se magte val, maar partykeer kry ons goedkeuring wat deur die Nasionale Behuising gegee word en dan word ons wel 'n afskrif gegee maar die eienaars van die ou geboue word direk gemagtig om dit te doen en ons vind partykeer, en dit is dikwels dat ons dan nie eers in kennis, dat ons geen kennis gekry het en dat die gebou gesloop word sonder dat ons enige stappe gemaak het. Ons het meters in die rommel gevind, ons het lewendige kabels gevind en alhoewel die verantwoordelikheid nie by ons berus nie, wil ek graag tog sien hoe kan ons dit voorkom dat iemand doodgaan.

**Mr. M.P.P. Clarke (Newcastle):** I have no answer to Mr. Trautmann's problems, but I have an interesting similar problem that everybody might like to hear about. In Newcastle, where we are breaking down faster than we are building in many cases, we have had an interesting application for demolition through the usual procedures to the department and in due course on the appointed day, the electrician dashed along and promptly whipped up all supplies and whipped all meters and put them away. A little later in the afternoon, we were very embarrassed and very redfaced to find that we had overlooked a very important factor and that is, that although the demolition request and orders and things had been signed on behalf of the owner, we had no formal request on behalf of the consumer and he, who had a contract with the Council for purchasing electricity from us, was in the very happy position where he could force us to re-estate and re-install meters and wiring. This is something which we didn't realise and I'm not sure whether that everybody else is fully aware of the implications on this score and therefore one should be very careful in shutting off supplies or cutting them off when demolition takes place. There is now a case on between the owner and the tenant in this particular regard.

**Mr. D.H. Fraser (Durban):** This is a very real problem and while it might be quite simply solved in theory, in practice it is not always the case, and I was interested to hear Mr. Clarke's experience there.

This sort of thing can happen unless you make sure that you cover the thing fully and deal with the right party over this matter. The Factories Act certainly provides the legal outlet for the supply authority, the regulation is quite clear there; that nobody must demolish a building before he has insured that the electricity service is disconnected. But I think it is just a case of persevering that the people who are active in this field and taking up with them directly any breach of the regulation. That is a very serious matter because of the danger involved in the disconnection without going about in the right manner. But I can't offer a solution. I am afraid we have the same problem in Durban on large scale. The question of getting the certificate is one which is controllable in respect of the local authorities' own area, but where you are supplying outside of your own Municipal area, you are faced with the problem of trying to get that sort of procedure through and that is not always easy, particularly if there is no sort of formal local authority existing in a rural area for example.

**Mr. P.V.E. Rautenbach** (Electrical Contractors Association of S.A.): We are very much aware of this problem with contractors, but unfortunately we are not demolishers. This is normally done by a demolishing contractor. In our industrial agreements, which are applicable to the major portion of the country, we certainly regard this type of operation as a skilled operation, and we insure that we incorporate clauses to this effect in our industrial agreements. It would appear to me, however, that your problem will lie mainly with the demolishing contractor and I could possibly suggest you to make an approach to the organised building industry which covers in their industrial agreements, the activities of demolishing contractors. It is a feature of industrial Council agreements these days that we endeavour to incorporate as much safety measures as we can.

**Mr. G. W. Wesselsburg** (Chief Inspector of Factories): Mr. Fraser has said something about a regulation. The one that he refers to, is Regulation D.14. In accordance with D.14 sub-section 1: "There must be a responsible person appointed in charge of demolition work," and D.14 sub-section 2: "Places the onus on that person to see that all electricity etc. is uncoupled before he starts demolishing work." So if he does anything like that, to start demolishing, before having taken off electricity, gas, water etc. it is a contravention of the Act.

## 2.

In Natal, the Town Planning Ordinance does not recognise electricity as an essential service, and when initial negotiations for establishment of a Township take place, often the Electricity Department is not advised and consequently when the Township is ready for development, additional time-wasting negotiations have to take place for provision of electric power.

It is felt that satisfactory arrangements should be made between the Township developer and the Council prior to proclamation of the Township, and provision for this should be made in the Town Planning Ordinance.

**Mr. John Barrie** (Glen Anil Investments): I am deeply interested in this particular problem and it probably arises as a result of an antiquated approach to the valuation of what constitutes an essential service. In the old days it probably wasn't quite so important to have electricity available in the new township, but today we have heard about increasing demands and this is quite definitely the case. The Ordinance in Natal hasn't kept pace with the changing life standards and methods, but the suggestion is made in the question that we ought to consider legislation. Now I have got some very grave reservations about the efficiency of legislation in creating a better and more streamlined approach, and we have had some very poor examples of legislation designed to improve township proclamation procedures in recent years and the net effect of most of them has been to make it slower. I think the answer really lies here, on a more domestic note, that in any well organised municipality, and I trust you all work for well-organised municipalities, it should not be possible for a new township development to even get off the ground without all the departments being informed of the development and be fully aware of the implications in respect of bulk services and the like and I think, as electrical engineers who really should be setting the tone in any municipality, you can carry out a very valuable service here by encouraging the development of a concept of a township development committee within the framework of a municipality whereby all departments are concerned in direct negotiations with the developer at a very early stage. It does happen that an application is submitted, it goes to the Administrative Section, who pass it on theoretically to all departments, but they don't do it on a co-ordinated basis because the City Engineer or other departments may be somewhere else. Now I think there is a very real need here for a small working group within each municipal organisation to deal with these extensions to services to new townships. From the development point of view everybody is concerned that things should go smoothly and I am sure the industry as a whole would welcome a development of this nature and because the electricity sections have a problem I think they ought to take the lead in coordinating the whole approach.

**Mr. I.H. Hess** (Cape Town): Mr. Chairman this is a rather big problem the last speaker made out because in many of the larger municipalities certainly in Cape Town, we have a number of different municipalities we supply electricity to. One can control the issue without your own municipality or get co-operation amongst the various services but it is impossible to get the same co-operation from the

Town Engineers or other people of other municipalities. Within our area supplying Cape Town, we have got Fish Hook, Simons Town, Divisional Council area and others. So it is very difficult. The answer really, I think, lies in getting the co-operation of the Province. We were in considerable trouble up to about 3-4 years ago.

Well then, some way or other, we managed to have got the Province well trained and every subdivision now, or any development plan with any of the municipalities in our area of supply, now comes directly to the Electricity Department of Cape Town for our comments before any approval is given to them.

**Mr. E.E. de Villiers** (Rustenburg): Mnr. die Voorsitter, dit is vir my bietjie eenaardig dat daar nog munisipaliteite is wat probleme het met die saak. Ek was miskien in die gelukkige posisie dat ek by ander munisipaliteite gewerk het waar ons intensief met die probleme te doen gehad het. Privaat dorpsgebiedeenaars het nou maar onlangs hul verskyning in Rustenburg gemaak. Die eerste geval het ons baie maklik hanteer en dit is net deur jou eie huishouding in orde te bring. Indien die Stadsleker en dan ook jou kollegas en ander departementebestuurders goed koördineer, kan daar nie so-lets plaasvind nie want u moet tog ooreenkomings aangaan met die lewering van dienste met die betrokke ontwikkelaar en indien u die ooreenkomings van ooreenkomste vervat in een dokument of dit nou elektrisiteit is, watervoorsiening, voorsiening vir riool, paai, wat ookal, dan kan daar nie so-lets plaasvind nie, want die ordonansie vereis tog baie beslis dat die Plaaslike Bestuur moet "ser-tifikat kan indien dat die nodige fasiliteite geskep kan word vir dienste voordat proklamasie oorkom kan plaasvind. Nou, vind ek dit die enigste metode om te toe pas. Ek wil ook net meld dat u ken natuurlik die verslag van die Niemand-Kommissie, as u dit nou moet deurlies sal u vind dat elektrisiteit is pertinent daarin gebied en 'n baie belangrike essensiese diens, wat in ag geneem moet word, so ek wil graag vir ons Natal vriende aan die hand doen, bring julle huis plaaslik in orde dan sal hierdie ding nie plaasvind nie wat iulle nou ondervind nie.

**Mr. J.L. Inglis** (Pietersburg): I'm going to be very brief, but I will say this that as far as the organised and the recognised property developers are concerned, they make it their business to make sure that all departments concerned are notified in good time, but the problem does arise when you find a Government department who have come along and developed a township within a municipal area without advising even the Town Clerk, what does one do then?

**Chairman:** Can't help you, I'm sorry.

**Mr. E.P.E.W. Trautmann** (Ladysmith) I would just like to add a few thoughts on the ideas of the Electrical Engineer being the leading person in a municipality. I think this is wishful thinking. Unfortunately we are normally the last, and especially in this respect of a township development, where the whole negotiation takes place really among clerical people. They do not see always the complications. May I also remind you that we all have to crawl before we can walk, and the smaller places are frequently caught this way.

I give you an example what happens to Ladysmith. It was happening when town planning in its first stages and when negotiations were carried out on legal and clerical levels, and this is from a town planning adviser: "We would be pleased if you could put forward to our office at the earliest opportune and appropriate time certificates to the effect:

- 1) Town planning scheme, that the town planning scheme may be amended in accordance with the layout and use of plots;
- 2) Water: that your Council have certified that a suitable water supply is available;
- 3) Essential Services: that satisfactory arrangements exist for the removal and disposal of refuse." (That's the place where we should comment)
- 4) Sewerage Reticulation: that the type of sewerage, etc. etc.
- 5) Electricity Transformer Substation: that all substation servitudes required have been provided;
- 6) Drainage: Drainage servitudes - "

Nou streets! All these important services are bestowed by name, electricity not; The point to be stressed is that under paragraph (3) under 'Essential Services' electricity is not mentioned, and under (5) only substation sites are required - the form of servitudes.

The question of reticulation and link services is thus left out, and the electrical engineer may not even have been consulted at this particular important stage of development. That is why I say we should have an amendment to the ordinance that electricity is really named, like roads and water as an essential service, directly, not under refuse and post delivery.

**Chairman:** Thank you Mr. Trautmann, I think we as a Natal Branch wish to do our homework.

**Mr. A.F.W.H. Eggers** (Chief Engineer G.P.O.): I think the Post Office is really interested in this question on the provision of services in townships. While our telephone services at the moment is perhaps in general regarded as an essential service, I think it is moving that way. To a large extent the Post Office these days is perhaps the last in. The Municipal Engineers who have been speaking here tend to find that they are the last, but this is not entirely true and to a certain extent we are dependent on the planning and the good officers of the municipal engineers. Please don't overlook the post division in township development.

**Chairman:** Thank you very much indeed, we shall bear that in mind. Ek stel nou vraag drie aan die orde wat soos volg lees: „Soos lede bewys is verhoog die Elektriesiteitsvoorsieningskommissie ook sy prys, in sommige gevalle het hierdie verhogings klein winste in verliese omskep. Die hersiening van munisipale tariewe en die uit-

eindlike afkondiging daarvan neem baie tyd in beslag en dit kan aansienlike verliese vir die Raad meebreng. Daar word aan die hand gedoen dat munisipale elektrisiteitstariewe aan die elektrisiteitsvoorsieningskommissie se heffing gekoppel moet word teneinde te verseker dat enige wysiging van hierdie heffings nie 'n nadelige uitwerking op munisipaliteit het nie."

**Mnr J.K. van Ahlften** (Springs): Mnr. die Voorzitter, lyk my julle Natalers het regtig probleme. Ons kry julle jammer.

In die Transvaalse Ordonnansie word daar spesifiek voorsiening gemaak dat wanneer Evkom sy tariewe verhoog, kan jy onmiddellik op jou ou tariewe 'n toeslag hef om daardie koste te verhaal. Die enigste voorwaarde is dat jy dan binne ses maande die nuwe tariewe moet afkondig. Ek dink dit is 'n kwessie om jou eie ordonnansies net in orde te kry.

**Mnr. T.C. Stoffberg** (EVKOM): 'n Dame van die Transvaalse Provinsiale Departement het my verlede week geskakel en gesê dat hierdie fasiliteit wat daar nou bestaan om 'n munisipale tarief aan te pas by die Evkomtarief met 6-maande kennisgewing, nou probleme gee, en u weet die Evkom-tariewe vir grootmaat het 'n outomatiese aanpassing vir steenkoolkoste. Die eenheidskoste van die tarief word verstel elke kwartaal volgens die steenkoolkoste van die vorige kwartaal. In die verlede was hierdie steenkoolkoste-aanpassing klein, maar ons lewe blykbaar nou in 'n tyd van vinnig stygende steenkoolkoste en daar was, ek dink die naam van Alberton Munisipaliteit genoem. Die voorstel was gemaak dat afgesien van die spesifieke aanpassings wat miskien ses-maandelike kan gebeur en ses maande kennisgewing nodig het, daar ook 'n outomatiese aanpassing moet kom van die eenheidstarief van die munisipale tariewe, wat gepaard gaan met die steenkoolaanpassing van die Evkom-tarief. Die dame het vir my voorgelê 'n voorstel wat mnr. Odendaal in die verband aan haar voorgelê het. Ek het nog nie met mnr. Odendaal daaroor gesels nie, maar die voorstel klink vir my baie intelligenter en prakties. Maar die probleem is blykbaar dat die 6 maande kennisgewing wat nodig is van die verandering van tarief, moeilikheid meebreng, m.a.w. dit is nie heetlantal 'n oplosstandigheid wat ons nou mag hê wanneer daar aansienlike steenkoolaanpassings elke kwartaal kan kom nie. Ek verstaan van die Provinsiale mense dat hulle met die probleem besig is, en moontlik 'n wetswysiging in die verband ooreweg.

Ek het aan haar gesê dat daar nie 'n probleem kan bestaan nie want Pretoria munisipaliteit het al baie jare sy tarief aangepas volgens sy eie steenkoolkoste en Johannesburg munisipaliteit het nou onlangs aangekondig dat hulle ook so 'n aanpassing doen. Sy het toe gesê dat sy dink die prosedure van Pretoria onwettig is, en ek het net gedink ek moet hierdie inligting aan u meedeel.

**Mr. I.H. Hess** (Cape Town): In Cape Town we've for years had a co-adjustment clause which was coupled with the industrial tariffs. I mentioned earlier we revised our tariffs last year, and domestic tariff was then brought on to a purely unit basis, now when we did that we at the same time brought the co-adjustment clause on to all tariffs, including domestic, that was fine in theory. In practice we ran into rather difficult snags, that was the first quarter of this year when at that stage we were purchasing greatly more power from Escom. We then found that by applying the co-adjustment clause to the tariffs we also had to apply it to all the units we bought from Escom, and instead of possibly increasing a particular tariff by say 0.01 cents per unit we had to increase it by something like 0.04 cents per unit, we were loading it terrifically. We then with agreement of our Council revised the adjustment on the basis of cost of fuel and cost of units purchased and on that basis we have an adjustment formula which is done quarterly but within the first 10 days of each quarter make out an adjustment for each tariff, that includes domestic, the whole lot, and therefore, as the cost varies so our tariffs vary accordingly.

**Mr. S.H. Hawkeswood** (Richards Bay): We're just in the process of having new tariffs promulgated and in discussions with the Natal Province, in reply to Mr. van Ahlften's remarks, the Natal Provincial Administration are planning to introduce legislation to allow for a linking of the local authorities tariffs' truce with Escom.

I would just like to mention our tariffs; What we do there is to find a factor, two factors M & E. M being the monthly demand charge of Escom for the preceding months and E being the energy charge for the preceding months plus adjustments and any adjustments that go with it. One of the remarks that came back from provinces said that this is fine that we must advise our consumers of what this amount is, and we agreed with them, that we would publish with our accounts whenever there is a price change made, and we feel that this would allow the consumer to know exactly what is being charged.

**Chairman:** As it is gentlemen, Estcourt was been rather fortunate in this position. I think we were probably the first town in Natal to have had our tariff, the industrial tariff, tied entirely to Escom, any variation we merely add a copy of the Escom notice to the industries concerned and we have no further problems.

**Mr. R.W. Barton** (Welkom): I was going to say that I thought I could give you an easy answer to this problem that would possibly only work in the Free State, but I see it works in Natal as well. It is this question of an automatic increase: Escom tariffs have been revised, the structure has been revised, and that the structure will remain, we take it for some years, so that the only increase we are going to be subjected to will be in the form of a surcharge. In Welkom we have arranged that in future any surcharge applied to us will be passed on as it stands to all bulk consumers and that the surcharge will be halved and the %

applied to all consumers, domestic as well as others. This was approved by the Provincial Administration, somewhat to our surprise, and I don't think we'll have any further problem there.

**Verdrag vir middagete 12.45 - 2.00 nm./Adjournment for lunch 12.45 - 2.00 pm.**

**Chairman:** We have been busy with question No 3, and should there be any contributions, please continue.

**Mnr E. de C. Pretorius** (Potchefstroom): In verband met hierdie vraag, het mnr. van Ahlften die oplossing gegee, maar wat by gesê het laat my so dink aan wat Sanus Rautenbach 'n dag of twee gelede gesê het, hy sê Hitchop is 'n ver agter die tyd hulle het nou eers 1933 se droogte.

**Mnr. H.C. Dreyer** (Paarl): Ek dink ons gaan 'n bietjie vinnig oor hierdie kwessie van tariewe, tariewe-aanpassings, vir almal van ons wat verspreiders en verkopers van elektrisiteit is hierdie 'n baie belangrike saak, en ek dink nie ons moet so vinnig daarop gaan nie.

Ek wil hier net graag noem wat ons in die Paarl gedoen het onlangs, dit was gemik op hierdie kwessie van elektrisiteitstariewe, wat met eenvoudig vinnig 'opgejack' word deur Evkom, en dan sit ons met die probleem dat ons inkomste nie ons uitgawe dek nie, en ek het aan my Raad aanbeveel dat hulle weer om die ooreenkomste met Evkom te onderteken. Om die eenvoudige rede dat die ooreenkomste 'n standaard ooreenkomste is, wat opgestel is vir gewone elektrisiteitsverbruikers.

'n Stelling is nog aflyf dat 'n elektrisiteitsondernemer nie 'n verbruiker van elektrisiteit is nie. Hy is 'n handelaar, en hy moet as sulks behandel word en daarom kan die gewone ooreenkomste wat deur Evkom opgestel word en wat die verbruiker moet teken, glad nie juridies van toepassing wees op 'n elektrisiteitsonderneming nie.

Ons het aangebring daarop dat 'n spesiale ooreenkomste opgestel moet word. Spesiaal ingestel op 'n handelaar van elektrisiteit. Die Paarl munisipaliteit om 'n voorbeeld te noem, wat elektrisiteit gebruik vir sy waterwerke, vir sy riool, vir sy eie werksinkels, is 'n verbruiker van die elektrisiteitsdepartement van Paarl en nie van Evkom nie. Evkom het nie 'n enkele meter daar nie. Die enigste Evkom-meter is waar by die krag oorhandig aan die Paarl Munisipaliteit, en daarom het die Paarl Munisipaliteit besluit hulle is nie 'n verbruiker van Evkom nie en sal nie 'n verbruikers-ooreenkomste aangaan nie.

Ek voel net dat dit is 'n baie belangrike punt en ek wou dit graag hier genoem het.

**Mnr. T.C. Stoffberg** (Evkom): Ek verstaan die vraag dan so, waarskynlik verstaan ek dit dan verkeerd, die argument is as iemand elektrisiteit koop om dit weer te verkoop dan moet hy anders hanteer wat as iemand wat elektrisiteit koop om dit self te gebruik. Daar mag waarheid in steek, ek sien nie die waarheid daarin nie, maar entlik is dit nie vir ons beskore om daaroor te oordeel nie. Evkom kan net werk volgens die wetgewing wat sy werking kontroleer en hierdie Wetgewing wat vir Evkom neerlê wat hy moet doen, sê dat hy so presies soos hy moontlik kan die kostes moet toedeel, soos dit aangegaan word, m.a.w. sover dit moontlik is, moet elke verbruiker sy elektrisiteitsrekening, 'n presiese verband hou met die koste wat dit verg om elektrisiteit aan hom te lewer, in ander woorde, Evkom word nie geoorloof om verskil te maak tussen 'n barbier of 'n boer nie, en ook nie, Evkom kyk nie na die eindgebruik van die krag nie maar die koste daaraan verbode.

As die filosofie van die wetgewing verkeerd is, dan is dit bokant my vaarskiedingsplek.

**Voorzitter:** Baie dankie mnr. Stoffberg. Paarl is sekerlik nie te verdeel met u antwoord, nie.

**Mnr. J.E. Heydenrych** (Middelburg Tvl.): My probleem is nie eintlik die eenheidskoste van energie nie, maar in die aanvraagkoste. Mnr. Stoffberg het nou-net gesê dat hulle probeer so ver as moontlik die koste versrei soos wat dit werklik aangaan word. Ek wonder of hy vir my kan sê, hoe hy dit kan verklaar dat Evkom se aanvraagkoste skielik gaan spring van R1 per kVA tot R2,20 per kVA. Dit is juis hierdie aspek, mnr. die vraesteller, wat my bekommer, want ons moet hierdie aanvraagkoste nou oordra aan ons verbruikers.

Nou, ons verbruikers, ons het vanmore gehoor mnr. Barnard van Johannesburg voorsien 'n 80 ampere stroombreker vir 'n huishoudelike verbruiker. 80 Ampere is gelykstaande aan omtrent 15 kVA. Nou 15 kVA teen R2,20 per kVA, wat Evkom aan ons vra, is 'n bedrag van omtrent R33 per maand, ek wonder of daar huishoudelike verbruikers is wat bereid sal wees om hierdie bedrag in basiese koste te betaal.

Ons probleem lê dus daarin, dat ons hierdie koste moet oordra aan ons verbruikers, en ons kan dit nie doen deur ons eenheidskoste te verhoog nie, want Evkom het in werklikheid vir ons die voorbeeld gestel deur die eenheidskoste in teorie te verlaag.

Ek dink mnr. Dreyer het miskien daar die antwoord met die tarief-stroombreker-struktuur waar die verbruiker werklik betaal vir die aanrag wat hy wel skep.

**Voorzitter:** Here, ek wil dit graag hier so stel, mnr. Stoffberg is net een, ons is baie. Ek dink ons sal die saak vir hom oplos deur nou die volgende vraag te bespreek.

4.

Huise word dikwels deur jong egpare gekoop en soos die inkomste en die gesin groter word, word dit dikwels nodig om die huis te verhoog, wat 'n behoefte aan bykomende elektriese stroom-bane meebreng, en welke veranderinge baie geld kos.

Sou dit nie 'n goeie voorsorgmaatregel wees om in die distribusie-koste bykomende ruimte te laat vir stroomonderbrekers, aard-



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lekkrel's en geleibuse in die dakruimte nie, teneinde uitbreidings teen die minimum koste te vergemaklik?

Beskou die lede dit as gereëdig?

**Mnr. P.J. Botes (Roodepoort):** Ek het die Afrikaans van vraag 4, die tweede paragraaf gelees, en u dit nou net saam met my sal lees:

"...Sodit nie 'n goeie voorsorgmaatregel wees om in die distribusiekoste bykomende ruimte te laat vir stroomonderbrekings, aardlekkrels, en geleibuse in die dakruimte nie, teneinde uitbreidings teen die minimum koste te vergemaklik."

**Mnr. die voorsitter,** ek kan ook Engels verstaan, die Engels lui heeltemal anders. Dit praat nie van distribusiekoste nie maar van "Distribution Boards", wat heeltemal 'n ander betekenis aan die saak gee.

Maar mnr. die voorsitter, die kwessie van addisionele spasie of addisionele voorsiening vir die toekoms in die huis self, is 'n kwessie tussen die verbruiker of die huisneer en die bouer, en as ons nou ons neus daarin gaan steek gaan ons welike implikasies baie groot wees. Wie gaan die addisionele koste dra? Is dit gereëdig in terme van die wet, daar is geen voorsiening daarvoor nie. Ons steek ons neus in sake waar ons neus moet uithou, en ons kompliseer sake so kwaai - ek weet nie, as dit moet gebeur of as ek dit moet toesien hier in Roodepoort en al die ander probleme op soortgelyke vlak, dan wil ek liever as Elektrotegniese Ingenieur bedank.

**Die Voorsitter:** Dankie mnr. Botes, ek stem saam, maar dit lyk vir my die vraag word verstaan, dit maak nie saak in watter taal dit is nie.

**Mr. K.J. Murphy (Somerset West):** You know, I can see what the party who has posed the question has in mind, although it is a local problem; it is nevertheless a problem and perhaps one shouldn't pass over this quite so superficially. You know that it is a fact that some years ago at a previous municipality where I was, we did require space for the possible installation at some future time of a ripple control, you know ripple control relay, in case it was ever necessary to make use of this.

I know it is a question as Mr. Botes has quite rightly said, between the owner of the house and his contractor, but we have certain other responsibilities with each and every electrical installation and it may not be such a bad idea to allow an extra conduit and sufficient space on the board, although it may be that the local authority could do this at the local level. I've just bought a house and I would like to install some more plugs and there is no provision for this unless I start chopping the walls, so I do have a certain amount of sympathy.

**Mr. D.H. Fraser (Durban):** I think this is a good idea, I go along with Mr. Murphy in suggesting that it is not entirely a matter between the contractor and the owner of a property at the time, in fact I don't think the owner of the property has much to do with the contractor at the time of the installation unless the owner happens to be an electrical engineer; But from the point of view of standardisation and putting the contractors in a position where they all quote on the same basis, I think it's as well for it to be clearly laid down that this is a requirement for future possible extensions of the installation, and I think it is inevitable that extensions will take place, and this requirement will prove to be essential in the long run. But at the present time, shall we say a good contractor would tender on the basis of making provision for this future expansion whereas another one perhaps interested in cutting costs to a minimum would not, so if we could convince ourselves that it is in the long term interest of the user, the owner of the property, or the future owner of the property, then I think it's a good thing to lay this down as a requirement by the supply authority, and this is in fact what we are doing in Durban.

**Mr. E. de C. Pretorius (Potchefstroom):** Mr. Chairman, how far do we want to go with this type of thing? For instance, if you only have one socket outlet in say a living room, we very well know that in time to come they'll probably require two or more socket outlets in that living room. Now, must we say "look here, you must provide conduits for the eventual installation of two or three socket outlets in your living room", I asked a question.

**Mr. D.F. Kneale (Electrical Contractors' Association)** It seems to me that the time has now arrived that should we not incorporate a practice note in the new wiring regulations to the effect that 25% spare space should be allowed in any distribution board to accommodate this kind of eventuality. The cost implications would not be very much at the initial installation stage. I think that if the pipes and the additional size in the distribution board was incorporated in the beginning this would not place an onerous cost on the consumer.

**Chairman:** Thank you very much indeed, I trust Mr. Middlecott has been listening to that.

**Mr. A.A. Middlecott (S.A.B.S.):** You asked me very shortly, I think there are standards for distribution boards. This will give a certain amount of, allowable, shall we say latitude. The other thing is it can be borne in mind in fact, I think the international discussions, I can't remember the detail, centre round a certain amount of a safety point of view for allowing in future extensions. But this can be noted, and I think this is about all one could do at this stage. We will bear it in mind from a Bureau of Standards point of view.

**Mr. S.H. Hawkeswood (Richards Bay):** I just want to answer Mr. Pretorius's question. In Richards Bay we are insisting that all houses have provision for socket outlets for television sets in the future, and a conduit leading up from this point to the roof-space for future aerials. I can assure you we are getting a lot of support from consumers and ratpayers.

**Mnr. P.J. Botes (Roodepoort):** Ja, solank dit net nie die plig van die Elektriese Ingenieur is nie, stem ek saam. Mag ek nou net vir u 'n saakie vertel wat nou amper verband hou hiermee. Hierdie stadsaal is 45 jaar gelede gebou. U sal merk dat hierdie stadsaal het 'n platdak. Hierdie stadsaal het 'n platdak gekry omdat die Stadsvaders destyds besluit het, en u moet weet dit was lank vooruit dat daar so-iets soos 'n heikopter was, dat in die toekoms sal daar 'n vliegtuig wees wat rasop styg en weer gaan sit, en daarvoor sal hulle dit nodig hê om op die dak van hierdie stadsaal te gaan sit, en het hulle dus 'n platdak daaraan gegee.

Nou, ons kan nou so aangaan oor allerhande ding, maar ek weet nie of daar ooit 'n vliegtuig op hierdie dak sal gaan sit nie.

**Chairman:** Thank you Mr. Botes. I think Gentlemen, we shall proceed to the next question. Question No. 5.

5.  
Often vacancies in Municipal Electricity Departments are filled with artisans who have no previous Municipal experience and have to be taught the municipal type of electrical work. When they master the additional knowledge and become economical, they seek appointments elsewhere often out of the municipal sphere. The above assumes there are applications to an advertisement in the R3 500 p.a. range. This salary plus perks does not, lately, attract any applications.

Is it not now the time to start a training centre specifically for municipal electricians? Such training would improve quality of municipal electricians and probably increase numbers of available artisans.

It is understood the costs are going to be high, but surely costs as a result of retarded development and delays are higher.

**Mr. D.C. Plowden (Johannesburg):** This question of training electricians purely for municipal service, is one that my first reaction is to this, that if we want to set out to train youngsters as municipal electricians, it could mean that in their whole futures they would be tied to municipal service, we would like this very much, no doubt, but I have fear that if we try to do it we'll find that the pool from which we can recruit trainees will shrink very rapidly. Now this may not necessarily be the case because we do know that apprentices which we have trained or whom we have trained have found ready employment outside. In Johannesburg we gave a lot of consideration to setting up our own apprentice committee in terms of the apprenticeship Act. For a variety of reasons we found that this was virtually impracticable. To give you an example, one of the reasons was that we have about 25 or 30 trades in our own local authority and if we wanted to set up an apprentice committee we have to have a representative from every one of these different trades, plus one or two from ourselves that meant two from the employers and say 30 from the Trade Unions, and such a committee would never have worked. I don't want to go any further into this matter at the moment because, this matter has been referred by the Executive Council to the Training Sub-committee, but whether fortunate that the question has been raised because perhaps members of this training sub-committee might hear a lot from delegates here today, I would like to hear from them because it would certainly help us in our work.

**Chairman:** Thank you Mr. Plowden. Please don't refer to translations Mr. Botes.

**Mr. P.J. Botes (Roodepoort):** We have started an Apprentice Training Centre in Roodepoort and where we couldn't get apprentices through, we pushed them through like hot cakes lately, but from experience it seems that these gentlemen, are of no use for municipal work. You train them in a different sphere. I'm definitely certain of that fact - I have established it myself. What I am going to do in future, is also to concentrate on the same Training Centre, train all electricians that I can gather from the outside, train them how we are doing our job in Roodepoort. First for a week or so and then give him out in the field and I think that will give us much greater satisfaction. We are putting through apprentices and for those nearby towns who might make available, want to make use of our Training College, we got space for about 100 apprentices but local authorities will have to come to some agreement on how we will divide the cost basis of these apprentices. It is a proper programme that the apprentice must go through and if you want to make use of such facilities, an apprentice will have to be in our Training Centre for at least six weeks every year.

**Chairman:** Thank you Mr. Botes.

**Mr. L.H. Hess (Cape Town):** I rather gather Mr. Botes is thinking very much in the same line as I am. Now mine goes back to our previous Technical Convention at the Holiday Inn, two years ago. The suggestion was raised then that surely we should train apprentices in the work we want them to do, the work we need to have done. We train in accordance with the code which really concerns work we have very little to do with.

I remember some speakers had suggestions that we should follow ESCOM and get together with them. The suggestion was raised, that if we couldn't get our apprentices through the test at the Training Centre now, we had little hope if we are going to train them the way that ESCOM did - their standards were much higher. I don't think it is a question of standards - it is a question of the type of work that we want to do and if we can't train them in the work we want, we will get them through the tests. This is a problem, which I know, has as Mr. Plowden mentioned, been handed over to the Apprentice Sub-committee of the A.M.E.U. Executive. We have from time to time

talks of having a Central Training Centre; I don't think that can work. Each Province has its own problems which a Technical Training Centre can't deal with. We in the Cape have a coloured population, in Natal we have an Indian population. In Cape Town we now are training 100 per year, 10 coloureds and 10 European apprentices as electricians apart from the other trades, per year. Obviously we could not combine that with the Central Training Centre; I have heard it mentioned that Rodepoort might be a central spot for the Reef, it is probably a very central spot. But it wouldn't satisfy the requirements of the Western Cape. It possibly would not satisfy the requirements of Natal or Eastern Cape. But they probably have the same problem there with the different populations that they want to train as apprentices to be electricians that the Central Training Centre may not meet this case. We are trying to find our own solution in the Western Cape. Now the only Training Centre, apart from the C.O.T.W.O.N., at Westlake, which is only of use for those over the age of 21, the only Training Centre in Cape Town itself, Cape Town Municipal, is over 1000 boys that we can get together with them and have a major Training Centre in the Western Cape and I think this is perhaps where the large Municipalities in each of the areas, can take the lead and give the assistance to the small Municipalities and get together to form one Central Training School for each area.

**Chairman:** Thank you very much Mr. Hess. I think the problem has been largely that the smaller Municipalities are unable to effectively train their own people, and your suggestion is indeed a very good one. In case of Eastcourt, we as a Municipality cannot train an apprentice. I have contacted four larger factories and we are trying to establish a sort of a common school where these apprentices are shifted from one place to another and in that way we believe that we could produce a very well-trained artisan, however, this is obviously not a solution to the problem because there are some legal complications that have arisen since our application to the Apprenticeship Committee to do just that.

**Mr. A.H.L. Fortmann (Boksburg):** Mr. Chairman, I think this is a two-sided problem that has been discussed here. One on the one side which has been fairly well discussed, but I'm looking at the salary here. If you compare this with what they pay electricians along the Reef, no wonder they can't keep electricians. I think this is far too low. This is just my contention.

**Mr. H. Barnard (Brakpan):** Mr. Chairman, I think we are slightly off the point. My little agenda says: "Municipal artisan training facilities". Now from that I can just say that if we train the apprentices well enough, it wouldn't be necessary to train the artisans, but after all I think much has been said about training of the apprentices all over. I think it is about time that we do something. Training of apprentices is not an easy thing and especially in smaller centres where you hardly have enough staff in the form of electricians to do the work. It is impossible really to train these apprentices and a centralized training centre would be the answer. I feel however, that the Committee considering this at the moment, should also take into consideration that many of the work that an artisan does nowadays, is purely clerical in functions. I think for instance, when a township is developed, planting of poles, erecting of mini-substations, laying of cable, making of mechanical glands, Pratlley glands and so on, those items are not an electrician's work; in other words, if those particular items or jobs are given to less qualified people to do like gangers for instance, more electricians would be available to do electrician's work. By doing that, the shortage of electricians wouldn't be as acute as it is as the moment.

I would also suggest that the Committee considering this item, should consider the training of artisans in municipal work, for instance if he gets an electrician or an apprentice that did his trade on the Mines or the private sector, you will find that he is absolutely at a loss when he comes to a Municipality. The other way around when you train an apprentice for municipal work, he is quite adaptable in any outside or mining condition; in other words, we are training our people too well and they can be used all over, and I feel that there is a lack of training as far as it is concerning the training of electricians from the outside firms and that should also be considered in the training of these.

**Mr. M.J.W. Chappel (Port Elizabeth):** I think we got to remember this is a question also of supply and demand. Today there are just not enough hands to do the amount of work available, and when it comes to apprentices the time when you could pick and choose your boys, today you got to look very hard to find boys even though you are standard 8 certificate. A large number are not really motivated, that doesn't apply on me too; to apprentices it applies all the way through, but the fact is

that we are confronted with a shortage of suitable trainees and in my organisation we have tended to dilute the labour, by, we take operatives of various sorts who have some likelihood to becoming artisans and send them to Westlake. They are tried for 3 years - we consider them as major apprentices. We use, what we call, learner artisans, that is men who possibly have had some small amount of experience somewhere else in factories or in industry and treat them more or less as major apprentices but in one area only for instance, a man might be taken on as a fitter and virtually made into a boiler fitter, similarly with electricians, a learner is not learner electricians and learner linemen and as such he would become a lineman and that is what he would do.

When it comes to the apprentices, our experience with the examination at the end of their training period, has never been good. We feel that our methods are rather different to those provided or on which they are tested by the trade test. We feel that our methods of making joints, for instance, working on live cables and things are not what is done by industry certainly. Our boys are trained as electricians; they go through the various departments, what they pick up is very largely up to themselves. They are given the opportunity to go to school; they have the block release system - some of them make use of it, some of them don't, but if they stay they ultimately tend to specialize in one area. They either become electricians or they become cable jointers or they become substation electricians or something of that sort. In other words we attempt to give them a wide superficial knowledge of the whole operation and then they can specialize and it seems to be fairly successful because we have great difficulty in keeping these boys once they passed their, finished their time, a big proportion leave us and go out and seem to do very well in industry and I think that the training that we do, that is, we are no longer apprentice amongst the metal industries arrangement, we are now apprentice amongst the Common Law and they don't even go to a trade for their trade test anymore but there is no difficulty in these boys finding jobs outside, in fact our biggest problem is to try and keep them in the department and my feeling is it might be very selfish, but if we could train men who could do our particular job even if it is only just a small section of a job, because we don't normally ask them to do a variety of jobs, if we could train them and we have them tied so that they virtually weren't acceptable outside, would be better still, but of course the fact they can all get jobs outside and I quite honestly, I think the big problem always is just that there are not enough hands to do the amount of work available.

**Mr. P.V.E. Rautenbach (Electrical Contractors Association of S.A.):** A year ago at your Convention at Pietermaritzburg, I addressed your Convention of what we were doing in our industry. Please bear in mind Mr. Chairman, we have been under the whip from Mr. Wannenburg and his department for a number of years now and I think we are beginning to get on top of the situation, I hope. We as an industry, and having a good look at the structure of our industry, find ourselves in the position, but the large majority of the boys, through the country, spread all over the Republic and South West Africa are basically semi-employers. It is possibly an organisation with one or two artisans, and a number of lads apprenticed to this organisation. Now training on that basis is extremely difficult. As an industry, and possibly the results of the trade testing for electrical wremen for years, I think this can be substantiated by Mr. Hare as shown a decimal figure.

We had to correct this situation and we are now in a position that we in our industry, in conjunction with the Building Industry's Training and Recruitment Fund to establish an Institutionalized Training Centre at Baragwanath at the old Post Office Training Centre.

We have hostel facilities, for six lads and we can handle twelve lads at a time. It is our intention to take on virtually, on very similar lines to a block release course, where we will take the lads for six-week periods, then he will go back to his employer again. Finding the finance for this has been quite a thing. We have had to incorporate into our various Industrial Agreements, training funds. We have had to make them obligatory on all employers, and this is how it is financed. Besides the country, we do, we also subsidize the apprentice training. We don't have facilities in the Western Cape yet for training apprentices, but this is something we are planning in the future and we would welcome interchange with your industry.

I may just mention that our other two pilot courses which I mentioned to you last year, which was the training of electrical artisans. Now I refer here to the broad category of electrical artisans for the purpose of obtaining a Wiremen's Licence on a parttime basis at the Johannesburg Technical College and the Benoni Technical College which is financed by my Association, has proven them to be a huge success. We have proven that we can get these fellows licenced. Some of them had been in the industry 10 to 15 years without licences, but I would like to put it to the meeting that your objectives must be clear; you must know what you train people for and our objective in this exercise has been a selfish one. It is virtually cramming. Our philosophy in this, is we don't take a chap along to an institution and teach him something on the basis. Oh, it is very nice to know or useful to know. We are teaching just what we have got to know, the bare essentials for the Wiremen's Licence. I mentioned to your Convention last year that these facilities are open to everybody. It is done in conjunction with the Department of National Education. We subsidise it, we are paying for it, basically, but we are doing this as a public service to everybody.

**Chairman:** Thank you Mr. Rautenbach. I did hear your comment about being selfish and I'm believing it.

**Mr. L.H. Hare (Central Organization for Trade Testing):** Mr.

Chairman, I would like to support Mr. Raubenbach and I would like the members of this meeting to know what his Association has accomplished in this way. The pilot schemes were of course, at the Smit Street Technical College in Johannesburg and at the Technical College at Benoni. Candidates who have attempted the Electrical Wiremen's practical examinations from between 5 to 10 times, and never got more than a 40%, attended these classes and came up and got a distinction. They had obviously learnt something. They were being taught the basic things that nobody had ever taught them before, and this has proved so successful that this new scheme at Baragwanath is being started and from the results of the previous one, I can only wish Mr. Raubenbach's Association all the success in the world. I would like to comment here. I am always being accused of throwing statistics at people, we have to do this unfortunately. ESCOM with their training, with their very, very comprehensive syllabus, are running over 70% pass rate; the national average for all trades is 43% and electrical wireman has the dubious distinction of being the second lowest with 22% pass rate.

**Chairman:** Thank you Mr. Hare. We appreciate that there is a problem - we have not found a solution and it seems that the original basis, or rather training on the original basis, is going to be the answer.

#### QUESTION No. 6

**By die gebruik van 'n ossillokoopvoetsoeker is daar moeilikheid ondervind met die opsporing van foute of moontlik die vertolkung van spore.**

**Watter ondervinding het ander lede met hierdie soort toerusting gehad?**

**Mnr. E. de C. Pretorius** (Potchefstroom): Mnr. die Voorsitter, ek dink ons kan hierdie vraag baie kortliks beantwoord en tyd bespaar, as ek vir u neem dat ons hoop op die volgende Konvensie in Durban, 'n referaat van iemand te kry wat handel oor die opsporing van kabel-foute, waar hierdie spesifieke probleem dan ook behandel sal word.

**Chairman:** A suggestion had been made; we don't talk about it. We will have a paper next year on the subject. So we will drop it.

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A member has had problems with an electrical contractor who sent unqualified men to do wiring work. After several written warnings, the matter was handed over to the Public Prosecutor - there was no action. The matter was passed onto the Inspector of Factories - still no action. The member would like to know there to go from here. Is it not the time to have a prosecutor who could handle such cases?

**Mr. J.L. McNeil** (Kokstad): Mr. Chairman I had considerable trouble in this particular case and eventually, in terms of Section 15 of the Electrical Wiremen and Contractors Act, I served the required notice, and stating to the contractor that I intended refusing to re-issue the licence. At the same time I got a letter from his lawyer, threatening me with an action for damages, and he stated in this letter that his client contended that I had acted illegally. I am sure that I acted legally, however after further discussions, I was advised by the Municipal Legal Adviser that it would probably be better if I did issue a temporary licence. I stated that in issuing a temporary licence I would have to go through the same unpleasant procedure in withdrawing it. However, he told me that it was undesirable. I would have to face an action for damages myself and rather let the Council do it. So in these circumstances, I issued a temporary licence with the proviso that this was issued subject to the finding of the Court. On reporting further to the Council, the Council took up this problem, supported what I have done fully and instructed the Town Clerk to proceed and discuss this matter with the Public Prosecutor. I have issued about five or six charges in all. The Town Clerk did exactly that - he went to the Public Prosecutor and in due course, the Public Prosecutor called me along and I thought this was for the required information. Anyway, all he asked me for was my copy of the Electrical Wiremen and Contractors Act plus our local Bylaws. I had been advised that it would be most desirable if I could issue a conviction. Well eventually the Public Prosecutor did issue the necessary summonses and the sequel was that this particular contractor despite all that he had claimed and all that he had said in letters to me - paid admissions of guilt on four counts of R5 each. The Council took the view that R5 was ridiculously low but nevertheless he paid the four admissions of guilt.

**Chairman:** Thank you Mr. McNeil and congratulations on your success.

**Mr. J.K. von Ahlfen** (Springs): Mr. Chairman, yes this is quite a tricky problem. I have been a member of the Wiremen's Registration Board for quite a few years now and the impression I get is the Municipal engineers don't quite know how to implement the Act. If you want to prosecute a wireman, for contravention of the Act, it is specifically laid down the firms you must comply with, the procedure you must follow. It has been quite clear to me that the few cases that I had been brought forward to the Board, that it is very difficult for a Public Prosecutor or even for the Inspector of Factories on the information supplied and the action taken by the supplier to be able to determine whether there action can be taken. I would suggest that we as suppliers, make absolutely certain that we know what the Act says and that we comply strictly in accordance with the Act. I think then only will we succeed in getting a prosecution. Otherwise I see problems. I feel sorry for the contractor, I feel sorry for the prosecutor and for the

Inspector of Factories because it is very difficult for him on information supplied if we don't go strictly in accordance with the requirements of the Act to be able to get a prosecution. I would make an appeal to members to make absolutely certain that if they do have any actions, to comply strictly with the Act, otherwise we are just running around in circles.

**Chairman:** Thank you Mr. Von Ahlfen. I trust you mean Electrical Wiremen's and Contractors' Act.

**Mr. H.C. Dreyer** (Paarl): Mr. Chairman the point is that your Public Prosecutors in South Africa, are used to dealing with law from the point of view of Dutch-Roman law. There are certain exceptions however. The Factories Act is one example, certain portions of the Factories Act and certain portions of the Wiremen's Act. It is specifically stated that the accused is deemed to be guilty of the offence until it is proved to the contrary. Now most Public Prosecutors, if you go to them with a charge against a contractor or any member of the public for that matter, they immediately look at your evidence and the first thing they say, "you haven't got enough proof, you will never win a case in Court with this and they just throw it out promptly and I presume this is exactly what has been happening in this particular instance. I had such a case in Paarl, where the Public Prosecutor refused to prosecute the contractor concerned until I pointed out to him that in this Act provision was made for the accused to prove that he is an innocent which is a very difficult thing to do and this man was found guilty and since that instance we have had no further difficulties in Paarl to succeed with our charges and I must say Mr. Chairman, that we are very hesitant to lay any charge unless we are fairly certain of our case and all in all I think over the last five or six years we have had something like 30 or 40 odd court cases of which we haven't lost one, but the point to be remembered is this is not Dutch-Roman Law the charged person has to prove he is innocent. In practice, if it had been the other way around, you would never get a conviction against a man.

**Chairman:** Thank you Mr. Dreyer. I believe Mr. Raubenbach of the Contractors Association would like to defend himself.

**Mr. P.V.E. Raubenbach** (Electrical Contractors' Association of S.A.): Mr. Chairman, firstly I don't want to defend the illegal acts of Contractors although I'm employed by contractors. I believe that justice must take its normal course here. I heard that Mr. McNeil in Kokstad was advised by his Council's Legal Adviser to grant a provisional licence to a contractor. Now Mr. Chairman, I don't profess to be a fungi on the Act but I'm not so sure whether the Act provides for this. I do know that in terms of Section 13, provisional certificate can be granted to a wireman but certainly not by a supply authority by the Wiremen's Registration Board. While speaking about the subject of the Electrical Wiremen's and Contractors' Act, we should bear in mind that we live in an economy where the accent is on growth at the moment and we must look at the demand situation. A week ago Mr. Plumbridge, the President of the Chamber of Mines, opened the tri-annual congress of the South African Electrical Workers Association in Durban. Now you will know that the Electrical Trade Union. He stated, and this was quoted by the papers, that they experienced a shortage of 1000 electrical/artisans in the Mining Sector alone. I can assure you here today that we have a similar shortage, the same figure, in the Contracting Industry alone. We have tried our best with immigration, we are doing what we can with training. Our country is an expanding one and the infra-structure has to be provided. More than often, the contractor is faced with Hobson's choice. The job's got to be done. Now, we as an Association, have made other attempts to get some alleviation from some of the provisions of the Act, but all the same, Mr. Chairman, we can give you the assurance, but I believe I speak on behalf of the reputable organisation, and our members are reputable, and we will impress on our members at all times to try to the best of their ability to comply with the provisions of this Act.

**Chairman:** Thank you very much Mr. Raubenbach. I hope you will not only try, you will in fact succeed.

**Mr. J.G. Wannenburg** (Department of Labour): In labour ten years haven't produced anything yet. The trouble with courtesans on the Wiremen Contractors Act and the Factories Act, and this I want to say with the greatest respect to our magistrates and our prosecutors, is their lack of technical knowledge. They don't know what it is about, and like one magistrate one day said to me, how can he sit in judgement over a case of electrification if he doesn't even know what makes a light go on if you press a button and the light goes on. That is the biggest trouble that we have. In the Transvaal now, we are fortunate in that the Attorney-General has decided they are going to have a different way of doing and working on the cases for the Factories Act. The normal enquiries will be held, and copies of the enquiries will be sent, one to the Attorney-General the other one to the senior magistrate, the senior prosecutor in Johannesburg. The senior prosecutor, who is well versed in the Factories Act, and other Acts, like for instance the Electrical Contractors' Act, he will decide which Court this case will go to; whether it will go to an Inferior Court or to the Regional Court. He will also be in a position to appoint a prosecutor, and when he appoints a prosecutor, it will probably be a prosecutor from the Mining Court, and those prosecutors, I can promise you, they know their jobs. They know a little bit more than the average prosecutor in a normal Court. So in the Transvaal matters are going to be different and matters are going to be easier, but I don't know what we are going to do in the other three Provinces yet. That's the other thing in the Wiremen's and Contractors' Act is that the inspectors of machinery, not the inspectors of factories, they don't hold en-

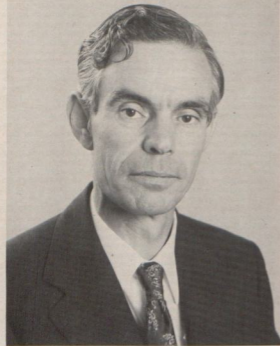
quiries, but the inspectors of machinery, are not entitled to hold enquiries.

The only thing they are entitled to do, is that under the Act provision is made that the Board can call on an inspector to go and make an investigation like we did once in a certain town up in Northern Transvaal somewhere, I don't want to mention the name, but we sent an inspector there because we had a lot of complaints and this inspector merely investigated and reported it to the Board and after that, the case was going to be just handed over to the prosecutor, so we have no real right to prosecute from the Department's side, to prosecute under the Wiremen's and Contractors' Act. It is not the same as under the Factories Act. And that is our biggest difficulty.

**Mr. D.F. Kneale** (Johannesburg - Electrical Contractors' Association): Mr. Chairman, being a member of the Wiremen's Registration Board as well as representing the Electrical Contractor's Association, I would like to bring it to the notice of the members present here today, that should a contravention on the part of the wireman be noted by a municipality, this is to be brought to the Board, but in the case of a contractor, the municipality itself must take the necessary steps. Under Section 19, this is clearly detailed: The procedure 19(3) - If in the opinion of the supplier, the fault or defect or contravention is of a nature that would justify the removal from the Register of the name of any wireman responsible for such wiring work or the suspension of any certificate issued to him, or an endorsement against his name in the Register, as the case may be, the supplier may, - and it says - he may bring such report and information to the notice of the Board for their consideration. Now that is the wireman. And now if it is a contractor, the Municipality must take the necessary action themselves, with a notice to the Wiremen's Registration Board.

**Chairman:** Thank you very much for your contribution, Gentlemen, time of the Natal Branch is up. We thank you very much for your contributions and thank you for making my stay up here a pleasant one. May I hand over to the President.

**President:** Thank you Mr. Bozyczko. You did very well indeed and that is only to be expected because you served your apprenticeship in Pietermaritzburg. Now we come to the questions by the Good Hope Branch and our Chairman will be Mr. Murphy.



CHAIRMAN: K.J. MURPHY: VOORSITTER

#### QUESTIONS:- GOOD HOPE BRANCH

**Voorsitter: Mr. K.J. Murphy** (Somerset-Wes): Wel menere, ek kan maar net hoop dat die sessie van die Goeie Hoop-Tak net so voorspoedig sal gaan soos die vroeëre vanmore en dat u nie in die tussentyd dalk a 'n bietjie moeg en vaak geword het nie. Die eerste probleem wat ons hier het, is deur Mnr. Hess van Kaapstad voorgee.

#### READING OF MFTERS IN LOCKED PREMISES-

The problem of obtaining access to meters is increasing daily with more and more premises being locked during the day because both

husband and wife work. In Cape Town meter readers carry very large bunches of keys (supplied by the consumers) to give access to such premises but this system is not entirely satisfactory.

To overcome the difficulty it has been suggested that such consumers be sent cards each month by post with a request that they fill in the meter reading on the card and post it back to the Council. The meters would have cyclometer dials so reading would be easy.

**Has any member tried this system, and, if so, with what success?**

**Mr. I.H. Hess** (Cape Town): This problem is really a very serious one in Cape Town and I don't know how the other larger municipal authorities deal with it. In Cape Town today we have something in the order of I think 8,600 keys of private premises. One's mind does boggle at the responsibility that we land with. We had numerous cases over the years. I've been there, where our meter readers have been accused of theft and a whole lot of things. I'm happy to be able to say that we've never had a single case where one of our staff has been convicted, but it does encourage consumers to take a chance and see what they can get out of it. Now, it's a problem that's been exercising our minds for a long time, my predecessors could not find the solution to it, somebody suggested to me that possibly we can get over this by means of sending out cards which the consumers could fill in themselves. My own staff tell me about all the difficulties, you know we have computerised accounts and I have long sheets of papers here written by my staff telling me what I can do, and I'm hoping that possibly amongst all my friends here and various other authorities that they could give me some lead as to how we can get rid of this system of having keys to private premises. This even goes to some of the larger departmental stores, where they have odd stores, stores, not for the stores themselves, its where they have odd stores away from their premises which are normally kept locked, and they are probably just lighting meters in these premises, and have to be read.

We try in every way we can to make arrangements with the consumers to have fixed times when they can have people present to unlock the premises so we can get to the meters. But with, I think 126 000 consumers, that obviously is not an easy thing to arrange. The meter readers have fixed rounds, if you depart from those you can get yourself into an awful lot of difficulties. It has been suggested to me that some other municipality has tried this system, I'd like to know where and I'd like to know what success.

**Chairman:** Well gentlemen, you've always known that Cape Town is a key city, now you know why.

**Mr. E.E. de Villiers** (Rustenburg) Ja, ek dink nie ek kan sommer 'n kits-oplossing vir mnr. Hess gee nie, en die ander persone wat die probleem het nie.

Waar die probleem by 'n munisipaliteit opgeduik het waar ek vroër was en wat ek van daardie tyd af oral toepas met baie groot sukses, is dat jy net moet seker maak dat jy die kloustele in jou verordeninge has wat bepaal dat die verbruiker moet ten alle tye normale toegang tot sy perseel verleen th tot die toerusting van die raad. Jy kan jou daarop beroep en as die persoon dan nie daardie toegang verleen binne 'n sekere tyd nie dan mag jy sy krag afsny tot tyd en wyl hy dit gedoen het, en jy kan hom dan ook forseer om op sy koste wel die veranderings aan te bring om die toerusting op so 'n plek te plaas waar jy dit kan lees sonder dat jy hoef toeveg te neem na 'n paar honderd stelsels om oop te sluit. Ek besef dit gaan miskien in die geval van Kaapstad 'n langtermynprojek wes om dit op daardie manier reg te stel, maar ek dink dit is die beweging in die regte rigting, as hulle dit wil doen gaan hulle metertyd daardie probleem oplos.

**Mr. H.C. Dreyer** (Paarl): We all know Mr. Hess very well, he can be quite impatient at times. I'm very surprised that he has tolerated such horrible situations for such a long time. In Paarl we also had such a situation about 12 years ago, electricians running about with big bunches of keys, quite a few hundred, not quite 8000 though, but large enough to be awkward, and all we did we just changed all the locks under a master-key system. Each consumer has got his own keys, he can open his own lock, he can't open his neighbour's lock and I'm referring now to meter rooms as such not the front-door of a man's house for e.g., that I wouldn't accept under any circumstances. We've got a uniform master key system, each electrician has only got two keys and can enter any substitution or meterroom although nobody else can, you get master system, sub-masters and also individual keys to each lock.

Apparently people in Cape Town don't sell these locks, but I think you can get them, I think, in Johannesburg.

Mr. Chairman, as far as domestic installations are concerned, if the meter is inside the house we just refuse to read it, the man has got to remove the meter to the outside.

**Mr. E.P.E.W. Trautmann** (Ladysmith): I have got a solution to offer, but I just want to remind that these problems definitely have been dealt with, perhaps not in S.A. but in European countries, long, long ago; and there is a system we can perhaps think about. That is, we should include in our By-laws the provision that the meter readings can be averages; at certain times there will be an adjustment and things will be back to the actual figures. That would necessitate to having only a few readings during the year.

**Mr. J.R.N. Mackay** (Cape of Good Hope - Provincial Administration): I'm surprised that we haven't had anything from Salisbury because Salisbury some years ago was working on this system and I as a householder and consumer had to work under that. My colleague, the Electrical Engineer and the Electrical Foreman who

were also living nearby, immediately saw the implications of this and we trained our wives to do it for us, so they filled in the cards which were sent to us each month and we never had any problems, what the problems were on the municipal side, I don't know, but it worked in Salisbury with everybody, everybody was under this system and it was a very simple system from the consumer's point of view, it was merely and just a cyclometer deal and you put a line as to where the pointer was on the deal, that was all, and they came around to check from time to time to see that the readings were right, perhaps once or twice a year, as far as I know nobody ever came to check ours so it must have been right. If anybody wishes to get any information I think Salisbury is the place to get it from because if they're not working on it now then they will, I think, know all the answers as to why it didn't work, if they are working well then it shows that it has been working since about 1959/60 or thereabouts.

**Mr. E.C. Lynch** (Salisbury/Rhodesia): I'm afraid the previous speaker is not quite correct. Self-reading meter cards are not the answer. First of all, it didn't apply throughout the Salisbury system but only in the licensed area, and it was introduced because of the distances between properties and considerable economies were expected from the saving of mileage by the meter readers. The system was used in the peri-urban areas for about 10 years or more. It was reasonably successful but, I have to admit that the return of cards was only about 50% of the number of cards that should have been returned each month, so the first lesson is that you won't get anything like 100% of your meter reading cards back. So there's a terrific lot of follow-up work. The Treasury of course average for any consumer who has not returned the cards and invariably the average figures tend to be very widely out, so that the consumers complained bitterly on that score. That means that you get correspondence and you've got to send out somebody, not a meter reader now, but somebody competent enough to explain why their consumption was about 2 or 300 units per month for six months and then went up to several thousands units for the 7th month.

It, as I say, is by no means the answer to the problem faced at Cape Town. The problem can only be solved in my opinion, by insisting that premises are available at all reasonable hours for meter reading or that the consumer should have the meter so positioned that it can be read from outside, or at least gain entry into the premises.

Now, a further complication as far as Salisbury is concerned is that we have recently incorporated most of the peri-urban consumers into the municipal area, well not so recently - three years ago, and the Councilors representing the peri-urban consumers were just not prepared to see the municipal consumers, of the original municipal area consumers, having their meters read and the ones outside using a self- or being expected to read their own meters, possibly a little petty, but anyway I rather welcomed the return to full meter reading, and it certainly, I think, the only satisfactory system is to have regular meter readings at periods not exceeding two or three months as a limit, you can average in between for a month or two but you can't go on month after month expecting the consumer to send in reliable meter reading cards, at least that has been our practical experience in Salisbury, and now, it has been a fact that except for a few consumers in the remaining municipal area, and there are very few of them, I'm speaking from memory I think it's only about 600 consumers left within an area from about 400 square miles. Now in an area like that it's worth having meter-reading cards, but that has no relation to the problem in question at Cape Town and carrying hundreds and hundreds of keys, I think it is quite unreasonable for consumers to expect that, and they should find some way of being relieved of that burden.

**Mr. D.C. Plowden** (Johannesburg): In Johannesburg for a number of years now we have adopted the principle of reading meters quarterly for domestic consumers only. The interim months we submit a provisional account and on the third month when the meter is read we submit a reconciliation account. So that the problem of not getting into houses is reduced then to once in every three months. Now it has also been our practice for the past, I should say 25 years, to require that domestic consumers have their meters mounted on an outside wall, or on the stand boundary, so this presents no problem in reading these meters. We do of course have a very large number of houses that were built before this requirement, if we have trouble in getting into a house to read the meter we write to the consumer and ask him to make an appointment so that the meter can be read. If he ignores that request we then give him a provisional account and it's high enough to make sure that next time he will comply with our request. So we don't have an awful lot of trouble that way.

When we come to business consumers, in terms of our tariff a block of flats is also a business consumer, or industry, we have a dual purpose lock which is something we have developed, I don't know if other people have this, in the general run it's a Yale type of lock with two barrels both operating the bolt, we have a standard key for the one, the consumer has his own key for the other because he needs access to his own low-tension chambers. This means then that our meter readers carry only one key to get access to any building - business or industrial consumer.

**Mr. D.H. Fraser** (Durban): I don't know whether any of the suggestions made has really helped Mr. Hess. I think his problem is a legacy of the past, I think he well knows how to deal with the situation in respect of the current new consumers, but his problem is what to do about the ones that his forebears have left him to handle, and I've got sympathy with him we've certainly haven't got the problem of that magni-

tude in Durban although I think there are some areas in which special arrangements are required. I was rather concerned by a remark I think made by Mr. Dreyer of the Paarl, in that, the supply authority should resort to such drastic action as to require a consumer to rearrange his supply, which might have been quite a sort of legitimately installed in the present fashion at some previous date, I think there is a principle here that we've got to bear in mind that if an installation is approved and a regulation or legal requirement is changed it should apply to consumers hereafter and not to what has gone before, by and large.

**Mr. M.W. Odendaal** (Alberton): I think the key to the key problem in Cape Town is by simply attaching a small metalbox to each door and then deposit the key of the door in this box and this little box in turn is locked again by a municipal padlock.

**Mr. C.Lombard** (Germiston) According to a publication received from one of the well known meter manufacturers, they could provide a simple device which you can attach to your meter to provide remote indication of your meter reading.

I can't remember off-hand the name of the firm but I've got it in our records, and this may possibly provide the answer to this problem.

**Mr. H.C. Dreyer** (Paarl): Before we go on to the question of remote meter reading which might invoke a long discussion, I would just like briefly to reply to Mr. Fraser. In a case of requiring consumers to put their meter boards outside it is almost invariably coupled to some other matters such as rewiring or where we definitely have got problems we are now forced to use Coloured meter readers, and a few, not many, consumers have objected to that and refuse access to their house by Coloured meter readers, in which case we promptly instructed them to move their meters outside. I think that more or less answers that question.

**Mr. L.H. Hess** (Cape Town): I don't really want to reply I just want to say I'm sorry that Mr. Cosser didn't want to speak, he did give me one solution of the key, and that is to employ more meter readers and working a lot of hours. But I'd just like to let the other delegates know that these other problems have been thought of, we have provision in our by-laws that we can cut-off supply, we can force them to put their meterboxes outside. I think you must appreciate that most of these consumers involved are Non-European. You see all our Coloured areas are reticulated, they all have electricity, every single one and some of these are ancient and if we've got to ask them to spend R100 or more to put the meterbox outside, I think that my Council would soon find another Electrical Engineer.

It's a problem which we've tried to solve from all aspects. Mr. Fraser is quite right, it is one that I have inherited. Over the last ten years all meter-boxes have had to be outside, in fact over the last five years they are all in the streets - in the street-pillars, so that this is not a problem we have now it is one we inherited and we're trying to get rid of. If anybody should in future come across or think of a solution please inform me at P.O. Box 82, Cape Town.

**Chairman:** Thank you Mr. Hess. We have closed the discussion on that question and proceed now to Question no. 3 and we'll return to Question No. 2 afterwards.

#### H.V. RING MAINS WITH SOLIDLY CONNECTED TRANSFORMERS

The views of members would be appreciated on the system of solidly connecting transformers to H.V. ring mains without protection on the H.V. side but possibly with disconnecting links.

Gentlemen, I personally submitted this question, I'd just be interested to know what other undertakings are doing and to what extent they are making use of the fuse type unit to protect a feeder having on it a number of miniature substations with transformers connected by means of links, and so forth.

**Mr. W. Barnard** (Johannesburg): This is a question which is of great importance to us, particularly in the Transvaal province at this stage. We have been asked by the Director of Local Government to draw up guide lines for the reticulation of new residential townships, and in trying to draw up these guide lines we have to consider the various parameters involved in providing this reticulation. The first thing of course that does come to mind is what type of protection you provide and where you provide it. Now I personally feel that protection of transformers must be related to the risk and the incidence of faults and also the effect and inconvenience that such faults will cause.

Now when we talk about protecting transformers on ring mains, I'm not entirely sure what this means. Our proposals are that you have a main distributor with main transformer substations, and associated with each transformer substation you would probably have four minisubstations. In our main transformer substation, which is connected to the main distributor supplying that whole township, we feel it is essential to have protection. Now this must either be fuse protection or an automatic oil circuit breaker of that nature, so that if you do have a fault on the other side of your protection at least you are not going to lose a large substantial area consisting of a number of townships. But when you come to the local minisubstation as I mentioned, if you have only four of such connected in a ring to your main transformer substation, a fault on the ring can only affect a limited number of consumers. Now, you might say that that is a risk that we are not prepared to carry, but then again on the other side the only type of fault you're trying to protect against, my view, is a transformer fault, a fault on the high voltage winding of the transformer, and more probably a fault close to the terminals of your high voltage winding.

We in Johannesburg, we've had faults on minisubstations, not many, we claim that transformer faults are very, very few and far between. On the odd occasion that we have had a fault we have found that fuse protection has not operated, because there has been insufficient fault current operated. In one particular case the whole minisubstation burnt out before any protection operated. Now, I feel that this in itself indicates that we're not achieving anything by putting protection at the point, and we are in actual fact recommending, that one puts your protection on your main distributor, and there on your subsidiary rings you have something like compact switchgear giving you on-load isolation, and no other protection.

**Chairman:** Thank you Mr. Barnard for a very interesting and informative reply.

**Mr. C. Lombard (Germiston):** I entirely agree with the remarks made by Mr. Barnard. The point that we have to bear in mind too is that providing fuse protection for miniature substation transformers, will only give you fault protection, not, that is, phase to phase fault protection, not earth leakage protection, whereas at your feeder end you would have oil circuit breaker providing overload and earth leakage protection, and the chances are that your earth leakage protection level is of course much lower than your phase to phase fault protection. I think that is entirely adequate, I can't see any point in providing the individual protection for miniature substation transformers.

**Mr. I. H. Hess (Cape Town):** I'd like to go back a few years, about ten years ago or so, we had quite a large number of pole transformers on our overhead 11-kV distribution system, and we were getting a lot of faults on the Yorkshire fuses which were protecting those transformers. We took our figures for one year, we had 32 faults, two of them were transformer faults the other 30 were just faults in the fuse itself. The result was we connected all our transformers solidly on the overhead system. To the best of my knowledge we've never had transformer failures which gave us any trouble.

In our current housing estates which have very extensively been developed in Cape Town over the last five years, we endeavour to house hundred thousands of Non-Europeans, we started ring main systems with transformer positions about 10/15 on one ring feeder. I hear Mr. Barnard entirely, we put circuit breakers at the start and finish of these rings. We initially start off with fused T-off isolators on each transformer, a costly arrangement. We search for a long time to try and find a simple load making fault rating switch, so that we could have one switch at each transformer position, just to isolate, so that we could isolate a switch plus the next cable, we isolate the next switch just in the event of a fault.

Not a very great success, we have one or two of these on our system now and we hope to have a lot more. I think it's a simple arrangement. I would disagree with Mr. Barnard, I think that one must be prepared to accept that if one transformer goes faulty that a certain number of consumers will have to wait for their supply. But I'm not prepared to accept that we must allow 3/4 transformers to go out because of one fault. So I've been looking for some means of isolating, the rings would do the case but it still takes time to isolate: - A simple means of isolation for one transformer and it's associated cable. I don't think the transformer is likely to give a fault but the cable boxes of course are always the problem.

**Mr. P. J. Botes (Roodepoort):** Ek is bietjie verbaas om te hoor van mnr. Barnard van die probleem wat hulle het met die foutsroom en dat een van die miniatuursubstansies heeltemal uitgebrand het. Ons gebruik soveel as omtrent tussen 10/14, dink ek miniatuursubstansies op 'n kring, en ons het heelwat foute gehad, ons is heilig onoor te skakel van 6 kV na 11-kV, en in die proses het ons heelwat probleme gehad met die tap-skakelaar en het foute in die miniatuursubstansie ontstaan, toe ons ingeskakel het, het hy uitgeskakel op die sekering. Die sekering-beweging wat ek gebruik is die eenheid waar jy - as die enkelafse uit-skakel dan skakel dit alreë uit, in ander woorde dit is 'n driefasiese eenheid, dit is nie ene wat net die een afskakel nie, ek verkies dit. Maar, dit is noodsaaklik, en ons het ook gevind in foute wat by ons werklik plaasgevind het, het ons gevind dat jy kry altyd a foutsroom wat, ons het nog nooit probleme gehad eintlik nie, wat nie die sekering geblaas het nie.

Die ander punt wat ek net graag wil noem in dié verband is die kwessie van, ons het natuurlik aardlek-indikasie wat aantoon waar 'n foute is op so 'n kring, ons hou omtrent 5 of 6 miniatuursubstansies op 'n radiaal-kabel wat natuurlik 'n kring vorm. In die middel is hy oop sodat ons die aardfout kan bepaal, maar dit is noodsaaklik dat jy aan die hoogspanningskant een of ander skakelaar, nie 'n olie-stroombreker, maar 'n skakelaar het, en hierdie kompakte tipe skakelaar is vir my heeltemal onseker, en ek dink wanneer 'n mens gaan na 315kV eenheids- of driegeveel om 'n kompakte skakelaar, 'n lem-skakelaar te installeer. Maar wanneer jy 100kV miniatuursubstansies gebruik is dit 'n onekonomiese proposisie, so wanneer dit by die 200 en 300 kom is dit moontlik om daardie skakelaar in te sit, maar, ek wil dit net bevestig, dit is dringend noodsaaklik om so-lies te hê want as jy in die middel van die nag na 'n miniatuursubstansie moet gaan en daar is 'n fout op daardie miniatuursubstansie en jy moet hom afskakel en dit is in die koue, in die winter, en die eerste ding wanneer jy daar kom, daar is nie 'n elektriese draad nie en jy is persoonlik daar, nou moet jy 'n mes kry, jy het nie 'n mes om hierdie bande af te sny - die isoleermateriaal af te sny, jy het nie 'n mes nie en al daardie tipe van dinge, en nog 'n "spanner" (skroefhamer) kry, dan het jy nie een nie, en nou wil jy dit doen en dit is koud, en jy kan jou hande nie oopkry nie, ek dink dit is absoluut noodsaaklik dat 'n mens so 'n afskakelaar moet hê.

**Mr. K.G. Robson (East London):** If I might just ask Mr. Barnard one or two questions? I must confess I'm concerned that it would appear that standards are being laid down, possibly in the Transvaal, and we realise that some of these Transvaal influences seem to spread. Sometimes when we don't want them to spread, but they have a means of spreading into other, you know, more congenial atmospheres. I'm a bit concerned that we are perhaps talking about one compact substation or miniature substation, of say a 150 consumers, when in fact you could have something like 600 consumers affected with 4 substations involved. I would like to ask Mr. Barnard if the system that they are suggesting probably go to suggest envisages purely local rings for the miniature substations of say 4 such substations. I would think that probably you'll get a very much more flexible system if your 11-kV cable ring forms part of your system, in other words, that you can have a miniature substation established anywhere on your system, provided you've got the adequate protection and the fault capacity in your switchgear, so that you're not limited in that you return a ring back to, assuming the substation that Mr. Barnard refers to, where his oil circuit breaker protection is in fact situated. I wonder if he could answer that question for me.

**Chairman:** Mr. Barnard has left.

**Mr. D.C. Plowden (Johannesburg):** The first thing is that we are not prepared to put a miniature substation with a limited kind of protection you can have on it onto a main ring feed. We are not prepared to have a fault in a small thing like that, a 300 kV transformer brings out something like perhaps 20 or more than 1000 centres. Therefore, we have only on our main feeders, our main load centres with full protection as Mr. Barnard described. Now, we may have from a load centre a ring, that's the local ring with up to 4 minibus on, it's not really a very common practice of ours because more likely we feed these four minibus on radial feeds from the load centre. Now one load centre of 300 kV capacity will feed about 200 consumers, if we loose that load centre, if it's on a radial feed, there are only about 200 consumers affected; we are so organised on the low-voltage side that if we loose such a transformer we can feed back on the low-voltage side in a matter of about 1-hour to give temporary supply to those 200 consumers. If its on a ring and we happen to loose that whole ring well then there are about 80 consumers affected, and as far as possible we feed back on the low-tension side.

I think that might answer Mr. Robson's question.

**Mr. H. Barnard (Brakpan):** Ek gaan nie lank wens nie. Ek wil net eerstens sê, "Dankie vader, ek is nie Rooodepoort se ingenieur nie, want ek is 'n fankal met 'n mes en 'spanner' weggehoel."

Tweedens, glo ek ook dit is 'n baie goeie gedagte hierdie om transformators in die minisubstansie op 'n ring te sit sonder enige beskerming tussenin. Ek glo net van 'n praktiese oog af moet 'n mens in gedagte hou dat jy sal moet een of ander vorm van indikasie daarin sit, wat vir jou sal wys watter spesifieke minisubstansie probleme veroorsaak het, want as jy so 'n ring kry waar daar 4 minibus op is en jy het miskien 'n stel 'links' op die hoogspanningskant wat jy wil afsakel en daardie ander drie terugkry, dan moet jy weet watter een van die vier dit is anders gaan jy heelwat probleme oop en tyd mors voordat jy weer die sisteem terug het in werking.

**Voorsitter:** Dankie mnr. Barnard. Menere baie dankie vir 'n interessante bespreking. Sal ons maar voornem dat die volgende vraag? Ek het gesê dat ons sal weer terug kom na vraag 2 toe. Ek lees net vir u die vraag:-

#### USE OF PLASTIC TUBING BURIED IN PLASTER

Because of periodic shortages of steel tubing, pressure in some towns put on municipal electrical engineers to allow the use of plastic tubing even where it is buried in the wall. In the past permission to do so has been refused because of the risk of nails piercing the tubing and becoming alive. The views of members would be appreciated.

**Mr. D.F. Kneale (E.C.A.):** I would like to say that it seems to me that the way is now open with the probable introduction of earth leakage on all lighting and plug points circuits in October, that we will be able to use plastic conduit in concrete slabs and plastered walls.

There seems to be only one limiting factor, and that is the workmanship and the checking of the conduit once the conduit's been installed prior to the concrete being cast or the walls being plastered. The earth leakage units seem to be the answer, possibly some of the municipal engineers would like to comment on that.

**Mr. A.J. v.d. Berg (Krugersdorp):** Ons het twee gevalle gehad in Krugersdorp waar kombuiskatte lewendig geraak het as gevolg van spylers wat deur hierdie eenheids geslaan is in die geleierbus in. In een geval was daar aardlek-beskerming, maar ongelukkig was daar 'n mat op die vloer in die kombuis, en die aardlekbeskerming het toe nie gewerk nie, gelukkig het die inspekteur die fout agter-gekem dat die kat lewendig is. In die ander geval was dit 'n klipvoer in die aardlek het toe gewerk. Ek het toe op daardie stadium gevoel dat dit is so belangrik dat ek alle gebruik van plastiese geleierbus verbied het in Krugersdorp, en daar was toe 'n versoek aan my gerig daarna, en ons het toe besluit om dit alleenk te laat installeer in oop ruimtes waar dit geïnspekteer kan word sonder dat daar enige gevare is en dit word ook nie in platdakke gebruik nie en ook glad nie toegelaat in betonmure of toegeelste nie.

**Mr. S.H. Hawkeswood (Richards Bay):** About a month ago the S.A. Institute of Fire Officers held their Conference, and one of the papers read was by Mr. Kotze of Johannesburg Fire Department. It

was a very interesting paper and it dealt with the, well the Fire Institute is endeavouring to introduce new Fire By-laws, and in particular by-laws relegating these materials. One of the materials that was mentioned was P.V.C., and he gave examples at the conference where he said a half a kilogram of P.V.C. when ignited in a fire would produce enough smoke and gasses to fill up a corridor 30 M. long. I think I'm right about that too, a corridor's normal width is about 3 Metres by 3 Metres.

**Mr. R.W. Barton (Welkom):** For more information, particularly with regard to its composition, and whether one could depend on its composition remaining the same, over a period of years, in other words, would the material in different batches be different as it was in the old days of P.V.C. insulated cable as we know. There was no control over specifications and the melting point varied from batch to batch and that type of thing and if I remember correctly, we did not approve it for use for that specific reason. I think if one could get a guarantee that the stuff is uniform and always will be uniform, same hardness, same response to temperature and so on, and provided the earth leakage is installed, I personally would have no objection putting it into the wall.

**Mr. D.F. Kneale (Electrical Contractors' Association):** In support of what Mr. Barton has just said, I personally noticed that the material becomes very brittle when subject to extreme differences in temperature particularly here on the Reef where the night temperatures could be below freezing and the day temperatures, particularly at this time of the year, at midday it is quite, considerably warmer. The conduit tends to become brittle, and the one wheelbarrow over this conduit, of course shatters it like a piece of glass. This is one of the problems, the other problem is that I think that the current rating of the wires has to be reduced because the dissipation of heat is somewhat less through the conduit being plastic as against steel.

**Chairman:** Thank you Mr. Kneale.

**Mr. A.A. Middlecot (S.A.B.S.):** I'm just trying to stop saying too much, because I think if you start on a subject like P.V.C. you could have a symposium on its own and still be in rather a lot of trouble. I don't think at this stage one should worry about things like migration of plasticizer, one of my colleagues favourite subjects on this, with regard, I don't think one should overdue the burning, the flammability; after all in practice it is encased in concrete, it is hardly likely to give trouble. Where, I think, the fear of fire has come has been in a switchboard. We know, there is on the Continent, they would like to find a better substitute than P.V.C. simply because when it does catch a light, and it is no worse than any other material, it unfortunately gives off a gas which corrodes relay contact and leads to damage of the electrical equipment. That is the real danger. You shouldn't complicate the matter by talking about these other matters. The big thing is, will a nail be knocked into the wall, the big fear in Britain they are not too keen on it. I understand the usage isn't as high as I thought it was for the same reason as we have here and that is we appear to knock nails into walls. The Continent uses it much more. They do guard against excessive probability by only allowing horizontal or vertical runs of plastic conduit in other words it must go directly out from the socket outlet or horizontally from it, and they trust that the public will know not to knock a nail in there. The other point normally claimed, is that if in a normal conduit with the normal amount of wires, it is very difficult to get a nail into the conductor because when it gets through the conduit itself, it tends, P.V.C. being fairly slippery, tends to deviate the core away and not allow the nail to go through into the copper. Now this is based on a certain amount of experimentation but, I think this is where one wants practical experience because that is the best. I have heard from someone here and I think this is correct, and I'm listening that they have cases where the nail has hit the copper, and I think that is very important and if there are such cases, then it wouldn't be a good thing, but I think based on P.V.C. alone and assuming it is a good quality and that the plasticizer are most, it won't migrate and in fact, in any case we will accept a statistical occurrence of this because we don't often pull the wires out of the conduit. How often do we do that? Possibly it may not be so bad, but if amongst the members here, they can state that the probability of a nail going through and hitting the wire, is high, then I think it would be a bad thing.

**Chairman:** Thank you Mr. Middlecot. Gentlemen, I think we have covered this question fully and very well and we would like to close it now. May I ask you by the show of hands, to indicate what undertakings are prepared to accept this conduit in walls if any? It seems there are such a majority of you allowing it within walls at the moment in any case. Thank you gentlemen. The next question on the agenda was submitted by the Strand Municipality.

#### ESCOM'S RESPONSIBILITIES VIS-A-VIS LOCAL AUTHORITIES REGARDING THE FAULT CAPACITY OF THE LATCHER SWITCHGEAR

I want to read you a little covering letter; I think it is rather important I feel to all of us: "The Strand Council received from ESCOM advice to the effect that as a result of improvements to their system, the prospective half level at their Orange River Substation would be in excess of 250 MVA and that in order to establish what Escom's responsibilities are in this connection Strand would have to consider means of limiting the fault level, all of upgrading their switchgear from 250 MVA to 350 MVA. It was realized, that even if this were to be accomplished, the rating of the high voltage underground network would require similar attention to accommodate

the increase prospective fault level. It was generally felt that the onus should be upon ESCOM to so equip and control its system to insure that the system fault level remained within the capabilities of the consumer's equipment and less of course, ESCOM's installed transformer capacity required to meet the consumer's needs had a prospective fault level greater than the fault-handling capacity of the consumer's system for example: A consumer with a maximum demand of 10 MVA, must have a system capable of handling a fault level of at least 3 x 5 MVA transformers, that is 180 MVA at 100 Volts in parallel of at most 2 10 MVA transformers in parallel whereas at the Orange River Substation in question, the installed transformer capacity is 40 MVA and the Strand maximum demand current is only 9 MVA."

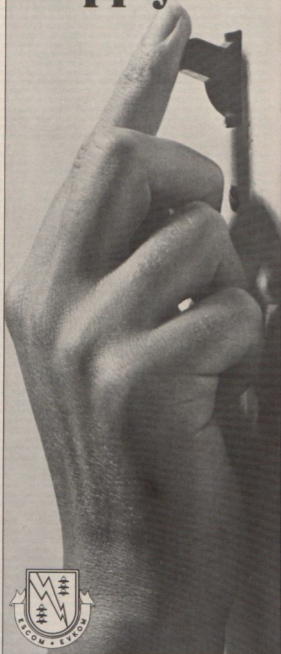
I know that some of our ESCOM colleagues are burning to give us the necessary answers over here. I would like them to come forward.

**Mr. J.L. McNeil (Kokstad):** I was interested in this point because at Kokstad we have a type of fuse switchgear, which I last used at a Naval Air Station in the north of Scotland about 1943, so I approached ESCOM representatives and asked them carefully as they had two transformers connected and operating in parallel; one of which was more than double the reading of the load that Kokstad was taking. If, to limit the fault level, we would isolate one. So we took the next step up, and they told me that ESCOM did this because a case had occurred where they had a spare transformer not energised which, when it was required urgently and was put on load, developed a fault, so I said well, I can understand that, but is it essential that both transformers be connected in parallel. I said that, to ensure that a fault did not occur on the spare transformer, wouldn't it be practicable and feasible to isolate one side? Either the primary, the 88 kV or the secondary 11 kV. So they went back again and the reply I received was: that this was ESCOM's policy and that was that.

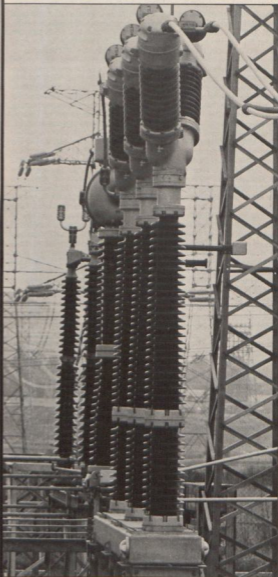
**Mr. I.H. Hess (Cape Town):** Some six, seven years ago, we negotiated for our first connection to ESCOM, 132 kV connection and it meant a number of meetings with their then Chief Engineer and we were ensured that the fault level of the switchgear to supply point, we had installed the switchgear, with the 3 500 MVA. From our own calculations we were a bit doubtful about this, we thought 5 000 might be a safer bet, so I put this in writing to ESCOM and asked them for a written assurance that 3 500 MVA would meet the case. I got that written assurance. I say within a fortnight Mr. Radley is getting his... from them, I got one as well advising me that I would have to upgrade the switchgear to 5 000 MVA. Their argument was it is something they have to face up regularly - as the system expands, they must upgrade the gear to a level feasible for ESCOM to do so. They can take the gear out from substation A and put in to substation B. We have one, 132 kV supply point from them. If we take that switchgear out there, we will have to throw it away, now, at a cost of quite a few hundred thousand rand. That is hardly a feasible proposition. I felt I was obliged to throw the ball back into their court, which I did, and told them I frankly refuse to change the switchgear. I then had a reply back from the General Manager, this time, telling me that he thought it was quite reasonable that this switchgear would do until about 1982 or 1983 by which time it would have been in about 13 or 14 years and he felt that was a fair life. Now had he said 30 or 40 years I would have been with it, but for 13 years I could not accept it. In my own particular case there was a happy ending in so much that we asked them for their calculations. They had assumed a fault contribution from my own system, which was quite wrong, it actually was only about half of that amount, so in effect the 3 500 MVA switchgear is going to last us until the 1990's. But that is purely fortuitous as far as I am concerned. I really feel that this is a question that our executives must take up strongly with ESCOM, that once they have specified a fault level at your supply point, by hook or by crook, they've got to stick to it.

**Mr. F.J.W. Barnard (EVKOM):** U probleem van verhoede foutvlakke, is seer sekerlik vandag 'n baie wenneke een. Soos wat die aanvraag op EVKOM se netwerk toeneem, by onseker 10% per jaar, en ons opekkende transmissie en distribusie-kapasiteit toeneem, moet ons vermag dat foutvlakke ook sal toeneem. Wanneer EVKOM 'n gebied binnebring, word die netwerk normaalweg ontwerp om aan die behoeftes van daardie verbruikers te voorsien. In sekere gevalle word netwerke onder-ontwerp. Dit doen ons met opset om terme so aanneemlik moontlik vir verbruikers te maak en hier dink ons veral aan afgeleë munisipaliteite, die Suid-Vrystaat, die Wes-Transvaal ens. In ander gevalle om tegniese redes, word netwerke oor-ontwerp, maar mnr. die vraesteller, nadat die netwerk dan ontwerp is, verander ons normaalweg nie, behalwe as die benodigdhede van ons verbruikers toeneem. Dat ek eintlik wil sê is dit: hoewel ons dan fisies die vermag van ons netwerk opstoot, en die netwerk verbeter, is die onderliggende rede eintlik die toeneemende verbruikers. In die verandering EVKOM die verantwoordelikheid vir die koste van die verandering van brekers op verbruikers se installasies sou aanvraag, sou dit slegs beteken dat ons hierdie kostes weer van ons verbruikers moet verhaal. Ons het geen ander manier om daardie geld terug te kry nie. Dit is myns insiens onregverdig teenoor verbruikers wat op 'n vroeë stadium die addisionele koste aangegaan het en groter skakeluitjesteinstalleer het. In die lig hiervan, op die Rand & O.V.S. Onderneming in alle geval, aanvraag ons nie die verantwoordelikheid vir die verandering van verbruikers se skakeluitjeste, maar ons is nie onpatiatiek teenoor verbruikers nie; ons gaan uit ons pad om hierdie hulpe te kry deur by ons stamme te kei sodat daar minder transformators in parallel loop. Hierdie werk gaan gewoonlik gepaard met koste, maar minder koste as om al jou skakeluitjeste te vervang. Aan die onderkant moet verbruikers

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ook besef, wanneer 'n mens bv. twee transformators het en jy skiel hulle op een of ander manier deur een-sit te skakel, (ons sou tussen hakies daardie een transformator waarna een vorige spreker verwys het, maar uitgeskakel het op die verbruiker se verskeie) maar as mens twee transformators dan nie in parallel loop nie, beteken dit dat jy betroubaarheid van jou netwerk inhoet, maar ons sou dit beslis doen indien dit ons verbruiker sou help. Ek swet nou Kampstad sal nou my aanmerking snaaks vind, maar ek wil tog aan die hand doen dat u maar u plaaslike tak van EVKOM kontak wanneer u skakeltuig wil koop en uitvind water tipe hulle koop op daardie stadium, maar mnr. die vrassteller, ek beklemtoon, ek dink met die veranderende omstandighede in die land waaroor EVKOM eintlik maar baie min beheer het, en waarvoor ons maar eintlik in die kristalballetjie soos eke een van u moet kyk, aanvaar ons nie verantwoordelikheid as ons tien jaar in die toekoms, of vyftien jaar verkeerd sou wees nie.

**Voorsitter:** Dankie Mnr. Barnard. Mr. Hess, would you care to make any further comment?

**Mr. L.H. Hess** (Cape Town): Mr. Chairman, I made some enquiries of what the practice was in the central generating authorities in England. They still maintain 250 MVA switchgear on the 11 kV distribution system. They still maintain 3 500 MVA on their 132 kV system. Now surely, if they can manage it there, they are a far bigger organisation in a much smaller area, much more interconnected, then surely ESCOM can do the same for us here. But I feel that the only right thing is that when you take a supply from ESCOM, we don't expect them to use a crystal ball, but I think in the first case for 11 kV systems that is the time that they must insist that a 350 MVA switchgear is installed. We have been negotiating with ESCOM for a second supply point which will be at 400 kV and the first one will be a converted 400 kV. We have asked them and they have given us the requirements for the switchgear for this 400 kV substation. Now I feel that I must accept what they have given us, but then they must stick to it too, they must not come back in 10 years or even 12 years after we had taken that supply point, and say we now have to uprate the switchgear. It is not a feasible proposition for a municipal authority, be it even the biggest in the country, be it Johannesburg. They will only have a few supply points from ESCOM. They can't juggle the switchgear around and get over this problem. I really feel this is a question that our Association should take up with ESCOM and find a solution that suits us all.

**Chairman:** Thank you Mr. Hess. Gentlemen, you have heard Mr. Hess's remarks. Do you support his proposal or suggestion that it be taken up with our Association and that they have discussions with ESCOM on this matter? Is there any other speaker?

**Mr. D.H. Fraser** (Durban): I sympathise with ESCOM's point of view here, and I don't think we must lose sight of the fact that we as municipal electricity undertakings, are also suppliers of electricity and



MR. D. HAIG-SMITH  
CHAIRMAN OF THE EASTERN CAPE BRANCH

I would be interested to know whether other municipalities accept onto themselves the obligation to uprate their consumers' circuit breakers when they increase the fault level on their system, the low voltage system or the high voltage system.

**Chairman:** Thank you Mr. Fraser. Well gentlemen, I think that will wind up our discussion and we leave it to our Executive to consider this question further. Thank you very much for being a kind and attentive audience and thank you Mr. President for the opportunity to handle this portion of our members' forum.

**President:** Thank you Mr. Murphy, you handled that very well indeed. Now, Mr. Haig-Smith has been sitting up here all day and his Branch did not put in any questions so he probably thought he was going to get away doing nothing. That is the privilege reserved for the President, so I think he has got one or two questions that has been handed to him by affiliates and perhaps we have just got time for one of them.

**Mr. D. Haig-Smith** (Queenstown): Gentlemen, we have got a question here handed in by one of our affiliates. It reads as follows: "What redress, if any, does the consumer have against the supply authority for exceptionally low voltage at his distribution board? He states that in recent months voltages appear to be low resulting in longer cooking time, also extra consumption. Three tests have recently revealed voltages of 186 - 192 volts." Would anybody like to speak to this, gentlemen?

**Mr. P.J. Botes** (Rodepoort): Mnr. die voorsitter, hulle het my nou op my nommer gedruk, nou sal ek maar weer 'n paar woorde sê, maar ek wil u net sê dat die vraag is nie heeltemal reg nie. Daar is baie verbruikers wat eintlik kla oor hoë voltal. Nou wil ek net vir u die regte voltal gee, en net die volgende staalige vertel: Jare gelede het ons in Florida-Noord nie voltal-probleme gehad. Ons het dit toe goed ondersoek, beplan en uiteindelik het ons nou, sal ons nou die oorsakeling doen deur 'n nuwe substasie in werking te stel. Nou wat ons toe gedoen het, die substasie is toe in werking gestel is toe reg, en hier in die nag, daar twaalfuur rond, skakel ons gou-gou af en ons skakel die ander stroombaan in, en binne 'n halfuur is die krag aan. Dit is nou goed en wel - ons het niemand vertel daarvan nie. 'n Sekere dame bel my toe gedurende die dag, sy is verskrrik kwaad. Sy sê, kyk, ek is gewoond om 7-uur in die oggend op te staan, die pan op die stoof te sit, die olie in te gooi, die twee eiers te breek, een vir my en een vir my man, in die pan, en dan het ek die badwater gaan intap en dan het ek gebad en nadat ek gebad het, is die eiers net mooi gaar. Sy sê, nou toe van more sweet ek nie wat aangaan nie, maar daar het iets vreesliks aangegaan. Sy sê, ek was nog besig om die badwater in te tap, toe is die kombuis in vlamme.

**Chairman:** Any other comments gentlemen?

**Mr. E. de C. Pretorius** (Potchefstroom): Mnr. die voorsitter, daar is gevra wat kan 'n verbruiker doen in so 'n geval. Hy kan net een van twee dinge doen: hy kan of kla by die Ingenieur of hy kan 'n klag gaan indien by die Polisie dat die Voorsieningsowerheid is besig om die Wet te oortree, want die Wet bepaal dat die verbruikerspanning moet binne 5% wees van die verklaarde spanning.

**Mnr. P.J. Botes** (Rodepoort): Mnr. die voorsitter, ek dink dit is nie reg nie. Dit is heeltemal verkeerd. Dit is by opwekkers. By EVKOM kan jy so gaan kla, maar nie ons wat nie krag opwek nie, ons val nie daarop nie. Ek is seker daarvan.

**Voorsitter:** Dankie Mnr. Botes. Gentlemen, that is the last question. Thank you very much, it is over to our President.

**President:** Thank you Mr. Haig-Smith, I don't think you would be let off so lightly as you think, we may call you up again tomorrow. I have been asked to draw your attention to this very nice banner that has now been made with our new coat-of-arms and I hope that you are all pleased with it. That is all for this afternoon gentlemen. Tomorrow we resume at 9.00 a.m.



The Secretary Mr. Bennie van der Walt  
in conversation with the President  
Mr. Jack Waddy, Mrs. Waddy and Mrs. Annetjie van der Walt.

**President:** This morning we have the first of our two papers and this one will be presented by Mr. Eddy Baumann, who I think is well-known to quite a lot of you. Mr. Baumann, as you know, is Vice-President of Zellweger Uster, Switzerland and he has come all the way out here especially to present this paper, the title of which is: "New Developments in the Field of Audio Frequency Signal Transmission over Power Mains."

#### MR. EDUARD BAUMANN

*Mr. Eduard Baumann was born in 1924 Uster, Switzerland. He started his apprenticeship as a mechanic at Oerlikon Engineering Company and took his Diploma in Electrical Engineering at the Federal Institute of Technology Zurich.*

*He held various positions in the electrical and electro-chemical industry before he started working in the ripple control field with Zellweger, Uster Ltd. Switzerland in 1963.*

*Mr. Baumann was initially concerned with the basic design and development, from where he moved on to the projecting and sales branch for English-speaking countries. He is today General Manager and Chief Engineer of the Ripple Control Division of Zellweger Uster Ltd.*



## NEW DEVELOPMENTS IN THE FIELD OF AUDIO FREQUENCY SIGNAL TRANSMISSION OVER POWER MAINS

By E. Baumann,  
Zellweger Uster Ltd,  
Switzerland.

### General

Electricity supply networks have a number of properties which make them very suitable to be used for signal transmission. First of all, extensive electricity supply networks are already in existence and reach almost every point where people work or live. Furthermore, they are composed of thick wires and cables and other physically substantial components. To avoid electrical accidents and failures, the components of the networks are well protected and consequently the reliability of the net-work, even under adverse conditions, is very high. On top of this, the healthiness of the networks is almost permanently supervised by the consumers and interruptions are normally reported. At least this applies to interruptions of some duration.

It is not surprising therefore, that the first attempts to use the electricity supply system to transmit signals go back as far as to the end of the last century. Already at this time, transmission systems were developed to influence the load taken by the consumers. Technology however was obviously not ready at this time to solve the problem properly. In the 20's of our century, the problem was tackled again when multi-frequency systems were developed. Thereby, a certain audio-frequency was allocated to every command to be given and although these systems were much more successful than its predecessors there was no real breakthrough. It was not before the 40's when a new era in ripple control – and this time a successful one – began. This coincided with the introduction of the so-called impulse interval system with little synchronous motors for coding on the transmitter and de-coding on the receiver side. These systems now permitted the transmission of a number of commands with one single frequency and relatively simple transmitters. Most of the ripple control installations existing today work on this principle. They control networks of a peak power of approximately 100 GW, i.e. about 10% of the total world generating capacity.

At the time of the basic design of these ripple control systems, that is thirty years ago, the technology then available for reliable and economical operation was electro-mechanics. In the meantime, however, great developments have taken place in the field of electronics. With the introduction of semi-conductors and integrated circuits it became possible, to perform a multitude of functions, at the same price and with the same reliability, than was the case with previous technologies. Components of fairly high complexity became available

## NUWE ONTWIKKELINGE OP DIE GEBIED VAN OUDIOFREKWENSIESEIN-TRANSMISSIE DEUR DIE KRAGNET.

Deur E. Baumann,  
Zellweger Uster Bpk.,  
Switzerland.

### Algemeen

Elektrisiteitvoorsieningsnettes beskik oor talle eienskappe wat hulle besonder geskik maak vir seintransmissie. Eerstens, bestaan daar reeds uitgebreide voorsieningsnetwerke wat feitlik elke plek waar mense woon of werk, kan bereik. Die nettes bestaan uit dik draad en kables en dele wat fisies besonder sterk is. Ten einde elektriese ongelukke en onderbrekings te vermy, is die onderdele van die net goed beskerm en gevolglik is dit selfs in baie swak omstandighede uiters betroubaar. Die toestand van die net word boonop deeglik dopgehou deur verbruikers en alle onderbrekings wat enigins lank duur.

Dus is dit geensins verbasend dat pogings reeds aan die einde van die vorige eeu aangewend is, om die elektrisiteitvoorsieningsnet aan te wend vir die versending van seine nie. Toendertyd was daar reeds transmissiebedryfs ontwikkel om die kraggebruik van die verbruikers te beïnvloed. Die wetenskap was egter nog nie in staat om die probleem heeltemal te bowe te kom nie. In die twintigs van hierdie eeu is die probleem weer aangepak met die ontwikkeling van oudiofrekwensiestelsels. Hiervolgens is 'n bepaalde oudiofrekwensie aan elke opdrag toegeken en hoewel die stelsel baie geslaagder as vooriges was, was daar geen buitengewone deurbraak nie. Eers in die veertigs in 'n nuwe tydvak in rimpelkontrole – en geslaagde – betree. Dit het saamgeval met die sogenaamde impulsintervalstelsel wat klein gesinchroniseerde motortjies gebruik vir kodering aan die sendkant en de-kodering aan die ontvangkant. Dit het mens nou in staat gestel om 'n hele aantal bevels met een frekwensie en betreklik eenvoudige senders oor te send.

Die meeste van die rimpelbeheerstelsels wat vandag bestaan, werk op die beginsel. Hulle beheer nette van ongeveer 100 GW, d.w.s. ongeveer 10% van die wêreldopwerkvermoë. Toe die rimpelbeheerstelsels ongeveer 30 jaar gelede ontwerp is, was elektromeganika die tegnologie vir betroubare en ekonomiese werking. Sedertdien het gewelddige ontwikkeling op die gebied van die elektronika plaasgevind. Deur die gebruik van geïntegreerde bane in die ontwikkeling van semigeleiers het dit moontlik geword om veelvuldige funksies te verrig met dieselfde betroubaarheid en teen dieselfde koste as wat voorheen die geval was met ander tegnologieë. Betreklik komplekse komponente is

and with the aid of these it is now possible to introduce systems which before would have been much too complicated and too expensive.

On this background, a number of new electronic transmission systems for power mains have been developed over the last few years and are still under development. These are, in particular:

- DECABIT – a new electronic ripple control system,
- RETROBIT – a system for re-transmission of information from any point of the low voltage network to the main high voltage substation,
- MINIBIT – a low power transmission system for special purposes and
- PARGUIDE – a parking guidance system.

### DECABIT – a new electronic ripple control system

#### Introduction

As already mentioned, the present ripple control systems were developed some thirty years ago and great developments in the field of electronics have since taken place. Many functions, formerly performed mechanically can now be carried out by electronic circuitry which is faster, does not wear, is insensitive to vibration and indifferent to mounting position. To find the optimum approach however, it is not good enough simply to introduce electronics into conventional ripple control. As there are now many more possibilities than before it is appropriate to reconsider the basic choice of signals and also of the coding.

#### Basic considerations

Virtually all electricity supply networks are designed to transmit a symmetrical three phase electrical phenomenon of low frequency with as little loss as possible. It can be safely assumed that these properties will apply also in the future. Therefore, the best possible way to ensure proper propagation of ripple control signals is to select a signal that is also three phase, symmetrical and of a frequency which is not too far removed from the power frequency. Such a signal will always be subject to only small attenuation. These are the main reasons why this type of signal has also been chosen for the new system.

The next basic consideration concerns the time allocated to transmit and recognize the state "signal" as distinct from the state "no signal".

As a first approximation, it can be said that the band width of the filters used in the transmitters and the receivers is inversely proportional to the response time, i.e. the time the filter needs to reach its full amplitude. In other words, the sharper the filter is, the longer is the time required for full response. From this, it is clear that the duration of the proper signal must be at least equal to the response time of the filters to be fully effective. If, for instance, highly selective filters with a band width of approximately 6 Hz are to be used, the minimum duration of the signal must by no means be less than approximately 150 ms, for reasons of frequency selection.

Highly selective, that means narrow band filters reduce the sensitivity of the system to white noise and neighbouring harmonics and make it possible to work with reasonably low signal levels.

With regard to network harmonics, it is important to maintain a sufficient safety margin between the actual selectivity curve of the receiver and the minimum requirements as, for instance, stipulated by the VDEW (Fig. 1). This particularly in view of the fact that the application of semiconductor in power circuits becomes more and more widespread. The possibility can not be excluded that the harmonic levels now considered to be tolerable could be exceeded in future. From the example of a DECABIT receiver selectivity curve for 217 Hz, as shown in Fig. 1, it follows that the above mentioned safety margin is remarkable. It is about 1 : 7 at 200 Hz and about 1 : 5 at 250 Hz.

With regard to transient phenomena, it must be assumed that these will fully excite at least a first filter stage of a receiver and that this excitation results in a voltage across the filter output which is above the minimum response level of the subsequent de-coding circuit and is of a duration which is comparable to the filter response time. Filter output voltages of this nature can be suppressed by a timing circuit inserted between the filter and the decoder. This circuit passes the signal on only, if its duration is significantly longer than possible oscillations of the filter caused by transients.

It has just been mentioned that the duration of the oscillations of a filter, with a selectivity as envisaged, would be approximately 150 ms. Therefore, the time available for the timing circuit must be at least a few hundred ms.

The basic criteria for the choice of the signal duration are thus known, they lead to a duration of about half a second. With the DECABIT system, the length of one bit was set at 600 ms, resulting in a transmission speed of 1.7 Baud.

One of the main purposes of coding is to formulate a large number of commands with a limited number of bits. The maximum theoretically possible number, namely 2n commands, is obtained if the combinations of all classes of n bits are used. For the classical applications of ripple control, some 10 to 20 on-off command pairs have proved to be adequate in most instances. Today, in some countries however, ripple control is already extensively used and with network automation on the door-step there will be more applications in the future. In these circumstances, some 50 to 100 on-off pairs are considered to be adequate as a base for a new system. To form 100 "on-off" pairs, 200 commands are required and this requirement could, in principle easily be met by combinations of 8 bits, because  $2^8$  is 256. In this case however, nearly all combinations would have to be

besikbaar en met hulle is dit moontlik om stelsels daar te stel wat voorheen te ingewikkeld en duur sou wees.

Teen die agtergrond is 'n aantal elektroniese versendingstelsels vir kragnet te gedurende die afgelope paar jaar ontwikkel en word daar nog ontwikkel. Die belangrikste is:

- DECABIT – 'n Nuwe elektroniese rimpelbeheerstelsel.
- RETROBIT – 'n Stelsel vir die hervestel van inligting van enige plek van die laaspanning na die hoëspanningsubstansie.
- MINIBIT – 'n Laaspanningsstelsel vir spesiale doeleindes; en
- PARGUIDE – Parkeerleidingstelsel.

### DECABIT – 'n Nuwe elektroniese rimpelbeheerstelsel.

#### Inleiding

Soos reeds genoem, is die rimpelbeheerstelsel wat tans gebruik word al dertig jaar gelede ontwerp. Sedert daardie tyd het die veld van die elektronika geweldig uitgebrei. Talke funksies wat voorheen meganies verrig is, kan nou elektronies verrig word. Die elektroniese stroombaan doen dit vinniger, kan nie slyt nie, is nie gevoelig vir vibrasie nie en hoef nie op 'n bepaalde plek vasgestel te word nie. Om die optimum benadering te vind, is dit nie goed genoeg om elektronika bindelings in konvensionele rimpelbeheer aan te wend nie. Angesien daar nou baie nuwe moontlikhede vir soos voorheen bestaan, sal 'n herbetraging van die basiese keuse van seine en kodering paslik wees.

#### Basiese Oorwegings

Bykans alle elektriese toevornetwerke word ontwerp om 'n simmetriese driefaasige elektriese fenomeen met 'n lae frekwensie met so min verlies moontlik te versend. Daar kan met veiligheid aangeneem word dat hierdie eienskappe ook in die toekoms oorewag sal word. Dus is dit noodsaaklik om 'n sein te kies wat simmetries, driefaasig en nie te ver van die kragfrekwensie is nie ten einde te verseker dat die rimpelbeheersing behoorlik voortgegaan word. So 'n stelsel is gewoonlik slegs aan geringe verswakking onderworpe. Dit is dan die hoofrede waarom hierdie tipe sein vir die nuwe stelsel gekies is.

Die volgende basiese oorweging is die tyd wat toegelaat word vir die versending en erkenning van die toestand „Sein” soos onderskei van die toestand „Geen Sein”.

As voorlopige skatting kan gesê word dat die bandwydte van die filters wat gebruik word in die senders en ontvangers omgekeerd in verhouding tot die respons-tyd is, d.w.s. die tyd wat die filter neem om sy volledige amplitude te bereik. Hoe skerper die filter dus is, hoe langer sal dit neem om ten volle te repondeer. Hiervan kan afgelei word dat die duur van die werklike sein minstens so lank moet wees as die tyd wat die filters neem om ten volle effektief te raak. As daar, byvoorbeeld, filters met hoe selektiwiteit gebruik word en die bandwydte ongeveer 6 Hz is, moet die minimum duur van die sein vir frekwensiekieking in twee omstandighede minder as ongeveer 150 ms wees nie. Filters wat hoogs selektief is, d.w.s. smalbandfilters, verminder die sensitiwiteit van die stelsel na witkalk en die aangrensende harmonie wat dit moontlik maak om met redelik lae seinpeil te werk.

Ten opsigte van nethermonieë is dit raadsaam om 'n relatief groot veiligheidspeiling tussen die werklike selektiwiteitskurwe van die ontvanger en die minimum veiligheidsvereistes – byvoorbeeld die van VDEW (fig. 1) – te laat, veral met die oog daarop dat steeds meer semi-geleiers in kragstroombaan gebruik word. Die moontlikheid is nie uitgesluit dat die harmoniepele wat tans as aanvaarbaar beskou word in die toekoms oortref kan word nie. Die bestaande speiling is buitengewoon soos afgelei kan word uit die voorbeeld van die selektiwiteitskurwe van 'n Decabit-ontvanger by 217 Hz (kyk fig. 1). Dit staan naasteby gelyk aan 1 : 7 by 200 Hz en 1 : 5 by 250 Hz.

In die geval van oorgangverskynsels moet aangeneem word dat hulle ten minste die kleinste filterstadium van 'n ontvanger ten volle sal aktiveer. Die aktivering kan lei tot 'n hoër spanning op die filter-uitlaat as die minimum responspeil van die daaropvolgende dekodeer-stroombaan. Die spanningsduur kan met die filterresponstyd vergelyk word en onderduur word deur die aanbring van 'n tydreëlstroombaan tussen filter en dekodeerder. Die tydreëlstroombaan stuur die sein slegs aan as dit langer duur as die ossilasiepele wat moontlik deur oorgangverskynsels in die filter veroorsaak kan word.

So pas is genoem dat die duur van die filterosillasies, by filters met die beoogde selektiwiteit, ongeveer 150 ms is. Dus moet daar minstens 'n paar honderd ms vir die tydreëlstroombaan beskikbaar wees.

Die basiese kriteria vir die keuse van die seinduur is dus bekend en dui op 'n duur van ongeveer 'n halwe sekonde. In die DECABIT-stelsel is die tydskedule van een bit op 600 ms gestel wat 'n sendspoed van 1.7 Baud tot gevolg het. Een van die hoofdoelwitte van die formulering van groot getalle bevels deur so min as moontlik blyse te gebruik. Teoreties is die maksimum getal bevels 2. Dit word verkry met behulp van kombinasies van die verskillende klasse n-bisse. In die meeste gevalle was 10 tot 20 aan-afbevele pare genoeg vir die toepassing van rimpelbeheer. Tans word daar in party lande intensief gebruik gemaak van rimpelbeheer en met outomatiese kragnette om die draai sal dit nog intensiewer gebruik kan word. In die omstandighede kan 50 tot 100 aan-afpare beskou word as genoegsaam vir 'n bisse want  $2^8 = 256$ , maar dan sal bykans al die beskikbare kombinasies gebruik moet word. As daar deur ingryping of andersins 'n merk of ruimte byvoege of weggeneem word van 'n kombinasie vorm die nuwe kombinasie ook deel van die stelsel. Om dit te voorkom en om die stelsel teen wanwerking te beskerm deur die byvoege of weggeneem van impulse, kan slegs die kombinasies van een besondere soort uit-sluitlik gebruik word, byvoorbeeld al die kombinasies met dieselfde

used. If, however, by way of interference a mark or space would be added to or subtracted from any combination, this new combination is also part of the system. To avoid this and to safeguard the system against maloperation when impulses are lost or added, the combinations of one particular class only could be used exclusively, e.g. all combinations with equal number of marks and spaces. Of course, this does reduce the number of possible commands but with the numbers considered here this can be compensated for by a minor increase in the number of bits. If, for instance, the number of bits is increased from 8 to 10 but only the impulse sequences of the fifth class are used, 252 commands are obtained. This is about the same number as obtained before by using all combinations with 8 bits.

#### The operation of the DECABIT System

The transmission of a command starts with the transmission of the first impulse, the so-called start impulse (Fig. 2).

This impulse activates the system and ensures synchronism between transmitter and receivers for the code sequence to be transmitted.

The code sequence consists of five marks and five spaces which are distributed over the ten time slots which follow the start impulse in a way characteristic for a command (10 bits = DECABIT). The start impulse and each of the following time slots have a length of 600 ms. The complete transmission of a command including the start impulse, hence takes 6.6 seconds.

After this, the transmitter and the receivers come back to the standby position and the system is ready for the transmission of another command.

If code sequences with only five marks and five spaces are used exclusively, the possible number of commands equals the number of combinations of the fifth class from ten elements, i.e.:

$$C = \frac{n!}{k! \cdot (n-k)!}$$

$n$  = number of time slots

$k$  = class

$C$  = number of commands

If  $n = 10$  and  $k = 5$ , we find

$$C = \frac{10!}{5! \cdot 5!} = \frac{252}{1}$$

These 252 commands can be combined to form 126 on-off pairs. In the DECABIT system, 7 of these are not used whilst a further 19 are set aside to perform overriding key functions. The standard system therefore, provides 100 on-off pairs.

As just mentioned, the system provides the possibility to perform overriding key functions. The receivers can be set in such a way that one of the marks and one of the spaces is not supervised. This does not mean that the receiver loses its ability to receive the code sequence which is assigned to it. On the contrary, it becomes responsive to a second code sequence which is different to the first and which can be common for many receivers which are set to different individual commands. With the DECABIT system, the commands have been allocated in such a way that, if necessary, all receivers of a group of five command pairs, e.g. Nos. 20 to 24, can additionally be made responsive to a particular code sequence of the numbers 100...118. The second code sequence thus becomes a master command with which all receivers of the group concerned can be switched on or off in a single 6.6 second transmission (Fig. 3).

As pointed out earlier, 100 on-off pairs can be transmitted by the standard DECABIT system. For additional commands, combination control may be introduced which permits an increase to several hundred or even thousands of command pairs. To do this, for instance, the "on-off" pairs 80 to 99 can be used. These 20 pairs are composed of 40 code sequences. Combination of these in pairs results in 1'600 combination code sequences of 14 seconds duration each (Fig. 4). Grouped in pairs again, additional 800 on-off pairs are obtained. If half of the standard system is used for combination control, 5'000 command pairs are obtained and if combination control is used exclusively, 30'000 "on-off" pairs are available. The master command principle can also be used with combination control.

#### The components of the DECABIT System

The brains of the control system is the controller. In conjunction with the audio-frequency generator and the coupling circuit it governs the receivers spread over the network. Fig. 5 shows a controller with the essential elements:

- The Encoder with two thumbwheel switches for channel selection and associated start pushbutton.
- The Plug-board allowing a twentyfour hour schedule to be pre-set. Up to 40 channels can be accommodated by proper insertion of small special plugs.
- The Memory of Channel Status retaining for each channel the last function transmitted.

getal merke en openings. Dit verminder vanselfsprekend die moontlike getal bevele maar met die getalle hier ter sprake kan daarvoor vergoed word deur enkele bisse by te voeg. As die getal bisse van 8 na 10 vermeerder word en net die impulsvolgordes van die vyfde klas word gebruik, is die getal bevele 252. Dit is net soveel as wat verkry word met al die kombinasies van 8 bisse.

#### Werkings van Decabit-stelsel

Die versending van 'n bevel begin met die versending van die eerste impuls, die sogenaamde aanvangsimpuls (Fig. 2).

Die impuls aktiveer die stelsel en verseker sinkronisering tussen sender en ontvangers wat betref die kodevolgorde wat versend gaan word.

Die kodevolgorde bestaan uit vyf merke en vyf openings wat versprei is oor die tien tydkepe wat die aanvangsimpuls volg in 'n karakteristieke orde vir die bevel (10 bisse = Decabit). Die aanvangsimpuls en elk van die daaropvolgende duur 600 ms. Die volledige versending van 'n impuls, die aanvangsimpuls inbegrepe, neem gevolglik 6,6 sekondes.

Die senders keer dan terug na die paraatstand en die stelsel is gereed vir versending van nog 'n bevel.

Wanneer die kodevolgorde met net vyf merke en vyf ruimtes uitsluitlik gebruik word, is die moontlike getal bevele gelyk aan die getal kombinasies van die vyfde klas, 10 elemente, d.w.s.

$$C = \frac{n!}{k! \cdot (n-k)!}$$

$k$  = Klas

$n$  = Getal tydkepe

$C$  = Getal bevele

As  $n = 10$  en  $k = 5$ , vind ons dat

$$C = \frac{10!}{5! \cdot 5!} = \frac{252}{1}$$

Die 252 bevele kan só gerangskik word dat dit 126 aan-afpares vorm. In die DECABIT-stelsel, 7 hiervan nie gebruik nie tweelyf 19 afgesonderd word vir oorheersleutelfunksies. Die standaardstelsel voorsien dus 100 aan-afpares.

Ons het so pas genoem dat die stelsel voorsiening maak vir oorheersleutelfunksies. Ontvangers kan so gestel word dat een van die merke en een van die openings nie bewaak word nie. Dit beteken nou nie dat die ontvanger sy vermoë verloor nie. Dit ontvang steeds die kodevolgorde van die ontvanger. Dit volgorden kan dit nou op 'n tweede kodevolgorde reageer. Die volgorde kan van die eerste verskil en gemeenskaplik wees vir verskillende ontvangers wat gestel is om verskillende boodskappe te ontvang. Die bevele van die ontvangers met 'n groep van vyf bevelpares, bv. No's. 20 tot 24, bykomend reageer op 'n besondere kodevolgorde van die getalle tussen 100 en 118. Die tweede kodevolgorde vorm dus 'n meesterbevel waarmee alle ontvangers in die betrokke groep aan-afgeskakel kan word met 'n enkele sein van 6,6 sekonde (fig. 3).

Soos reeds aangedui kan die Decabit-stelsel 100 aan-afpares versend. Vir bykomende bevele kan kombinasiebeheer ingestel word. Hierdie metode maak dit moontlik om die bevelpares met etlike honderde of selfs duisende te vermeerder. Om dit te doen, kan die aan-afpares tussen 80 en 99 gebruik word. Die 20 pare bestaan uit 40 kodevolgordes. Kombinasies hiervan het 1'600 kombinasiekodevolgordes van 14 sekondes elk tot gevolg (Fig. 4). As hulle swer in groepe van 2 saamgevat word, word nog 800 aan-afpares verkry. As die helfte van die standaardstelsel vir kombinasiebeheer gebruik word, word 5'000 bevelpares verkry en as kombinasie beheer uitsluitlik gebruik word, is 20'000 aan-afpares moontlik. Die meesterbevelbeginsel kan ook by kombinasiebeheer gebruik word.

#### Die ONDERDELE VAN DIE DECABITSTELSEL.

Die verstand van die beheerstelsel is die kontroleur. Saam met die audiefrekwensiegenerator en die verbindingstroombaan beheer dit die ontvangers in die net. Figuur 5 toon 'n kontroleur met die vereiste elemente:

- Die kodeerder met twee duimwielkakelaars vir kanaalkiesing en geassioerde aansitdrukknop.
- Die propbord maak 'n vier-en-twintigurskiedule moontlik. Dit kan vooraf gestel word. Voorsiening kan gemaak word vir tot 40 kanale deur klein spesiale proppe behoort in te steek.
- Die geheue vir die kanaalstatus behou die jongste funksie vir elke kanaal nadat dit versend is.

d) The Blocking Unit for the suppression of transmissions on particular channels.

e) The Internal Clock which is line operated and which actuates the channels set on the plug board at the proper instant.

The Audio-Frequency Generator shown in Fig. 6 provides the signal power for injection into the power bus. The unit is entirely solid state. Its subunits are:

a) Power Supply Unit.

b) Electronic Switch for pulsing and protection.

c) Three single-phase converters combined to form a three-phase output.

d) Electronic Control Devices.

e) Output Transformer.

All units are of the plug-in type.

Coupling circuits for either parallel or series injection are shown in Figs. 7 and 8.

Fig. 9 gives the block diagram of the DECBIT receiver.

The bandpass filter (FI) separates the signal from the line voltage. The output of the filter is passed on to the timing device (TD). This device transmits the signal only if its amplitude and uninterrupted duration meets the minimum requirements as pointed out earlier. Under this condition, the first impulse is passed on to the clock device (CD) which in turn sets the storage device (SD). During the following ten time slots the comparator (C) - driven by the clock device - successively compares the information of the code card (CC) with the information arriving from the transmitter via the FI and (TD).

In case of coincidence during all slots, the storage device remains set. At the end of the transmission, the clock device closes switch (S) and load switch (L) operates. However, if non-coincidence occurs during any of the time slots, the comparator (C) resets the storage device. Now, the load switch cannot operate when switch (S) is closed at the end of the transmission.

Finally, Fig. 10 shows a DECBIT two-channel receiver. This receiver is set to operate on channels 25 and 73 as can be seen on the numbers of the code cards programming the two 25 amp switches.

## RETROBIT, a system to transmit information from any point of any low voltage network to the supplying high voltage main substation

### General

Today, ripple control is a well established technique to control networks and modern equipment provides fast and reliable operation as well as a great number of channels. No equipment, however, has been available so far, for the transmission of information in the opposite direction, i.e. from the outskirts of the network back to the supplying main substation. This gap is closed by the RETROBIT system.

If, for instance, the position of a switch or the level of a water reservoir (Fig. 11) is to be supervised, a RETROBIT transmitter can be connected to the next low voltage point. The supervisory contact is connected to the RETROBIT transmitter and this injects an audio-frequency telegram backwards into the point of connection as soon as the supervisory contact closes or opens. The injected signal travels through the transformer to the 11 kV line and back to the main substation. At the substation, the signal passes the current transformer of the feeder and consequently can be detected on the secondary side of the C.T. where the RETROBIT receiver is connected to a small burden of about 1 VA. In many cases, the 11 kV feeders are already fitted with current transformers for protection and supervision and, therefore, no special current transformers are required for the purpose just described.

The RETROBIT transmitter injects a signal current of approximately 6 - 10 Amps between phase and neutral or between two phases of the low voltage network. In principle, the same frequencies can be used as for ripple control. To avoid any collisions however, the band of 100 Hz to 150 Hz and further frequencies between harmonics and ripple control frequencies may preferably be used for the application of RETROBIT.

Typical values regarding signal level and signal propagation can be seen from Fig. 12. This shows left the principle diagram of a 20 MVA 11 kV network with five outgoing overhead feeders. Each of these is assumed to be approximately 9 kilometers long and to carry a load of 4.1 MVA; 2 MVA at a distance of 3 kilometers, another 2 MVA at the end and 100 kVA 6 kilometers away from the main substation. For the purpose of this example the RETROBIT transmitter is located in the low voltage network of the 100 kVA distribution substation whilst the receiver is connected to the current transformer of the feeder at the main substation. The righthand side of Fig. 2 shows the equivalent diagram with impedances as applicable to a frequency of 125 Hz. Furthermore, the signal voltages and currents at the various points and in the different branches are given. As the general picture is not unduly affected, the signal was assumed to be three-phase for reasons of simplicity.

In this example the injection of approximately 6 A at the low voltage side results in a signal voltage at the injection point of 1.1 volt. Related to the 11 kV side this corresponds to 200 mA and 31 volts. 20 mA are lost towards the 100 kV load of the distribution station, whilst 197 mA pass through the 100 kVA transformer to the 11 kV feeder. Here, 21 mA are again lost towards the 2 MVA load at the

d) die blokeerheid vir die onderdruk van seine in bepaalde kanale.

e) Die inwendige horlosie wat lyngewerk is en die kanale aktiewer op die tydstop wat op die proppord gestel is.

Die oudiofrekwensiegenerator wat op Figuur 6 aangetoon is verskaf die sein vir injeksie in die kragbus. Dit is 'n ten volle soliedetoestandenheid. Sy subeenhede is:

a) Kragtoevoereenheid.

b) Elektriese skakelaar vir pulsering en beskerming.

c) Drie enkelfasemeters wat gekombineer is om 'n drie-fase-eenheid te vorm.

d) Elektroniese beheertoestelle.

e) Uitslaattransformator.

Al die eenhede is van die inproptipe.

Verbindingsstroombane en injeksie - parallel of in serie - word in Figuur 7 en 8 aangetoon.

Die blokdiagram van die DECBIT-ontvanger word in Figuur 9 aangetoon.

Die banddeurlaatfilter (FI) skei die sein van lynspanning. Die uitslaan van die filter word na die tydtoestel (TD) deurgelaat. Hierdie toestel versend die sein slegs as die amplitude daarvan en die omversteurde duur aan die minimum vereistes voldoen wat hierbo uiteengesit is. Onder hierdie voorwaarde word die eerste impuls na die horlosietoestel (CD) versend wat op sy beurt die bergoestel stel (SD). Tydens die duur van die volgende tien tydkepe vergelyk die vergelyker (C) met deur die horlosietoestel gedryf word die informasie van die kodekaart (CC) suksesvol met dié wat van die sender ontvang word. (FI) en (TD).

In geval van gelyktydige besetting van al die keppe bly die bergoestel gestel. Aan die einde van die versending sluit die horlosietoestel skakelaar (S) en laskakelaar (L) kom in werking. As die kepe nie gelyktydig beset is nie verset die vergelyker (C) die bergoestel. Die laskakelaar kan nou nie werk as die skakelaar (S) aan is aan die einde van die sein nie.

Ten slotte toon figuur 10 'n DECBIT-tweekanalaalontvanger. Dié ontvanger word gestel om op kanale 25 en 73 te reageer soos aangedui word aan die syfers van die kodekaarte wat die twee skakelaars van 25 amp programmeer.

## RETROBIT - 'N STELSEL VIR DIE VERSEND VAN INLIGTING VAN ENIGE PLEK IN ENIGE LAESPANNINGSTREK NA DIE TOEVOERHOESPANNING HOOFSTASIE.

### Aigemeen.

Rimpelbeheer is tans 'n gevestigde tegniek vir die beheer van nette en moderne uitrusting maak dit moontlik om winnige en betroubare werking sowel as 'n groot getal kanale te behou. Tot dusver was daar nie uitrusting beskikbaar om inligting in die teenoorgestelde rigting te versend nie, d.w.s. van die buitekyk van die net af na die hoofsubstansie nie. Die RETROBIT-stelsel oorbrug die kloof.

Vir toetsing oor die stand van 'n skakelaar of die watervlak in 'n opgaart (Fig. 11) kan 'n RETROBIT-sender aan die volgende laespanningspunt gekoppel word. Die toesigpunt word aan die RETROBIT-sender verbind. Die sender injetteer 'n oudiofrekwensie-telegram agterstevoor in die verbindingspunt in sodra die toetskontak oop of oopmaak. Die geïnjekteerde sein beweeg met die laespanningspunt terug na die transformator langs terug na die 11-kV-draad en dan na die hoofsubstansie. By die substansie gaan die sein verby die RETROBIT-sender injekteur 'n seinstroom van ongeveer 6 - 10 die sekondêre kant van die stroomtransformator bespreek word. Vir laasgenoemde is die RETROBIT-ontvanger verbind aan die transformator maar dra dit 'n stroom van slegs 1 VA. In baie gevalle is die 11-kV-transformators reeds toegerus met 'n stroomaantransformator vir beskerming en toetsing en dus is geen spesiale stroomtransformators nodig vir die bestaande doel nie.

Die RETROBIT-sender injekteur 'n seinstroom van ongeveer 7 - 10 amp tussen die fase neutral of tussen twee fase van die laespanning-net. Die frekwensie wat vir rimpelbeheer geld kan in beginsel hier ook gebruik word. Om oorvleueling te voorkom is dit raadsaam om die band 100 Hz tot 150 Hz en bykomende frekwensies tussen harmonieën en rimpelbeheerfrekwensies te gebruik vir RETROBIT.

Figuur 12 toon die tipiese waardes betreffende seinpeil en seinopwekking. Links word die beginseldigram van net van 20 MVA/11 kV met 5 bogronde uitgangsovervoers. Elke eenheid veronderstel om ongeveer 9 kilometer lank te wees met 'n las van 4,1 MVA; 2 MVA op 'n afstand van 3 kilometer; nog 2 MVA aan die end en 100 kVA ses kilometer van hoofsubstansie af. Vir die doel van hierdie voorbeeld is die RETROBIT-sender in die laespanningnet van die 100-kVA-distribusie-substansie. Die ontvanger is verbind aan die stroomtransformator van die toevoerder by die hoofsubstansie. Reps op figuur 2 is 'n soort gelyke diagram met impedansies van toepassing op 'n frekwensie van 125 Hz. Die seinspannings en strome by die verskillende plekke en die verskillende vertakkings word ook aangedui. Aangesien die geheel ingewikkeld is, is 'n driefasiese gekies om dit makliker te maak.

In die voorbeeld lei die injeksie van ongeveer 6 A by die laespanningskant tot 'n seinspanning van 1,1 volt by die injeksiepunt. As dit in verband gebring word met die 11-kV-kant staan dit gelyk aan 200 mA en 31 volt. 20 mA gaan verlore na die 100-kV-las van die distribusie-substansie, terwyl 197 mA deurgaan na die 11-kV-toevoerder en wel deur die 100-kVA-transformator. By die toevoerder gaan daar weer 21 mA verlore na die 2-MVA-las aan die ent van die toevoerder. 185 mA

end of the feeder. 185 mA travel towards the point of supply, 3 km away from the main substation another 13 mA are lost towards the second lot of 2 MVA load so that 179 mA pass the current transformer of the feeder which is loaded with 215 amp 50 Hz.

At the point of the transmitter the signal voltage is, as mentioned before, 1,1 volts on 220 V base and 31 volts on 11 kV base. On the 11 kV side of the 100 kVA transformer it is down to 1,3 volts; 0,8 volts 3 km away from the main substation, and 0,3 volts on the busbar of the main substation. That is less than half a percent of a percent of the 50 Hz voltage.

Obviously, the essential part is the signal current. Of the 200 mA injected, 179 mA pass through the current transformer at the root of the feeder, i.e. about 90% of the injected current. Unlike Ripple Control where information is transmitted from the source to the outskirts of the network and the signal voltage is the important factor, the signal current is the important factor with RETROBIT, transmitting information from the outskirts of the network back to the source.

Nevertheless, however, the 50 Hz current at the root of the feeder is 215 A at full load. Therefore, the ratio of the signal current to the 50 Hz current is 1 : 1'200 and in other network configurations it might even be higher. These are very high ratios. For comparison, the minimum signal required by a normal ripple control receiver is approximately 1 volt on 220 volt base, corresponding to a ratio of 1 : 220 only.

It goes without saying, that in these circumstances high selectivity is required on the part of the RETROBIT receiver in order to be able to properly separate the signal. This implies the application of very narrow band filters.

Whilst in principle the design of such filters does not present any problems, it is very difficult to make sure that, once tuned, these filters do accurately maintain the resonance frequency and this regardless of variations of the ambient temperature and of the ageing of the components. As will be seen, this problem has been completely avoided in the RETROBIT concept.

#### Transmitter

Fig. 13 shows the block diagram of the transmitter. It contains the following units: an Encoder E, an oscillator O, a power output stage PO and a power supply unit S. Depending on the application, the encoder E is fitted with a number of input terminals to which the contacts to be supervised can be connected, i.e., for instance, one or more contacts supervising various levels of a water reservoir or the position of various switches of a substation. The encoder is fitted with a number of slots — one per pair of input terminals — into which a small punch card key can be plugged. This key determines the pattern of the telegram which is being sent. The codes used are similar to those of the DECBIT system.

However, unlike the DECBIT system, which operates on the principle of amplitude modulation (AM), the RETROBIT works on frequency modulation (FM). Accordingly, the oscillator O supplies a frequency of — for instance — 124,9 Hz to the output stage to mark the state "NO IMPULSE" and a frequency of 125,1 Hz to mark the state "IMPULSE". Furthermore, these frequencies are derived from a phase locked loop governed by the frequency of the network. The transmission frequencies, therefore, are in fixed relations to the network frequency and any variation of the network frequency results in a proportional variation of the transmission frequencies.

If one of the supervised switches opens or closes, the encoder starts and within the following seconds transmits to the oscillator a signal telegram which corresponds to the punch card key applicable for the purpose. The oscillator in turn supplies the output stage with the same telegram in frequency shift keying and the output stage injects it into the network with the power required.

#### Receiver

At the receiving end, the frequency of the network is, of course, also permanently available. Using exactly the same multipliers and dividers from which the frequencies are derived at the transmitter end, these can be accurately reproduced also at the receiving end. Therefore, to ensure that the necessary narrow band receiver filters are always perfectly tuned to the transmission frequencies, a type of filter is required, the resonance frequency of which can be continuously governed.

This requirement is ideally met by a commutating filter (Fig. 14). It consists of a resistor R between input and output and a number of capacitors which — one after the other — are sequentially connected across the output terminals by a rotating switch S. If a frequency is applied to the input terminals which is equal to the frequency of rotation of the switch, then — by way of synchronism — the connection of one and the same capacitor consistently occurs during the very same phase interval of the sine wave and consequently — after a while given by the time constant RC — every one of the capacitors is charged up to a voltage which is equal to the average of the instantaneous voltages of each particular phase interval of the sine wave. Provided the number of capacitors is high enough and the load on the filter is low, the particular frequency under discussion passes the filter practically unattenuated.

All that has just been said also applies to all frequencies which are even multiples of the frequency of rotation of switch S, but as these are away from the fundamental by a factor 2 and more, they can be suppressed easily after the filter by other means.

The attenuation, however, is very high for all other frequencies, i.e.

beweg na die leweringpunt. Drie kilometer van die hoofstasie word 13 mA afgegee aan die tweede groep laste van 2 MVA. Uiteindelik gaan 179 mA deur die stroomtransformator na die toevoerder wat 'n las van 215 amp/50 Hz het. By die senderpunt is die seinspanning soos reeds genoem 1,1 volt vir 220 volt en 31 volt vir 11 kV. Aan die 11-kV-kant van die 100-kVA-transformator is dit so laag as 1,3 volt, 0,8 volt 3 km verder van die substasie af, en 0,3 volt by die busstang van die hoofstasie. Dit is minder as 'n half persent van die 50-Hz-spanning.

Die seinstroom is oeglopig die belangrike deel. Van die 200-mA-injeksie is die deurlating 179 mA deur die stroomtransformator aan die worte van die toevoerder, d.w.s. ongeveer 90% van die geïnjecteerde stroom. Anders as by rimpelbeheer waar die inligting van die bron na die buitewyke van die net oorgesien word en die seinspanning die belangrike faktor is, is die seinstroom die hooffaktor by retrobit waar die inligting van die buitewyke na die bron van die net versend word.

Die stroom van 50 Hz by die worte van die toevoerder is 215 A teen die volle las. Dus is die verhouding van die seinstroom tot die 50-Hz-stroom 1 : 1'200 en in ander nette kan dit selfs hoër wees. Dit is uiters hoër verhoudings dié. Ter vergelyking: Die minimum sein wat nodig is vir gewone rimpelbeheerontvangers is ongeveer 1 volt vir 'n basis van 220 volt — 'n verhouding van slegs 1 : 220.

Dit is dus nie nodig om te sê dat in hierdie geval die Retrobit-ontvanger hoogs selektief moet wees nie ten einde die sein beoordeel te kan skei. Dit beteken die aanwend van filters met 'n gewelddige smal band.

In die beginsel lewer die ontwerp van sulke filters nie probleme op nie. Dit is egter noodsaaklik dat hierdie filters nadat hulle ingestem is die resonansiefrekwensie noukeurig handhaaf. Die kontroleer hiervan is nie so moeilik, want daar is in 'n basis van die omgewingstemperatuur en die verandering van onderdele wat voortdurend in gedagte gehou moet word. In die RETROBIT-weergawe word hierdie probleem ten volle vermy.

#### Sender

Fig. 13 is 'n blokdiagram van die sender. Dit bevat die volgende eenhede: 'n kodeerder, E, 'n ossilator O, 'n kraglewerstadium PO, 'n kragtoevoereenhede S. Na gelang van die gebruik beskik die kodeerder E oor 'n aantal insetterminals waaraan die kontakte waaroor toetsing gehou moet word, verbind kan word, byvoorbeeld een of meer kontakte wat toegang hou tot verskillende watervlakke in 'n opgaartent of die stand verskeie skakelaars van 'n substasie. Die kodeerder het 'n aantal kepe — een per insetterminals — waarin klein ponskaart-sleutels geprop kan word. Hierdie sleutel bepaal die patroon van die bodskap wat versend word, en die kodes is soortgelyk aan dié van die DECBIT-stelsel.

Die DECBIT-stelsel gebruik die amplitude-modulasiebasis (AM) en die RETROBIT-stelsel die frekwensie-modulasiebasis (FM). Ossilator O lewer 'n frekwensie van — bv. 124,9 Hz aan die uitlaattadium om die stand „GEEN IMPULS“ aan te dui en 125,1 Hz om die stand „IMPULS“ aan te dui. Hierdie frekwensies word afgelei van 'n faseverlooplus wat deur die netfrekwensie beheer word. Sendrefrekwensie is dus in vaste verhouding tot die netfrekwensie beheer word. Sendrefrekwensie is dus in vaste verhouding tot die netfrekwensie sodat skommelinge in die netfrekwensie lei tot 'n proporsionele wisseling in die sendrefrekwensie.

As een van die bewaakte skakelaars konak maak of breek, versend die kodeerder in die daaropvolgende sekondes 'n seinteleggram ooreenkomstig die ponskaart-sleutel vir die besondere deel. Die Ossilator verskaf dieselfde frekwensie in verskuiwfrekwensiesleutels, aan die uitlaattadium, wat dit weer met die vereiste krag in die net injekteer.

#### Ontvanger

Die netfrekwensie is natuurlik ook by die ontvankant permanent beskikbaar. Deur dieselfde vermenigvuldigers en verdelers waaruit die frekwensie by die sender afgelei word by die ontvankant te gebruik, kan die identiese frekwensie daar gereproduseer word. 'n Filter met voortdurend gereelde resonansiefrekwensies word dus vereis om te verseker dat die smalbandontvangerfilters altyd noukeurig op die senderfrekwensies ingestem is.

'n Kommutasiefilter (figuur 14) voorsien in dié behoeftes. Dit bestaan uit 'n resistor R tussen die inset en uitlaat en 'n groep kapasitors. Die kapasitors word agtermekaar in volgorde oor die uitlaatterminals verbind met 'n roterende skakelaar S. As 'n frekwensie die insetterminals bereik en glyk is aan die roterende frekwensie verbind 'n kapasitor — deur synchronisering — aanhoudend gedurende 'n enkele fase-interval van die sinuskurwe en na 'n pause toegelant deur die tydkonstante RC word elke kapasitor gelei tot 'n spanning gelyk aan die gemiddeld van die omliggende spanning van elke interval van die sinuskurwe. Mita daar genoeg kapasitors is en die filterlas laag is, kan die bepaalde frekwensie bykans sonder enige verswakking deur die filter beweeg.

Die bogenoemde geld ook vir alle frekwensies wat gelyke veelvouders van die roterende frekwensie van die skakelaar S is, maar aangesien hulle onderduur word sodra hulle deur die filter is en op enige ander geskikte manier.

Alle ander frekwensies verswak haie, d.w.s. frekwensies wat nie voldoen aan die filtervereistes ten opsigte van synchronisering nie. Hulle kan nie betekenisvolle ladinge in die kondensators opbou nie, want elke keer as 'n kondensator verbind word, is die fase-interval van

frequencies which do not fulfil the requirements of the filter regarding synchronism. These frequencies can not build up any significant charges in the condensers because any time a condenser is connected, the phase interval of the asynchronous frequency is different from what it was during the preceding connection and consequently the average charge is zero.

It is obvious that the output voltage of the filter is the closer to a sine wave the higher the number of capacitors. In practical operation, however, good results are already obtained with relatively few brushes. In an analog filter, switch S, of course, not a mechanical device but fully solid state.

For the application under discussion, the type of filter just described is very well suited because:

- the resonance frequency does not depend on the values of the components but is equal to the frequency supplied to the rotary switch. There are no temperature and no ageing problems;
- selectivities equivalent to conventional filters with very high quality factors are easily obtainable. The higher R and/or C the higher the "Q" value and the sharper the filter;
- no tuning and no highly accurate components are required.

A block diagram of the receiver is shown in Fig. 15. The input of the receiver is shunted with a resistor of approximately 0.04 ohms corresponding to a burden of 1 VA at 5 A. A narrow band filter F, a limiter L, a discriminator DI and a de-coder DE follow. All these units are supplied by the supply unit S. Furthermore, the filter, the discriminator and the de-coder are given the necessary timing information by the timing device T, being the rotating frequency for the switches of the commutating filters comprised in units F and DI and the clock impulses for the de-coding device DE. Unit T derives this information from the network frequency over a phase locked loop, as does the oscillator in the transmitter.

Similar to the input of the transmitter, the de-coder output is fitted with a number of slots into which punch card keys can be plugged. These keys determine the telegram which is to be de-coded and which is to operate one of the output contacts.

As with the arrangement just described, accuracy of frequency is no problem, 20 to 30 channels can be allocated in the frequency band of 100 to 150 Hz and more channels are available at higher frequencies. Apart from the applications mentioned so far, RETROBIT may of course be used to confirm commands which have been transmitted by ripple control. In this respect RETROBIT is a very useful complement to ripple control with many applications. For the last 25 years we have often been asked by our Ripple Control clients: "Why can't you transmit the other way round?" Now we can; with RETROBIT.

## MINIBIT - a low power transmission system for special purposes

### General

The price of a receiver to receive audio-frequency signals in power distribution networks, largely depends on the minimum signal voltage available at the point of reception. If this minimum signal voltage is relatively high, the input circuit of the receiver can be kept simple because selectivity is not much of a problem and no special measures against interference are required. The receiver - in this case - is simple and cheap but, of course, the transmitter must be powerful and consequently is expensive. On the other hand, very sensitive and highly selective receivers are more complicated and expensive but the transmitter can be less powerful and accordingly is cheaper.

A general picture of these circumstances is given in Fig. 16. Curve 1 shows the cost of the transmitter as a function of its power whilst curve 2 represents the cost of  $m$  receivers also as a function of the power of the transmitter. The sum of curve 1 and 2 is given by curve 3. From this curve 3, it follows that a plant consisting of a transmitter and  $m$  receivers is cheapest when the receivers are designed to operate on a signal voltage which can be met by a transmitter with the power  $P_{opt}$ .

However, the picture is different if there are less receivers to a transmitter. Curve 4 shows the costs for  $n$  receivers and curve 5, the sum of curve 4 plus curve 1. In this case, the minimum cost for  $n$  receivers plus transmitter is at  $P_{opt}$  i.e. with a less powerful transmitter. In short, with a great number of receivers per transmitter, the important thing is that the receivers are cheap. On the other hand, with a small number of receivers per transmitter it is important that the transmitter itself is cheap whilst the cost per receiver is of minor importance.

With conventional ripple control, the number of receivers per transmitter averages about 1'300. In the light of the aforesaid, a relatively strong transmitter is well justified.

There are, however, other applications for audio-frequency signal transmission over power mains with much smaller numbers of receivers. For these, the optimum solution is reached with a small transmitter and with receivers which are much more complex than with ripple control. For these applications, one of which will be described later, the MINIBIT system has been developed.

Like RETROBIT, MINIBIT works on the principle of frequency modulation. The injected signal level at the point of injection is as low as 0.1% of the 50 Hz voltage; related to 220 volts this is 220 mV. Compared to the signal levels of ripple control installations, this is more than one order down as far as voltage is concerned and more than two orders down regarding signal power.

ongesynchroniseerde frekwensie verskillend van wat dit gedurende die vorige verbinding was en gevolglik is die gemiddelde lading zero.

Dit is opogend dat die uitlaatspanning van die filter nader aan 'n sinuskurwe is hoe meer kapasitors gebruik word. In bedryf is goeie resultate verkry met min kapasitors. In 'n werklike filter is die skaalelaar S natuurlik nie 'n meganiese toestel nie maar 'n volledige vaste-toestandstelsel.

Die filter wat so pas beskryf is, is uiters geskik vir die gebruik onder bespreking, want:

- die resonansiefrekwensie is onafhanklik van die waardes van bestelnde maar is gelyk aan die frekwensie gelewer deur die roter-skaalelaar. Daar is nie temperatuur- en verouderingsprobleme nie.
- die selektiwiteit wat verkry word, is van hoë gehalte gelykstaande aan dié van hooaangeskrewe konvensionele filters. Hoe hoër R en / of C is, hoe hoër is die Q-waarde en hoe skerp die filter.
- geen instemming of hoogs noukeurige onderdele is nodig nie.

'n Blokdigram van die ontvanger verskyn in figuur 15. Die inset van die ontvanger word met 'n resistor van ongeveer 0.04 ohm omvat en die las is ongeveer 1 VA teen 5 VA. 'n Smalbandfilter f, 'n begrens L en 'n diskriminator DI en 'n dekodeerder DE volg. Al hierdie eenhede word gevoer deur 'n toevoerseenheid S. Verder word die verskeie tydrelingtinging word deur die tydreltoestel aan die filter, diskriminator en die dekodeerder versterk. Die ingligting bestaan uit die roterfrekwensie vir die skaalelaars van die kommuterfilters vervat in eenhede F en DI en die horlosieimpuls vir die dekodeerstoestel DE.

Eenhed T verkry hierdie ingligting uit die netfrekwensie oor 'n faseoorloop soos in die geval van die osillator in die sender. Net soos die inset van die sender, is die uitlaat van die dekodeerder ook voorsien van 'n aantal gleuwe waarin ponskaartselekties geprop kan word. Hierdie sleutels bepal die telegram wat gedekodeer moet word en wat een van die uitlaatkontakte moet werk.

Akkuraatheid van frekwensie is in die geval van die samestel wat pas beskryf is, geen probleem nie. 20 tot 30 kanale kan in die frekwensieband 100 tot 150 Hz toegewys word en in hoër frekwensies is meer kanale beskikbaar. Uitgesonderd die genoemde toepassings kan RETROBIT ook gebruik word vir die bevestiging van bevele wat deur rimpelbeheer versend is. In hierdie geval is RETROBIT 'n uiters bruikbare toevoeging tot rimpelbeheer en bied dit baie geleenthede. Die afgelope 25 jaar het telkens van ons rimpelbeheerklante die vraag gekom: "Hoekom kan julle nie andersom uitsaai nie?" Nou kan ons, met RETROBIT.

## MINIBIT 'N LAEKRAKSENDERSSTELSEL VIR SPESIALE DOELEINDES.

### Algemeen.

Die prys van 'n ontvanger om audiefrekwensies in kragverdelernette te ontvang, hang grotendeels af van die minimum seinspanning wat beskikbaar is by die ontvangingspunt. As hierdie minimum seinspanning relatief hoog is, kan die ingangsaan van die ontvanger eenvoudig gehou word omdat selektiwiteit nie 'n groot probleem skep nie. Geen maatreëls teen sturing word dus vereis nie. Die ontvanger is in hierdie geval eenvoudig en goedkoop, maar die sender moet natuurlik kragtig wees en is gevolglik duur. Ontvangers wat baie sensitief en uiters selektief is, is aan die anderkant meer gekomplekseer en duurder, maar die sender kan minder kragtig wees en is dus goedkooper.

'n Algemene beskrywing van die omstandighede word in figuur 16 gegee. Kurwe 1 toon die koste van die sender as 'n funksie van sy krag, terwyl kurwe 2 die koste van  $m$  ontvangers voorstel, ook as 'n funksie van die krag van die sender. Die som van kurwe 1 en 2 word deur kurwe 3 aangetoon. Uit kurwe 3 blyk dat 'n toestel wat bestaan uit 'n sender en  $m$  ontvanger die goedkoopste is wanneer die ontvangers ontwerp is om met 'n seinspanning te werk wat deur 'n sender met die krag  $P_{opt}$  behartig kan word.

Dié sien egter anders daar uit wanneer daar minder ontvangers per sender is. Kurwe 4 toon die koste van  $n$  ontvangers en kurwe 5 toon die som van kurwe 4 plus kurwe 1. In hierdie geval is die minimum koste van  $n$  ontvangers plus sender teen  $P_{opt}$  d.w.s. met 'n minder kragtige sender. Kortliks kan gesê word dat dit belangrik is dat die ontvangers goedkoop sal wees wanneer daar 'n groot getal ontvangers per sender is. Aan die ander kant is dit belangrik dat die sender op sigself goedkoop sal wees wanneer daar 'n klein getal ontvangers per sender is, omdat die koste per ontvanger van minder belang is.

Met die konvensionele rimpelkontrole is die getal ontvangers per sender gemiddeld 1 300.

In die lig van die bogenoemde is die gebruik van 'n relatiewe sterk sender geregtig.

Daar is egter ander gebruike vir audiefrekwensie-insending oor hoofkragleidings met heelwat minder ontvangers. Vir die gebruik word die optimum oplossing bereik met 'n klein sender en ontvangers wat baie meer kompleks is as dié wat rimpelkontrole gebruik word. Die MINIBIT-stelsel is ontwikkel vir hierdie gebruike, waarvan een later beskryf sal word.

Net soos die Retrobit-stelsel, werk die MINIBIT-stelsel op die beginsel van frekwensiemodulasie. Die invoerspeil by die inoerpunt beslaan so min as 0,1% van die spanning van 50 Hz - in verhouding tot 220 volt is dit 220 mV. Vergeleke met die seinpeil van rimpelkontrole-installasies is hierdie peil meer as een keer laer wat spanning betref, en meer as twee kerwe laer wat seintrag betref.

### The Transmitter

As is the case with DECABIT, the MINIBIT transmitter comprises a control panel and a static frequency converter. The signal frequency, however, is derived from the 50 Hz of the network and is, for instance, 115.2 Hz to mark the state "NO IMPULSE" and 116.8 Hz to mark the state "IMPULSE". The coding is similar to DECABIT. As the signal level is extremely low, the injection of the signals can be made very simply through bar type current transformers.

### The Receiver

Similar to the transmitter, the receiver derives the frequencies to be received from the 50 Hz network frequency. Furthermore, like the RETROBIT receiver it is fitted with narrow band commutating filters with all the features as described in detail on page R - 5.

Except at times when a telegram is being transmitted, the MINIBIT transmitter permanently emits the lower of the two frequencies used. This is a very effective safeguard against interference and in particular solves the problem of spillover and mutual interference between neighbouring installations working of the same frequency.

Today, MINIBIT is only economical for special applications where few receivers are required. Looking twenty years ahead however, it might well be the all-round control system covering the needs of conventional ripple control, network automation and special applications as well.

It is unlikely that the space and the material required to handle 1 kW or 1 kVA of active or reactive power will become significantly less in the near future. Consequently, the cost per kVA of condenser or transformer capacity is not likely to decrease. To the contrary, as raw materials are becoming more and more scarce the costs per kVA of transmitter power are likely to increase in future.

The contrary however, applies to the receivers. Here, the power involved is of minor importance. The problem is reception and processing of information and in this field considerable further development may still be expected. It is very likely that more and more complexity will be available per dollar and in these circumstances, the price of the MINIBIT receiver may well compare favourably with the transmitter in some distant future.

## PARGUIDE, A SYSTEM TO GUIDE CAR DRIVERS TO THE NEXT AVAILABLE PARKING SPACE

The problem of finding a suitable parking space in a city area is well known to everybody. Many cities and also private enterprises have invested enormous sums to ease the situation by sorting out parking areas and building of parking houses. However, there is no hope to ever fully meet the demand and particularly at peak times all parking space is occupied. The drivers who come to the city then start to circle round from one parking house to the other, each one finding out for himself that there is no more room. It is estimated that, at certain times, this type of traffic reaches more than 30% of the total.

It goes without saying that this part of the traffic is, of course, unwanted in every aspect. For the searching driver it means loss of time, unnecessary wear on the nerves as well as on the car and burning of petrol for nothing. For the other part of the traffic and the public, it means unnecessary usage of traffic space and embarrassment caused by noise and exhaust gasses.

This situation can be helped by a Parguide system (Fig. 17). Parking signs showing a white "P" on blue background, fitted with three illuminated arrows are installed on important intersections with one arrow pointing straight ahead, one to the left and one to the right. The illumination of these arrows is controlled in function of the fact whether in the directions indicated, parking space is still available or not. On his way to the city, the aforementioned driver watches whether the arrows in his direction are illuminated. As soon as this is no longer the case, he follows the last possible alternative and parks his car in the next parking area. This is the last possibility which is nearest to the place where he wanted to go. To go further into the city with the car would be useless because all parking space is already occupied.

A system as just described is in service in the city of Aachen in Germany. Trial installations are in operation in Stuttgart and Salzburg and a project is under consideration for the City of Zurich.

To operate such a system, it is necessary to transmit information about the parking space available from the parking houses and parking areas to a central station and to spread it again from there to the "P" signs all over the city. To do this, an extensive network of control wires is required which in most cases is not available and would be too expensive to install.

This problem, however, can be solved economically with RETROBIT, as far as the connection between parking houses and the supplying high voltage substations is concerned, and with MINIBIT between the supplying high voltage substations and the "P" signs. All that is required is a pilot connection between the supplying high voltage substations and the central station, for instance, at the police headquarters.

Thanks to MINIBIT the latest information regarding the occupation of the parking houses and parking areas can be received at any point where electricity is available. The "P" signs can be everywhere in the area of supply and the information is received over the same wires as is the energy for illumination.

### Die Sender.

Net soos die Decabit-sender, bevat die Minibit-sender 'n kontrolepaneel en 'n statiese frekwensie-omsetter. Die seinfrekwensie word eger afgelei van die net van 50 Hz, en is byvoorbeeld 115,2 Hz om die „GEEN IMPULS“-stand aan te dui, en 116,8 Hz om die "IMPULS"-stand aan te dui. Die kodering is soortgelyk aan dié van die Decabit. Daar die seinpeil baie laag is, kan die invoer van die seipe baie vreesvuldig deur staaf-tipe stroomtransformators.

### Die Ontvanger

Net soos die sender, lei die ontvanger die frekwensie wat ontvang moet word van die netfrekwensie van 50 Hz af. Verder is die ontvanger, soos in die Retrobit-stelsel, toegerus met smalbandkommuteerfilters met al die eienskappe soos dit in besonderhede beskryf is op bladsy R-5.

Die Minibit-sender straal voortdurend die laaste van die twee frekwensies uit wat gebruik word, behalwe wanneer 'n telegram oorgesend word. Hierdie metode bied doeltreffende beskerming teen sturing en los die probleem van oorloop en onderlinge sturing op tussen nabygeleë installasies wat op dieselfde frekwensie werk.

Vandag is Minibit ekonomies net vir spesiale gebruike, waar min ontvangers nodig is. Maar oor twintig jaar mag dit heel moontlik die algemeen gebruiklike kontrolestelsel wees wat net so goed sal voldoen aan die vraag na konvensionele rimpelkontrole, netoutomatisasie en spesiale gebruike.

Dit is onwaarskynlik dat die ruimte en die materiaal wat nodig is om 1 kW of 1 kVA ware vermoë van reaktiewe vermoë te hanteer aansienlik sal verminder in die toekoms. Gevolglik sal die koste per kVA kapasitor, of transformatorvermoë waarskynlik nie verminder nie.

Die koste per kVA sanderkrag sal intendeel waarskynlik verhoog in die toekoms, omdat grondtoesae steeds skaarser word.

Die teendeel is eger van toepassing op ontvangers. Hier is die betrokke krag van minder belang. Die ontvangs en verwerk van informasie skep die probleme, en op dié gebied kan aansienlike ontwikkeling nog verag word. Dit is baie waarskynlik dat kompleksiteit per dollar steeds in groter mate beskikbaar sal wees. In hierdie omstandighede kan die prys van die Minibit-ontvanger heelwaarskynlik gunstig vergelyk met die sender in die toekoms.

## PARGUIDE - 'N STELSEL WAT MOTORBESTUURERS LEI NA DIE EERSTE BESKIKBARE PARKEERPLEK.

Almal ken die parkeerprobleme in die stad. Talle stede en privaatinstansies het al enorme bedrae bestee aan die oplos van hierdie probleem, deur die oprit van parkeergeboue, parkeerterreine, ens. Daar bestaan eger geen hoop om ooit in hierdie tekort te voorsien nie, veral nie gedurende spitsytse wanneer al die beskikbare ruimte gevul is nie. Die motoriste wat dan stad toe kom, begin van een parkeergebou na die ander te ry - slegs om ekeken op sy beurt te vind dat dit vol is. Hierdie soort verkeer is na raming soms so hoog as dertig persent van die totaal.

Dis vanselfsprekend dat hierdie tipe verkeer ongewens is. Vir die soekende bestuurder beteken dit tydelikes, onnodige lysis van sensuue en voertuig en petrolverkwisting. Vir die res van die publiek beteken dit onnodige besetting van verkeersruimte en ongerief as gevolg van lawani en uitlaagasse.

Dié toestand kan verlig word deur 'n PARGUIDE-stelsel (Fig. 17). Parkeerkeens met 'n wit "P" op 'n blou agtergrond en voorsien van drie verligte peltjies word by belangrike oorgange geïnstalleer sodat een peltjie reg na voor, een na links en een na regs wys. Die beligting van die peltjies word beheer deur die beskikbaarheid van parkeering in die aangeduide rigting. Onderweg na die stad lei die motoris op of die verlig is in die rigting wat hy reis. Sodra hulle nie meer verlig is nie, volg hy die laaste alternatiewe aanduiding en parkeer op die eerste beskikbare staanplek. Dit sal dan die laaste moontlike staanplek wees naaste aan sy bestemming.

'n Soortgelyke stelsel word reeds in Aachen, Duitsland, gebruik. Toetsinstallasies is in werking in Stuttgart en Salzburg en 'n projek vir Zürich word tans ooreweg.

Om so 'n stelsel moontlik te maak, moet besonderhede van beskikbare parkeerruimte in geboue en terreine versend word na 'n sentrale beheerpunt en van daar na al die P-tekens in die stad. Dit vereis 'n uitgebreide bedradingstelsel wat in die meeste gevalle nie beskikbaar sal wees nie en te duur is om te installeer.

Hierdie probleem kan verbinding te houe gekom word met RETROBIT wat betref die eenkinding tussen die parkeerplekke en die hoëspanningsvoorsieningsasies en met MINIBIT tussen sodanige substasies en die P-tekens. Al wat vereis word, is 'n loodsverbinding tussen die substasies en die sentrale beheerpunt, bv. die polisiehoofkantoor.

Danksy Minibit kan die jongste inligting oor die besetting van parkeergeboue en -terreine op enige punt waar elektriese krag beskikbaar is, ontvang word. Die P-tekens kan oral binne die voorsieningsgebied wees en die inligting word met dieselfde drade versend as die beligtingskrag.



Fig. 1 Typical DECABIT receiver selectivity curve  $f = 217$  Hz  
 1: 4th harmonic according to VDEW  
 2: 5th harmonic according to VDEW

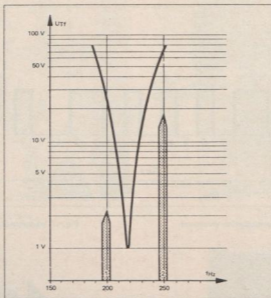


Fig. 1 Tipiese DECABIT-ontvanger se selektiwiteitskurwe  $f = 217$  Hz  
 1: 4de harmonie, volgens VDEW  
 2: 5de harmonie, volgens VDEW

Fig. 2 Time sequence of a DECA-BIT command

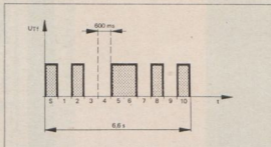


Fig. 2 Tydvolgorde van 'n DECA-BIT-bevel

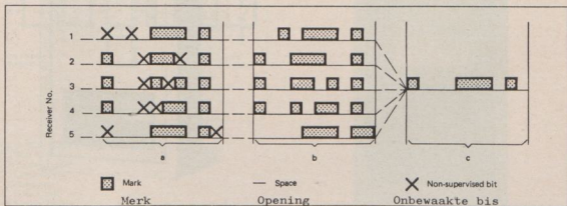


Fig. 3 Example for receiver setting and code allocation to switch a group of receivers each of which has an individual code, with one common master command.

- a: Code supervision by receiver
- b: 5 individual codes operating 1 receiver each
- c: Master command operating all 5 receivers

Fig. 3 Voorbeeld vir ontvangerinstelling en kode-toewysing om 'n groep ontvangers te skakel wat elk 'n afsonderlike kode het asook 'n gemeenskaplike meesterbevel.

- a: Koderigting deur ontvanger,
- b: 5 afsonderlike kodes, beheer elk 1 ontvanger,
- c: Meesterbevel, beheer al 5 ontvangers

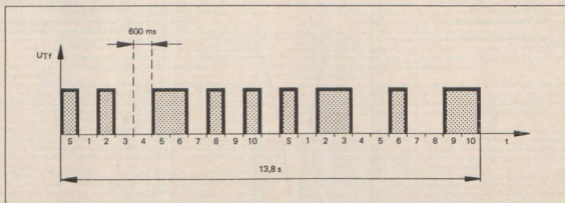


Fig. 4 Time sequence of a DECABIT combination command.

Fig. 4 Tyd volgordes van 'n DECABIT-kombinasie bevel.

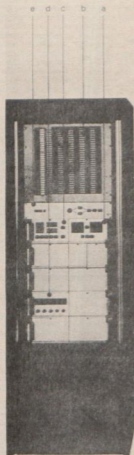


Fig. 5 DECABIT kontroleur

- a: Encoder
- b: Plug Board, for 24 Hour Schedule, 40 channels
- c: Memory of Channel Status
- d: Blocking Unit
- e: Internal Clock

Fig. 5 DECABIT-kontroleur

- a: Kodeerder
- b: Propbord, vir 24-uurskedule, 40 kanale
- c: Geheue van kanaalstatus
- d: Blokkeereenheid
- e: Inwendige horlosie

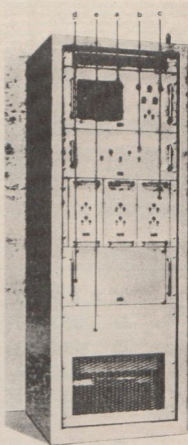


Fig. 6 Audio Frequency Generator

- a: Power Supply Unit
- b: Electronic Switch
- c: Single Phase Converter (one of three)
- d: Electronic Control Devices
- e: Output Transformer

Fig. 6

- a: Oudiofrekwensiegenerator
- b: Elektroniese skakelaar
- c: Enkelfaseomsetter (een van drie)
- d: Elektroniese Beheertoestelle
- e: Uitlaattransformator

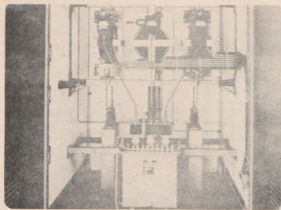


Fig. 7 Coupling Circuit for parallel injection  
Fig. 7 Verbindingsstroombaan vir paralelinjeksie

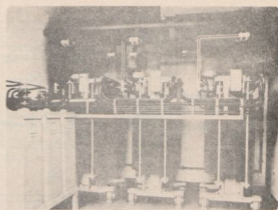


Fig. 8 Coupling Circuit for series injection  
Fig. 8 Verbindingsstroombaan vir serie-injeksie

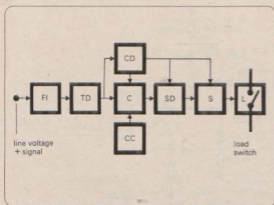


Fig. 9 Block Diagram of DECABIT Receiver

FI Filter Unit  
TD Timing Device  
CD Clock Device  
C Comparator  
CC Code Card  
SD Storage Device  
S Switch  
L Load Switch

Fig. 9 Blokdigram van DECABIT-ontvanger

FI Filtereenheid  
TD Tydreeltoestel  
CD Klokttoestel  
C Vergelyker  
CC Kodekaart  
SD Bergtoestel  
S Skakelaar  
L Laskakelaar

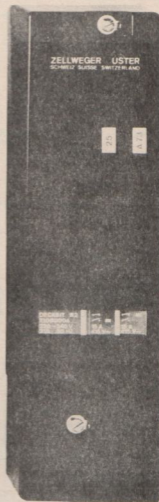


Fig. 10 DECABIT Receiver equipped with 2 channel switches (15 A  $\cos \varphi = 0,3$ ; 25 A  $\cos \varphi = 1$ )

Fig. 10 DECABIT-ontvanger toegerus met 2 kanaalskakelaars (15 A  $\cos \varphi = 0,3$ ; 25 A  $\cos \varphi = 1$ )

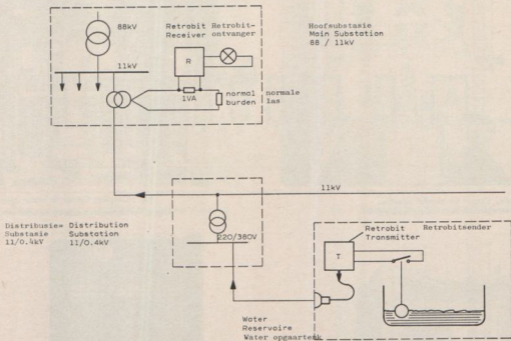


Fig. 11 Application of RETROBIT. Principle diagram.  
Toepassing van RETROBIT. Beginseldiagram.

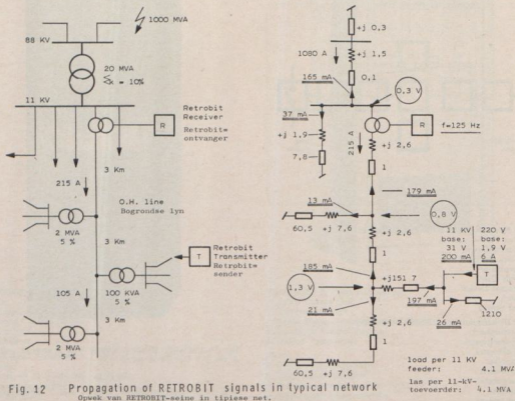


Fig. 12 Propagation of RETROBIT signals in typical network  
Opwek van RETROBIT-seine in tipesne net.

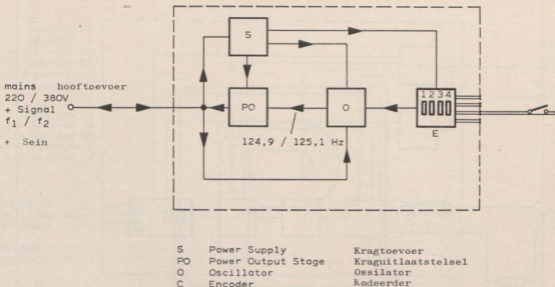
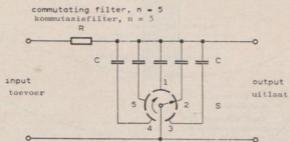


Fig. 13 Block diagram RETROBIT transmitter

Blokdiagram RETROBIT-sender



number of revolutions of switch S per second =  $f$   
 getal omwentelings van skakelaar S per sekonde =  $f$

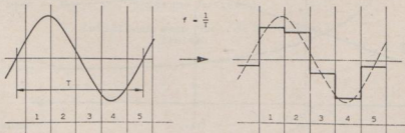


Fig. 14 Commutating filter

Kommutasiefilter

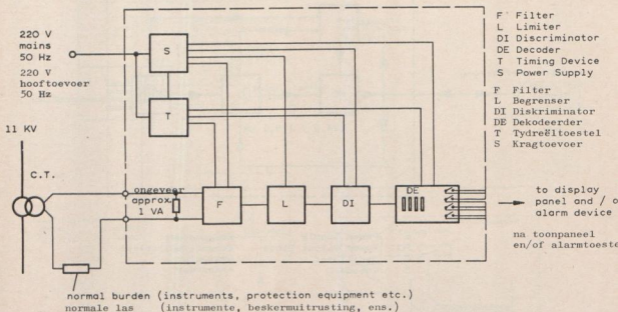


Fig. 15 Block diagram RETROBIT receiver  
 Blokdigram RETROBIT-ontvanger

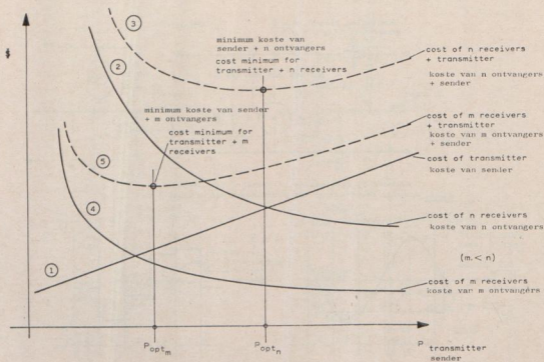


Fig. 16 Number of receivers, power of transmitter and cost minimum  
 Getal ontvangers, krag van sender en minimum koste.

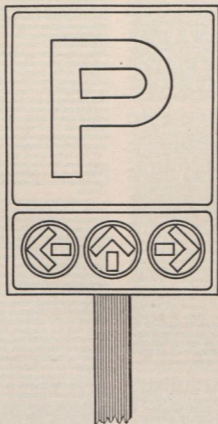


Fig. 17

Information sign for the Parking  
Guidance System

Inligtingsteken vir die Parkeerlei-  
stelsel

/Stability/

**President:** Will anyone open discussion on Mr. Baumann's paper?

**Mr. I.F. Boyack (Pretoria):** The author refers in general terms to the development of audio frequency signal transmission in power networks for load control purposes. This system has the disadvantage that the signal strength is affected by the system load conditions and changes in system configuration. As the individual load grows so the number of individual load served by an injection plant will decrease and hence of course, the load control will increase. The "retrofit" system is particularly susceptible to changes in system configuration either due to fault conditions or for load purposes. The major change that has been made at this stage to solid state equipment, should eliminate many of the drawbacks of the present equipment particularly in respect of injection plant and the author's views on the relevant merits and costs of injection onto an RHV network and say 132 kV compared to individual plants and primary subs at 11 kV would be appreciated. In the present, electro-mechanical receiving relay has been optimized to an extent that with our experience the failure rate of better than 100% per annum appears to apply. The author's views on the reliability of the new solid state relay would be appreciated particularly in view of the severe lightning conditions prevalent in this country.

With regard to the cost of the receiving relays, a recent publication suggested that with the use of integrated circuits, the cost of these relays would be half the cost of the existing equipment with no maintenance. The author's views would be interesting on that. The question of harmonics has been mentioned and particularly with the use, the increased use of semi-conductors and power circuits. This is certainly causing concern at the present time and the author's views would be appreciated on whether steps are being taken to specify the limits of harmonics on an international basis with particular mention to AF injection. Further, a considerable amount of correction equipment is acquired and is being installed for this type of equipment and the author's comments on the effect of the injected signal over a period of time would be of interest. One of the problems that power engineers have with a system of this type, that once the particular system has been decided on and installed the network tied to that particular system and virtually tied to supply by one manufacturer. Reference was made in the paper to the fact that most systems operate on a principle of one frequency with the impulse interval system of coding. Frequencies used are in a lower part of the harmonics spectrum which is understandable as natural gaps are wider. In the interests of standardisation would it not be possible for agreement to be reached regarding the injection frequency and the method of control to be used throughout the country. Has an attempt been made in any other system to achieve this aim? Further it would be interesting if the author could provide information on the applications other than direct load controls such as switching of two rate meters and the experience obtained in his applications. Finally Mr. President I would like to thank Mr. Baumann very sincerely for presenting his paper to us here this morning.

**Mr. E. Baumann (Zellweger):** Mr. President, gentlemen, I'm sorry, I might have missed some of the questions of Mr. Boyack. There are quite a few, but I will try to answer them to the best I can. One of the questions is: The question of, "where injection should be made", say for instance at the 132 kV level or at the other end, say, the other extreme, that would be on the low voltage side. Of course, there are solutions in between, maybe at 66 kV or 88, then at 33 as a possibility, or at 10, 11 kV or 6.6. Now we had the experience over the last 30 years that the future development of networks, is normally fairly well-known on voltage levels like 6.6 or 11 kV, perhaps also on 33 kV, but the future development of voltages higher up of networks with higher voltages, that is for instance 132, is normally not known. There are plans, but when we ask what will be the maximum power, how many stations will there be connected to this network, the information we get is just preliminary or provisional and cannot be relied on. You know that the power injected is absorbed not by the receiving relays but by the load of the network itself, in other words the A.F. transmitter has to be designed for the power of the supplying transformers, the power of the network, the maximum power of the network, and unless this is not known, the size of the transmitter can not be determined. There are examples of ripple control installations which we have used: one big transmitter for a 110 kV network or also 66 kV. The transmitter was designed and after 5 years or even 8 years this network configuration changed completely, the power of the network increased very much, or even they interconnect this where it is installed, inter-connecting the system with other systems. Then of course, either the transmitter has to be replaced by a bigger one or then very costly stoppers have to be inserted. You insert into interconnectors going out of the area to be controlled. This can be avoided, definitely avoided, if transmission is made for, or the injection is made on a lower voltage level, that is for instance 11 kV, because the maximum power of an 11 kV network, is normally fairly well known, it does not go over certain limits, such as for instance of short circuit capacity of the switchgear. In a city area for instance we made the experiments with so-called decentralized injection on a relatively low level with a number of transmitters, but if the load increases, it is not the power of the substation which is going to be increased, but new substations are being introduced which then of course, have to be equipped with a transmitter, but the equipment once installed, can be left as it is, and also the danger that the network configuration is subject to major alterations, is much smaller. A further

advantage of injection on the lower level, is the fact you have not all your eggs in one basket. If the transmitter fails, you are not losing control over the entire area, but you might lose control only over one of the networks, one of the smaller areas, a smaller area anyway. Also the equipment involved is much smaller; it can be handled easily by a man or two, and if one of the pieces fails, you can, within an hour or so, you can replace it with a big transmitter of 200 or 300 kW per hour, or 500 or even on to a megawatt A.F. power. You need a crane and heavy equipment to replace it. Also the spares are of course cheaper because one set of spares for a small transmitter serves for all of them whereas in the case of one big transmitter, you need a complete set of spares for the lot. I hope this is the answer to your question regarding injection level. There are other considerations to that point, that is the question of interference between plants. The number of frequencies available for ripple control are not very many as already mentioned by Mr. Boyack. The space between harmonics is being used for ripple control and not too many frequencies can be allocated within the free space. Now the higher up the injection is made, take for example a 132 kV, that A.F. signal must travel through the 132 kV line, through the transformer to perhaps 33-kV, then through the 33-kV line, then through the transformer to 6.6, then through the 6.6 line, through the transformer to low voltage and finally to receiving relay. The attenuation of the signal with so many steps of transformation is much higher than in the case with 11-kV injection. But the receiving relay at the end requires the same voltage whether you inject on 132 or on 11-kV. If you require one volt on the receiving relay, you might require 4 or 5 volts on the 11-kV bus to operate it, but if you go up to 132 you might, you need to inject 15 or 20 volts on a 220 volt bus. Then of course the danger of interference of neighbouring plants is very much increased, so the problem of interference is much easier to govern with decentralised injection.

Another question was the question of "The reliability of Receiving Relays". It is quite true that these receiving relays, the conventional type of receiving relay on the electro-mechanical basis they have now been manufactured for 30 years and of course all the teething troubles they are known and they are gone, and the reliability of these receiving relays they are very high. We have figures of many of our clients with 10 000's of receiving relays with failure rates as low as .3 of a per cent per year. The electronic receiving relay, "this question is a very good one actually": The electronic receiving relay is a good relay only if it meets that standard I was talking about. Now, the electronic receiving relay has the advantage that most of the functions are combined in one integrated circuit, the electronic receiving relay contains in one custom designed I.C. (integrated circuit), there are about a 1000 transistors and diodes are all included in one integrated circuit, and it is an established fact that the complete full integrated circuit has got practically the same reliability as just one transistor has, because there are no bondings, on semi-conductors the bonding problem is one of the serious ones, and in fully integrated circuits there are no bonds because all its connections are done on one chip.

Of course this question has been very thoroughly investigated and we are confident that we can with fully electronic receiving relays maintain the same standard.

About regulations regarding frequencies to be used for A.F. control, ripple control, there are regulations in many countries, but recommendation, but the frequencies to be used, and these are all frequencies, at least at the lower end, these are the frequencies: 166, 183, 217, 233, 275, 315, 317, 375 and so on, then 450, 500, 600, 750, 1050, 1350, 1600. There are recommendations to use these frequencies and no others, and you'll see that all our frequencies used so far are well in this regulation. As a matter of fact this is perhaps also an interesting point - In an area, if you take Johannesburg with all the surrounding Councils/Municipalities, if they all would have to be equipped with ripple control, I think the best thing would be to keep them all on the same frequency, but to provide all transmitters with a very effective absorption effect, that's a point which we always stressed right from the start but care should be taken that the transmitter is able to short-circuit the busbar for the particular frequency used, and in fact, the price of an injection equipment is in many instances given by this absorption fact and not by the injection, so that the condensers and the coils and everything has been designed to provide good absorption. Because then you have full protection, any signal coming in from a neighbour is on that frequency your absorption is tuned to and your absorption, short-circuits, all incoming interference signals.

The absorption circuit cannot do that if the frequency is different, and the rest might still go through and that might start up problems, which can be avoided if the same frequency has been used.

Other applications of ripple control: As a matter of fact, nearly all ripple control installations installed so far have been installed and economically justified by load shedding, shedding of load during peak time, which is being normally sometime during the afternoon or at 5 or 6 o'clock in the evening. But, I'm convinced that this is not actually the main application of ripple control, and the big advantage of it is at another time.

You know that a nuclear energy is on the doorstep now, particularly on the Continent, and these nuclear power stations, not only the nuclear ones but also if there are some others on fuel, (fossil fuels) but the size of the generators and turbines, and in the region of 1000 to 2000 megawatts for new power stations. Now these new big sets cannot



be regulated more than about 1% per hour, in other words, if you would load them up completely during peak time, you would have to maintain this loading because you cannot regulate it down to half at night time. If in a country, for instance, if I take Switzerland, the total generating capacity installed is about 10,000 megawatts, today. The rate of growth of consumption is about 6%. Not at 6%, in about 10 or 12 years' time the demand will be doubled, in other words, we'll have to build power stations, just as many power stations or just as many megawatts as we have built in the past up to now, within ten years' time. So another 10 gigawatts will have to be added in the next 10 to 12 years, these other 10 gigawatts will be nuclear power stations, which cannot be regulated, nearly not – no regulation in other words, the peak demand in Switzerland now, if it takes the night load, the minimum load, this is perhaps about 40% of the total load in day time. We have no hope whatsoever in 10 years' time when we have another 10 gigawatts of nuclear power stations to come down to this 40% of the peak load by regulating, we will then have to regulate also the nuclear power stations, which we can't.

So, what is the solution? There is in my opinion, and I haven't heard any other opinions so far, is either to put up big pump storage schemes and use the nuclear power stations at night time to pump up water in the day time, that's one solution, but that needs really huge power stations and huge storage schemes, or then, to sell this energy at night time, and that I think would be the sensible thing to do. This energy could be sold at night time, but this would require a policy which we would have to start now, a policy to build-up night load which is controllable.

The third possibility of course would be to destroy the energy, just to put up big cooling towers and let the energy go into the air again after it has been produced, or into the sea, this we can't do in Switzerland of course.

So I think the big advantage of the future of ripple control is to control night load, to be able to maintain the consumption within limits.

Conventional ripple control has been designed to do load control basically and also of course to switch street lights and to transmit alarms or any other thing – tariff meters and so on. I don't think these systems are particularly good for other applications, which are what we would call discreet applications, just on one point to switch just one thing, for instance to wake up Mr. Miller at 5 in the morning it would be a waste to use ripple control and to start up all the thousands of receiving relays just for this one Mr. Miller. Because electro-mechanical receiving relays, they are out, they are designed for about 300 000 operations in 20 years' time, so they are not designed to operate all day long, but electronic receiving relays, it doesn't matter whether they are operating all day long, they are alive anyway, so whether they operate or not it doesn't matter.

So, a new ripple control – electronic ripple control system, offers many more applications, for instance, the operation of circuit breakers, or any other application which is just for one particular thing, and that is the reason why we have designed this system with so many channels, which is then of course necessary.

Now, one of the questions was about corrective measures: I'm not quite sure what Mr. Boyack meant with 'corrective measures'. Perhaps he thinks about power factor condenser blocking? It's a fact of course, that a condenser attenuates A.F. signals more the higher the frequency is, because its impedance is getting lower and lower with higher frequency and that is certainly one of the reasons why lower frequencies, signal frequencies, are advantageous. But lower frequencies have other disadvantages, the equipment becomes much bigger and bulkier and is much more expensive than at higher frequencies. So, it is again a question of economics; what is the cost of low – frequency equipment and what is the cost of corrective measures?

Now, we have some figures of corrective measures which have been necessary in installations working on 1050 Hz, or even higher frequencies, and as far as we know this has never gone above 12% of the total investment in the entire ripple control installation. In one particular case it was nearly 13%, but all others are well below this figure. Also, there are regulations about the international recommendations, and in some countries are regulations regarding the connection of power factor correction capacitors to networks; so that the electricity authorities have already, years ago, taken some measures to prevent the unrestricted connection of condensers to their networks.

I might add perhaps that even if you go to a frequency as low as 166 Hertz, you are not completely free of any problems with condensers. There are always the odd industrial consumer which might have some equipment requiring power factor capacitors which are more than the nominal kVa rating of the supply transformer, being switched off when the load goes down, but once you are over about 70%, the (kVa R) value of the capacitors is more than about 70% of the feeding transformer rating, corrective measures are also necessary at frequencies which is as low as 166. So, I think we cannot really condemn the higher-up end or the lower-up end of frequencies available, one has to consider the case as it is and has to try and find the best possible economical solution.

That is what I noted here Mr. Boyack. I hope I answered at least the bulk of the questions, but I'm also prepared to answer further.

**The President:** To continue the discussion gentlemen, I'd like to call on Mr. Plowden.

**Mr. D.C. Plowden (Johannesburg):** Mr. Baumann is to be congratulated on a paper in which he has described some very significant

developments in a short time without sacrificing clarity and without glossing over the underlying principles. It is very evident, however, that the announcement of these developments has been preceded by a considerable effort on the part of a large number of people and that the translation of the designer's original concepts into working systems which are both reliable and cost effective is a considerable achievement.

The developments described all appear to have resulted from an intensive search for methods of improving the security of transmission coupled with the exploitation of the properties of semiconductor devices. The first and probably most significant change has resulted from the use of frequencies which are not multiples of the supply frequency. While the maximum levels for the 4th and 5th harmonics stipulated by the VDEW quoted by Mr. Baumann are a distribution higher than the levels which are generally present in a distribution system, higher frequency has shown at levels approaching the lower limit of the older type of ripple control installation have been observed on Johannesburg's system. With the proliferation of thyristor controlled devices and appliances it is conceivable that ripple control systems using harmonically related frequencies could be subject to interference for significant periods in the future.

Up to now, the receivers in a ripple control system have been sensitive only to the amplitude of the received signal, the maximum sensitivity occurring at the nominal frequency of the system. The receivers used for the Retribit and Minibit systems go one step further however. While the signal frequency is not harmonically related to the supply frequency, it is related by the ratio of two integers. This is achieved by using a circuit which is in effect an electronic gearbox. The receiver can therefore be made sensitive to the relationship between the signal frequency and the supply frequency as well as to the amplitude of the signal frequency. This technique has proved invaluable for recovering signals which are buried in noise and its application to ripple control systems has permitted a similar situation, namely, the level of the signal frequency can be reduced substantially.

A second development which goes hand in hand with the first is the use of frequency shift keying instead of ON-OFF keying for the modulation of the signal frequency. Frequency shift keying has been adopted by most of the manufacturers of supervisory control equipment because of the very low error rates which can be obtained. With this type of modulation it is no longer necessary to make the receiver sensitive to signal amplitude and the receiver is required to sense whether the signal frequency is above or below the nominal value instead. This means that both the 'on' or mark and the 'off' or space value of the control signal is transmitted and it is therefore very difficult for the reception of a command or an indication to be affected by interference. This latter feature does of course mean that the transmitter must be capable of providing a continuous signal for the duration of the transmission but this will not in general be a problem.

The third development which is common to all the new systems described by Mr. Baumann is the use of a coded transmission instead of the time division multiplexing used by most of the ripple control installations in this country. In fact, since it is rare to send more than two commands at the same time, it is more logical to send each command separately in the form of a code. This approach provides a tremendous increase in the security of the transmission because of the error checking feature which features in the code adopted. The check is more powerful than a parity check because the number of marks in the code is not only odd but is also constant. The probability of interference causing incorrect operation of a receiver is therefore very small. On the other hand, the probability of a receiver not responding to a code as the result of interference becomes significantly larger and the nuisance value of increased security must be weighed up against its benefits.

The developments just discussed have all made such large contributions to the security of transmission that it has become possible to abandon the one feature which provided security in the past, namely, a high signal level. This in turn has reduced the cost of the transmitter to a point where it is feasible to transmit indications from a number of widely separated points and where the Retribit and Minibit systems become feasible and economically attractive. This is indeed a great step forward.

A consideration of the features of these systems indicates, however, that the maintenance of the equipment will require specialist electronics and more sophisticated test equipment. This fact alone may cause smaller municipalities to hesitate when considering the benefits that can be obtained from some of the systems which Mr. Baumann has described. It is evident, however, that the maintenance of this equipment has not been forgotten by the designer and one example of this is the use of a special punched card to set up the code to be transmitted or received. Another example is a feature of the coding scheme where an inverse code (all marks replaced by spaces and V.V.) is used to transmit an 'off' command. This makes the memorisation of the code for a given function simpler although this is still more difficult than remembering a channel number. It would, however, be interesting to know what test equipment has been developed to measure the very low level impulses of relatively short duration and to measure the very small frequency shifts which are inherent in these new systems.

Over the years a large number of applications have been devised for the original ripple control systems but all suffered to a smaller or larger extent from lack of knowledge of the state of equipment at the receiving end. This gap has now been filled by the Retribit system described

by Mr. Baumann. The Parguide system is a very interesting example of what can be achieved when two way communication is possible and when sufficient codes or channels are available. Other possible applications which come to mind are the transmission of a general alarm type of indication from street lighting control centres, from traffic signal controllers and from certain types of load centres. There is certainly a great deal of scope for those with ingenious minds.

In conclusion I would like to pose a further question. If several Retrobot transmitters are connected to a common feeder, the possibility exists that two or more transmitters will attempt to transmit simultaneously and the receiver(s) at the sub-station may not respond. Is the system therefore restricted to one transmitter per feeder and if not, how are the transmitters made to transmit in sequence? A transmission can also be affected by interference such as switching surges and it would be interesting to know if provision is made for retransmission at a later stage.

**Mr. E. Baumann:** (Zellweger): First of all, I would like to thank Mr. Plowden very much. I think he gave such a good and brief summary which is even much better than my paper. Concerning the two questions of Mr. Plowden, about the test equipment, I must honestly confess we haven't got any, so far.

The demonstration set, I have with me here, that is of the prototype nature, it's just coming out of the laboratory, so these things are still in the process of development at the present time. We will certainly have to design some test equipment to measure the most characteristic features of the signal, that is the amplitude and the frequency shift. But so far we haven't got any of this equipment, but I don't think this is a difficulty to make them.

The second question about the several transmitters, transmitting on the same feeder. As already indicated by Mr. Plowden, there are in principle two solutions, either we can use different frequencies for different transmitters which would of course require a receiver for each frequency, or then on the other hand, we could make sure that these transmitters are always transmitting sequentially, that means one after the other.

We had in mind to develop retrobot that way, and you might also see that from the fact that the frequency shift is very narrow; we had in mind to use a number of frequencies, we think that we can allocate 30 different frequencies within the band of 100 to 150 cycles, so that means up to 30 retrobot transmitters you could easily install on one feeder without any danger of interference.

The time-sequence system can of course be easily introduced when the network is already equipped with the Decabit system, because when a Retrobot transmission arrives, the decabit transmitter can start up and tell all the retrobot transmitters - 'Be quiet'. Then they start up with different time-lags inherent to them, so that they come one after the other.

So the solution is as I said only possible if one has a, well as the President who says "quiet, now Mr. Miller first please". So that not everybody is talking at the same time.

I hope that this is the answer I have for these two questions, and I hope they are satisfactory to Mr. Plowden.

**Mr. D. Moorhouse** (Roodepoort): We at Roodepoort are familiar with the concept of ripple injection. We also have a network automation system which works on a bit-transmission principle. In short, we accept the fundamental concepts of Decobit. With the relatively large number of on/off commands as facilitated by Standard decabit equipment, I feel that it is imperative that Engineers consider automation of networks in order to apply the equipment to its full extent. If decabit were to be applied to network automation, the fact that decobit is dependent on network supplies, become a distinct disadvantage, in some instances.

**Mr. E.E. De Villiers** (Rustenburg): First of all I wish to thank Mr. Baumann for his excellent paper. I have for many years been very interested in load shedding, ripple control, at other municipalities I've been at.

Unfortunately, over the past few years in Rustenburg we have now discovered that our daily load curve is such we can't apply load shedding without getting into trouble with our consumers, and it won't be economical either. But I am very interested in this minibit system that Mr. Baumann described, particularly for taking over various signals for indication, warnings and whatever have you. I wonder if he could give us a brief list of typical applications, where he reckons the minibit system would be an economic advantage, and would also, I would say, be cheaper than die decabit. Of course people who have the pairs in system, have the advantage that they can make use of the available channels for that type of job.

In connection with the indication of the maximum or minimum number of receiving points that can be made available on the minibit system, I would like to know, what would be the comparative figure to make it economical?

Then I would also like to know, how many on/off channels would normally be provided on a typical minibit system for a municipal installation, that would perhaps tie up with my first question.

Then perhaps for the people who have decabit systems at the moment. It might be interesting to have an indication of the cost of the transmission and receiving equipment in relation to the number of channels on this new electronic system. Because they may decide to have 20, 100 or a 1000 as Mr. Baumann described, but we'd like to have an indication of how the cost rises if it does.

**Mr. E. Baumann:** Mr. De Villiers, your first question was - an indication of what would be done with minibit? I think one of the applications I have already mentioned, that is the Parguide, and actually this was one of the main, the Parguide system was one of the main reasons why we have been thinking about a new electronic transmission system on a very low level with relatively cheap transmitters, but with more expensive receiving relays. But we think that there are other applications which might be, the minibit, might be a good solution. Particularly in connection with retrobot. For instance the operation of circuit breakers through an A.F. signal in connection with retrobot to get the confirmation back, if only that should be done in a network it wouldn't pay to go for a decobit system, but instead the minibit system could be applied for the operation of circuit breakers for instance, where there are no supervisory channels or there is no supervisory equipment available.

With regard to the number of channels, it doesn't matter actually how many channels you choose, as I said, and I'm talking now about decabit and minibit, because these two systems are basically, in the basic design, as far as coding is concerned, the number of channels - they are identical.

It is not cheaper to have less channels and it's not more expensive to have more channels, the only difference to receive more than 100 channels is that you then need a receiving relay which is fitted to the reception, fitted with the equipment to receive combination commands.

I did not point out that in my lecture for shortage of time, the decabit receiver and so it is the minibit receiver too, consists of a housing, a basic unit as we call it, that contains the filters and all the timing and all that sort of thing, and the additional channel units as we call them which can be plugged in. A normal relay then has a basic unit plus one or two plugged-in channel units which can just be plugged in, you can use it with one or with two.

The difference between a normal receiving relay and the combination control receiving relay is that it always needs two channel units for the reception of one combination command. The decabit receiver relays are somewhat more expensive perhaps about 20% more expensive for the reception of combination commands. But on the transmitter side there's no difference. The transmitter is basically capable of sending normal channels as well as combination channels. (Permission was now granted by the President for the demonstration of equipment to take place.)

**Mr. E. Baumann:** We have a retrobot equipment here, you see the transmitter here as I pointed it out earlier. This is a proto-type transmitter made in the laboratory, it's not off the production line yet. This retrobot transmitter is connected to the power plug here, and there are 3 switches, when I change one of the switches the retrobot transmitter will send a signal and this signal then goes into the power point, here, through the installation of the town hall, goes to the next low-voltage transformer, through the low-voltage transformer onto the 6.6 cable, travels over the 6.6 cable to the substation, 33 to 6.6, passes the current transformer of the 10 mV, transformer and is appearing also on the secondary circuits of that current transformer, and there we have this one (1) VA additional burden, and the receiver is connected across this one burden.

The receiver will get that signal from here, and then it will transmit the signal onto the Roodepoort ripple control installation. This ripple control installation will start up when the signal is received and will cut-off the light here, the signal then comes back the same way and operates the receiving relay at the back box, here, and switches off the light.

This transmission takes a little time, it takes about 8 seconds for the retrobot transmission to go through, then the converter will start-up, take 10 seconds to come to rest, then the start signal from the receiver will be received, that takes another 5 seconds, and the operation of the first channel here is the signal, the operation of the first channel takes about 10 more seconds.

**Mr. A.F.W.H. Eggers** (G.P.O.): Mr. President, I don't want to comment on the paper itself, but I think it may be appropriate to refer to the P.O. Act in this respect, for general information. "Section 78(1) of the P.O. Act states that the Post Master General shall have the exclusive privilege, of constructing and maintaining telegraph lines, and of transmitting telegrams or other communications by telegraph within the Republic and territorial waters" "Telegraph," in a definition means, any system or means of conveying signals, sounds or communications by the agency of electricity, magnetism or electro-magnetism.

Now, the use of ripple control systems by local authorities was, as far as I am aware, agreed to by the Post Master General, I do not know how long ago, for the purpose of controlling the distribution systems by local authorities.

The system described here this morning appear to be capable of being used for other and more sophisticated purposes, which could be considered to fall within the definition of a telegraph.

It is suggested that an application should be made to the Post Master General for a licence to employ such systems, indicating the purpose of application for which they are to be used.

**Mr. E. Baumann:** I think many supply authorities, they use supervisory controls, they have their own pilot wires, they are sending telegrams forward and backwards, is there a licence for that?, what is

the difference between your own pilots and your network? I can't see much difference between the two, both being to you,?

**Mr. A.F.W.H. Eggers (G.P.O.)** Mr. President, I'm not in a position to argue the case, I don't think this is the point. It's merely a matter of regularising the situation. It is quite true - pilot wires are used; it is quite news that carrier systems over power routes are being used in the country, but there is, shall we say, an understanding, this is known, and it is an agreement which exists between the Post Master General and the organisation which uses such systems.

**President:** Well, it seems that whoever wants to adopt this system first will have to put in an application for a licence and see what happens.

**Mr. E.C. Lynch (Salisbury):** This legal problem is one I've struck myself because I quite recently had a new Act in Salisbury, covering this very point in Rhodesia, and unfortunately it slipped through without change before I noticed it; I was too late to object. But really the problem is that we're using legislation which was designed in the last century when none of this equipment was thought of.

Now, the Railways has been sensible enough to get exemption, and I think its quite time that the Electricity Supply Authorities were also exempted from that legal requirement which has been set, it is quite outdated and that was admitted when I raised the point with the Government, as I said, I was too late for a formal objection, but they did admit that it was ancient legislation, and they hoped that I would be in time when it is next revised. So we just mustn't try to work to such outdated legislation and preserve it on the books and try to get exemption for every little change at the Post Master's whim and fancy.

The real answer is the one the Railways have got, the Railways were there before the Post and Telegraph people, and they took good care to see they were excluded.

**Mr. President,** I suppose I should really be here asking questions not answering them, but if Mr. Baumann will please excuse me, I did want to ask one question. I was very fascinated by that description of the parking system, and in the paper the reference is always to parking houses, I therefore conclude that this only covers the parking garages where there would be hundreds of cars parked in a small area under supervision and making payment for admission, or public car parks, parking areas, which again are under supervision, you know the cars going in and you know how many vacant spaces you have in the particular parking area, and so can provide that information to the computer and say, - we've got 100 vacant bays here, a hundred or so in another parking garage. How, or is it possible to deal with the 'on-street' parking in, with an installation of this type, because in most places a large proportion of the parking available to the motorist is bays with parking meters in the streets. I can't see quite how that section was covered.

**Mr. E. Baumann (Zellweger):** Of course, to work this system it is necessary to know whether parking is available or not, and it is certainly restricted to the areas where there is equipment detecting the cars coming in and the cars going out. It is in fact, restricted to parking houses and large parking areas where the inlets and outlets can be supervised. It is not applicable to individual parking possibilities which might be on the side of the road for instance. But in Aachen, as far as I know, where such a system is in operation, they have freed the city, there are no longer such parking possibilities available. They did away with all this individual parking but they have a number of big parking houses and parking areas, and these are supervised.

**Mr. G.C. Theron (Vanderbijlpark):** Mr. President, I'll be very brief. One point I would like to mention here, that is - that I believe that the printing and translation of this paper was the work of Mr. Baumann and his organisation, I think I want to thank him - the standard of printing and translation is very high indeed. One other point regarding this question of the problem of the Post Office Act, Mr. President, this may involve a lot of us and instead of all of us writing in letters and asking requests I would like to suggest to the Executive that they follow it up for us, and I think the best thing will probably be to change the Post Office's Act and bring it up to date.

**Mr. C.L. Cosser (Bulawayo):** I'd like to ask Mr. Baumann whether any thought has been given to using this Retrotab system to remote reading of house-service meters. I'm particularly interested and I've been trying to find somebody to supply us with such a system over the last few years, and it would appear that this could be adopted to it, particularly where several meters are placed in one cubicle and a single transmitter could be used, it may have some economical aspect there.

Looking at the transmitter we have here it seems rather bulky, I presume when production occurs they will be making them smaller, cubicles which could fit into the metering cubicles that are used in streets, the type that we use outside our properties. Thank you.

**Mr. E. Baumann:** The question of meter reading is in the air, or it has been for a long time, several attempts have been made to solve this problem. We also conducted a survey about the possibility of remote meter reading, but, we got to the conclusion that it is not an economical proposition, yet. Whether it will ever become an economical proposition, I'm not too sure, because as I think Mr. Plowden pointed out yesterday, that Johannesburg is reading the meters only every three months, and on the Continent there are quite a number of authorities, in fact the one where I live too, they read the meters only once a year. They said that the cost of meter reading is about two Swiss francs, that's roughly exactly half a Rand. Now if we capitalize that we would be able to invest about ten times this, that's about R5, in equipment, and this is not possible yet. This figure is much too low. Also they say that they have to go around once a year to see the consumer whether everything is still all right, that the meter is not being tampered with, is not being interfered with. They also maintain that they like to have a man go around once a year just to keep a minimum of contact between the authority or the representative of the authority with the client. So that these are two aspects which I think we just cannot completely forget about. In these circumstances as I said, the amount to invest is rather very small. It might be possible in future to do that cheaply, but this point I think is quite some 10 or 15 or even 20 years away, and it will then be an economical proposition when every household meter is an electronic meter, without any mechanical devices through the electronic, then of course it is cheap to transmit the information into the coded signal, we do not have to have a second sophisticated register doing that, a second one to the one you have today. Then of course everything becomes easier and cheaper.

Now with retrotab as it is today, we can certainly make meter reading, but as I said the costs are quite out of scope, when it is based on the facts I was just pointing out. But in special circumstances where more money can be invested, then retrotab might already today be a proposition. I've been talking about R5 before, but with retrotab the figure to be invested is a factor hundred higher today. I think that might answer Mr. Cosser's question. In special circumstances and particularly when they are more than one meter at the same point, if you have ten meters at the same point then of course per meter reading the investment is ten times lower, practically, because one of the same transmitter then is capable of transmitting the information of many meters.

**President:** Thank you Mr. Baumann, I think you will have to come back in twenty years time and let us know how you're getting on with it. Gentlemen, I think we'll have to conclude discussion now on Mr. Baumann's paper. To wind-up on this paper I'd like to thank Mr. Baumann and the Zellweger Co. and also Mr. G. Gerber for the assistance he gave me in arranging the paper. I'm sure that the discussions that has taken place on this has indicated the great interest there is in it, and I'm sure we'll all appreciate the opportunity that you've given us of having a peep into the future. Thank you very much indeed.

**President:** Now we come to the Committee Reports, gentlemen. The first two I have here have been submitted by Mr. Plowden. One is the report on the Technical Training of Staff.

## REPORT ON THE TECHNICAL TRAINING OF STAFF

The Sub-Committee investigating the technical training of staff comprises Messrs. R.W. Barton, P.J. Botes, S.C. Dreyer, D.H. Fraser, K.G. Robson and D.C. Plowden (Convener).

At the request of the United Municipal Executive, the Institute of Town Clerks prepared a memorandum on, and established a sub-committee to investigate, the training and retention of local government staff. A copy of this memorandum, which was supported in full by the four Provincial Municipal Associations and accepted in principle by the United Municipal Executive, follows this report.

The AMEU was invited by the Institute of Town Clerks to appoint two representatives and an alternate to serve on its sub-committee and Messrs. Botes and Plowden with Mr. Barton as alternate were nominated.

The difficulties confronting the AMEU in its endeavours to establish basic training centres for apprentices have been fully ventilated in previous reports and the Technical Training Sub-Committee has reached the conclusion that the AMEU has gone as

## VERSLAG OOR DIE TEGNIESE OPLEIDING VAN PERSONEEL

Die Onderkomitee wat die tegniese opleiding van personeel ondersoek; bestaan uit mnr. R.W. Barton, P.J. Botes, H.C. Dreyer, D.H. Fraser, K.G. Robson en D.C. Plowden (saamreger).

Op die versoek van die Verenigde Munisipale Dagbestuur, het die Instituut van Stadsklerke 'n memorandum opgestel om die behoud van plaaslike bestuurspersoneel en 'n onderkomitee om dit te ondersoek. 'n Afakrif van die memorandum, wat ten volle ondersteun is deur die vier Provinsiale Munisipale Verenigings en in beginsel aanvaar is deur die Verenigde Munisipale Dagbestuur, volg op hierdie verslag.

Die VMEIO is deur die Instituut van Stadsklerke gevra om twee verteenwoordigers en 'n plaassvanger aan te stel om die komitee te dien en mnr. Botes en Plowden met mnr. Barton as plaassvanger is benoem.

Die moeilikhede waarmee die VMEIO te doen kry in sy pogings om basiese opleidingsenters vir vakleerlinge daar te stel is ten volle gelug in vorige verslae en die Tegniese Opleidings-onderrigkomitee het tot die

far as it can on its own. It therefore reported on this basis to the Executive Council at its meeting on the 16 November 1973 and a recommendation that the AMEU should give its full support to the Institute of Town Clerks was adopted. It will be noted that the memorandum referred to above gives prominence to the need for establishing apprentice basic training centres.

The first meeting of the sub-committee of the Institute of Town Clerks was held on the 6 December 1973 and was attended by both of the AMEU's representatives. This meeting was devoted primarily to examining the sub-committee's terms of reference, but discussion also took place on the training and utilization of Non-White personnel.

**D.C. Plowden**  
Convener - Technical Training Sub-Committee.



MR. D.C. PLOWDEN  
General Manager Electricity Department Johannesburg.

## INSTITUTE OF TOWN CLERKS OF SOUTHERN AFRICA

### TRAINING AND RETENTION OF LOCAL GOVERNMENT STAFF

1. This memorandum is in reply to a request by the United Municipal Executive of South Africa for a report on the best method of training employees for, and retaining them in local government service.

2. It is stressed at the outset that no matter how advanced training for local government service in South Africa may become, training on its own will not secure good staff for the South African local authorities. It must be remembered that the professions and trades necessary for local government service are professions and trades which are also needed in private enterprise and by authorities other than local authorities. The local authorities must, therefore, be able to compete the local authority must offer comparable pay rates and other conditions of service. Unless the local authorities are able to do this, staff training schemes will be of little help in the recruitment and retention of staff. Indeed, it has been said that the more the employer trains the more he must be prepared to pay to keep his well-trained staff. The truth of this statement is illustrated by the experience of a local authority which directly and indirectly spends much time and money on staff training. Reference is made here to the City Council of Johannesburg, although the same will probably apply to other cities. Johannesburg awards university bursaries; it has subsidized education schemes for all officials; it undertakes in-service training; it provides management training on a continuous basis for all its departments through a special Division of its Staff Board; it has an apprentice training scheme providing basic training for all newly engaged apprentices; it has first class training facilities for bus drivers, traffic inspectors, firemen and ambulance drivers.

3. Despite these considerable efforts in the field of staff training, the City Council of Johannesburg has experienced great difficulty in attracting and keeping good staff. This happens because the City Council has to compete for staff with other undertakings in a city where competition for staff is of the keenest. For instance, it is generally admitted that the City Council's training of apprentices is of the best in the city. The result is that the City Council's trained apprentices are snatched up by outside undertakings the moment their apprenticeship has been completed. As a result of the good training and experience which the official gains in Johannesburg, the City Council is also faced with strong competition for other local authorities. For instance, the Johannesburg-trained traffic inspector

gevolgtrekking gekom dat die VME0 so ver gekom het as wat dit op sy eie kan gaan. Dit het gevolglik in diervoe verslag gedoen aan die Uitvoerende Raad op sy vergadering van 16 November 1973 en 'n aanbeveling dat die VME0 sy volle steun aan die Instituut van Stads-klerke behoort te gee, is aangeneem. Daar sal geleid word dat die hierbo aangehaalde memorandum voorrang verleen aan die behoefte om basiese vakleerlingopleidingsentra op te rig.

Die eerste vergadering van die onderkomitee van die Instituut van Stads-klerke is op 6 Desember 1973 gehou en bygewoon deur albei die VME0 se verteenwoordigers. Hierdie vergadering was hoofsaaklik gewy aan die ondersoek na die onderkomitee se opdrag, maar bespreking oor die opleiding en benutting van nie-blanke personeel het ook plaasgevind.

**D.C. Plowden**  
Sameroeper - Tegnieese Opleidings-nderkomitee.

## INSTITUUT VAN STADSKLERKE VAN SUIDELIKE AFRIKA

### DIE OPLEIDING EN BEHOU VAN PERSONEEL VAN PLAASLIKE OWERHEDE

1. Hierdie memorandum is opgestel na aanleiding van die Verenigde Munisipale Bestuur van Suid-Afrika se versoek om 'n verslag oor die beste metodes om personeel vir plaaslike owerhede op te lei en hulle in die diens te behou.

2. Daar word uit die staanspoor beklemtoon dat, al sou die opleiding vir werk in diens van plaaslike owerhede in Suid-Afrika nog so gevorderd wees, opleiding op sigself nie genoeg is om personeel van 'n goeie gehalte vir Suid-Afrikaanse plaaslike owerhede te verseker nie. Dit moet in gedagte gehou word dat die beroeps- en ambagsluit wat plaaslike owerhede nodig het, ook nodig is vir private ondernemings en ander owerhede as plaaslike owerhede. Die plaaslike owerheid moet dus kan meeding vir sover dit die dienste van geskoolde en selfs ongeskoolde personeel betref en om dit te kan doen moet hy vergelykbare salarisse en lone en diensvoorwaardes aanbied. Tensy plaaslike owerhede dit kan doen, sal personeelopleidingskemas van weinig waarde wees in verband met die werwing en behou van personeel. Daar is trouens al beweer dat hoe meer opleiding die werkgewer verskaf, hoe meer hy bereid moet wees om te betaal ten einde sy deeglike opleide personeel te behou. Die waarheid van hierdie bewering blyk uit die ondervinding van 'n plaaslike owerheid wat regstreeks en onregstreeks heelwat tyd en geld aan personeelopleiding bestee. Daar word hier verwys na die Stadsraad van Johannesburg maar dieselfde geld waarskynlik ook vir ander stede. Johannesburg ken universiteitsbeurse toe; daar is 'n gesubsidieerde onderwyskema vir alle beamptes; daar is ook 'n indiensopleidingskema en bestuursopleiding op 'n deurlopende grondslag vir sy afdelings deur bemiddeling van 'n spesiale tak van die personeelraad; daar is 'n vakleerlingopleidingskema vir die basiese opleiding van alle nuwe vakleerlinge; daar is puik opleidingsgeriewe vir busbestuurders, verkeersbeamptes; brandwermerne en ambulansbestuurders.

3. Ten spyte van dié daadwerklike pogings wat die Stadsraad van Johannesburg op die gebied van personeelopleiding aanwend, vind hy dit baie moeilik om bewake werknemers te werf en te behou. Dit gebeur omdat die Stadsraad met ander ondernemings moet meeding na personeel, in 'n stad waar mededinging na personeel verklik straf is. Dit word byvoorbeeld algemeen erken dat die Stadsraad van die beste opleiding in die stad aan vakleerlinge bied. Sodra die Stadsraad se vakleerlinge dus hulle vakleerlingskap deursoort het word hulle deur buite-organisasies afgekolkei. Vanweë die grondige opleiding

easily finds promotion in the service of a smaller local authority. At a time when Johannesburg may not have a vacancy in the senior ranks of its Traffic Department, the Johannesburg traffic inspector will easily find a senior post elsewhere. The same applies to other City departments. In such a case the person concerned is at least not lost by local government service, although it does appear unfair that one local authority should bear the burden of training while others reap a large part of the benefit.

4. In many categories local government needs a more highly qualified employee than private enterprise does. For instance, the local government official must have a high standard of bilingualism. The doctor in local government service must have a Diploma in Public Health to aspire to senior ranks, while his colleague outside without this diploma is likely to earn far more than he does. To be of real use in local government service the lawyer must be experienced in dealing with complex legal issues and should have advanced knowledge of Administrative Law which is to-day the most difficult and controversial part of law. Other professions, like engineers and accountants, also find that local government service requires more of them than they normally have to know in private practice. Artisans find that in local government service they often have to work during unusual hours. The local authority cannot eliminate shift work which has become so very unpopular with White persons in South Africa.

5. There was a time when local government service, although it might have paid less, attracted professional people and artisans because it offered job security and certain benefits like pensions and medical schemes. To-day the good man does not have to be in local government or in the public service to obtain these benefits. Indeed, the local authorities to-day lag behind not only in pay but also in other conditions of service.

6. There is no doubt whatsoever that salary control by external authorities over top staff salaries in local government has done tremendous damage to the image of the local authority as an employer and to local government service as a career. The Institute of Town Clerks is not saying this simply because town clerks resent such control in respect of their salaries. It has become the considered opinion of many persons who are fully aware of the reactions of career-seekers, that this control is inhibiting recruitment and retention of the very people needed in local government service — namely people who are prepared to take their work seriously and make a career of meeting the great challenge of rapid urbanization in South Africa. It is noteworthy that in the very department of local government where the salary control has prevailed longest, namely the health department, the staff position is at its worst. The effect of the salary control is simple and direct. The young man who may want to make a career of local government service is immediately put off when he realizes that regardless of his efforts and his merit, his own employer will not be able to pay him the salary which he should earn. His salary will be depressed. When he looks at the salary of his head of department or at the salary of the town clerk, he finds it no great goal to aspire to. It is no use answering him by saying he must not be materialistic, because he thinks in materialistic terms.

7. Local government's main concern is the rendering of immediate and essential public service. That is why the Industrial Conciliation Act places every employee in local government service in the category where striking is unlawful and arbitration is compulsory. Before the Industrial Tribunal Senior Counsel recently made this statement of the law: "Once a statutory authority such as a local authority has been given or has undertaken, an essential public service, it must render that service and must render it regardless of the cost." These are hard words, but they are absolutely correct. The local authority has the absolute responsibility. The public sees it this way. The Courts may see it this way. The local authority must, therefore, also have the right to pay adequately to recruit and retain the competent staff it needs to carry out its duties to the public.

8. While it is true that the local authority must be able to compete freely for staff, this is far from the whole answer to the problem. The Institute of Town Clerks certainly cannot advocate that local authorities follow a policy of simple determination to outbid all other employers on the ground that local government renders round the clock essential public service.

9. Just as the hard fact of competition for staff in a competitive economy must be faced, so must another hard fact be faced. Namely that in most categories of employment (professional, skilled and semi-skilled) there are just not enough qualified people in South Africa to do the jobs that have to be done. Unless this problem can be faced and resolved the local authorities will soon be left with no option but to follow the kind of policy rejected in paragraph 8 above, a policy which would lead to economic chaos in this country.

wat die beampte in Johannesburg ontvang en die waardevolle onder-vinding wat by opdoen, sterk mededinging van ander plaaslike owerhede. Die verkeersbeampte wat in Johannesburg opgelei is, word byvoorbeeld maklik bevorder in die diens van 'n kleiner plaaslike owerheid. As Johannesburg nie 'n vakante betrekking vir 'n senior beampte in sy Verkeersafdeling het nie, kan die Johannesburgse verkeersbeampte maklik elders 'n senior betrekking kry. Dieselfde geld vir die ander afdelings van die Stadsraad. In so 'n geval is die betrokke persoon gelukkig nie vir plaaslike-owerheidsdiens verlore nie alhoewel dit betwist onbillik lyk dat een plaaslike owerheid met die opleiding betas is, terwyl andere flink die vrugte daarvan pluk.

4. Plaaslike owerhede so beamptes in tallige kategoriese moet hoër opgelei wees as die van private ondernemings. Die plaaslike-owerheids-beampte moet byvoorbeeld aan 'n hoër tweetaligheidspas volendo. Die geneesheer in plaaslikebestuursdiens moet oor 'n diploma in volka-geneeskunde beskik as hy vir 'n senior betrekking in aanmerking wil kom terwyl sy kollega buite die diens sonder hierdie diploma waar-skyflik heelwat meer as hy verdien. Om werklik van nut te wees in die plaaslike-owerheidsdiens moet die regsgeleerde onderdinding hê van ingewikkelde regskwessies en goed op die hoogte wees van die Administrasie — vandag die moeilikste en mees omstrede deel van die reg.

Ook die bekleër van ander professionele betrekkinge soos ingenieurs en rekenmeesters vind dat hulle in die plaaslike-owerheidsdiens gewoonlik meer kennis moet hê as wat in 'n private praktyk nodig sal wees. Vakmanne in die plaaslike-owerheidsdiens vind dat hulle dik-wels buite gewone werke moet werk. Die plaaslike owerheid kan nie skofwerk, wat so ongewild is onder Blankes in Suid-Afrika, uitskakel nie.

5. Daar was 'n tyd toe plaaslike owerhede, alhoewel hulle miskien minder betaal het, beroeps- en ambagslyk aangelok het omdat die owerhede betrekkingveiligheid en sekere voordele soos pensioen- en mediese skemas gebied het. Vandag hoef die bekwaam man nie vir 'n plaaslike owerheid in die Staatsdiens te werk om bierdie voordele te geniet nie. Trouens, plaaslike owerhede het vandag 'n agterstand wat betref besoldiging en ander diensvoorwaardes.

6. Daar bestaan geen twyfel hoegenaamd nie dat salarisbeheer wat buite owerhede toefoen, die beziel en die passie om hoër te wêr-gewer en die plaaslike-owerheidsdiens 'n hoopbaar-geweldig geskaad het. Die Instituut van Stadslerke sê dit nie bloot omdat stadslerke gezelg is oor sodanige beheer ten opsigte van hulle salaris nie. Dit is die oorwoë mening van talloze mense wat goed bekend is met die reaksie van diegene wat op soek is na 'n loopbaan dat hierdie beheer 'n stremende uitwerking het op die werwing en behou van juis die mense wat in die plaaslike-owerheidsdiens nodig is — mense wat bereid is om hulle werk met erns te bejeen en dit as hulle loopbaan beskou om die groot uitdaging wat die snelle verstedelings-proses in Suid-Afrika bied, aan te durf. Dit is opmerklik dat die personeelstoestand in die Gesondheidsafdeling, wat juis die plaaslike-owerheidsafdeling is waar salarisbeheer reeds die langste in swang is, baie owerhede toefoen, die beziel en die passie om hoër te wêr-gewer. Die jongman wat die plaaslike-owerheidsdiens 'n loopbaan wil maak word onmiddellik afgelik as hy agterkom dat, sy eie pogings en verdienstelikhed ten spyt, sy werkgever hom nie die salaris sal kan betaal wat hy behoort te verdien nie. Sy salaris word laag gehou omdat die salaris van sy hoof laag gehou word. As hy kyk na die salaris van sy Afdelingshoof of die van die Stadslerk, is dit vir hom nie juis 'n aantreklike doel om na te streef nie. Dit help nie om te sê dat hy nie materialisties moet wees nie want sy denke is met mate-riële faktore gemoed.

7. Plaaslike owerhede is hoofsaaklik gemoed met die lewering van dringende en noodsaaklike openbare dienste. Dit is waarom elke werknemer in die plaaslike-owerheidsdiens kragtens die Wet op Nywerheidsveroeniging in die kategorie val waarin stakings onwettig en arbitrasie verpligtend is. 'n Senior advokaat het onlangs voor die nywerheidshof die volgende verklaring in verband met dié wet gemaak:

"Once a statutory authority such as a local authority has been given, or has undertaken, an essential public service it must render that service and must render it regardless of the cost."

Dit is harde woorde dit, maar hulle is absoluut juis. Die plaaslike owerheid het die absolute verantwoordelikhed. Dit is hoe die publiek dit beskou. Die plaaslike owerheid moet dus ook die reg hê om toe-reikende salaris en lone te betaal sodat hy die bekwaame personeel wat hy nodig het om sy verpligtinge teenoor die publiek na te kom, kan werf en behou.

8. Dit is wel waar dat die plaaslike owerheid vrylik na personeel moet kan meeding maar dit is nog geensins 'n afdoende oplossing van die probleem nie. Die Instituut van Stadslerke kan dit sekerlik nie bepleit dat dit plaaslike owerhede se beleid moet wees om eenvoudig alle ander werkgevers summier te oorbie op grond daarvan dat plas-lijke owerhede bedags en snags noodsaaklike openbare diens te lewer nie.

9. Ons moet nie slegs die nugtere feit dat daar mededinging na personeel in 'n konkurrerende ekonomie is onder die oog sien nie, maar ook die nugtere feit dat daar in die meeste werkkategorieë (professio-neel, geskoolde en halfgeskoolde) net eenvoudig nie genoeg gekwalifiseerde in Suid-Afrika is om die werk te verrig wat ver-rig moet word nie. Tensy hierdie probleem aangepak en opgelos kan word, sal daar vir plaaslike owerhede binnekom net een weg op wees, naamlik om die beleid te volg wat in paragraaf 8 hierbo verwerp word, 'n beleid wat tot ekonomiese chaos in hierdie land sal lei.

10. The problem just mentioned must not only be faced, but it must be seen as basic to the whole situation which has developed. It is the basis of the vicious circle of jobs chasing people with the local authority ending up with neither the quality nor the number of staff needed by it.

11. Immigration does not solve this basic problem. It may solve it for a time on an ad hoc basis for an individual employer. On the whole it may even accentuate the problem – particularly for the local authorities which may, as a result of immigration, have to extend their essential services more rapidly than would be necessary with just the normal population growth.

12. As far as local government is concerned, a major aspect of the problem is the question of employing people other than Whites in professional, skilled and semi-skilled jobs and getting Non-Whites trained for such work.

13. Before the same sitting of the Industrial Tribunal where the Senior Advocate stated the law as quoted above, a representative of commerce gave evidence. He stated that the only way to get and keep staff was to pay. An assessor then asked him what the race of the staff was that he employed in his own undertaking. He answered that he employed Indians.

14. There is a fact which, deplorable as it may be, must yet be faced as a fact. It is one that is get anywhere near a solution of the basic problem. This fact is that due to the optimum educational and employment opportunities for Whites in our country, the White man is no longer interested in a very large number of the skilled and semi-skilled jobs that must be done by local government. The job of motor mechanic is one of these; yet the large local authorities must have motor mechanics, specially where they run public transport. Already they farm out the long and large jobs to firms which are also short of mechanics; but certain work they must do themselves to keep their essential vehicles moving. All shift work has become unpopular with the White man; but it is the local authority which must have shift work to keep its services going.

15. It is obviously not going to help the local authorities to offer optimum training facilities to White persons for work which they do not like and which they will either not accept or else leave as soon as the opportunity arises. Even high pay rates and optimum conditions of service do not make a man an efficient operative in a job he does not like.

16. There can be no doubt that local government service is popular with the Non-White races. To them the relative job security means what it used to mean to the White man.

17. It appears however, that it is precisely the local authority – precisely the employer with the large number of jobs unpopular with Whites – which is not making much progress in the appointment of Non-Whites in skilled and semi-skilled work. **Even where Non-Whites are to be employed to serve Non-Whites or to work in areas occupied by Non-Whites, there are tremendous obstacles.** Take the example of electrical wiremen. The trade union concerned has in the Transvaal adopted the standpoint that its White members will not train Non-White apprentices. They want Coloured electricians to train Coloured apprentices for this trade and to do so in areas occupied by Coloureds. To obtain the services of the Coloured electricians is virtually impossible. In addition the work in the Coloured areas only is inadequate to train the Coloured apprentice properly.

18. Mainly because of the attitude of the trade unions, which in turn influences the attitude of the Department of Labour, it is still not possible in practice to train Non-Whites everywhere in the country for skilled work for Non-Whites. It will be unrealistic for the local authorities to think that this problem will be overcome within the framework of the apprenticeship system. It is, however, not an unrealistic request on the part of local government that it should be authorized –

(i) to train Non-Whites for exclusive employment by local authorities in any trade or occupation for work in Non-White areas only;

(ii) to train such Non-Whites under qualified instructors, but without apprenticeship, on the lines of the provisions of the Bantu Building Workers Act.

19. Once this authorization has been obtained on a clear and permanent basis, local government should proceed with the establishment of further training facilities for Non-Whites of all races to produce skilled Non-Whites to serve in Non-White areas.

20. Another field in which local government should be able to obtain a clear and permanent authorization to train and use Non-Whites is in the field of semi-skilled work such as driving of all kinds of motor vehicles.

21. Authorization on the lines of paragraphs 18 and 20 above will only ease the position for a number of local authorities. It will not solve the problem regarding artisan staff required for general use in local government service. The situation in this regard will only be improved as artisans become more freely available in the country. In this connection it is suggested that local authorities can make a contribution within the present frame-work by providing facilities for the basic training of apprentices at basic training centres established

10. Die probleem wat so pas genoem is moet nie slegs onder of gesien word nie maar dit moet gesien word as die grondslag van die hele toestand wat ontwikkel het. Dit is die oorsaak van die bese kringloop van te veel vakatures en te min werkers. Vir die plaaslike owerheid beteken dit dan nie net minder personeel as wat hy nodig het nie, maar ook personeel van 'n swakker gehalte.

11. Immigrasie bied geen oplossing vir hierdie grondliggende probleem nie. Dit kan wel 'n tydelike ad hoc-oplossing bied vir die individuele werkgewer. In sy geheel gesien, kan immigrasie die probleem slegs vererger, veral in die geval van plaaslike owerhede wat vanweë immigrasie hulle noodsaaklike dienste daal vinniger sal moet uitlei as wat nodig is om vir die gewone bevolkingsaanwinst voorsiening te maak.

12. 'n Belangrike aspek van die probleem, vir sover dit plaaslike owerhede betref, is die kwessie van die indiensneming van Nie-blankes vir professionele, geskoolde en halfgeskoolde werk en die opleiding van die Nie-blankes vir die betrokke werk.

13. Voor die sitting van die Nywerheidshof waarop die Senior Advokaat voormoede verskerping uitgespreek het, het 'n verteenwoordiger van die sakewêreld getuigenis afgelei. Hy het gesê dat personeel net behou kan word as hulle behoorlik besoldig word. 'n Assessor het hom toe gevra wat die ras van die personeel in sy onderneming is. Hy het geantwoord dat hulle indiens is. 14. Daar is 'n feit, hoe onsmaklik ook al, wat onder die oë gesien moet word as daar enigens vordering gemaak moet word met die oplossing van die grondliggende probleem. Die Blanke in ons land stel naamlik vanweë die optimum onderwys- en werkgeleentheid wat aan hulle beskikbaar is, nie meer belang in 'n baie groot getal betrektings vir geskoolde en halfgeskoolde wat plaaslike owerhede uiteraard vul nie. Die betrekking van motorkuigiunkundige is een daarvan, maar groot plaaslike owerhede moet motorkuigiunkundiges hê, veral as die betrokke owerhede 'n openbare vervoerdienste lewer. Hulle bestee alreeds tydrowende en groot take uit aan firmas wat ook 'n tekort aan werktuigiunkundiges het, maar hulle moet tog sekere soorte werk self verrig om hulle noodsaaklike voertuie op die pad te hou.

By Blanke is alle skofwerk ongewild, maar vir die plaaslike owerheid is skofwerk noodsaaklik om sy dienste aan die gang te hou.

15. Dit sal plaaslike owerhede klaarblyklik nie help om optimum opdragings-geriewe beskikbaar te stel sodat Blanke opelei kan word vir werk waarvan hulle nie hou nie en wat hulle of nie sal aanvaar nie of, sodra die geleentheid hom voordoan, sal verlaat. Sels hoë besoldigingskale en optimum diensoverwaardes maak nie van 'n man 'n doeltreffende werker in 'n werk waarvan hy nie hou nie.

16. 'n Plaaslike-owerheidsdiens is ongetyfeld gewild onder die Nie-blankes. Vir hulle beteken die betreklike betrekkingveiligheid net soveel as wat dit vroer vir die Blanke beteken het.

17. Dit blyk egter dat dit juis die plaaslike owerheid – juis die werkgewer met die grootste getal betrektings wat ongewild is onder Blanke – is wat nie veel vordering maak met die aanstelling van Nie-blankes in geskoolde en halfgeskoolde betrekkinge nie. Sels waar om te werk in gebiede waarin Nie-blankes woon, is daar ontsaglike struikelblokke. Die elektrotegniese draadwerkers is 'n voorbeeld hiervan. Die betrokke vakbond het in Transvaal die standpunt ingeneem dat sy Blanke-lede nie die Nie-blanke-vakleerlinge sal oplei nie. Hulle wil hê dat Kleurlingelektroisians Kleurlingvakleerlinge vir hierdie ambag oplei en dat die opleiding byvoorbeeld aangebied moet word in gebiede waarin Kleurling woon. Dit is bykans onmoontlik om die dienste van Kleurlingelektroisians te bekom. Hierbenewens is daar in die Kleurlinggebiede te min werk om die Kleurlingvakleerling behoorlik op te lei.

18. Dit is hoofsaaklik vanweë die houding van die vakbonde, wat op hulle beurt die houding van die Departement van Arbeid beïnvloed, is in die praktyk nog nie moontlik om Nie-blankes te lei nie. Dit sal onrealisties wees as plaaslike owerhede dink dat hierdie probleem binne die raamwerk van die vakleerlingskapstelsel oorkom kan word.

Dit is egter nie 'n onrealistiese versoek van plaaslike owerhede nie dat daar magtiging verleen moet word –

(i) om Nie-blankes, wat uitdruklik deur plaaslike owerhede in diens geneem sal word, op te lei in enige ambag of beroep wat werk slags in Nie-blanke-gebiede betref;

(ii) om sodanige Nie-blankes, sonder dat hulle 'n vakleerlingskap hoef te deurloop, deur gekwalifiseerde instruuteurs op te lei ooreenstemmend wetsbepalings soos vervat in die Wet op Bantoe-ouwerkers.

19. Sodra hierdie magtiging op 'n duidelike en blywende grondslag verleen is, moet plaaslike owerhede voortgaan met die danstelling van meer opleidingsgeriewe vir Nie-blankes van alle rasse sodat geskoolde Nie-blankes opelei kan word om in Nie-blankes-gebiede te kan werk.

20. Plaaslike owerhede behoort ook op die terrein van halfgeskoolde werk, soos byvoorbeeld die bestuur van alle soorte motorkuigiunkundige, 'n duidelike en blywende magtiging te verkry om Nie-blankes op te lei en te gebruik.

21. Magtiging ooreenkomstig paragrawe 18 en 20 hierbo sal die toestand net in die geval van sekere plaaslike owerhede verbeter. Dit is nie 'n oplossing vir die probleem betreffende ambagspersoneel wat vir algemene werk by plaaslike owerhede nodig is nie. Die toestand in hierdie verband sal slegs verbeter as daar meer ambagsmense hier te lande beskikbaar is. In hierdie verband word daar voorgestel dat plaaslike owerhede binne die huidige raamwerk 'n bydrae maak deur

and paid for by local authorities on a joint and regional basis. It has been conclusively shown that where apprentices first go through a basic training course, the number of failures in the trade tests are far less than where apprentices are simply assigned to journeymen for training from their first day.

22. Reference has been made to opening of the skilled and semi-skilled field for Non-Whites where external barriers (including trade union attitudes) at present preclude this. It is suggested that there are also internal and self-imposed barriers in local government. The staff position will be greatly improved for local government by the use of Non-Whites in semi-skilled capacities where this can be done without the need of any special dispensation by the Department of Labour. Municipal Departments often tend to take an unduly cautious attitude in this regard that they cannot get the staff to do the work at the rate of pay offered.

22. When it comes to professional staff, like engineers and doctors, it does help to award study bursaries on the condition that the bursar serve the authority concerned for a period equivalent to the course completed by the bursar.

24. Training does help to improve quality of staff – and improvement in quality is badly needed in local government service. It is suggested that local government should, on an organized basis, apart from training in the trades and for certain semi-skilled work such as driving, provide specialized training in the following fields:

- (a) (i) Local government administration and accounting, including practical knowledge of the laws applicable in local government;
- (ii) Management as related to local government, including the training of senior market staff;
- (b) Traffic control and traffic law enforcement;
- (c) Fire-fighting and fire prevention. Thought can be given to the training of army trainees in the Fire Brigades of more local authorities than is the case at present;
- (d) Selected aspects of abattoir administration;
- (e) Basic training for apprentices at regional basic training centres.

Each local authority should in addition make arrangements for the proper inservice training of new appointees.

25. A point which the Institute of Town Clerks would like to stress is that more competitive conditions of service broadening of the recruitment field by greater use of Non-White staff and improvement of quantity and quality by training facilities, must not be seen as factors which on their own would enable local government to find and retain good staff. Whether a service will be magnet drawing and keeping its staff will depend very much too on its internal organization and atmosphere and the proper instruction and treatment of its staff. Group discussions organized by the Institute of Town Clerks have drawn attention to a number of shortcomings in local government service. These cannot be dealt with comprehensively in this memorandum, but a few should be mentioned –

- (i) Insufficient opportunities offered for advancement.
- (ii) Lack of adequate in-service training facilities and proper staff selection.
- (iii) Insufficient recognition given for qualifications and experience in determining commencing salaries.
- (iv) Lack of encouragement offered to employees to improve their educational qualifications.
- (v) Maximum use is not always made of an employee's ability.
- (vi) Occasional failure to appoint the best available applicant to a vacancy. Infrequently as such cases may occur, they still do occur, and they do irreparable damage to the reputation of local government as an employer.
- (vii) Promotion is tied too much to seniority.
- (viii) Lack of delegation. There is a tendency in local government not to give responsibility and authority to the official, even where he is professionally qualified, to carry out the task in his sphere of duty.
- (ix) Professional people spend too much time doing non-professional work.

26. All the above shortcomings are very closely related to lack of systematic training in management for senior staff and practical application of the principles learned through such training.

27. It is felt that local government is not projecting its true and proper image to the young work seekers of to-day. While some of the most challenging problems of our time flow from urbanization and have to be faced by local government, local government service is seen by young people as a dull routine. This is so because local government is geriewe te voorsien vir die basiese opleiding van vakleerlinge by

basiese opleidingsentrums wat plaaslike owerhede op 'n gesamentlike en 'n streekgondalag kan oprig en finansier. Dit het duidelik geblyk dat, as vakleerlinge eers 'n basiese opleidingskursus deurloop, die druipeysfer in die ambagstoets baie laer is as wanneer vakleerlinge van hulle eerste dag af eenvoudig aan gekwalifiseerde ambagsmanne vir opleiding toegewys word.

22. Daar is reeds verwoys na die moontlikheid om betrekking vir geskoolde en halfgeskoolde Nie-blanke oop te stel op gebiede waar dit tans nog deur eksterne hindernisse (met inbegrip van die vakbonde) verbied word. Daar kan beweer word dat daar by plaaslike owerhede ook interne en selfgeploegde hindernisse is. Plaaslike owerhede se personeelprobleme kom grootliks verbeter word as Nie-blanke aangestel word in betrekking vir halfgekooldes in gevalle waar dit gedoen kan word sonder dat die Departement van Arbeid 'n spesiale vrystelling vereis. Munisipale afdelings is gewoonlik uiters oortuigend in hierdie verband en dan kila hulle teenoor hulle Rade dat hulle nie die personeel vir die werk kan kry teen die besoldiging wat aangebied word nie.

23. In die geval van beroepspersoneel soos ingenieurs en geneesheer is dit 'n goeie plan om studiebeurse toe te ken op voorwaarde dat die beurshouer, vir 'n tydperk wat gelyk staan aan die duur van die kursus, by die voetspoor van die betrekking in die owerheid in diens bly. 24. Opleiding help wel om die gehalte van die personeel te verbeter en dit is werklik nodig dat die gehalte van die personeel van plaaslike owerhede verbeter word. Daar word voorgestel dat plaaslike owerhede, op 'n georganiseerde grondslag en bo en behalwe die opleiding in die ambagte en vir sekere halfgekooldes werk soos dié van voertuigbestuurder, gespesialiseerde opleiding op die volgende terreine aanbied:

- (a) (i) Plaaslikebestuursadministrasie en rekenkundige, met inbegrip van praktiese kennis van die wette wat in plaaslike bestuur ter sake is;
- (ii) Bestuurswese, met betrekking tot plaaslike bestuur; insluitende opleiding van senior personeel vir munisipale markwese.
- (b) Verkeerbeheer en verkeerswettoepassing;
- (c) Brandbestryding en brandvoorkoming. Gedagte kan ook gegee word aan opleiding in weermagtopleiding in die Brandwerkdienste van meer plaaslike owerhede as wat tans die geval is.
- (d) Gekose aspekte van slagplaasadministrasie.
- (e) Basiese opleiding vir vakleerlinge by streeksentrums vir basiese opleiding.

Elke plaaslike owerheid behoort hierbenewens reëlings te tref vir die behoorlike indiensopleiding van nuwe werknemers.

25. Die Instituut van Stadskerke wil dit graag beklemtoon dat mededingende diensvoorwaardes, die uitbreiding van die potensieel werkgemeenskap deur meer gebruik te maak van Nie-blanke-personeel en verbeterings wat die zeter werknemers en hulle gehalte betref deur middel van opleidingsgeriewe, nie beskou moet word as faktore wat op sig self daartoe sal lei dat plaaslike owerhede personeel van 'n goeie gehalte sal kan werf en behou nie. Faktore wat ook grootliks daartoe bydra dat 'n plaaslike owerheid personeel kan lok en behou, is die interne organisasie en atmosfeer soos die kwessie van die behoorlike opleiding en behandeling van die personeel. Tydens groepsbesprekings wat deur die Instituut van Stadskerke gereël is, is die aandag gevestig op 'n aantal tekortkominge in die plaaslike owerheidsdiens. Daar kan in hierdie memorandum nie breedvoerig op die betrokke tekortkominge ingegaan word nie, maar 'n paar daarvan moet tog genoem word: –

- (i) Te min geleentheid vir bevordering.
- (ii) Onvoldoende indiensopleidingsgeriewe en gebrek aan behoorlike personeelkeuring.
- (iii) Onvoldoende erkenning wat betref kwalifikasies en ondervinding by die vasstelling van beginsalarisse.
- (iv) Ongenoegsame aansporing van werknemers om hulle onderwyskwalifikasies te verbeter.
- (v) 'n Werknemer se vermoëns word nie altyd tot die uiterste benut nie.
- (vi) Soms gebeur dit dat die beste beskikbare aansoeker nie in 'n vakature aangestel word nie. Al gebeur dit nie dikwels nie, gebrek dit tog en dit kan die beeld van die plaaslike owerheid as werkgewer onherstelbare skade berokken.
- (vii) Bevordering word te sterk gekoppel aan senioriteit.
- (viii) Gebrek aan delegering. Daar is 'n neiging by plaaslike owerhede om die beaampte, selfs as hy beroepkwalifikasies het, nie met die verantwoordelijkheid en gesag te beklee om take op sy werkteerrein uit te voer nie.
- (ix) Professionele mense bestee te veel tyd aan nie-professionele werk.

26. Voornoemde tekortkominge is ten nouste verbonde aan die gebrek aan sistematiese opleiding in bestuurswese vir senior personeel en die gebrek aan geleentheid om kennis wat werknemers tydens hulle opleiding opdoen, prakties toe te pas.

27. Dit is die mening dat die ware en juiste beeld van plaaslike bestuurswese nie aan die hedendaagse jong werksoker voorgehou word nie. Alhoewel plaaslike owerhede te kampe het met sommige van die tengerdste probleme van ons tyd, wat uit die versedelingsproses voortvloei, is die plaaslike-owerheidsdiens in die op van jongmense 'n sieledodende roetine. Die rede hiervoor is dat plaaslike owerhede hulself nie laat geld nie, en nie aan die probleme wat hulle aanpak op die silwerdoek en in die populêre tydskrifte publiseit verleen nie. Hier-

not asserting itself and showing the problems it is tackling on the cinema screen and in the popular magazines. This lack of the right publicity for local government and its task should be dealt with on a national basis, for instance through short films with the theme - LOCAL GOVERNMENT PRESENT A CHALLENGE.

28. Recruitment and training of staff for local government has become a nationwide problem. It is a problem which must be solved if local government is to survive. The United Municipal Executive is the most experienced and authoritative body in the country when it comes to dealing with problems common to all or most local authorities. It is submitted, therefore, that the United Municipal Executive should deal with the following aspects of the staff problem on behalf of local government as a whole:-

- (A) The obtaining of clear and permanent authority from the Government in regard to the extended use of Non-Whites in local government service, at least to the extent to which they are employed by the State and Statutory bodies.
- (B) The elimination of external control over the salaries of officials in local government service on the ground of the bad effect of the present control on the image of the local authority as employer.
- (C) The setting up of regional facilities for training in the fields mentioned in paragraph 24 of this memorandum - on the basis of all local authorities contributing to the cost of such facilities and having the right to use them.
- (D) The institution of a local government bursary scheme under the administration of the United Municipal Executive on the basis that bursars will serve in local government service after completion of their courses.
- (E) The giving of publicity to local government and its task and achievements in the form of a series of filmlets.

#### CO-ORDINATING COMMITTEE FOR HIGH VOLTAGE RESEARCH AND TESTING FACILITIES

A. The ninth meeting of the Committee which was an informal meeting, was held in the Boardroom, Head Office, SCIENTIA, on 10 May 1973.

The following are the main points arising from the meeting:-

##### (1) RESEARCH IN THE MANUFACTURING INDUSTRY

The Working Group reported on the situation existing in the South African High Voltage Engineering Field, with regard to research in the manufacturing industry. The Committee felt that the field of research could be considered in three categories.

- (a) **Apparatus Research** - which was largely concerned with design problems and was carried out by the manufacturer's principals.
- (b) **Phenomena Research** - which was closely related to basic research.
- (c) **Material or Process Research in Relation to Apparatus** - the Committee agreed that an approach be made to the various Industrial Apparatus Associations with a view to establishing what problem areas existed within their respective fields.

##### (2) EXTERNAL INSULATION AND POLLUTION

The scope of this Working Group was extended to include measurement of radio interference voltages and R.I.V. signals on transmission lines and insulators.

Consideration was given to the development by the CSIR of cheap compact instrumentation for the purpose of monitoring leakage currents across the surface of polluted insulators.

##### (3) INSULATION AND INTERNAL DISCHARGES

It was reported that progress was being made by the Railways with their surge testing of motor coil insulation.

Another interesting development was the expansion of the Escom Fault Reporting Scheme to include data from outside organisations into a standardised fault reporting system.

##### (4) ESCOM EHV RESEARCH CENTRE

Escom's decision to erect a testing station at Rosherville was confirmed and the Committee informed that the main interest would be the testing of transmission lines and equipment up to system voltages in the region of 1 100 kV.

B. The tenth meeting of the Committee was held in the Committee room of the Civil Engineering Building of the SABS on 22 October 1973.

The following are the main points arising from the meeting:-

##### (1) RESEARCH AND DEVELOPMENT BY INDUSTRY

The Committee agreed that the various industrial organisations should be contacted by a small panel and that in order to make initial contact, the technical personnel from a specific industry (such as, for example, The Association of Electric Cable Manufacturers) be invited to visit the CSIR and to inspect the available facilities and to discuss the possibility of further research.

die geheer aan die regte soort publisiteit vir die plaaslike owerheid en sy taak moet op 'n landsyde grondslag aangepak word, byvoorbeeld deur kort rolprente te vertoon met die tema - PLAASLIKE OWERHEIDSDIENS - 'N UITDAGING!

28. Die werwing en opleiding van personeel vir plaaslike owerhede is tans 'n landsyde probleem. Dit is 'n probleem wat opgelos moet word om die voortbestaan van plaaslike bestuurswese te verseker. Wat die hantering van probleme wat eie is aan alle of die meeste plaaslike owerhede betref, is die Verenigde Munisipale Bestuur die liggaam met die meeste ondervinding en gesag. Daar word herhalende voorgestel dat die Verenigde Munisipale Bestuur namens plaaslikebestuurswese in die algemeen, aandag skenk aan die volgende aspekte van die personeelprobleem:-

- (A) Die verkryging van duidelike en permanente staatsmagtiging om meer Nie-blankes in die diens van plaaslike owerhede te gebruik, ten minste tot die mate wat hulle deur die staat en statutêre liggame gebruik word.
- (B) Die uitskakeling van eksterne beheer oor die salaris van beamptes in die plaaslike-owerheidsdiens, op grond daarvan dat die huidige beheer 'n skadelike invloed op die beeld van die plaaslike owerheid as werkgewer uitoefen.
- (C) Die daarstelling van stroekgeriewe vir opleiding op die terreine wat in paragraaf 24 van hierdie memorandum genoem word - op die grondslag dat alle plaaslike owerhede tot die koste van sodanige geriewe bydra en die reg het om daarvan gebruik te maak.
- (D) Die instelling van 'n plaaslike-owerheidsbeursskema wat deur die Verenigde Munisipale Bestuur geadmireer word, op die grondslag dat beursoeurs na die voltooiing van hulle opleiding by plaaslike owerhede sal werk.
- (E) Die verlening van publisiteit aan plaaslike owerhede se taak en hulle prestasies by wyse van 'n reeks kort publisiteitsrolprente.

#### KO-ORDINERENDE KOMITEE VIR HOOGSPANNING-NAVORSING EN TOETSFASILITEIT

A. Die negende vergadering van die Komitee, wat 'n informele vergadering was, is gehou in die Raadsaal, Hoofkantoor, SCIENTIA, op 10 Mei 1973.

Die volgende is die hooftrekke wat uit die vergadering voortgespruit het:-

##### (1) WERKSGROEP OOR NAVORSING IN DIE VERVAARDIGINGSBEDRYF

Die Werksgroep het verslag gegee oor die toestand wat bestaan in die Suid-Afrikaanse Hoogspannings-ingenieursgebied wat navorsing in die vervaardigingsbedryf betref. Die Komitee was van mening dat die navorsingsveld in drie klasses beskou kan word:-

- (a) **Gereedskapsnavorsing** - wat grotendeels beheer was met ontwerp-probleme en diesulkes is uitgevoer deur die hoof vervaardigers.
- (b) **Verskynselnavorsing** - wat naverwant aan basiese navorsing was.
- (c) **Material en Prosesnavorsing met betrekking tot Toestelle** - die Komitee het saamgestem dat die verskillende Nywerheidstoestelverenigings genader word met die doel om vas te stel wat probleemgebiede in hulle onderskeie velde bestaan.

##### (2) UITWENDIGE ISOLERING EN BESOEDILING

Die bestek van hierdie Werksgroep is uitgebrei om meting van radiosteuringsspannings en R.S.S. seine op oorbreningsleidings en isolators in te sluit.

Oorweging is ook gegee aan die ontwikkeling, by die WNNR, van goedkoop en beknopte instrumentering om 'n oog te hou oor lekstrome op die oppervlaktes van besoedelde isolators.

##### (3) ISOLERING EN INWENDIGE ONTLEDINGS

Daar is verslag gegee dat die Spoorweë vordering maak met hulle stuwings-toets op motorspoelisolering.

Nog 'n belangwekkende ontwikkeling is die uitbreiding van Evkom se foutverslagskema om gegewens van ander inrigtings in te sluit in 'n eenvormige foutverslagsstelsel.

##### (4) EVKOM SE EHS NAVORSINGSSTREEM

Evkom se besluit om 'n toetastasie te Rosherville op te rig is bevestig en aan die Komitee is berig dat die aandaag verligte gespits sal wees op die toets van oorbreningsleidings en toerusting tot by stelselspannings in die omgewing van 1 100 kV.

B. Die tiende vergadering van die Komitee is gehou in die Komiteekamer van die Siviele Ingenieurswesegebou van die SABS, op 22 Oktober 1973.

##### (1) NAVORSING EN ONTWIKKELING DEUR DIE NYWERHEID

Die Komitee het saamgestem dat die verskillende nywerheids-inrigtings genader behoort te word deur 'n klein span en dat, om aanraking te bewerk, die tegniese personeel van 'n bepaalde nywerheid (soos byvoorbeeld, die Vereniging van Elektriese Kabelvervaardigers) genood word om die WNNR te besoek, om die beskikbare geriewe te ondersoek en om die moontlikheid van verdere navorsing te bespreek.



## (2) REPORTS OF THE CO-ORDINATORS

### (a) Lightning and Surges

Dr. Anderson reported on the progress made at the three CSIR institutes concerned with lightning research during the past year. On the question of earthing, Dr. Anderson reported the difficulty being experienced in obtaining satisfactory earthing for towers situated on hill tops.

### (b) Surges on Systems

At present, two co-operative projects were in operation measuring surges on systems, one at the SAR Surge Recording Station at Olifantsfontein and the other at Escom's 400 kV system at the Apollo Distribution Station. NEERI has also been called upon to undertake surge measurement in seven industrial situations where breakdown of equipment had been experienced. The Co-ordinators also report that the possibility of reviewing the specification for medium voltage lightning surge diverters had been considered as a large number of diverters had been damaged.

It was recommended that the extent of surge diverter damage in the republic should be ascertained and steps taken to determine the cause and to amend the specification as required.

### (c) Corona and Properties of Arcs

Professor Heymann presented his report on the work of the Committee in this field.

### (d) External Insulation and Pollution

Mr. Reynders tabled his report on insulation and mentioned that an aspect which had assumed considerable significance was a question of radio interference voltages caused by insulators and associated hardware.

### (e) Insulation and Partial Discharges

It was proposed that all users of rotating electrical machinery participate in the collection of performance data on machine insulating systems in use in South Africa.

## (3) EARTHING

Mr. Middlecott reported on the work done at NEERI, SABC and ESCOM. He suggested that the situation be reviewed upon the return of the C.S.I.R. staff member engaged on a study overseas.

## (4) PROGRAMME OF LIGHTNING RESEARCH IN SOUTH AFRICA

The Sub-Committee under the Chairmanship of Dr. Carte continued to meet and was providing a useful forum for the co-ordination of the lightning research programmes.

## (5) FAULT REPORTING

Mr. Randall mentioned that a research group of Escom had investigated the proposed scheme which was suitable for Escom requirements but could, with amendments, be suitable for accepting data from the various municipalities.

## (6) CO-ORDINATED SCHEDULES: REVIEW OF RESEARCH AND FACILITIES IN SOUTH AFRICA

The Committee agreed that the schedules contained much valuable information both in regard to research being undertaken and the H.V. facilities available, and especially with regard to the listing of publications and proposed that wider publicity should be given to the availability of these reports.

## (7) SYMPOSIUM ON HIGH VOLTAGE

Professor Heymann reported that the SAIEE had decided to arrange a two-day symposium on high voltage research and development in South Africa on a date to be decided.

## (2) VERSLAE VAN DIE KO-ORDINEERDERS

### (a) Weerlig en Stuwings

Dr. Anderson het verslag gedoen oor die vooruitgang wat by die drie WNNR inrigtings, gemeoed met weerlignavorsing, gedurende die afgelope jaar gemaak is. Aangaande die kwessie van beaarding het Dr. Anderson verwyd na die moeilikheid wat ondervind word om bevredigende beaarding te verkry vir torings wat op heuweltoppe geleë is.

### (b) Stuwings op Stelsels

Op die oomblik was twee ko-operatiewe skemas om stuwings op stelsels te meet, aan die gang, een aan die SAS Stuwingsopmetingsentrum te Olifantsfontein en die ander aan Evkom se 400 kV Stelsel te Appollo Verspreidingsstasie.

NEERI is ook aangewyn om stuwingsmeting te onderneem in sewe nywerheidsaangehentede waar bedryfstreking van toerusting ondervind is.

Die Ko-ordineerders het ook berig dat die moontlikheid van hersiening van die spesifikasie vir mediumpansingsweerligstuwingsafleiers oorweeg is aangesien 'n groot getal afleiers beskikbaar is.

Daar is ook 'n aanbeveling gemaak dat die omvang van skade aan stuwingsafleiers in die Republiek vasgestel behoort te word en maatreëls getref word om die oorsaak vas te stel en om die spesifikasie te wysig soos nodig mag blyk.

### (c) Korona en Boogeienskappe

Professor Heymann het sy verslag oor die werk van die Komitee in die gebied voorgelê.

### (d) Uitwendige Isolasië en Besoedeling

Mr. Reynders het sy verslag oor isolasië ter tafel gelê en het gemeld dat 'n gesigpunt wat heelwat belangrikheid aangeneem het, is die probleem van radiosteuringspanninge veroorsaak deur isoleerders en verwante toerusting.

### (e) Isolering van Gedeeltelike Ontladinge

Daar is voorgestel dat alle verbruikers van draaiende masjinerie saamwerk in versameling van werkverrigtingsgetuens oor masjien isoleringstelsels wat in Suid-Afrika in gebruik is.

## (3) BE-AARDING

Mnr. Middlecott het verslag gedoen oor die werk onderneem deur NEERI, SAUK en EVKOM. Hy het voorgestel dat die toestand hersien word by die terugkoms van die WNNR personeel wat besig is met studie oorsee.

## (4) PROGRAM VAN WEERLIGNAVORSING IN SUID-AFRIKA

Die Onderkomitee onder die voorsitterskap van Dr. Carte het met vergaderings voortgegaan en het 'n bruikbare forum gebied vir die ko-ordinasie van die weerlignavorsingsprogramme.

## (5) FOUT BERIGGEWING

Mnr. Randall het gemeld dat 'n navorsingsgroep van Evkom die voorgestelde skema ondersoek het wat geskik is vir Evkom se doel, maar dat dit, met wysigings, geskik kan wees om gegewe van die verskillende munisipaliteite te ontvang.

## (6) SAAMGEVATTE OPAGAWES: HERSIENING VAN NAVORSING EN HULPBRONNE IN SUID-AFRIKA

Die Komitee het saamgestem dat die opagawes baie waardevolle inligting bevat, beide met betrekking tot navorsing wat onderneem word en oor die H.S. geriewe beskikbaar, maar in besonder met betrekking tot die lysste van geskrifte en daar is voorgestel dat meer reklame gemaak word vir die beskikbaarheid van hierdie verslae.

## (7) SIMPOSIUM OOR HOOGSPANNING

Professor Heymann het berig dat die SAIEE besluit het om 'n tweerigting simposium oor Hoogspanningsnavorsing en ontwikkeling in Suid-Afrika te reël op 'n datum waarvoor nog besluit moet word.

D. C. PLOWDEN  
REPRESENTATIVE/VERTEENWOORDIGER

## SOUTH AFRICAN ELECTROLYTIC CORROSION COMMITTEE

The seventh meeting of the Main Committee was held in Johannesburg on 5 September 1973, when the following matters were discussed:

### (1) Technical Reports

The Chairman stated that Technical Reports Nos 3 and 4 had been sent to members of the Regional Field Committees during the past year.

### (2) Regional Field Committees

The representative of the Witwatersrand and O.F.S. Regional Field Committee stated that, notwithstanding the appeal made last year to the AMEU to assist in ensuring that local authorities be made aware of the existence and functions of Regional Field Electrolytic Corrosion Committees, there had been little reaction from local authorities in the area covered by his Committee. It was therefore decided that, for a trial period of one year, this Committee would furnish Town Clerks of local authorities with copies of the minutes of its meetings for circulation to their respective engineering departments.

## SUID-AFRIKAANSE KOMITEE INSAKE ELEKTROLITIESE VERWERING

Die sewende vergadering van die Hoofkomitee is te Johannesburg gehou op 5 September 1973, waar die volgende sake bespreek is:

### (1) Tegniese Verslae

Die Voorsitter doen verslag dat Tegniese Verslae Nrs. 3 en 4 aan die lede van die Streekskomitees gestuur is gedurende die afgelope jaar.

### (2) Streekskomitees

Die verteenwoordiger van die Witwatersrand- en Vrystaatse Streekskomitee doen verslag dat, tansy van die oproep wat verlede jaar gemaak is aan die V.M.E.O. om te help dat plaaslike owerbede bewus gemaak word van die bestaan en die rol van Streekskomitees insake elektrolitiese verwerking, was daar min reaksie van plaaslike owerbede in die gebied deur sy Komitee gedek. Daarom is daar besluit dat, vir 'n toets tydsy van een jaar, hierdie Komitee afskrifte van die notule van sy vergaderings aan Stadsklerke van plaaslike owerbede sal voorsien vir verspreiding aan hulle onderskeie ingenieursafdelings.

# ROODEPOORT



'n Tipiese koeslote in een van Roodepoort se talle parke. Die foto is op die Florida-meer geneem teen die ontspanningsgeriewe wat die dorp sy inwoners byna by hul voordeure bied.

## ENKELE MYLPALE IN DIE ONTWIKKELING EN GROEI VAN ROODEPOORT

- 1886 – Hoofrif word deur J.G. Bantjes ontdek;
- 1887 – Roodepoort, Florida en Maraisburg as dorpe gestig;
- 1890 – Spoorlyn vanaf Johannesburg met stasies op Maraisburg, Florida en Roodepoort geopen;
- 1904 – Roodepoort se Munisipaliteit gepronklaamer;
- 1910 – Elektriesiteitsretikulase;
- 1931 – Ontdekkers-Gedenkhospitaal geopen;
- 1946 – Roolstelsel vir hele gebied ingestel;
- 1959 – 33 000 Volt elektriesiteitskema in diens;
- 1963 – Diamant-Jubileum, Nuwe Wapen, Nuwe Vlag en Ampsketting;
- 19 – Volwaardige STAD

***A town to live in  
'n Dorp om in te woon***

**ROODEPOORT** – 'n Rasegte myndorpie met 'n beskeie bestaan tot net 25 jaar gelede, beslaan vandag 'n gebied van nie minder nie as 148 vierkante kilometer.

Indien die huidige groeikoers gehandhaaf kan word, sal Roodepoort in 1980 'n bevolking van 80 000 Blankes hê, in 1990 sowat 97 000 Blankes en 117 000 Blankes teen die jaar 2000.

Bogenoemde groei is feitlik verskeer aangesien ou myngrade beskikbaar geword het vir Nywerheidsgebruik. Roodepoort is ook besonder gunstig geleë ten opsigte van dienste terwyl die Suid-Westelike Bantoeedorpe 'n onoortreflike arbeidsbron is.

During the past financial year the electricity unit consumption increased by 13,35% whilst the average annual increase of the past 10 years was 10,25%

This year tenders for the main supply to the Northern areas are being called for. This main supply consists of two 88000 Volt cables through the centre of Roodepoort to Kloofendal from where distribution will be taken further at 33000 Volts.

In 1973 – 299 258 units were bought whilst the maximum demand was 67 117,7 kW.

*One of the very modern libraries in Roodepoort. It is Council policy to supply in all the needs of its community. That is possibly the most important reason why so many people from the Witwatersrand Area chooses Roodepoort as their home.*



## ENKELE MYLPALE IN DIE ONTWIKKELING EN GROEI VAN ROODEPOORT

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***A town to live in  
'n Dorp om in te woon***

Roodepoort. It is Council policy to support the Witwatersrand Area chooses their home.



It may be noted that the Field Committees for the Cape Western, Cape Northern and Natal Regions are not experiencing this difficulty.

#### (3) Codes of Practice

(i) Proposed SABS Code of Practice for Cathodic Protection of Steel Pipelines:

Progress on this Code has been slow, but it is expected that work will be completed by the end of 1973 or early in 1974.

(ii) Proposed SABS Code of Practice for Cathodic Protection of Buried Structures:

This Code has been completed and, after translation, it will be circulated to the relevant organisations for comment.

It was pointed out that, although account had been taken in the drafting of this Code of the South African Electrolytic Corrosion Committee's "Code of Practice for Cables and Pipelines Crossing Beneath Railway Tracks: SAECC/1", the crossing of pipelines had not been considered. It was agreed that this, and also the possibility of incorporating a colour code, should be taken up with the SABS.

The Chairman stated that when the SABS Code is published, the Committee's Code No. SAECC/1 referred to above would fall away.

#### (4) AMENDMENT TO THE CONSTITUTION

The proposal made at the Sixth Meeting of the Main Committee that meetings be held every two years instead of annually received further consideration. It was decided, however, that such a step would not be in the best interest of the functioning of the Committee and the proposal was not adopted.

D.C. PLOWDEN

#### REPRESENTATIVE/VERTEENWOORDIGER

**Mr. D.C. Plowden** (Johannesburg): In the report, my published report on the work of the Technical Sub-committee, I have pointed out that the Sub-committee feels after examining all the bad news they could think of, that we should join forces with the Training Committee which has been established by the Institute of Town Clerks, with the blessing of the U.M.E.

I wrote the report of I think, the last meeting of the Cape of Good Hope Branch, and some misgivings were expressed there because they said that the memorandum drawn up by the Institute of Town Clerks referred to all types of category and training and didn't just concentrate on artisan training.

I must reiterate here the statements that I have made previously on other occasions. The A.M.E.U. has no authority to compel local authorities to contribute to the cost of establishing training centres. We have no financial resources of our own that will permit us to do this. Even if we could establish centres, we would have a great deal of difficulties in trying to administer these, its the finding of the staff, controlling of staff, and its for these reasons that we have recommended that we join forces with the Institute of the Town Clerks. I think our investigations have shown that if we want to train artisans adequately we do need basic training centres. The example in Johannesburg, were initially we established a training centre with no thought of putting people through a trade test, we wanted to produce artisans. But the

Dit dien gelet te word dat die Streekskomitees vir die Wes-Kaapse, Noord-Kaapse en Natalise Streke nie hierdie moeilikheid ondervind nie.

#### (3) Gebruikskodes

(i) Voorgestelde SABS-kode vir die Katodiese Beskerming van Staalpylyne.

Voortyding met hierdie kode was stadig, maar dit word verwag dat die werk teen die einde van 1973 of vroeg in 1974 voltooi sal wees.

(ii) Voorgestelde SABS-kode vir die Katodiese Beskerming van Ondergrondse strukture.

Hierdie kode is voltooi en, na vertaling, sal dit versprei word na belanghebbende instansies vir kommentaar.

Aandag is daarop gevestig dat, alhoewel by die opstel van hierdie kode rekening gegee is van die Suid-Afrikaanse Komitee insake Elektrolitiese Verwering se „Gebruikskode vir Kabels en Pylyne wat onder Treinpoortjies deurgaan SAECC/1", is die oorgang van spoorlyne nie in ag geneem nie. Daar is saamgestem dat hierdie, sowel as die moontlikheid om 'n kleurkode in te lyf, met die SABS bespreek moet word.

Die Voorsteller is dat wanneer die SABS-kode uitgegee word, sal die Komitee se kode Nr. SAECC/1, waarna hierbo verwys is, vervaal.

#### (4) WYSIGING VAN DIE GRONDWET

Die voorstel wat op die Sesde Vergadering van die Hoofkomitee gedien het, dat vergaderings al om die twee jaar gehou word in plaas van jaarliks, het verdere aandag geniet. Daar is egter besluit dat sodanige stap nie in belang van die beste werking van die Komitee sal wees nie en die voorstel is nie aangeneem nie.

trade testing came into being and in our first year, I think we had about a 38% pass. In a very short time, a matter of two or three years, our figure went up to the order of 90%, and we've maintained that figure over a large number of years.

I must stress here that even although we must get people through trade testing, the prime purpose of a basic training centre is to produce artisans not to get them through a trade test, that's purely coincidental. Therefore, Mr. President, I would like to reassure the Cape of Good Hope Branch that we're not going to lose our identity with the Institute of Town Clerks, they have in fact referred to the necessity for training centres, not just one but if possible three or four.

I haven't anything to add to that but as a point of interest, I learnt yesterday that of the first six Bantu electricians we put up for a trade test, two of them passed their trade test. I understand that the trade test was drawn-up by Mr. Hare's organisation to the same standard that is applied to the whites, but the test itself was conducted by the Hantu Education Department.

That's all Mr. President. The other two reports that I have submitted - "High Voltage Research" and "Electrolytic Corrosion Committee", I have no further comment on those.

**President:** I have a report here that was submitted by Mr. Fraser on the activities of the Natal Electrolytic Corrosion Regional Field Committee.

## NATAL ELECTROLYTIC CORROSION REGIONAL FIELD COMMITTEE

I set out below my report on the activities of the above Committee during 1973.

The Natal Regional Field Committee comprises representatives of the following organisations:-

- South African Railways Administration
- Association of Municipal Electricity Undertakings.
- Electricity Supply Commission.
- African Explosives and Chemicals Ind. Ltd.
- Department of Water Affairs
- South African Coal, Oil and Gas Corporation.
- Oil Industries Corrosion Control Group.
- Fuel Flow (S.F.F.)

Other interested parties such as CORTEC (Pty) Ltd., also attended some meetings by invitation.

The present office bearers are:-

- Chairman - Mr. C.R. Stafford, S.A.R.
- Deputy Chairman - Mr. D.H. Fraser, A.M.E.U.

Two meetings were held during the year on 2nd May 1973, and 7th November, 1973, when a number of problems relating to electrolytic corrosion of buried services and structures were discussed to mutual advantage and, in some cases, satisfactorily resolved.

Amongst these were:-

- (a) A.E. & C.I. pipeline protection services, Umbogintwini.
- (b) Amanzimtoti Regional Water Board pipelines Isipingo Hills.

## NATALISE STREEKSKOMITEE INSAKE ELEKTROLITIESE VERWERING

Hier volg my verslag aangaande die bedrywighede van bovermelde Komitee gedurende 1973.

Die Natalise Streekskomitee bestaan uit verteenwoordigers van die volgende organisasies:-

- Die S.A. Spoorweg-administrasie.
- Die Vereniging van Munisipale Elektrisiteitsondernemings.
- Die Elektrisiteitsvoorsieningskommissie.
- Die Afrikaanse Springtouw en Chemiese Nywerhede Bepker.
- Die Departement Waterwese.
- Die S.A. Steenkool, Olie- en Gaskorporasie.
- Die Verweringsbeheergroep van die Olienewerhede.
- Fuel Flow (S.F.F.)

Ander belanghebbende liggame, soos byvoorbeeld Cortec (Edms) Bepker, het ook party vergaderings op uitnodiging bygewoon.

Die huidige ampdraers is:-

- Voorvoorsitter - Mnr. C.R. Stafford, S.A. Spoorweë
- Adjunk-Voorvoorsitter - Mnr. D.H. Fraser, V.M.E.O.

Gedurende die jaar is twee vergaderings gehou, en wel op 2 Mei 1973 en 7 November 1973. By hierdie vergaderings is 'n aantal probleme wat met die elektrolitiese verwering van ondergrondse dienste en strukture verband hou, tot wedersydse voordeel bespreek en, in sommige gevalle, bevredigend opgelos.

Hieronder was die volgende:-

- (a) Die A.S. en C.M. se pylyne-beskermdingsdienste, Umbogintwini.
- (b) Die Streekswateraad van Amanzimtoti se pylyne - Isipingo-heuwels.

- (c) Department of Water Affairs and Borough of Newcastle pipelines in the Newcastle area.
- (d) P & D Installation, Island View, Durban.
- (e) Chatsworth Housing Scheme, Durban.
- (f) Earthing of electricity supply systems.

Technical Report No. 3 "Cathodic Disbonding of pipelines wrapping" and Technical Report No. 4.4 "Comparison of test methods to ascertain electric strength of pipe wrapping", have been made available to the Committee and proved of interest.

An S.A.R. report headed "Basic requirements applicable to all new services crossing the Administration's Petroleum Products and Crude Oil Pipelines" has been issued to all Committee members. A copy is being circulated to all A.M.E.U. (Natal Branch) members for comment. It is understood that the S.A.B.S. has recently been requested by the Main Committee to incorporate these requirements into the Code of Practice for Cables and Pipelines Crossing beneath Railway Tracks, which is under preparation by the Bureau. It is essential, in my view, that all A.M.E.U. Branches should have the opportunity of examining and commenting upon this document before finalisation.

Although no electrolytic corrosion problems have been submitted to the Committee by members of the A.M.E.U. (Natal Branch), I am satisfied that representation on this body is beneficial. Copies of minutes of meetings are circulated to all Branch Members together with other relevant publications.

**D.H. FRASER**  
**REPRESENTATIVE**



**MR. D.H. FRASER**  
 City Electrical Engineer Durban

**Mr. D.H. Fraser** (Durban): I have stated in the report what has transpired in the past years in this sphere. The meetings are regularly

**CAPE WESTERN ELECTROLYTIC CORROSION  
 REGIONAL FIELD COMMITTEE**

Mr. President, I regret that my report, as the A.M.E.U.'s representative on the above committee, was too late for circulation. I wish, however, to report that the Cape Western Electrolytic Corrosion Regional Field Committee has been most active during the past year.

Meetings are held quarterly under the most able Chairmanship of Mr. R.R. Gilmour of the Cape Town electricity department. Meetings are well attended and bodies represented include the S.A.R., Oil Industry Corrosion Control Group, Electricity Supply Commission,

- (c) Die pylyne van die Departement Waterwese en die Munisipaliteit Newcastle in die Newcastle-gebied.
- (d) P. en D. - installasie, Island View, Durban.
- (e) Chatsworth-behuisingskema, Durban.
- (f) Die aarding van elektrisiteitsvoorsieningskemas.

Tegniese Verslag nr. 3 „Cathodic Disbonding of Pipelines Wrapping” en Tegniese Verslag nr. 4.4 „Comparison of test methods to ascertain electric strength of pipe wrapping” is aan die Komitee beskikbaar gestel en interessant gevind.

'n Verslag van die S.A. Spoorweë getitel „Basiese vereistes van toepassing op alle nuwe dienste wat die Administrasie se petrol- en ruolie-pylyne kruis” is aan alle Komiteeledere beskikbaar gestel. 'n Afskrif daarvan word vir kommentaar aan alle lede van die Natalse tak van die V.M.E.O. omgestuur. Daar word verneem dat die S.A.B.S. onlangs deur die Hoof-komitee versoek is om hierdie vereistes by die Gebruikskode vir Kabels en Pylyne wat onder spoorlyne deurloop wat tans deur die Buro voorberei word, in te sluit. Na my mening is dit noodsaaklik dat alle V.M.E.O.-lede die geleentheid gegun moet word om hierdie dokument te bestudeer en kommentaar daarop te lewer voordat dit gefinaliseer word.

Alhoewel geen elektrolitiese verweringsprobleme deur lede van die Natalse tak van die V.M.E.O. aan die Komitee voorgelê is nie, is ek daarvan oortuig dat verteenwoordiging in hierdie liggaam wel van waarde is. Afskrifte van die notules van vergaderings word, tesame met ander verwante publikasies, aan alle taklede aangestuur.

**D.H. FRASER**  
**VERTEENWOORDIGER**

held, only twice a year, but they are serving a useful purpose and they are continuing.

**WESKAAPLANDSE STREEKKOMITEE INSAKE  
 ELEKTROLITIESE VERWERING**

Dit spyt my dat my verslag, as die V.M.E.O. se verteenwoordiger in bogenoemde komitee, nie betyds gereed was om gesirkuleer te word nie. Ek wil egter graag verslag doen dat die Weskaaplandse Streekkomitee insake Elektrolitiese Verwerking gedurende die jaar baie te drywig was.

Vergaderings word kwartaaliks onder die uiters bekwame voorsitterskap van mnr R.R. Gilmour van die Kaapstadse Elektrisiteitsdepartement gehou. Die vergaderings word goed bygewoon en die liggame wat verteenwoordigers stuur, sluit in die S.A. Spoorweë, die Ver-

G.P.O., Cape Gas, Cape Town City Council, (Chemical Branch), C.S.I.R., S.A. Navy and of course A.M.E.U.

Problems related to electrolytic corrosion and, in particular cathodic protection of underground services are discussed, proposed solutions considered and results obtained, amplyed.

All A.M.E.U. members are encouraged to advise their Town Engineers of the existence of the S.A. Electrolytic Committee and to pass on their corrosion problems to their representative on the Committee.

This Field Committee is particularly indebted to the S.A.R. who, besides providing the necessary secretarial services, also provide the venue for the meetings

weringsbeheergroep van die Olievewerheid, die Elektriesiteitsvoorsieningskommissie, die H.P.K. Cape Gas, die Kaapstadse Stadsraad (Chemiese tak), die W.N.N.R., die S.A. Vloot en natuurlik die V.M.E.O.

Besprekings word gewy aan probleme wat verband hou met elektrolytiese verwerking en veral die katodiese beskerming van ondergrondse dienste, oorweging word verleen aan voorgestelde oplossings en die resultate wat verkry is, word ontleed.

Alle V.M.E.O.-lede word aangemoedig om die bestaan van die S.A. Komitee insake Elektrolise onder die aandag van hul Stadsingenieurs te bring en om hul verweringsprobleme aan hul verteenwoordigers in die Komitee voor te lê.

Die Komitee is veel dank verskuldig aan die S.A. Spoorweë, wat nie alleen die nodige Sekretariale dienste verskaf nie, dog ook die vergaderplek vir die vergaderings beskikbaar stel.

K.J. MURPHY  
REPRESENTATIVE/VERTEENWOORDIGER

**President:** The S.A.B.S. Progress Report of 1973 was submitted by Mr. Botes.

#### S.A.B.S. PROGRESS REPORT FOR 1973

I have pleasure in presenting the progress report on the S.A.B.S. Technical Committees. Much work was done and in some cases no meetings were held, but if you read the report carefully you will notice reasons therefore.

Please note that the editing and translation of a specification takes up a considerable time as well as the time it takes to go through the administration routine before it is approved by the S.A.B.S. Council.

Mention is to be made of the meeting held on the "Compact Transformer Substations for use in Public Areas" specification. Quite a number of comments were received. I wish to thank all instances, individuals as well as branches of the A.M.E.U. for their much appreciated comments.

I may mention that it was decided that the name of this project will in future be "Miniature Substations."

In conclusion I wish to thank the members of the A.M.E.U. for their support and hard work during the year. In particular I wish to thank the S.A.B.S. personnel for their guidance and very good work.

P.J. BOTES  
KO-ORDINERENDE VERTEENWOORDIGER  
CO-ORDINATING REPRESENTATIVE

#### S.A.B.S. VORDERINGSVERSLAG VIR 1973.

Dit is vir my 'n genoë om die vorderingsverslag van die S.A.B.S. Tegiese Komitees voor te lê. Heelwat werk is gedoen niteenstaande baie van die komitees nie gedurende die jaar byeengekom het nie, maar as u die verslag lees sal u sien dat daar 'n baie goeie rede voor was.

Kennis moet geneem word dat baie tyd in beslag geneem word met die redigering en vertaling van 'n spesifikasie, voorts neem dit 'n geruime tyd as gevolg van die administratiewe kanale wat so 'n spesifikasie volg voordat dit deur die Raad van die S.A.B.S. goedgekeur word.

U aandag word gevestig op die vergadering wat gehou is oor "Kompakte Transformator Substansies vir gebruik in Openbare Gebiede" na ontvangs van die kommentaar, wat ons so vrylik uit alle oorde ontvang het.

Ek wil alle instansies, die individue sowel as alle takke van die V.M.E.O. bedank vir hulle kommentaar. Ek mag net noem dat die naam van die projek in die vervolg bekend'sal staan as „Miniatur Substansies."

Ter afsluiting wil ek net graag al die lede van die V.M.E.O. bedank vir die ondersteuning en harde werk gedurende die afgelope jaar. In die besonder wil ek die personeel van die S.A.B.S. bedank vir hulle leiding en goeie werk.



MNR. PIET BOTES  
Elektrotegniese Stadsingenieur van Roodepoort

# Die groot oortuiger.

U kan vir voornemende kopers sê u produk is goed.

Party sal u sondermeer glo.

Meeste sal nie. Hulle moet eers oortuig word.

Die SABS-merk is 'n groot oortuiger.

Dit oortuig die publiek. Hulle weet dis die merk van gehalte.

Dit oortuig die owerhede. Daarom is dit nou as staatsbeleid aanvaar om

voorkeur te gee aan produkte wat die SABS-merk dra.

Dit oortuig kopers in die

buiteland. In meer as

70 lande word die SABS-merk

aanvaar as bewys

dat 'n produk aan bepaalde standaardspesifikasies voldoen.

Dit is maar een voordeel van die SABS-merkskema. Kom gesels of skryf vandag nog en ons sal u vertel van al die ander voordele.



**Merk van gehalte**

Rig u navrae aan die Direkteur-generaal, SABS, Privaatsak X191, Pretoria.

VZ 12/8033

V.M.E.O. VERTEENWOORDIGING OP S.A.B.S. TEGNIESE KOMITEES VORDERINGSVERSLAG VIR 1973.  
 A.M.E.U. REPRESENTATION ON S.A.B.S. TECHNICAL COMMITTEES : PROGRESS REPORT FOR 1973.

S.A.B.S. VERW/REF. NO.	ONDERWERP/TITLE	VERTEENWOORDIGER REPRESENTATIVE	VERGADERINGS MEETINGS	VERSLAG/REPORT
15/7/19	Keuring en metodes van ontleding van soliede brandstof. Sampling and methods of analysis of solid fuels.	G.T. Stevens	-	Geen vordering. No progress.
15/11/51	Die bevestiging van armature aan die vaste drastukke. The connection of luminaires to their supporting fixtures	H.J. de Bruin	-	Spesifikasie word gesirkuleer vir oorsese kommentaar. Draft specification was circulated overseas for comments.
15/7/22	Isoleroelie vir transformators en skakeltoerusting. Insulating oil for transformers and switchgear.	V.A. Raynal	Twee  Two	Goeie vordering is gemaak. Finale hersiening sal gedoen word sodra kleiner probleme wat deur 'n vervaardiger van transformatore ge- ooper is, uitgestryk is. Na afhandeling hiervan kan die projek as afgehandel beskou word.  Good progress made. Final revision awaiting clearing up of minor difficulties brought up by a manufacturer of transformers, after which this project appears to be complete.
15/14/1/3	Traksiebaterye Traction Batteries	H. Barnard.		
15/14/1/4	Treinligbaterye Trainlighting Batteries	H. Barnard		
15/14/1/5	Vaste Baterye Stationary Batteries	H. Barnard		
15/14/3/1	Veiligheid van elektriese toestelle. Standing advisory committee on electrical safety.	G.C. Theron	Vier Four	Deurlopend van aard. Continuous.
15/14/5/1	Omhuulde handlugbreek- en -afsonderskakelaars. Manually operated enclosed type airbreak switches and isolators (Rev. of S.A.B.S. 152/1951)	D.P. Viljoen	Een One	Werkgroep aangestel om nuwe spesifikasie op te stel. Working group appointed to draft new specification.
15/14/5/2	Muur-en toestelskakelaars S.A.B.S. 163-1963 Wall and appliance switches	J.A. Loubser	Een One	Goeie vordering. Binne bestek van die volgende twee vergaderings behoort hierdie onderwerp afgehandel te wees.  Good progress Within the next two meetings this subject should be finalised.
15/14/5/3	Vlakgemonteerde binnenshuise elektriese paneelborde. Flush-mounted indoor electrical panelboards	J.A. Loubser	-	Geen vordering. No progress
15/14/5/4	Ligdempers Light dimmers	J.E. Heydenrych	-	Konsep uitgestuur vir kommentaar. Het gesluit op 26/10/73. Draft for comments. Closed on 26/10/73.
15/14/9/1	Drie-fase induksie motore Three-phase induction motors (Rev. of S.A.B.S. 948-1969)	P.J. Botes	Drie Three	Nuwe konsep word opgestel. New draft is being drawn up.



S.A.B.S. VERW/REF. NO.	ONDERWERP/TITLE	VERTEENWOORDIGER REPRESENTATIVE	VERGADERINGS MEETINGS	VERSLAG/REPORT
15/14/9/2	Enkelfase wisselstroom motore Single-phase alternating current motors	H.J. de Bruin	Een One	Wag nou op uitslag van 15/14/9/1 Waiting for comment on 15/14/9/1
15/14/10/1	Fluoresseerbuislampe vir algemene gebruik. Tubular fluorescent lamps for general service.	J.S. v.d. Merwe	Twee Two	Derde vergadering Februarie 1974. Third Meeting February 1974.
15/14/10/5	Kapasitore vir balaste vir fluoreseer- en ontladingslampe. Capacitors for fluorescent and discharge lamp ballasts.	A.J. v.d. Berg	-	Besig met toetse. Behoort vroeg in 1974 voltooi te wees. Busy with test. Should be completed early in 1974.
15/14/12/1	Standaard regulasies vir die bedrading vir persele. Standard regulations for the wiring of premises.	D.C. Plowden E.E. de Villiers	-	Volgende vergadering sal op 22/1/74 gehou word. Next meeting scheduled for 22/1/74.
15/14/14/3	Kontaktors. Contactors	F.J. v.d. Merwe	Drie Three	Spesifikasie is gefinaliseer en word ge-eiteer, vertaal en in gereedheid gebring vir die Raad. Specification was finalised and submitted for editing and translation for approval by the Council.
15/14/14	Buigsame koorde vir krag- en verligtingtoestelle. General co-ordinating committee (Cables) Flexible cords.	G.C. Theron	Een One	Afgehandel behalwe probleme met aansluiters. Completed except for problems with terminals.
15/14/14/1	Buigsame koorde vir krag en verligtingtoestelle. Medium voltage vulcanized rubber insulated cables and flexible cords for power and lighting purposes. (Rev. of S.A.B.S. 168-1952)	G.C. Theron	Drie Three	Werkgroep moet nog verslag doen na ondersoek. Working group to report after investigations.
15/14/14/18	Hittebestande kables vir gebruik by die binnebedrading van elektriese toestelle. Heat resisting cables for use in the internal wiring of electrical appliances (Rev. of SABS 529-1956)	A.J. v.d. Berg	-	Finale dokument uitgestuur vir kommentaar. Sluitingsdatum 15/12/73. Sal in 1974 gepubliseer word. Final document sent out for comments. Closing date 15/12/73. Will be published in 1974.
15/14/14/24	Gekartelde of drukaansluiters Crimped or pressure type connectors.	H. Barnard		
15/14/18/1	Hoog- en laagspanningdeurvoerders High and low voltage bushings	C. Lombard	Een One	Standaard skag omvang vir invoeging in die spesifikasie is goedgekeur. Standard stem dimensions for inclusion in the specification have been accepted.
15/14/20	Keramiek- en glisolators vir bogrondse kraglyne met 'n nominale spanning bo 1000 V. Ceramic and glass insulators for overhead power lines with a nominal voltage greater than 1000V.	F.J. Sulter	-	Finale dokument na Raad vir goedkeuring. Final document sent to Council for approval.
15/14/20/1	Hoogspanningpaalisolators High voltage post insulators	F.J. Sulter	-	Nie aktief. Not Active.
15/14/21	Stroomverbrekers met gevormde hulse. (Metrieke eenhede). Moulded case circuit breakers (Metrication of SABS 166-1963)	F.J. v.d. Merwe	-	Geen vordering. No progress.

S.A.B.S. VERW./REF NO.	ONDERWERP/TITEL	VERTEENWOORDIGER REPRESENTATIE	VERGADERINGS MEETINGS	VERSLAG/REPORT
15/14/21/1	Aardlekbeveiligingseenhede van die stroombalansstipe. Core balance earth leakage protection units. (Metrication of SABS 767-1964)	F.J. v.d. Merwe	-	Geen vordering. No progress.
15/14/25	Hoogspanningblitsafleiers High voltage lightning arrestors	J.M. Gericke	-	Geen vordering. No progress.
15/14/26	Patroontipe sekering-akakels. Patroontipe elektriese sekerings. Cartridge type fuse links for low and medium voltage electric fuses	A.H.L. Fortmann	-	Konsep word nagesien. Titel is verander. Titel is verander. Draft being technically edited. Title amended.
15/14/30	Geleiers vir bogronde elektriese verspreidingslyne. 1) Koper geleiers. 2) Aluminium geleiers. 3) Staal versterkte aluminium geleiers. 4) Koper oorgetrekte staal geleiers. 5) Gegalvaniseerde staal geleiers. Conductors for overhead electrical transmission lines.	D. Briers	-	1) Aan Raad voorgelê vir goedkeuring. 2) Valtout. 3) Uit vir kommentaar. 4) Nie aktief. 5) Eerste vergadering November 1973.  1) Submitted for Council for approval. 2) Completed. 3) Out for comment. 4) Not active. 5) First meeting to be scheduled November 1973
15/14/34	Elektriese opgaar-watervarmers. Electric storage water heaters (Rev. of SABS 151/1958)	A.J. v.d. Berg	-	Voorgelê vir kommentaar. Sluitingsdatum Januarie 1974. Issued for comments, closing date for comments being January 1974.
15/14/35/1	Dompel verwarmers vir draagbare elektriese toestelle, toestelverbindertipe. Immersion heaters for portable electric appliances - apparatus connector type (Rev. of SABS 514-1956)	H. Barnard	-	
15/14/36	Huishoudelike elektriese wasserybehandelingstoestelle. Domestic electric laundry treatment machines (Performance)	G.C. Theron	-	Finale vergadering vir vroeg in 1974. Final meeting to be held during early 1974.
15/14/37	Tweepool en aardingpen proppe en sokkuitgange Two-pole and earthing pin plugs and socket outlets.	H. Barnard	-	
15/14/37/1	Kontakproppe en - sokke en koppelaars vir nywerheidsdoeleindes. Plugs, socket outlets and couplers for industrial purposes.	H. Barnard	-	
15/14/40	Elektriese roosters Electric toasters (Rev. of SABS SV 133/1950)	E.E. de Villiers.	-	Nou 'n deel van 'n Algemene Veiligheidsdokument wat deur die komitee voltooi is maar finaal deur die Buro goedgekeur moet word. Now part of a General Safety Document which has been completed by the Committee but is being finally processed by the Bureau.
15/14/41	Elektriese stryksters Electric irons (Rev. of SABS. SV 114/1950)	L.Dreyer	-	Soos bo. As Above.

S.A.B.S. VERW./REF. NO.	ONDERWERP/TITLE	VERTEENWOORDIGER REPRESENTATIVE	VERGADERINGS MEETINGS	VERSLAG/REPORT
15/14/43	Elektriese stowe en verwarmingsplate Electric stoves, hot plates and similar appliances (Rev. of SABS 153-1966)	W.F. Cronje	-	Geen vordering. No progress.
15/14/44/4	Verspreidingstransformatore Distribution transformers	I.F. Boyack	Een One	'n Verslag is deur S.A.B.S. voorsien oor toets resultate van 'n 100 kV transformator met 'n uitsettingsruimte van 14%. A report provided by SABS on test results of a 100 kV transformer with an expansion space of 14%.
15/14/44/5	Kompakte transformatorsustasies vir gebruik in openbare gebiede. Compact transformer substations for use in public areas.	E. de C. Pretorius	Twee Two	Finale Konsep sal vroeg in 1974 deur die Hoofkomitee oorweeg en aangeneem word. Final draft will be ready early in 1974 for submission and approval by the Head Committee.
15/14/53	Elektrotegniese benamings Electrotechnical nomenclature	J.K. von Ahlften	-	Geen vordering. No progress.
15/14/55	Grafiese simbole vir elektrotegniese diagramme. Graphical symbols for electrical diagrams	E. de C. Pretorius	-	Geen vordering. No progress.
15/14/56	(a) Muuruitlaatkassies en (b) Dekplate.	J.A. Loubser	(a) Een (b) Een	Konsep spesifikasie word gesirkuleer vir kommentaar. Konsep spesifikasie sal binnekort uitgestuur word. Een verdere vergadering sal nodig wees om projek te finaliseer.
15/14/56	SABS 518-1969 (a) Wall outlet boxes and (b) Cover plates	J.A. Loubser	(a) One (b) One	a) Draft specifications are being circulated for general comments. b) Draft specifications will be sent out soon for comments. One further meeting should be necessary to finalise.
15/14/60	Veiligheidsvereistes vir elektriese toebehore Safety requirements for electrical appliances.	G.C. Theron	-	Deurlopend. Continuous.
15/14/61	Elektriese yskaste en voedselvriesers. Electric refrigerators and food freezers	M.W. Odendaal	-	Konsep uit vir kommentaar. Out for comments.
15/14/64/1	Koördinerings van isolering (Hoogspanning) Insulation co-ordination (High Voltage)	I.F. Boyack E.H. Scholes J.K. von Ahlften E. de C. Pretorius	Een One	Kommentaar is bespreek. Tweede konsep sal binnekort uitgereik word waarin die veranderings waarop ooreengekom is, ingesluit sal word. Comments were discussed. Second draft will be issued shortly by SABS embodying agreed amendments.
15/14/64/1	Koördinerings van isolering (Laagspanning) Insulation co-ordination (Low Voltage)	J.C. Strauss	-	Geen vordering. No progress.
15/14/73/2	Bedringsroetering en - vloerlyste Wiring trunkings and skirtings	J.J. Boshoff	-	Laaste vergadering gehou op 3/6/1969. Laaste korrespondensie ontvang op 28/8/69. Last meeting held on 3/6/69. Last correspondence received on 28/8/69.
15/14/73/2	Geleistamme (koper en aluminium) Busbars (copper and aluminium)	C.R. Leaning	-	Geen vordering. No progress.

SABS VERW/REF NO.	ONDERWERP/TITLE	VERTEENWOORDIGER REPRESENTATIVE	VERGADERINGS MEETINGS	VERSLAG/REPORT
15/23/13/1	Skakelbordinstrumente Switchboard Instruments	G.R. Marloth	-	Geen vordering No progress.
15/24/4/5	Nie-metaal buigbare pype Non-metallic flexible conduit	J.J. Boshoff	-	Projek deur die Raad gekanselleer op 6/3/72. Project cancelled by the Council on 6th March 1972.
15/65/8	Kleur en senkleur televisie ontvangstoestelle Colour and monochrome television receivers.	J.A. Loubser	-	Afgehandel 1972 (Staatskoerant 3663 van 29/9/72.) Completed 1972 (Government Gazette 3663 of 29/9/72.)
19/3/3	Beskerming van geboue teen weerlig Protection of buildings against lightning.	J.A. Loubser	-	Wysiging goedgekeur deur S.A.B.S. op 15/11/72. Amendment approved on 15/11/72 by S.A.B.S.
19/9/5	Aansit van 3-fasige induksiemotors Starting of three-phase induction motors	P.J. Botes	-	Geen vordering. No progress.
19/9/6/1	Installering, bedrading en gebruik van elektriese toerusting in narkose en soortgelyke lokale.	C.A. Anderson	-	Deel 1 : Word tans vertaal. Deel 2 : Word tans vertaal. Deel 3 : Gefinaliseer en gepubliseer. Deel 4 : Die Omvang van die bestek geniet aandag.
19/9/6/1	Installation, wiring and use of electrical equipment in anaesthetizing and similar locations.	C.A. Anderson	-	Part 1 : Being translated at present. Part 2 : Being translated at present. Part 3 : Finalised and published. Part 4 : The extent of the scope is receiving attention.
19/9/6/2	Beheer van elektrostatiese gevare in narkose en soortgelyke lokale.	C.A. Anderson	-	Sien 19/9/6/1.
19/9/6/2	Administration of electrical danger in anaesthesia and similar local.			Refer 19/9/6/1
19/9/24	Hantering, installering en bediening van elektriese kables. Handling, installation and operation of electric cables.	A.H.L. Fortmann		Geen vordering. No progress.
19/9/27/1	Openbare beligting Public Lighting	A.F. Turnbull		Afgehandel. Completed.
19/9/82	Katodiese beskerming. Cathodic protection	P.J. Botes	Twee Two	Konsep aan Raad vir goedkeuring. Draft to Council for approval.
19/65/6	Koördinerende komitee vir geraas Co-ordinating committee on noise	W.F. Cronje		Geen vordering. No progress.
19/60/1	Isolators vir standaard deurvoeders. Insulators for standard bushings (Rev. and subdivision of SABS 834-1966)	C. Lombard	- -	Geen vordering. No progress.

**Mr. P.J. Botes (Roodepoort):** Mnr. die President, ek het nie veël van te voeg by die verslag nie, die verslag is daar. Ek kan net noem dat daar is 'n paar persone wat lateraan hulle kommentaar deur gestuur het, naamlik, die mense van Brakpan, hulle werk gewoonlik so hard dat hulle nie betyds hierdie goed kan deurmaat nie. Ek het die kommentaar, as iemand dit wil hê, dit is 'n hele paar, ek sal dit nie hier noem nie, dit sal net tyd vat. Maar as iemand wil weet wat die voorrede daar is, kan ek dit verskaf. Dan is daar net een baie belangrike aspek wat ek hier wil verskaf.

"The ballasts in fluorescent fittings: We have had requests from the S.A. Bureau of Standards to enforce the S.A.B.S. mark on ballasts in fluorescent fittings. This was deferred for I think six months because of certain problems and certain objections that we've had. But I think that it now is time that we do enforce it. I am not going to personally test each fitting, but I think when I come upon a fitting where the ballast does not bear the S.A.B.S. mark I'm going to force this chap to either get one with the B.S.S. mark or to give proof that it complies with the S.A.B. Standards. I think that we should all try and enforce this because it's our local manufacture.

Dan is daar net een ander probleem i.v.m. 'n projek 15/14/64(1) Standaard Koördinerende van Isolering Hoopspanning en Standaardspannings. Daar is verwarring, en ek dink die heer van Potchefstroom is altyd daar deurmekaar, hy weet nooit gewoonlik watter projek hy op dien nie. I can just say that this project in the beginning was called "The Insulation Co-ordination" under that number, but it was altered subsequently to a Code of Practice for Insulation Co-ordination, project No. 07915015 and the next one was a standard specification on Standard Voltages. I think that will clear that one up for Mr. Pretorius. Otherwise I've got no other comments to make."

**Mr. G.C. Theron (Vanderbijlpark):** I wonder if you'll permit me just to say something about the S.A.B.S. please? I'm referring now to a circular letter from the Secretaries of the A.M.E.U. dated April, 1974. It's in connection with the insulation of resistance of electric stoves. It deals with the wiring regulations of 1406 and 1407. Now I just want to read the last sentence here which is quoted from a letter from the S.A.B.S.

"Furthermore, S.A.B.S. 153 gives details of the drying out of stoves prior to the insulation resistance tests, that is switching 'on' all elements for one hour and then switching 'off' for half-hour and the responsibility for ensuring the correctness of the appliance and its insulation resistance lies with the manufacturer."

I've got no problems up to that point, but now the next one Mr. President: "It is not, therefore, necessary for the supplier's inspectors to test stoves after installation."

Mr. President, we've come across stoves, where wires were loose, touching the metal, and these had to be picked up by the installation inspectors.

Now, my point is this, as a matter of principle, if this is applicable to stoves, it's certainly also applicable to other materials and equipment carrying the S.A.B.S. mark, such as the wires, the conduit, switches, etc. Where are we going to draw the line? Who is going to take the responsibility for defective equipment installed? After all it may pass the test at the factory, but what happens in between?

**Mr. J.K. Von Ahlfen (Springs):** Mr. President, yes, this is one of the points Mr. Theron brought up that worries me, too. I've stressed this out with the Executive Council. I still don't know what is wiring work in terms of the Act. We talk about point of consumption, point of outlet. If somebody can tell me where the point of outlet is in terms of the Act, where the wiring works ends, I'm quite prepared to accept that I don't have to test a stove, a geyser or any appliance connected to the fixed wiring. That's something for the Act to resolve. But what I'm actually here for Mr. Chairman is another point, following from the report from Mr. Botes.

This SABS 15/14/21/1 - Core balance Earth Leakage Protection Units. Here I see is noted - no progress - but I quote from the Cape/Western Branch Minutes held on the 3rd June 73.

"Mr. Bester from Malmesbury, said that Mr. Middlecote of the S.A.B.S. had visited him and told him that the design of many of the earth leakage relays had been changed and that the quality should therefore improve. Mr. Radley said that he hoped that this would be so especially if earth leakage became compulsory." Now, Mr. President, where do we stand with earth leakage? We've got the polarised units, we've got the solid state units. Once this does become compulsory we know of the nuisance tripping we have with these earth leakage units. Could the Bureau possibly tell us what is the answer to our problems when this becomes compulsory.

**Mr. A.A. Middlecote (S.A.B.S.):** Mr. President, all I can say is that Malmesbury suffers from a difficulty of having lots of three-phase supplies to houses and welding sets and fluctuating neutrals, I wouldn't like to give an opinion but I don't think it is entirely a matter of earth leakage relays. I think it is the system, but I said nothing like what was said that I shall ask Mr. v.d. Walt to rather give the news with regard to earth leakage after I've spoken.

Mr. die President, baie dankie vir die geleentheid om 'n paar woorde te sê. Ons wil graag die hede van die Vereniging bedank vir die hulp wat hulle aan ons geege het, ons waarder dit baie. Nou en dan lyk dit 'n paar spesifikasies baie stadig vorder, maar ongelukkig ons het dieselfde tekort aan ingenieurs as julle, ons gaan net probeer in die toekoms om beter te doen.

In the first case, this stove, I think you can take this to a ridiculous extreme. I think what may have been missed in this whole, shall we say argument, is that the stove where it's connected permanently, must be connected for earthing. Now, if it's earthed it's safe, I mean if it's got a short circuit on it which develops the next day, its safe. I can't get more than the safe "touch voltage" taken internationally of 70 volts, even if the 'blummen' earth deteriorated to a 1 000 volts, the leakage currents that you deal with wouldn't even get anything near a dangerous touch voltage, so that if the inspectors inspected that the earthing is safe, right the installation is safe, now when we come to the apparatus itself, I don't mind, the more people I can have to help us, the better-off we are. My productivity will go up and yours will go down, because you will pay for the extra inspectors which I can't afford to pay for, but being serious, if we know anything about production there will always be a statistical now and then. Now, if there's a statistical now and then, on apparatus and the wiring is done correctly it will still be protected. All we've accepted in this country, we've argued about this right throughout, is that we've accepted earthing as protection and if the earthing is done properly the installation will be safe.

I think that you must just trust the Bureau, that it's doing its best to ensure that the percentage defectiveness is very low, and I can assure you, we're not at all ashamed here, our figures in this regard are no worse than most countries and in fact it's a darn sight better than most. We value your help, we don't even suggest that your inspectors don't look for, shall we say faults, they can write and say - Good Heavens, we've noticed the terminations on these stoves aren't as good as they should be, - fine, we'll put it right. But if there were several only be one body, we all know that if there's a lot of bodies arguing about details, you'll never get anywhere. You will also show down the productivities. I sincerely maintain that we've undertaken to give a good specification for a stove, the manufacturer has undertaken to make, and we can discipline him if he doesn't, a stove, or any other articles, the ballasts, will be quite safe, and will improve to perfection, we hope.

May I just add a few words to finish what I would like to have said with regard to the Bureau. The one is the world-wide plug socket, we've given you pictures of it. But just to make it quite clear, let me point out that the engineers such as you here present will have to decide on the future of this. We've got a basic world-wide plug, I understand that countries like Germany are planning to introduce it within five years, and most Continentals are going to work on the "non-switch" system. We've got to make these decisions, but I think the decision we'll make is to try and get it out I hope as soon as possible so that we change over very quickly and that we give, say a year's grace for new buildings, and then 10-15 years for the old buildings. If you look at the drawings that went out, you'll notice one nice advantage, and that is its small size, that will enable old installations to have increased numbers of socket outlets without as much expenditure as would be entailed with the old one.

Now during the year our activities internationally were quite good, we attended, thirteen people attended, I.E.C. meetings, of whom nine came from outside. Only four from the Bureau. We did very well.

We must thank the people; but, there are two lighter things I'd like to mention, that is, at the Annual General Meeting in Munich, the opening was quite incredible. It was opened in a music hall by an orchestra of 80 people, this is an amateur orchestra a hundred years old, but what we all liked to hear, it played before the President opened the meeting, was that 20% of these professional people who were amateur, and wonderful amateur musicians, were engineering or technical people. Now I'm not suggesting Mr. Chairman, that in future you have an orchestra of engineers from your rank, but I do suggest that some of you must be, in spite of the 25 mill-amp earth leakage, quite good conductors, and there are a lot of wind instruments here, and I'm sure Mr. Fletcher's 'mond-fluitjie' will help and finally, we all know Gordon Hain's outstanding organ.

**Mr. P.J. Botes (Roodepoort):** Mr. President, after hearing Mr. Von Ahlfen and Mr. Middlecote, I must say that in Roodepoort I will still test stoves. It is important, we have had quite a lot of difficulty in the past, without my knowledge some time ago, the inspectors had the practice of disconnecting the stove when there is low insulation, and passing the installation on the basis that the stove will be connected at a later stage, and then be passed again. But, it didn't come about that way, some people connected the stove themselves, with the result that some of the stoves were alive, some people received shocks. The first thing I heard about it was when one Councillor complained that I had sent an inspector down to a new house, it had been properly tested, but yet, they got a nasty shock, and consequently the testing of the electrical wiring is not so good, and a lot of criticism came about that way. Until such time Mr. President, that a stove is a plug-in appliance where you can visually see "plug-in and plug-out", I will test the stove. Then I just want to add, Mr. President, we all want to thank the Bureau for their hard work for their full co-operation we've had in the past year, I have noticed lately we have very few new projects, I'm very pleased about that, I think we'll rather stop all new projects, there was a lot of new projects in the previous year, but this year very few has come forward and I think it is better to concentrate on the ones we've had so far and complete those.

**Mr. Van der Walt (S.A.B.S.):** I would just like to point out some subtle features of this metrification revision of the specifications. There is two specifications I would particularly like to mention, its the one on the famous Earth Leakage one as well as the Circuit Breaker specification. Both these specifications came up from metrification as such, because there is certain small items in them that were not strictly S.I. system.

This in the case of the Circuit Breaker specification, this was done, the specification, although there's no progress report on it, it's at present under technical editing. The core balance earth leakage specification, we all know that S.A. has probably led in the field of earth leakage, but overseas countries are catching up now, and there's a very, very strong committee in the I.E.C. working on earth leakage

specifications, and they really started pushing out documents as we were busy in revising the specification. It might just be worthwhile to have a look at what they're doing for future reference, I think one of the decisions in the committee was already taken that instead of the 25 milli-amps to get moving to a system of 15/30, for "trip-non-trip" and the old concept, not the concept of E.L., but the various critical parameters of the earth leakage specification that might be changed, so we're trying to do the project as fast as possible, but also to try and save us some future work we keep a close look on the international scene.

**President:** I'd like to go on now to the report of the S.A.B.S. committee for the 'Revision of the Standard Wiring Regulations'. The report was put in by Mr. De Villiers.

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## S.A.B.S. COMMITTEE FOR THE REVISION OF THE STANDARD WIRING REGULATIONS

Since writing the previous report, which was tabled at the Convention in Pietermaritzburg in May 1973, your representatives, Messrs. D.C. Plowden, E.E. de Villiers, E. de C. Pretorius and B. Cumming, can report satisfactory progress.

The Working Groups 3 and 4 (established by the Main Committee at its meeting during November 1972) were very active and their respective activities can be summarised as follows:

**Working Group 3:** This Working Group, on which the A.M.E.U. is represented by Mr. E.E. de Villiers (Rustenburg), is responsible for the complete rewriting of the Regulations conforming as far as possible to international standards, commensurate with specialised local conditions and requirements. A number of documents issued by the secretariat of Technical Committee 64 (Electrical Installation of Buildings) of the International Electrical Commission were dealt with and comments prepared for submission to the annual meeting in Madrid, Spain, during September 1973. At this meeting international agreement was reached on a complete change in the compilation and form of wiring regulations which is much more logical than the approach that had hitherto been used. The South African National Committee (which is also in effect the S.A.B.S. Main Committee for the revision of the Wiring Regulations) is also represented on a sub-committee of T.C. 64 to edit the existing approved documents of T.C. 64 to conform to the new approach. It is anticipated that this work can be completed and tabled at the next meeting of T.C. 64 to be held during September 1974 in Bucharest, Rumania. Working Group 3 will, however, meanwhile also work on these lines in the rewriting of our own Standard Wiring Regulations.

**Working Group 4:** Mr. B. Cumming of Johannesburg is the A.M.E.U. representative on this Working Group. Due to the urgency of bringing the present Regulations up-to-date as soon as possible, since the complete rewriting of the Regulations by Working Group 3 will not be completed for a number of years, Working Group 4 is amending the present Regulations.

A completely new layout has been prepared and the objective is to introduce better continuity, eliminate anomalies, delete and change Regulations where deemed necessary, introduced new Regulations and apply some concepts of the I.E.C.

With this in view the Working Group's progress, as at the end of 1973, is:-

- A new section entitled "Fundamental principles, has been drafted.
- Sections 2,3,4 and 5 of the present Wiring Regulations have, with the exception of a few items, been redrafted.
- Sections 8 and 9 have been discussed and a final redraft is being typed.
- Proposals for Sections 11 and 12 have been submitted by members of the Working Group for discussion.
- Sections 6,7,10 and 13 have not yet been investigated.

The Main Committee considered the revisions tabled by W.G. 4 at a meeting held on 22 January 1974, and approved the publication of the three revised Sections. Some salient features of these amendments are:

- An acceptable and workable definition of "Bathroom" is formulated.
- Provision is made for compulsory earth leakage protection of all lighting and socket-outlet circuits of all new domestic installations (includes hotels and boarding houses; emergency lighting circuits are excluded) including instances where any rewiring or of addition to an existing domestic installation is carried out. It is also specifically provided that the Engineer may specify the installation of an earth leakage protection device in addition to the above in any installation (Regulation 226).
- For conduit wiring provision is made that conduit terminations in boxes may be made in other approved ways that the normal locknuts and bushes (Regulations 401).
- The wider use of circuit-breaker/socket-outlet combinations to ensure greater safety against overcurrent and fire hazards is provided for in amendments to Regulation 1203.
- Due to some oversight in the compilation of Table M1 - Types of Cable, a number of figures in column (9) on pages 13, 15 and 17 of Addendum No. 1 (1971) were erroneous and are now amended.
- Attention is also drawn to TABLE M13, Sizes of Fuse Elements, now amended to conform to a Renard Series.

The Main Committee has, inter alia, issued the following directives to its Working Groups:

- Further attention be given to the use of circuit-breaker/socket-outlet combinations especially as related to circuit design.
- The use of specially-designed socket-outlet circuits for lighting of fices, shops, display windows and the like to be investigated.
- To investigate the possible use of alternative wiring systems as are used extensively overseas, provided that safety is not impaired. Similarly the adoption of

## S.A.B.S. - KOMITEE VIR DIE HERSIENING VAN DIE STANDAARD-BEDRADINGSREGULASIES

sedert die opstel van die vorige verslag wat aan die Konvensie in Pietermaritzburg in Mei 1973 voorgeleë was, kan u verteenwoordigers, mnr. D.C. Plowden, E.E. de Villiers, E. de C. Pretorius en B. Cumming, bevredigende vordering rapporteer.

Werksgroep 3 en 4, (soos gestig deur die Hoof Komitee tydens sy vergadering in November 1972) was baie aktief en hulle onderseke werksaamhede kan soos volg opgesom word:

**Werksgroep 3:** Hierdie werksgroep, waarin die V.M.E.O. verteenwoordig word deur mnr. E.E. de Villiers (Rustenburg), is verantwoordelik vir die volledige omskryf van die Regulasies in ooreenstemming met internasionale standaarde met inagneming van spesiale plaaslike toestande en vereistes. 'n Paar dokumente uitgereik deur die sekretariaat van Tegnieke Komitee 64 (Elektriese Installasies van Geboue) van die Internasionale Elektriese Kommissie was bestudeer en kommentaar is opgestel vir voorlegging by die jaarlike vergadering in Madrid, Spanje, gedurende September 1973. Gedurende hierdie vergadering is internasionale ooreenstemming bereik ten opsigte van 'n algehele verandering in die opstelling en vorm van die bedradingsregulasies om dit in 'n meer logiese vorm te kry as tans. Die Suid-Afrikaanse Nasionale Komitee (wat in werklikheid die S.A.B.S. Hoof Komitee is vir die hersiening van die Bedradingsregulasies) is ook verteenwoordig op 'n sub-komitee van T.K. 64 na te sien om te verseker dat dit in ooreenstemming is met die nuwe benadering. Dit word verag dat hierdie werk voltooi en getabelleer sal wees ten tyde van die volgende vergadering van T.K. 64 wat gehou sal word in September 1974 te Bucharest, Roemenië. Werksgroep 3 sal intussen ook in hierdie rigting werk met die omskryf van ons eie Bedradingsregulasies.

**Werksgroep 4:** Mnr. B. Cumming van Johannesburg is die V.M.E.O. verteenwoordiger op hierdie Werksgroep. Omrede die dringende aard daarvan om die huidige Regulasies so gou as moontlik op datum te bring, aangesien die algehele omskryf van die Regulasies deur Werksgroep 3 nog 'n aantal jare sal neem om te voltooi, is Werksgroep 4 besig om die huidige Regulasies te wysig. 'n Algehele nuwe skema word gevolg en die doel is om beter samehang te verkry, om onreëlmatighede uit te skakel, om Regulasies te skrap of te verander waar dit nodig blyk mag wees, om nuwe Regulasies in te voeg en om sekere begrippe van die I.E.K. toe te pas.

Met die doel voor oë, was die Werksgroep se vordering tot aan die einde van 1973 as volg:-

- 'n Nuwe Afdeling, genoem "Basiese Beginsels" is geskets.
  - Afdelings 2,3,4 en 5 van die bestaande Bedradingsregulasies is, met die uitsondering van 'n paar items, nuut opgestel.
  - Afdelings 8 en 9 is bespreek en 'n finale nuwe opstelling word nou getik.
  - Voorstelle vir Afdelings 11 en 12 is deur lede van die Werksgroep ingehandig, vir bespreking.
  - Afdelings 6,7,10 en 13 is tot nog toe nie ondersoek nie.
- Die Hoof Komitee** het die wysigings, soos getabelleer deur W.G. 4 op 'n vergadering gehou op 22 Januarie 1974, oorweeg en publikasie van die drie hersiene afdelings goedgekeur. Sommige van die uitstaande kenmerke van hierdie wysigings is die volgende:
- 'n Aanvaarbare definisie van "badkamer" is opgestel.
  - Voorsiening is gemaak vir verpligte aardlek-beveiliging op alle lig-en kontak-stroombane vir alle nuwe huishoudelike installasies (insluitende hotelle en losieshuise; noodlig-stroombane word uitgesluit) insluitende gevalle waar herbedrading gedoen word of toevoegings gemaak word tot 'n bestaande installasie. Daar word ook spesifiek voorsiening gemaak dat die Ingenieur enige aardlek-beveiliging mag spesifiseer bykomend tot bogenoemde (Regulasie 226).
  - Voorsiening word gemaak vir leiplyfphagting in kassies in ander goedgekeurde maniere as die normale sluitmoere en busse in leiplyfbedrading (Regulasie 401).
  - 'n Meer omvattende gebruik van stroombreker/kontaksook kombinasies om groter veiligheid teen oorstroming en brandgevaar te verseker is voorsiening voor gemaak in wysigings aan Regulasie 1203.
  - Met die opstel van Tabel M1-Tipes Kabel, is 'n fout begaan met sommige syfers in kolom (9) op bladsye 13, 15 en 17 van Byvoegsel nr. 1 (1971) en dit is nou reggestel.
  - Aandag word gevestig op Tabel M13 Sekering groottes, wat nou rekwisit is in ooreenstemming met 'n Renard Reeks.

Die Hoof Komitee het, onder andere, die volgende aanbeveling by sy Werksgroepe:

- Verdere aandag moet gegee word aan die gebruik van stroombreker/kontak sok kombinasies met verwysing na stroombaan ontwerp.
- Die gebruik van spesiaal ontwerpte kontaksookstroombane vir die verligting van kantore, winkels, vertoonvensters ens. moet ondersoek word.
- Ondersoek die moontlike gebruik van alternatiewe bedradingsstelsels soos gebruik orsee, mits veiligheid nie benadeel word nie. Ook die ondersoek van

- (a) Alternative rewirable system, and  
 (b) alternative non-rewirable systems to be considered.
4. Continue revision (editing) of Sections 4 to 14 of the Regulations (including tables and appendix).

**E.E. DE VILLIERS**  
**REPRESENTATIVE.**



**MNR. E.E. DE VILLIERS Pr. Ing. B.Sc. (Ing.)**  
 Elektrotegniese en Meganiese Stadsingenieur Rustenburg.

**Mr. E.E. de Villiers** (Rustenburg) Mr. President, as soon as the report you have in front of you was written, certain things have materialised, as you will probably know, but these amendments mentioned there, that were a product of the editing by the Working Group 4, have been published, and I believe circulated to everybody now. I shall just mention again the most valued point there is, the Automatic Earth leakage, which will then become compulsory by October this year. Various other little things that are very important. I may mention that you have there a new definition for bath and bathroom which I think took that committee at least a couple of full days to decide on.

I think that is a very comprehensive and one we've been looking forward to for a long time.

Mr. President, regarding the work of Working Group 3 of this main committee, I can mention that a number of meetings have been held to comment on documents from T.C. 64 of the R.U.C. in preparation for the next meeting in Bucharest. This work is continuing and we hope that we will also get quite an interesting matter from that meeting of delegates from the S.A.B.S. and other people attending.

I'd like to perhaps at this stage give an indication of this new format that the I.E.C. is going in for now, that I also mentioned in my report, which might be very interesting at this stage. They have now decided, the I.E.C., and I believe that when we get our new regulations in time to come, they will possibly be in the same format. It is divided at this stage into six parts - I can just mention these, and amend them also with a different sub-paragraph to them.

The first one is: 'The scope object and fundamental principles;' and the next covers all the 'definitions'

The third gives you the general characteristics of the installations. In that part they cover the maximum demand, the types of systems, supplies, distribution, then external influences, compatibility and maintainability. Part four will cover 'protection for safety' which is again divided into quite a number of sub-paragraphs, which I won't mention now.

The fifth part is 'selection and erection' of equipment, and then the sixth part covers 'the inspection and tests'.

I think that is a very logical approach, and I believe that once we have that it will be very much easier to work with our wiring regulations.

**Mr. D.F. Kneale** (E.C.A.): It's going to be very interesting to record the number of times these earth leakage units trip out due to nuisance tripping, and I was wondering whether the Bureau would consider the incorporation of a device which would indicate where the shunt-trip circuit breaker has actually come out under overload conditions, or whether it has actually tripped due to earth leakage conditions. It seems to me that our Association's members are going to now

- (a) alternatiewe herbedradingsstelsels en  
 (b) alternatiewe nie-herbedradingsstelsels wat oorweg kan word.
4. Die hersiening van Afdelings 4-14 van die Regulasies (insluitende tabelle en aanhangsels) moet voortgesit word.

**E.E. DE VILLIERS**  
**VERTEENWOORDIGER.**

have to ask the Wiremen's Registration Board to give us what they call, a Switching hand, to run around and switch on all the earth leakage units that are tripping.

The other point I'd like to bring to the notice of the meeting is that the construction of distribution boards are going to be rather large in size now to incorporate the earth leakage units that one will have to install in, lets say a hotel installation. I'd like to ask the Bureau how one would overcome this problem?

**Mr. J.R.N. Mackay** (Prov. Adm. Cape Good Hope): Two questions Mr. President. One is that in the Wiring Regulations it states that these units should be tested before supply is connected, I think this should be gone into because I haven't found myself a method of testing the earth leakage relays under correct operation without putting the power on. There seems to be a bit of anomaly here.

The other point that Mr. Kneale raised - we recently in one of our laboratories in the Cape had 42 socket outlets in a very small space, perhaps a tenth of the size of this room, and we had a maximum of I think possibly 3 to 4 on each circuit, the idea being that investigations going on should not be affected by other investigations and equipment which might trip. We ended up with I think 14 or 15 earth leakage units, we had to build a special board to put them in, but really there was no real problem except a spacial one, but basically it is a principle which we adopted that people were working with wet hands and with wet equipment, in an area which was susceptible to electrical shock hazard and we put them in regardless of problems and, I think that this is really the attitude which has to be adopted. If you're going to go for earth leakage protection then there will be problems, but once people are used to working with them and installing them these problems will fall away or will be overcome as we're all quite used to doing.

**Mr. M.J.W. Chappell** (Port Elizabeth): Mr. President, I feel that the making of earth leakage circuit breakers mandatory is premature. My own attitude here is that it should be a matter of choice of the consumer. We must I think remember very clearly that the consumer has responsibility that the engineer's responsibility ceases at the point where the power is supplied, and that it should be left to the consumer, my opinion, to choose whether he puts earth leakage circuit breakers in or not, I feel that the time will come when we'll find a lot of circuit breakers are put in and are either shorted out or done something of that sort so that normally the things are there but they are not actually in use. That may even lead to further danger where people assume they are under our protection when they are not necessarily so.

**President:** The next two reports I have here were submitted by Mr. Von Ahlfen. Firstly, the annual report of the C.S.I.R. Advisory Committee for Electrical Engineering, and secondly Electrical Wiremen's Registration Board.



# ANNUAL REPORT ON THE C.S.I.R. ADVISORY COMMITTEE FOR ELECTRICAL ENGINEERING

This Committee under the Chairmanship of the Vice-President of the C.S.I.R. meets once a year in October/November when the work of the National Electrical Engineering Research Institute is reviewed and the proposed research programme for the following year is discussed.

In the morning the Committee was informed by means of lectures and practical demonstrations of the more important research projects in progress. The formal afternoon session dealt with the annual report of the Director and the proposed research programme. This being the first meeting attended by your representative (absence last year due to attendance of the I.E.C. meeting in Athens) he was very impressed with the work being undertaken by the C.S.I.R. in this respect.

Particularly impressive was the work being done in the Power Electrical Engineering Division under the leadership of Dr. R.B. Anderson with the research on lightning and the development of stroke measuring equipment. It was agreed that this survey be extended to other parts of the R.S.A. and a sub-committee consisting of the ESCOM and A.M.E.U. representatives together with the C.S.I.R. was appointed to investigate this aspect. Your representative assured the Committee that the A.M.E.U. would give every assistance it could in this respect as this was of importance to all electricity supply undertakings.

Regarding the work being done on earth resistance problems the Committee recommended that this be extended to cover not only resistance problems but to earthing systems as such in view of the many serious problems being experienced in this respect regarding the protection of various types of sophisticated electrical apparatus.

The development of conductor break sensing equipment on 11 kV lines has apparently reached a deadlock pending a possible breakthrough which has not been achieved. It was therefore decided to delete this project from the research programme but to keep in touch with possible developments elsewhere in the world.

The importance of a study of the mechanism of insulation failure with particular reference to the development of new insulating material was stressed especially in view of the increased use of such materials. This is also closely coupled with the research being done on surge voltages and corona on transmission and distribution lines.

The Director reported upon the suggestion by Mr Theron at the meeting last year that the Institute consider a research project on the telemetering of meter readings. This is being investigated in the U.S.A. but at this stage this was not considered an economic proposition with present techniques in the field of semi-conductors and applied electronics. It was clear that a local research programme could not make any further contributions at this stage.

Regarding the research being done in the field of semi-conductor technique and in view of the world energy crisis, especially as far as natural fuel was concerned, the importance of research into the latest developments of control systems and power sources for electrically driven vehicles was stressed. This would appear to have become of prime importance to the R.S.A. in view of the present world situation and political influence on natural fuel resources and the ready availability of electric energy in the R.S.A. with its large coal reserves.

It became clear once again that as in all other organisations relying on highly trained personnel that a heavy burden is placed on the available staff and the Director is to be congratulated on the excellent work being done by the Institute despite the shortage of staff being experienced.



MNR. J.K. VON AHLFTEN  
Elektriese en Meganiese Stadsingenieur Springs.

# JAARVERSLAG VAN DIE W.N.N.R. SE ADVIESKOMITEE VIR ELEKTRIESE INGENIEURSWESE

Hierdie Komitee onder Voorsitterskap van die Vice-President van die W.N.N.R. vergader een keer per jaar gedurende Oktober/November by welke geleentheid die werk van die Nasionale Navorsingsinstituut vir Elektriese Ingenieurswese in oënskou geneem word en die voorgestelde navorsingsprogram vir die volgende jaar bespreek word.

Gedurende die oggend is die Komitee by wyse van lesings en praktiese demonstrasies met navorsingsprojekte wat aan die gang is bekend gestel. Die formele namiddag sitting het gehandel oor die jaarverslag van die Direkteur en die voorgestelde navorsingsprogram. Dit was die eerste vergadering wat u verteenwoordiger kon bywoon (afwesigheid verlede jaar as gevolg van bywoning van die I.E.K. vergadering in Athene) en was hy besonder beïndruk met die werk wat deur die W.N.N.R. in dié verband gedoen het.

Besonder indrukwekkend was die werk wat deur die Elektriese Kragingenieurswese afdeling onder leiding van Dr. R.B. Anderson onderneem word met meerlik navorsing en die ontwikkeling van straalmetersapparaat.

Daar is besluit dat weerliknavorsing uitgebrei word na ander dele van die R.S.A. en 'n onderkomitee bestaande uit verteenwoordigers van EVKOM en die V.M.E.O. saam met die W.N.N.R. is benoem om die aangeleentheid te ondersoek. U verteenwoordiger het die Komitee die versekering gegee dat die V.M.E.O. alle moontlike bystand in die verband sal verleen aangesien dit van belang is vir alle elektrisiteits-ondernemings.

Betreffende die werk wat met aardweerstandprobleme onderneem word het die Komitee aanbeveel dat die projek uitgebrei word om aardingsstelsels as 'n geheel te bevat want die baie ernstige probleme wat ondervind word met die beveiliging van alle soorte gesofistikeerde elektriese apparaat.

Die ontwikkeling van 'n geleieronderbrekingsderuksie apparaat vir 11 kV leidings het blykbaar 'n dooie punt bereik afhangende 'n moontlike deurbrak wat nie verweselik kon word nie. Daar is derhalwe besluit dat die projek van die navorsingsprogram geskraap word maar dat voeling behou word met moontlike verdere ontwikkelings elders in die wêreld.

Van belang is die studie van die manganisisme van isolasiewigting met besondere aandag aan die ontwikkeling van die verwaardiging van isolasietowwe vermaanklik met die toenemende gebruik van sulke towwe. Hierdie studie hou ook nou verband met die navorsing van stuspanning en korona op transmissie en distribusie lyne en die belangrikheid van die navorsing is beklemtoon.

Die Direkteur het verslag gedoen oor mnr. Theron se versoek verlede jaar dat 'n navorsingsprojek oorweg word vir die telemetering van meterlesings. Dit word tans in die V.S.A. ondersoek maar op hierdie tydstop word dit nie as ekonomies geregtig beskou nie met die teenwoordige vordering op die gebied van half-geleiers en toegepaste elektronika nie. Dit was dus duidelik dat 'n plaaslike navorsingsprojek geen verdere hydrae op hierdie tydstop sou kon lewer nie.

Betreffende navorsing op die gebied van half-geleier tegnieke en as gevolg van die wêreld energie krisis, vermaanklik wat natuurlike brandstof betref, is die belangrikheid van navorsing in verband met ontwikkeling in beheerstelsels en kragbronne vir battery-aangedrewe voertuie beklemtoon. Hierdie saak is blykbaar van besondere belang vir die R.S.A. as gevolg van die huidige wêreld situasie en politiese invloede op natuurlike brandstof ontginning in die eredelike beskikbaarheid van elektriese energie in die R.S.A. met sy groot steenkool reserves.

Dit het weereens duidelik geword, soos met alle organisasies wat afhanklik is van hoogs-opeleide en gespesialiseerde personeel, dat 'n swaar las op die skouers van die beskikbare personeel geplaas is en die Direkteur moet geluk-gewens word die uitstekende werk wat geleer is ten spyte van die tekort aan personeel wat ondervind is.

U sal oplet dat deurjans in die verslag die woord „elektries” om nie „elektrotegnies” gebruik word. Die woord „elektries” is amptelik deur die W.N.N.R. aanvaar en ter verduideliking is gemeld dat alhoewel beide vorms aanvaarbaar is word „elektries” deur die W.N.N.R. verkies want die korter skryfwyse en om vertaling na „electrotechnical” te voorkom.

J.K. VON AHLFTEN.  
VERTEENWOORDIGER.

## ELECTRICAL WIREMEN'S REGISTRATION BOARD

The Board was constituted as follows for 1973:

Chairman: Mr. J.G. Wannenburg.

Members: Messrs. D.F. Kneale, G.R. Venter, A.H.M. Drysdale, J.K. von Ahlfen.

In an advisory capacity, Mr. Hare of the Central Organisation for Trade Testing, Olifantsfontein, attended all the meetings of the Board. It is with regret that the passing away in 1973 of Mr. F. Leemans, a member of the Board for many years, had to be reported.

## MEETINGS OF THE BOARD AND APPLICATION FOR REGISTRATION

The Electrical Wiremen's Registration Board held 11 meetings during 1973 and considered applications for registration in respect of 1234 persons. Of these applicants 1214 were accepted for the prescribed examinations or were exempted therefrom in part or in full and 20 applications were refused. The Board also granted provisional registration certificates or approved the renewal of such certificates in respect of 1944 applicants.

## EXAMINATIONS:

Three written examinations were held at 41 examination centres and 1877 candidates were entered. The results were as follows:-

## Part 1: (On the Standard Regulations for the Wiring of Premises)

Failed 568  
Passed 355

## Part 2: (On Electrical Theory)

Failed 317  
Passed 89  
Absentees 608  
1 877

A number of candidates who, for various reasons, were unable to undergo or pass the written examinations were allowed to undergo oral examinations.

During the year under review 271 practical examinations were held in the ten principal centres. Test arrangements were made in respect of 3008 candidates of which 532 passed, while 637 were absent.

Of the 1839 who failed, a number of candidates passed in certain tasks of the tests and they were granted exemption from these in subsequent tests. The pass mark for each test is 60%.

The above-mentioned totals of 1877 and 3008 include candidates who had failed in previous years.

## REGISTRATION CERTIFICATES:

Particulars of registration certificates issued since the Act came into operation are reflected hereunder:-

## REGISTRASIERAAD VIR ELEKTROTEGNIESE DRAADWERKERS.

Die Raad vir 1973 was soos volg saamgestel:

Voorsitter: mnr. J.G. Wannenburg.

Lede: Meneer D.F. Kneale, G.R. Venter, A.H.M. Drysdale, J.K. von Ahlfen.

Mnr. Hare van die Sentrale Organisasie vir Ambagstoets, Olifantsfontein, het die vergaderings van die Raad in 'n raadgewende hoedanigheid bygewoon. Dit is met leedwee dat die afsterwe van mnr. Leemans, jaarlange lid van die Registrasieraad, gemeld moet word.

## VERGADERINGS VAN DIE RAAD EN AANSOEKE VIR REGISTRASIE

Die Registrasieraad vir Elektrotegniese Draadwerkers het gedurende 1973 11 vergaderings gehou en oorweging verleen aan 1234 nuwe aansoeke vir registrasie. Hiervan is 1214 of tot die eksamens toegelaat of geheel of gedeeltelik daarvan vrygestel en 20 aansoeke is geweier. Die Raad het ook voorlopige registrasiesertifikate of die hernuwing van sulke sertifikate ten opsigte van 1944 applikante toegestaan.

## EKSAMENS:

Drie geskrewe eksamens is by 41 eksamensentra gehou. 1877 kandidate was daarvoor ingeskrif. Die uitval was as volg:-

## Deel 1: (Bedradingsregulasies)

Druip 568  
Slaag 355

## Deel 2: (Elektriese Teorie)

Druip 317  
Slaag 89  
Afwesig 608  
1 877

'n Aantal kandidate wat om verskillende redes nie skriftelike eksamens kon afle of slaag nie, is toegelaat om mondelings eksamens te ondergaan.

Gedurende die verslagjaar is 271 praktiese eksamens in die tien vernameste sentra gehou. Toetseerelings is ten opsigte van 3008 kandidate getref van wie 532 geslaag het en 637 was afwesig. Van die 1839 wat gedruip het, het 'n hele aantal in sommige van die take geslaag en is vrystelling van latere toetse toegestaan. Die slaagmerk vir elke toets is 60%. Bogenoemde totale van 1877 en 3008 sluit kandidate in wat in die vorige jaar gedruip het.

## REGISTRASIE-SERTIFIKATE:

Besonderhede van registrasie-sertifikate wat sedert die inwerking-treding van die Wet uitgereik is word hieronder weer gegee:-

YEAR	TO APPLICANTS EXEMPTED FROM THE EXAMINATIONS	TO APPLICANTS WHO PASSED THE EXAMINATIONS DURING 1973	TOTAL JAAR		AAN APPLIKANTE WAT VAN DIE EKSAMENS VRY GESTEL IS.		AAN APPLIKANTE WAT GEDURENDE 1973 OF IN DIE EKSAMENS GESLAAG HET		TOTAAL
			1972	1973	1972	1973	1972	1973	
1940/67	2 651	7 155	9 806	1940/67	2 651	7 155	9 806		
1968	50	169	219	1968	50	169	219		
1969	74	293	367	1969	74	293	367		
1970	89	371	460	1970	89	371	460		
1971	133	460	593	1971	133	460	593		
1972	94	546	640	1972	94	546	640		
1973	55	549	604	1973	55	549	604		
	3 146	9 543	12 689		3 146	9 543	12 689		

Particulars of the numbers of provisional registration certificates issued over the last six years (excluding renewals thereof) are as follows:-

Besonderhede van die aantal voorlopige registrasie-sertifikate wat gedurende die afgelope 6 jaar uitgereik is, (hernuwings uitgesluit) is soos volg:-

YEAR	NUMBER
1967	371
1968	386
1969	465
1970	702
1971	1 027
1972	1 288
1973	810

JAAR	NOMMER
1967	371
1968	386
1969	465
1970	702
1971	1 027
1972	1 288
1973	810

#### PROPOSED AMENDMENTS TO THE ACT:

The proposed revision of the Act is still under consideration and it is now anticipated that all the proposals received will be finalised and submitted to Parliament during 1975.

#### GENERAL:

It will be noted that the number of provisional registration certificates issued has increased substantially during 1971 and 1972 which was due to the temporary concession of the Board to exempt artisans with long experience, from the written examinations and to require them to only pass the practical test to qualify for full registration.

In conclusion I wish to thank the Board for the information provided in this report and for permission to submit it to the Technical Meeting.

#### J.K. VON AHLFTEN REPRESENTATIVE

**Mr. J.K. von Ahlften (Springs):** Mr. President coming to the Wiremen's Registration Board. Just a few points I would like to mention. First is the examination results. You will see that they are very disappointing. This also bears out what Mr. Hare said yesterday. Where the problem lies I don't know, on the written examinations the pass marks were very low, on the practical examinations they were much lower. Possibly the standard of training isn't correct, but that I can't comment on.

The other point I would like mention on the report Mr. President is the proposed amendments to the Act. As you know, that our association was approached in 1971 to put forward amendments to the Act. So far these things have been floating backwards and forwards, I think with the Dept. of Labour, I would very much like to call on Mr. Wannenburg to say something on that point.

Coming to the report of the C.S.I.R. There are a few interesting points coming out here. The first one is the work being done by Dr. Anderson on "Research on Lightning," especially where they've got this lightning flash counter, which he'd very much like to have installed over various points in the Republic, and I think we as an Association of Electricity Undertakings should give this our full support. But I'm sure Mr. Anderson will advise us more on what's got to be done here.

The other interesting points that transpired from discussions this morning on tele-metering on meter readings, you will see on page 2 of the report that Mr. Theron, when he was on this advisory committee did request the institute to go into this matter, and what's been said here by the C.S.I.R. is exactly what's been said by Mr. Baumann this morning. I believe that Mr. Lombard made a remark yesterday afternoon that he read somewhere some device was available for tele-metering, I don't know whether that type of device this is. Apart from that Mr. President I got nothing further to add to the report except to compliment the C.S.I.R. on the excellent work they've been doing in the research and on this committee for electrical engineering.

**Mr. J.G. Wannenburg (Dept. of Labour):** Mr. President, as far as the amendment of the Act is concerned it's very true what Mr. von Ahlften had said. That this Act has been floating backwards and forwards, it doesn't know whether its coming or going eventually. Its been through so many hands, I started off on it and then it was taken away from and was set to one, two, three, four, five, six different persons, eventually landed up in Cape Town to be done there and to be got ready for the Parliamentary Session, and it came back with nothing being done because there was other legislation which was more important. At the present moment there are quite a few sections of the Act which have more quills to it than a normal porcupine should have, and we are trying to thrash that out, amongst others is the interpretation of Section 11, that is for limited scope certificates, and also Section 13, and I suppose quite a lot of you people already know about this move of which is going ahead for getting people or persons who are lesser qualified than what is normally the case to do conduit work, and that particularly one is being worked on at the moment, that has also got a queer twist in it which we'll have to straighten out and try and do it administratively within the bounds of law, rather than change the Act, but for the present it looks as if by September 1975, it will be ready for the session in 1976.

**Mr. H. Barnard (Brakpan):** Mnr. die President ek het net twee opmerkings te maak. Die eerste een is - dit is kommerwekkend om te sien

#### VOORGESTELDE WYSIGINGS AAN DIE WET:

Die hersiening van die Wet is nog onder oorweging en dit word verwag dat die saak nou gedurende die Parlement-sitting van 1975 finaliseer sal word.

#### ALGEMEEN:

Daar sal opgelet word dat die aantal voorlopige registrasiesertifikate wat uitgereik is geweldig toegenem gedurende 1971 en 1972 wat te wyte is aan die tydelike toegewings van die Raad om ambagsmanne met jarelange ondervinding vir te stel van die geskrewe eksamens en slegs te vereis dat hulle die praktiese toetse moet slaag om te kwalifiseer vir volle registrasie.

Ten slotte wil ek graag die Raad bedank vir die inligting wat in hierdie verslag vervat is, sowel as vir die nodige toestemming om dit aan die Tegnieke Vergadering voor te lê.

#### J.K. VON AHLFTEN VERTEENWOORDIGER

die aantal persone wat die eksamen geskryf het en die klein persentasie van hulle wat geslaag het. Nou wonder ek net of Mnr. Hare van C.O.T.'s vir ons kan sê: Word die persone wat toegelaat word om eksamen te skryf darem gekeur of is dit "free for all", enigiemand wat dink hy wil die eksamen gaan skryf, word hy toegelaat om te gaan skryf, sonder dat hy vooraf 'n kursus geloop het of 'n ordentlike opleiding gekry het?

Dan daardie ander verslag wat mnr. von Ahlften nou-nou bespreek het in verband met die Advieskomitee vir die Elektriese Ingenieurswese die W.N.N.R.'s, wil ek net vra, so ses paragrawe van bo af, daar is besluit dat weerling-navorsing uitgebrei word na dele van die R.S.A. en 'n onderkomitee bestaande uit verteenwoordigers van EVKOM en die V.M.E.O. saam met die W.N.N.R. is benoem om die aangeleentheid te ondersoek. Ek sou graag net wil weet wie is die lede van die V.M.E.O. wat daarop dien, en dan het hulle ook eens op 'n tyd gesê dat 'n elektriese apparaat, dit is die laaste paragraaf daar, sal aan verskillende munisipaliteite beskikbaar gestel word. Is daar al enige lede van hierdie vergadering wat al van daardie apparate ontvang het en in werking het, want ek het nog niks daarvan op die Oos-Rand gehoor of gesien nie.

**Mnr. J.G. Wannenburg (Departement van Arbeid):** Mnr. Die President vir sover as wat keuring van kandidate vir die eksamen betref, kan ek maar net sê vir lede van die Raad is hier teenwoordig vandag, dit is mnr. von Ahlften, mnr. Kneale, mnr. Hare en eerself. U kan maar vir enige van die vier gaan vra, afsonderlik, want-nee ons nie bemekeer is nie, hoe streng ons is met keuring.

Dit is nie elke Jan Reno en sy maat wat toegelaat word tot hierdie eksamen nie. Maar ongelukkig is daar sekere dinge wat in die Wet omskryf is, en dit is as 'n persoon klaar sy vakleeringskap deursoort het, dan moet ons hom aanneem vir 'n eksamen anders sit daardie mannetjie op die veld en hy mag niks doen nie en hy mag nie werk nie, en ons wat sy brood uit sy mond uit. So wat die toedrag van sake bedendags is, as hy sy vakleeringskap klaar gedoen het dan kan hy of vir 'n jaarlang 'n verbeterleerling wees of hy kan dadelik ingaan vir sy eksamen. Nou as die persoon gedurende sy vakleeringsyd sy praktiese eksamen, verskou tot nie prakties nie, sy teoretiese eksamen afskryf, met ander woorde as hy die eksamen afgeskryf het op die Wet of op die teorie, dan kry hy vrystelling van Deel A, en dan is dit vir hom net nodig om Deel B te doen, maar nou ongelukkig vind ons dat daardie persone kom baie keer deur, hulle het die teoretiese gedeelte gedoen, maar dan vind ons dat daardie persoon totaal en al onbevoeg is om die praktiese gedeelte te doen, en hy sukkel verskriklik om dit te doen. Nou is die moeilikheid, waar is die moeilikheid? Hoekom kom daardie manne nie die eksamen doen nie, dit dui, wat dit my betref, en wat dit die res van die Raad betref, dui dit vir ons dat daar swak opleiding geskied, en wat mnr. Rautenbach hier gister van gepraat het, daardie spesiale opleiding wat gegee word, ons kan sommer dadelik sien as 'n persoon daar was, ons kan sommer sien dat sy punte is besig om op te gaan.

Ek wil dit regtig baie sterk aanbeveel dat daar in ander sentra, ons het dit op die oomblik net in Johannesburg, ons het dit in Pretoria, maar ek sal vreeslik graag wil sien dat dieselfde gedoen word in die groter sentrums soos in Kaapstad, Oos-Londen, Port Elizabeth en Durban, en miskien ook in Bloemfontein, want die resultate wat ons daar gekry het was regtig verstommend gewees.

**Mr. J.K. von Ahlften** (Springs): I'd like to request Mr. President to give Dr. Anderson and Mr. van Wyk a chance after lunch to say something on this report.

Om terug te kom na mnr. Barnard se vraag, as hy hierdie verslag weer sou lees dan sal hy sien dat hierdie komitee wat uit verteenwoordigers van Evkom en die V.M.E.U. bestaan, ek daar se - u verteenwoordiger het die komitee die versekering gegee dat ons die bystand sal gee, met ander woorde, ek is die verteenwoordiger op daardie komitee.

**Mr. C. Lombard** (Germiston): We have a problem in our area Mr. President, namely, Electrical Contractors when they apply for their

contractors' licences, generally at the beginning of the year, make sure that they occupy suitable and acceptable premises. Some of them, a few months afterwards, vacate these premises and operate from their homes. This is causing quite a lot of dissatisfaction.

I assume that the intention of the Electrical Contractors' and Wiremen's Act is that, a licenced contractor should occupy suitable premises during the full period of validity of the current licence. But there seems to be no provision made for the cancellation of a contractor's licence if he ceases to occupy suitable premises.

**Verdaging vir middagete 12.30 tot 2.00 nm. - Adjournment for lunch 12.30 to 2.00 pm.**

## SENSITIVE EARTH FAULT PROTECTION ON HIGH VOLTAGE OVERHEAD TRANSMISSION LINES.

By:-  
**V. Cohen B.Sc (Elec. Eng.) (RAND).**

*Viv Cohen graduated from the University of the Witwatersrand with a B.Sc. degree in Electrical Engineering in 1956, taking up an appointment with F.W.J. Electrical Industries (Pty.) Ltd., in 1959. He was a member of the team involved in the design and development of the very first earth leakage protection devices.*

*In his present position as Chief Designer of Fuchs Electrical Industries (Pty.) Ltd. Viv Cohen leads the team of Product Engineers involved in the design of Rectifier Equipment, Distribution Transformers, Instruments Transformers etc.*

*Viv Cohen frequently visits the United States, the United Kingdom and Europe and keeps ahead of the latest developments.*

### SUMMARY:

In recent times, the incidence of undetected earth faults on High voltage overhead transmission lines up to 22 KV has encouraged the Electricity Supply Commission to investigate the possibilities of introducing improvements to the long accepted and traditional means of earth fault detection.

The development of a new high sensitivity earth fault relay has made these improvements possible and protection can now be obtained under conditions where earth fault detection had previously been difficult or in some cases even impossible to achieve.

### 1. INTRODUCTORY.

#### 1.1 SCOPE:

Protection of earthed neutral transmission systems is important because the majority of faults involve earth or ground.

Protective devices specifically designed and applied to operate on earth faults, work from residual or earth currents and voltages which are not present during normal balanced operation of three phase systems.

Such faults are therefore independent of load, and earth fault protection relays can be manufactured and set more sensitive than phase relays.

There exists numerous sophisticated directional and limited zone protection relays for detection of earth faults on overhead transmission lines.

It is not the intention to discuss the application of these specialised relays in this paper.

#### 1.2 THE PROBLEM:

In the majority of developed areas of the world there has been little need for any improvement in the type or degree of earth fault protection systems as applied to high voltage overhead transmission lines.

The Highveld area of South Africa is possible unique in having a highly developed electrification network, the majority of which is located under a combination of environmental conditions, not found in other developed regions.

These environmental conditions include:-

- Wide temperature excursions - normally associated with desert areas.
- High elevation - averaging 1500 to 2000 metres.
- Marked storm activity associated with high winds.
- The highest global incidence of lightning, during the summer months.
- Confinement of the rainy season to less than six months of the year.
- Mainly rocky, and/or sandy terrain.
- Higher than average sunshine hours per year.

Such environmental extremes all too often result in overhead lines becoming fatigued or damaged and falling to the ground.

High contact resistances between the fallen line and the surrounding "earth", together with high earth return resistances, sometimes limit the resulting earth fault currents to the extent that traditional protection devices, due to their lack of sensitivity to these relatively low currents, are incapable of responding under such earth fault conditions.

## SENSITIEWE AARDPUNT BEVEILIGING OP BOGRONDSE HOOGSPANNING TRANSMISSIELYNE

deur:- V. Cohen B.Sc (Elek. Ing.) (RAND)



### OPSPOMMING:

Die verskyning van verskuilde aardfoute op Hoogspanning boggrondse transmissielyne, tot 22kV, het die Elektrisiteitsvoorsieningskommissie onlangs aangespoor om die moontlikhede van verbeterings aan die lang aanvaarde en tradisionele metodes van aardfoutbeveiliging te ondersoek.

Die ontwikkeling van 'n nuwe aardfout relê met hoë sensitiviteit het hierdie verbeterings moontlik gemaak en beveiliging kan nou verkry word onder toestande waar aardfout beveiliging voorheen baie moeilik en in sommige gevalle selfs onmoontlik was.

### 1. INLEIDING.

#### 1.1 VELD:

Beveiliging van ge-aarde neutraal transmissie stelsels is belangrik aangesien aarde betrokke is in meeste foute.

Beveiliging stelsels spesifiek ontwerp en aangewend vir aardfoute word gedryf vanaf residuele of grondstrome en spannings wat nie onder normale gebalanseerde bedryfs toestande van 'n drie-fase stelsel teenwoordig is nie.

Sulke foute is dus onafhanklik van las en gevolglik kan aardfoute-relêe meer sensitief vervaardig en ingestel word as faserelêe.

Daar bestaan talle geofatiseerde rigtingsensitiewe en beperkte-zone relêe vir gebruik in aardfout beveiliging op transmissielyne.

Die toepassing van hierdie gespesialiseerde relêe sal egter nie hierin bespreek word nie.

#### 1.2 DIE PROBLEEM:

In die meeste ontwikkelde dele van die wêreld was daar min rede vir enige verbetering in die tipe of graad van aardfoutbeveiliging stelsels vir boggrondse hoogspanning transmissielyne.

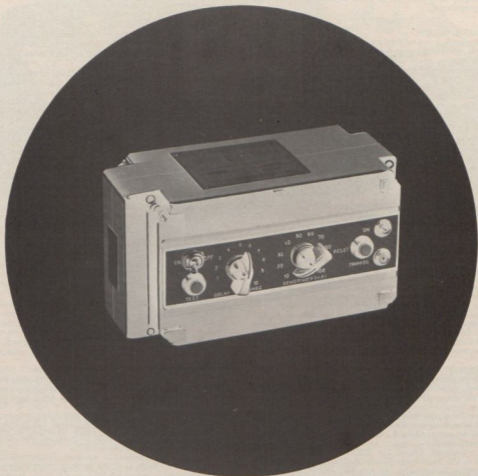
Die Hoëveld van Suid-Afrika is moontlik uniek met sy hoogs ontwikkelde elektrifiserings netwerk waarvan die grootste deel onderworpe is aan 'n kombinasie van omgewingstoestande wat in geen ander ontwikkelde gebiede gevind word nie.

Hierdie omgewingstoestande sluit in:-

- Groot temperatuur skommelings - normaalweg ge-assosieer met woestyne gebiede.
- Hoogte bo seespieël gemiddeld 1500 tot 2000 metres.
- Swaar storms met sterk winde.
- Die hoogste weerlig insident gedurende somermaande.
- Reënseisoen beperk tot minder as ses maande van die jaar.
- Hoofsaaklik rots en/of sanderige terrein.
- Hoër as gemiddelde sonskyn ure per jaar.
- Sulke omgewings uiterstes veroorsaak al te dikwels afmatting of beskadiging wat boggrondse lyne op die grond laat beland.

Hoë kontakweerstand tussen geleier en omliggende "grond" asook 'n hoë grondbaan weerstand beperk soms die aardfoudblootstelling sodanig dat tradisionele beveiligingsreëlwerke as gevolg van beperkte sensitiviteit, nie kan reageer op sulke aardfou-toestande nie.

# The VDS



## Earth Fault Protector

The VDS range of High Sensitivity Core Balance Earth Leakage Protection Devices offers complete safety in locations where it used to be almost impossible to obtain sufficiently high levels of protection. These include Medium and High Voltage Overhead lines. VDS Devices are the answer when there are unknown levels of, or irregular variations in standing leakage, when earth return bond resistance is high or when systems are subject to spurious tripping.



The VDS range supplies Earth Fault Protection on Low, Medium and High Voltage Overhead lines, in Arc Furnaces and even in chemically

contaminated or damp locations. For technical information on how to obtain positively discriminating back-up earth fault protection, ask for Bulletin 01-CA-01.

**Fuchs Electrical Industries (Pty) Ltd., (Industrial Division of the C. J. Fuchs Group) P.O. Box 3758, Alrode. 1451. Phone: 869-5311. Tel. Add: 'Breakers'**

Whilst it is true, that in the case of very high voltage transmission lines this problem is seldom encountered, this is due to sufficient voltage being available to drive the necessary current through the high earth return paths.

However, at transmission line voltages of approximately 22kV and below this problem becomes more marked and with ESCOM's rapidly increasing programme of rural electrification, is becoming more and more apparent.

The use of woodpole supports and absence of metallic earth current paths increased the urgency for the development of High Sensitivity Earth Fault Protection. The need for a device capable of responding to earth fault currents of all possible levels, precipitated the development of a largely solid state device which appears to satisfy most practical requirements.

### 1.3 STATE OF THE ART:

It is well known that inverse time and directional overcurrent relays are applicable generally for earth fault protection, however they must be used with caution where extra sensitive or low current pick-up types are employed, since high VA burdens may be encountered.

Inverse time relays are used for distance discrimination by providing fast operation for high fault currents near the relay, yet sufficient time delay for faults at remote points for co-ordination.

In cases where earth return resistances are very high and earth fault currents very low, under most conditions, including faults near to the relay, the inverse time characteristic assumes lesser importance.

Relays with definite time characteristics provide essentially constant operating times for near and remote faults, with the result that faults furthest from the source can be cleared rapidly. Cascading times for relay co-ordination provides longer operating times for relays near the earthed sources, but in cases where earth fault currents are low anyway, this can provide a more satisfactory discrimination scheme, without the dangers of maintaining high earth fault currents for long periods.

Most existing protection schemes include earth fault protection relays on overhead transmission lines, which are set to operate at 20% of the load current. Some types of relays can also be connected to give protection at 10% of the load current, but under these conditions, the impedance change and increased burden on the current transformers is such that little advantage is gained.

In an attempt to obtain improved earth fault protection, extensive use has been made in recent years of so-called "Sensitive Earth Fault Relays". These relays can usually be set to about 2% to 3% of the current transformer secondary current rating resulting in the detection of primary earth fault currents of some 4 to 8 amperes.

Whilst this represented a marked improvement when compared to the 20% load current protection level (eg. 30 amperes on a 150/5 current transformer) the operating experience of major supply authorities such as ESCOM, has shown that on medium to high voltage systems, the earth fault currents obtained with fallen lines was often below the current level required to operate even these sensitive relays.

### 1.4 HISTORICAL:

In a paper presented to the 1967 meeting of the A.M.E.U., the above problems were outlined and resulting from measurements taken under simulated earth fault conditions, the basic requirements for a more sensitive earth fault relay were proposed.

Although several attempts were made during the mid to late 1960's to produce a suitable device, it was not until 1969 that ESCOM, in recognition of the problem, issued a specification covering a device to meet their specific needs.

A device, developed around the ESCOM specification, after proving tests in the Simmerpan Electrical Test Department of the Electricity Supply Commission, has now seen nearly four years of field service.

This truly High Sensitive Earth Fault Relay has filled the void in the protection of High voltage transmission lines.

## 2. A PRACTICAL HIGH SENSITIVITY EARTH FAULT RELAY, FIG. 1

### 2.1 GENERAL:

The high sensitivity Earth Fault Relay that was designed and developed to meet these needs consists of a largely solid state relay package which is used in conjunction with associated current transformers.

The relay is designed to be used in conjunction with Current Transformers for two reasons:-

These are:-

(i) Potential isolation from the protected line.

These Are:- (i) Potential isolation from the protected line.

(ii) Reduction of burden on the protected line. Since there are transformation losses between the monitoring C.T. and the relay, at the very low fault current levels being considered, the relay must of necessity have a higher sensitivity than the actual primary sensitivity.

### 2.2 SENSITIVITY:

In order to realise the required primary sensitivity under worst-case conditions of high earth return paths, whilst being in a position to cater for widely varying field and environmental conditions, the relay itself was designed to have an adjustable current sensitivity of 10mA through 100mA.

In die geval van baie hoë spanning transmissie lynne word hierdie probleem selde ondervind omdat genoeg spanning beskikbaar is om voldoende stroom deur die aardbaan te stuur.

Teen transmissie spannings van 22kV en laer staan hierdie probleem sterk op die voorgrond, veral met EVKOM se vinnige toenemende plattelandse elektrifikasie program.

Die gebruik van hoëspanning sonder 'n metaal aardgeleiding het die ontwikkeling van 'n hoë-sensitiwiteit-aardfout-relé soveel dringender gemaak.

Die behoefte aan 'n toestel wat in staat is om te reageer op aardfoutstrome van alle moontlike groottes het die ontwikkeling van 'n groterde "soliede staat" toestel, wat klaarbyklik aan alle praktiese vereistes voldoen, genoodsaak.

### 1.3 OORSIG:

Dit is algemeen bekend dat relés met 'n omkerings tydensienskap en rigtingsensitiewe oorstrom relés algemeen gebruik word vir aardfoutbeveiliging, nogtans moet versigtigheid aan die dag gelê word wanneer uiters sensitiewe laestroom tipes gebruik word, aangesien VA belasting ondervind mag word.

Omkeringstyd relés high afstand diskriminasie deur vinnige werking vir hoë foutstrome naby die relé, dog met voldoende tyd vertraging vir foute op afgeleë punte vir goeie koördinasie.

In gevalle waar die aardweerstand baie hoog en die aardfoutstrome baie laag is, onder meeste toestande, ook naby die relé, verminder die effek van die omkerings tydensienskap egter.

Relés met 'n vaste tydensienskap lewer hoofsaaklik 'n konstante werktyd vir naby en ver foute, wat dus korter werktye kan lewer op punte verder van die bron af. Deur hierdie tye te spasieer, om relé koördinasie te verseker, ontstaan langer werktye egter vir relés naby die ge-aarde bron. In gevalle waar aardfoutstrome in elk geval laag is, word 'n meer aanvaarbare diskriminasie skema hierdeur verkry sonder die gevaar van hoë strome vir lang tye verduur moet word.

Meeste bestaande beveiligingskemas vir bogronde transmissielynne sluit aardfoute relés in wat ingestel is vir 20% laastroom. Sommige tipes kan selfs op 10% ingestel word maar die impedansie verandering en dus addisionele las op die stroomtransformators is gewoonlik sodanig dat weinig baat gevind word hierdeur.

In 'n poging tot verbetering in aardfoutbeveiliging is in die afgelope jare baie gebruik gemaak van die sogenaamde "Sensitiewe Aardfout Relés". Hierdie relés kan gewoonlik ingestel word op 2% tot 3% van die stroomtransformator sekondêre stroom wat sal reageer of foute in die omgewing van 4 tot 8 ampere.

Dit is wel 'n groot verbetering op die beveiligingsvlak van 20% van laastroom (bv. 30 ampere op 'n 150/5 stroomtransformator) maar bedryfsondervinding van vooraanstaande elektrisiteitsondernemings soos EVKOM het getoon dat op medium tot hoë-spanning stelsels, die aardfoutstroom vir geliers op die grond, dikwels laer was as wat nodig is om selfs hierdie sensitiewe relés te laat funksioneer.

### 1.4 HISTORIES:

In 'n referaat gelewer gedurende die 1967 byeenkoms van die (V.M.E.O.) is die basiese vereistes van 'n meer sensitiewe aardfout relé voorgestel uit metings geneem onder gesimuleerde aardfout toestande.

Ahoewel verskeie pogings om 'n geskikte eenheid te maak aangevond is gedurende die periode middel tot laat 1960 was dit nie vir 1969 toe EVKOM 'n spesifikasie vir 'n toestel wat aan sy eie besondere vereistes voldoen, uitgereik het nie.

'n Toestel wat ontwikkel is, gebaseer op EVKOM se spesifikasie en toegevoeg aan EVKOM se ELEKTRIESE TOETSDEPARTEMENT, te Simmerpan deurstaan het, is nou reeds vyf jaar in gebruik.

Hierdie ware Hoë Sensitiwiteit Aardfoutrelé het die gaping in die beveiliging van hoëspanning transmissielynne gevul.

## 2. 'n PRAKTIESE HOË SENSITIEWEIT AARDFOUTRELE'

### 2.1 ALGEMEEN:

Die hoë sensitiewe aardfoutrelé wat ontwerp en ontwikkel was om aan hierdie vereistes te voldoen bestaan hoofsaaklik uit 'n soliede staat relé-eenheid wat saam met bypassende stroomtransformators gebruik word.

Die relé is ontwerp om met stroomtransformators gebruik te word vir twee hoof redes:-

### NAAMLIK:

1) Spannings isolasie met die lyn wat beveilig word.

ii) Vermindering in las op die lyn wat beveilig word.

Weens die oordrag verliese tussen die stroomtransformator en die relé teen hierdie lae foute strome, moet die relé noodwendig 'n hoër sensitiewe it hê as die werklike primêre sensitiewe it.

### 2.2 SENSITIEWEIT:

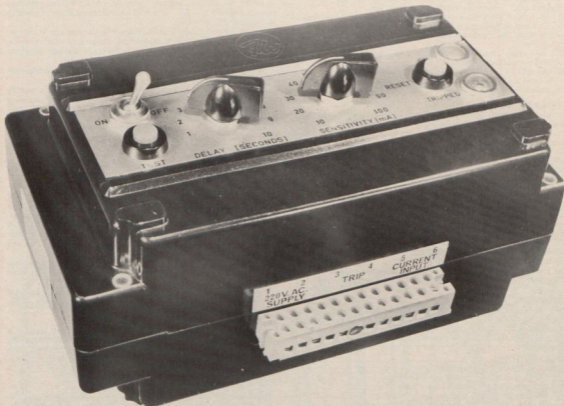
Om te voldoen aan die vereiste primêre sensitiewe it onder die moeilikste toestande van hoë aardbaan weerstand en ook voorsiening te maak vir die groot variasie in veld en omgewings toestande is die relé self ontwerp met 'n stroom sensitiewe it verstelbaar vanaf 10mA. tot 100 mA.

This is the sensitivity on the secondary side of the monitoring current transformers.

The actual primary earth fault sensitivity is obtained by multiplying the present relay sensitivity in milliamperes by the current transformer ratio.

Hierdie is dan die sensitiviteit aan die sekondêre kant van die stroomtransformators in gebruik.

Die werklike primêre aardfoutsensitiviteit word verkry deur die geselekteerde reïensitiviteit in m.A. te vermenigvuldig met die stroomtransformator verhouding.



For example, if current transformers of ratio 150/5 are used, these have an equivalent ratio of 30:1. At the two extremes of settings of the high sensitivity earth fault relay, this would give a primary earth fault sensitivity of 10mA X 30 = 300mA at the lowest setting and 100mA X 30 = 3000mA at the highest setting.

When necessary, earth faults lower than 300mA can easily be detected provided this device is used in conjunction with C.T.'s of ratio 100/5 or even 50/5, although ESCOM, in general do not recommend C.T.'s smaller than 100/5 on 6.6 KV, 11KV and 22KV feeder switches.

### 2.3 TIME DELAY:

Energisation of long lines results in transient zero phase sequence currents due to the "charging current" of the line.

At the voltages being considered a power line can be said to be "short" if its distributed capacitance can be ignored completely. This can generally be done for lengths up to perhaps 25 to 30 kilometres. The "charging current" through the line capacitance is small for such lines and the properties of the line influenced mainly by its series resistance and inductance.

As the length of the line increases, the effect of the distributed capacitance increases rapidly, for not only does the charging current increase, but also it flows through a larger series impedance.

The effect of this larger impedance is to increase the duration of this zero phase sequence charging current.

In order to prevent spurious operation of the earth fault relays, it is necessary to introduce a time delay to ensure that the device will not respond to these energising transients.

Like most prior art earth fault relays, the high sensitivity type is provided with an adjustable time delay feature of 1 second to 10 seconds.

As we have seen from para. 1.3 above, little or no advantage would be obtained by the adoption of an inverse time delay characteristic, associated with very low earth fault currents.

The standard high sensitivity relay therefore incorporates a definite time delay system, infinitely variable over a 1 to 10 second range, with special models available up to 60 second delay.

Neem as voorbeeld 'n transformator verhouding van 150/5, d.w.a. 30/1. Met die twee uiterste instellings op die hoë sensitiviteit relê, gee dit 'n primêre aardfout sensitiviteit van 10mA x 30 = 300 m.A. op die laagste en 100 m.A. x 30 = 3000 m.A. op die hoogste posisie.

Waar nodig kan aardfoute laer as 300 m.A. gedek word deur die gebruik van 100/5 of selfs 50/5 stroomtransformators, alhoewel EVKOM oor die algemeen nie verhoudings laer as 100/5 op 6.6 kV, 11kV en 22kV en 22kV lyn skakeltoeg gebruik nie.

### 2.3 TYD VERTRAGING:

Inskakeling van lang lynne lewer oorgangs nulvolgorder strome as gevolg van "lading strome" in die lyn.

Teen die spannings hier ter sprake kan 'n kraglyn as "kort" beskou word as die verspreide kapasitansie geïgnoreer kan word. Dit kan oor die algemeen gedoen word vir lengtes van waarskynlik 25 tot 30 kilometers. Die laaistroom deur die lyn kapasitansie vir sulke kort lynne is klein en die lyn eienskappe word hoofsaaklik bepaal deur die serie weerstand en induktansie.

Soos die lynlengte toeneem, neem die effek van verspreide kapasitansie vinnig toe omdat nie slegs die laaistroom toeneem nie maar ook die vloei deur die groter serie impedansie.

Die effek van hierdie groter impedansie is 'n toename in die tydsduur van hier zero fase volgorde laaistroom.

Om sporadiese werking van die aardfourelê te voorkom is dit nodig om 'n tydvertraging by te voeg sodat die eenheid nie reageer op hierdie laaistrome nie.

Soos meeste soortgelyke tradisionele aardfourelê's het die hoë sensitiviteit tipe 'n verstelbare tydvertraging fasiliteit van 1 tot 10 sekondes.

Soos ons gesien het in paragraaf 1.3 hierbo is daar min of geen voordeel te put uit die gebruik van 'n relê met 'n omkerings tydenskapskap onder baie klein aardfoutroum toestande nie.

Die standaard hoë sensitiviteit relê is daarom toegerus met 'n 1 tot 10 sekonde, definitiewe tydvertraging eenheid, kontinu verstelbaar tussen 1 en 10 sekondes, met 'n spesiale model beskikbaar wat tot 60 sekonde tydvertraging kan lewer.

#### 2.4 BURDEN:

It is essential that protection relays of this type present as low as possible a burden to the monitoring current transformers.

This is of importance from three different aspects.

- When sharing the C.T.'s with other protection devices, the burden should be minimal.
- If matched to its "own" current transformer the use of low performance C.T.'s permits considerable cost savings.
- A high burden will require more primary magnetising current and hence an appreciable increase in effective ratio at these low currents and this again will reduce overall sensitivity of the earth fault protection unit.

The new relay presents a burden of less than 0,01 VA on its associated current transformers.

When used in a Core Balance system, satisfactory performance can be obtained with current transformers having a metering performance as low as 5VA - Class 5 to BS3938 - 1973 and I.E.C. 185.

#### 2.5 POWER SUPPLY:

Although it would be desirable for relays of this type to be independent of mains supply voltage, in order to achieve the desired high sensitivity and for operation of the timing circuits, connection to a source of supply potential has been necessary.

To reduce the problems of voltage collapse under heavy fault conditions, these devices are designed to maintain their specified performance with the supply voltage reduced to as low as 50% of nominal voltage. Since such a voltage collapse would result from the flow of a high fault current, the fault would in any event be cleared by any existing less sensitive protection devices.

Standard devices are available for 200 Volt A.C. operation or alternatively, 110 V.A.C. These supplies are usually available from the sub-station lightning supply or from the secondary windings of potential transformers.

The excitation requirements of this class of high sensitive earth fault relay is approximately 4VA in the quiescent condition and 6VA in the tripped condition.

For even higher reliability similar devices are now envisaged for operation from the 30 Volt D.C. emergency tripping supply where this is required.

#### 2.6 TRIP INDICATOR:

An electronically actuated flashing light with manual reset, is provided for Earth Fault Trip indication. Should the earth fault be cleared, the relay automatically resets in preparation for the next earth fault, but the Trip indicator continues operating until it is manually reset.

#### 3. APPLICATION:

##### 3.1 VOLTAGES OF PROTECTED LINES:

At present, the most common application areas for this class of relay are on overhead transmission lines having voltages from 2.2 KV up to and including 22KV, with by far the majority used on 6.6 KV and 11KV lines, due to the wider usage of these voltages, and the lower available fault currents.

The problems of insufficient earth fault current being available to operate the prior art relays, decreases at voltages over 22 KV. There is, however, a case on record, where a broken 88KV line fell onto a rocky terrain and earth fault relays (20% of load current) failed to operate.

Enormous scope exists for applying this relay on low voltage overhead lines - typically 380 Volts. However, since faults on consumer's premises will be read by this device, (there is no interposing transformer) it is essential that selective protection is judiciously employed, with each consumer being protected by individual high speed 20mA devices. On reticulation networks having P.M.E. systems, the problem is further aggravated since obviously no earth connection on the neutral conductor can be tolerated on the downstream side of the sensitive earth fault protection relay.

##### 3.2 CURRENT TRANSFORMER CONNECTION:

Two possibilities exist for connection of the monitoring current transformers and resulting satisfactory performance of high sensitivity earth fault relays. These are:

- Core Balance connection.
- Residual connection.

##### 3.2.1 CORE BALANCE CONNECTION:

In this case, a single ring type current transformer is used, with all current carrying conductors being passed through the C.T., so constituting one turn per phase (and neutral if used). These conductors then become the PRIMARY winding of a DIFFERENTIAL TRANSFORMER. (FIG. 2)

The differential transformer also includes a secondary winding which is connected to the sensitive earth fault relay.

Under normal conditions, the total current flowing through the line conductors is VECTORIALLY balanced, independent of phase loading. Zero net magnetic flux is produced in the differential transformer core and there is therefore no output from the secondary winding.

Upon the occurrence of an earth fault, the vectorial balance of current in the line conductors is distributed by an amount equal to the magnitude of the fault current. This difference produces a non-zero net magnetic flux in the differential transformer core and induces a fault signal in the secondary winding.

#### 2.4 LAS:

Dit is essensieel dat beveiligings relés van hierdie tipe so 'n klein las as moontlik lê op hulle stroomtransformators.

Dit is belangrik vanuit drie verskillende aspekte.

- Wanneer stroomtransformators met ander beveiliging toestelle geelê word, moet die las 'n minimum wees.
- Indien die eenheid aangepas word by die stroomtransformators kan die gebruik van lê vermoë stroomtransformators aansienlike koste besparings meebring.
- 'n Hoë las vereis meer primêre magnetiseerstroom van 'n stroomtransformator en daarom 'n aansienlike toename in effektiewe verhouding teen hierdie lae strome. 'n Verlagting in algehele sensitiviteit van aardfoutbeveiliging word gevolglik ondervind.

Die nuwe relê plaas 'n las van minder as 0,01 V.A. op meegaande stroomtransformators.

Wanneer gebruik in 'n Kernbalans stelsel van bevredigende werking verkry word met stroomtransformators met metering werkverrigting so laag as 5 V.A. - Klas 5 volgens BS 3939 - 1973 en "IEC 185".

#### 2.5 KRAGTOEVOER:

Alhoewel dit verkieslik is dat relés van hierdie tipe onafhanklik moet wees van hoofkragtoevoer vir die nodige hoë sensitiviteit en aandrywing van die tydrelings eenheid, was dit nodig om van hoofkragtoevoer gebruik te maak.

Om die probleem van spanningsval onder swaar fouttoestande te verminder, is hierdie toestelle ontwerp om hulle gespesifiseerde werkverrigting te handhaaf met die toevorspanning so laag as 50% van die nominale waarde. Aangesien so 'n spanningsval gepaard gaan met hoë foutstrome, sal die fout in elk geval beëindig word deur bestaande, minder sensitiewe beveiligingsapparaat.

Standaard eenhede is beskikbaar vir 220 Volt W.S. werking of as 'n alternatief, 110 Volt W.S. Hierdie toevore is gewoonlik beskikbaar van sub-stasie beligtigtoevoer of van sekondêre windings van spanningstransformators.

Die toevoreveristes van hierdie klas hoë sensitiviteit aardfoutrêlê is ongeveer 4 V.A. in die rustende toestand en 6 V.A. in die klink toestand.

Vir selfs hoër betroubaarheid word soortgelyke toestelle, wat vanaf 'n 30 volt G.S. nood klinktoevoer gedryf kan word, waar nodig, in die vooruitsig gestel.

#### 2.6 KLINK INDIKATOR:

'n Elektronies aangedrewe flikkerig met 'n hand-herstel knoppie is voorsien as klinkindikator. Wanneer 'n aardfout deur die relê beëindig word, sal die relê outomaties herstel en gered wees vir die volgende fout, terwyl die klinkindikator aanhoudend sal werk totdat dit met die hand herstel word.

#### 3. TOEPASSING.

##### 3.1 BESKERMDE LYN SPANNINGS:

Teenswoordig is die mees algemene toepassingsgebied van hierdie klas relê begronde transmissielinje met spannings van 2,2 KV tot en met 22KV, met die oorgrote meerderheid op 6,6 kV lyn, aangesien hierdie spannings baie algemeen gebruik word en die beskikbare aardfoutrstrome laag is.

Die probleme as gevolg van onvoldoende aardfoutrstrome om vorige relés te aktiveer, neem af teen spannings bo 22kV. Daar is eger gevalle aangeteken waar 'n 88kV lyn in kontak met die grond gekom het en die aardfoutrêlê (20% van lasstroom) nie gereageer het nie.

'n Veld vir die toepassing van hierdie relê bestaan in laagspanning bo-grondse lyn - tipes 380 Volt. Omdat foute op verbruikers se persele deur hierdie toestelle "gesien" sal word (daar is geen transformators tussen in) is dit noodsaaklik dat selektiewe beveiliging met oorleg gebruik word in die vorm van individuele hoë speed 20MA. toestelle.

Op verspreidingsnetwerke waar die neutraal op verskeie punte geaard word ("P.M.E." stelsel) word die probleem vererger aangesien geen aardverbinding op die neutraalleië na die sensitiewe aardfoutrêlê geduld kan word nie.

##### 3.2 STROOMTRANSFORMATOR VERBINDING:

Twee moontlike stroomtransformator verbindings bestaan wat albei bevredigende werking van sensitiewe aardfoutrêlê sal lewer naamlik:-

- Kernbalans verbinding.
- Residuele verbinding.

##### 3.2.1 KERNBALANS VERBINDING:

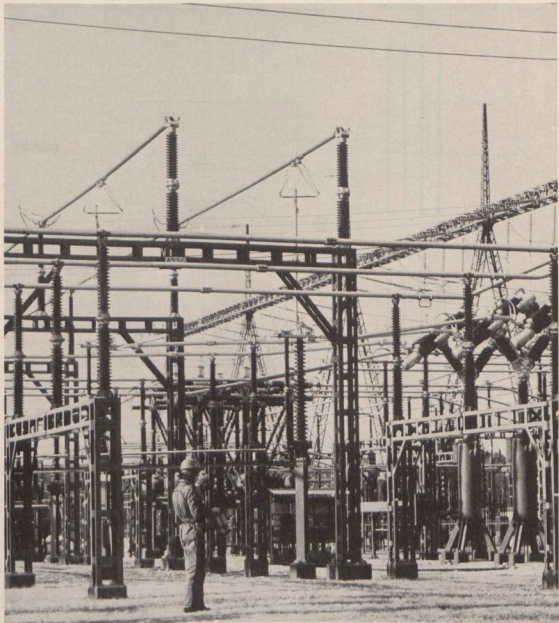
In hierdie geval word 'n enkele ringtipe stroomtransformator gebruik waardeur alle stroomdraende geleiers gaan om een draai per fase (plus neutraal indien gebruik) te vorm. Hierdie geleiers is dan die primêre windings van 'n differensiaal transformator.

Die differensiaal transformator bevat ook sekondêre windings wat met die sensitiewe aardfoutrêlê verbind word.

Onder normale toestande is die som van die strome wat deur die geleiers vloei vektorieel gebalanseer, afgesien van fase belasting. Zero netto magnetiese vloed bestaan dan in die differensiaal transformator kern wat dan geen uitgang uit die sekondêre winding lewer nie.

Wanneer 'n aardfout ontstaan word die vektoriale balans van strome versterk met 'n hoeveelheid gelyk aan die grootte van die aardfoutrstroom. Die verskil lewer dan 'n netto magnetiese vloed in die differensiaaltransformator kern en induiseer 'n foutein in die sekondêre winding.





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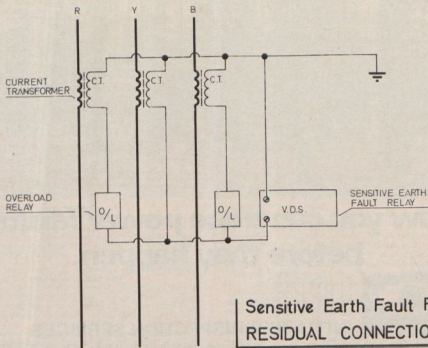
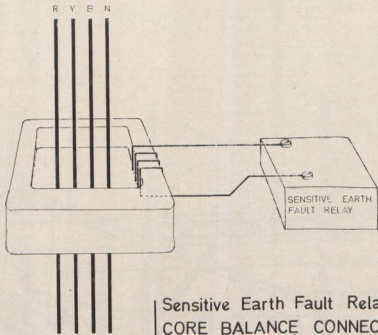
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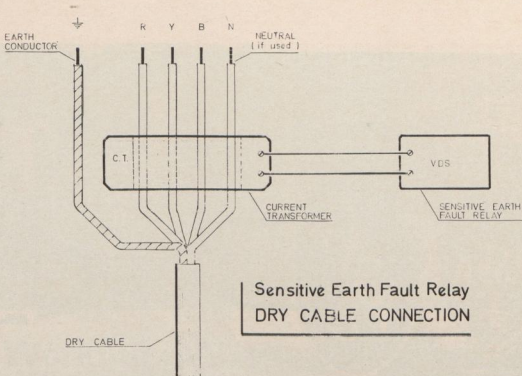
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With this connection, it is obvious that the earth conductor or armouring must not be passed through the differential transformer. If an earthed conductor is used, for satisfactory operation, no earth connection can be tolerated in the protected zone i.e. downstream from the core balance of differential transformer.

Met hierdie verbinding is dit ooglopend dat die aardeleier of kabel-omhulsel nie deur die differensialtransformator gevoer moet word nie. Indien 'n aardeleier gebruik word, kan vir bevredigende werking, geen aardverbinding hieraan geduld word binne die beskermde zone d.w.s. na die kernbalans of differensialtransformator nie.





## Sensitive Earth Fault Relay DRY CABLE CONNECTION

The differential transformers used are normally low voltage i.e. 600 Volt insulated ring type C.T.'s with full insulation provided on the conductors.

The advantages of the Core Balance connection are:-

- i) Low cost - low performance C.T.'s can be used satisfactorily.
- ii) On new installations, installation of the single ring type current transformer is relatively simple.
- iii) Only ONE transformer required for each earth fault relay. The disadvantages of the Core Balance system are:-
- (i) Current transformer ratios lower than 100/5 should not be used, to avoid transformation inaccuracies.

In practice, this limits the Best PRIMARY fault sensitivity to about 200mA.

(ii) On existing systems, it can be costly to break into the feeder cable for installation for the core balance transformer. The use of split-core core-balance C.T.'s would, at first sight, seem to offer many practical installation advantages, however the transformation losses in present state of the art split-core current transformers are such, that these are generally precluded in high sensitivity earth fault applications.

### 3.2.2 THE RESIDUAL CONNECTION:

This is the classical connection used on almost all three phase overcurrent and earth fault protection schemes. (FIG. 5) Three current transformers are used.

The primary windings are connected in series with the line conductors i.e. one per phase. All three secondary windings are connected in parallel and closed on to the earth fault relay. One side of the parallel connected secondaries is connected to earth for stability and safety.

In the Residual Connection, provided the three current transformers are accurately matched, due to vectorial balance, little or no residual current will flow through the earth fault relay, under healthy conditions.

The vectorial balance can be disturbed by an earth fault on any phase, with the resultant out of balance current flowing in the relay circuit.

The advantages of the Residual Connection are:-

- (i) In an existing system, high sensitivity earth fault relays can be added by simply connecting these in series with the existing earth fault relays, or fitted as a replacement for the existing relays. A minimum amount of labour is involved.
- ii) Conditions requiring primary sensitivities better than about 200mA can be satisfied, by the use of low ratio, wound primary type current transformers.
- iii) Can be used for overcurrent protection as well.

The disadvantages of the Residual Connection are:-

- i) High-cost - high performance C.T.'s required.
- ii) Each set of three current transformers must be accurately matched.
- iii) Three C.T.'s required as against one for the core balance connection.

Differentiaaltransformator in gebruik is gewoonlik laag spanning eenhede d.w.s. 600 volt geïsoleerde ringtype stroomtransformator met volle isolasie voorsien op die geleiers.

Die voordele van die Kernbalans verbinding is:-

- i) Lae koste - lae werkverrigting stroomtransformators kan met sukses gebruik word.
- ii) Met nuwe installasies is die installering van enkel ringtype stroomtransformators redelik eenvoudig.
- iii) Slegs EEN transformator is nodig per aardfoutrelê.

Die nadele van die Kernbalans stelsel is:-

- i) Stroomtransformator verhoudings van laër as 100/5 moet vermy word om oordragsfoute uit te skakel. In die praktyk beperk dit die primêre gevoeligheid tot 200 mA.
- ii) Op bestaande stelsels is die koste om kernbalans transformators te installeer baie hoog. Die gebruik van gesplete kems blyk op die oog af 'n praktiese oplossing te wees. Die oordragsverliese op beskikbare kems sluit dit egter uit vir gevoelige aardfoutbeveiligings toepassings.

### 3.2.2. RESIDUELE VERBINDING:

Hierdie is die normale verbinding wat in meeste driefase oorstrom plus aardfout beveiliging stelsels gebruik word. Drie stroomtransformators word dus gebruik, een per fase. Al drie sekondêre windings word in parallel verbind en die twee eindpunte verbind deur die aardfout relê. Een kant word aan aarde verbind om sekondêre kapasitiewe spannings t.o.v. aarde te voorkom.

In die residuele verbinding sal, wanneer die drie transformators goed aanpas, geen of weinig residuele stroom deur die aardfout relê vloei onder normale toestande.

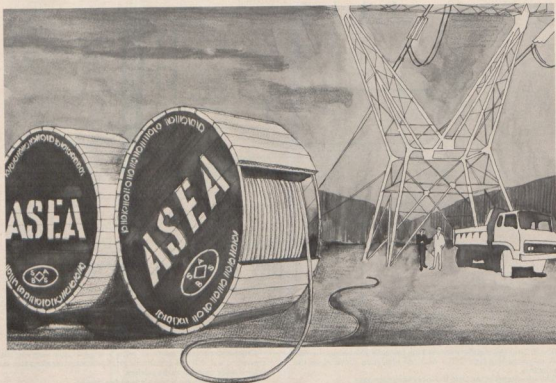
Hierdie vektoriale balans kan egter gesteur word deur 'n aardfout op enige fase wanneer die uitbalans stroom dan deur die relê sal vloei.

Die voordele van die Residuele verbinding is:-

- i) In bestaande stelsels kan gevoelige aardfout relê's maklik en teen lae koste in serie met, of in plaas van, gewone aardfout relê's geïnstalleer word.
- ii) Primêre sensitiwiteit van minder as 200mA. kan verkry deur die gebruik van lae verhouding stroomtransformators met 'n multi winding primêr.
- iii) Kan ook gebruik word vir oorstroming beveiliging.

Die nadele van die Residuele verbinding:-

- i) Hoë koste - hoë werkverrigting stroomtransformators is nodig.
- ii) Elke stel van drie stroomtransformators moet goed bymekaar aangepas wees.
- iii) Drie stroomtransformators, teenoor een vir kernbalans is nodig.



## Our cables are as tough as we can make them, and we've been making cables for 87 years

ASEA Electric S.A. Limited's team of experts in heavy power equipment has been working, both overseas and here in South Africa, for many years, developing cables to the high standard which the South African consumer has grown to expect from ASEA.

All PVC wire armoured cables manufactured to specifications of S.A.B.S.

The cores are insulated with a high quality PVC and the inner sheath and outer serving are executed in a sheathing grade of PVC. The cable is light and flexible and has no hygroscopic filters.

It has a high resistance to impact and abrasion and the weathering properties are particularly good.

It can be employed for lighting and power connections especially where there is a danger of corrosive chemical action.

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# ASEA



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## Working with the community

ASEA Electric South Africa Limited have developed a range of miniature substations primarily for use in residential areas. They have been designed to be small, neat, safe, blending into the natural surroundings thus not requiring a protective fence.

The internal components can be chosen to suit the requirements of either residential or industrial reticulation. They are arranged to facilitate quick installation and to make servicing easy.

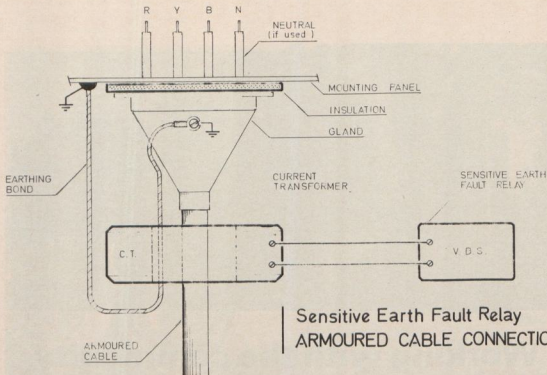
# ASEA



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## Sensitive Earth Fault Relay ARMOURED CABLE CONNECTION

The use of these high sensitivity devices with residually connected current transformers has had one interesting consequence. This has been the immediate detection of an unmatched C.T. in a set.

Whilst such a condition could have remained undetected with lower sensitivity relays, this would result in immediate operation of the new relays.

Typically, it has been found that the residual current from three high quality C.T.'s (having a protection class X or at the worst, a class of 15 VA - T10) can be held down to a value between 1mA and 5mA secondary current.

### 3.3 CHOICE OF CURRENT - TRANSFORMER TYPE:

As a general rule for sensitive earth fault protection, ring type current transformers should be chosen.

For the core balance connection there is no alternative to a ring type transformer.

Either ring or wound primary types could be used for the Residual Connection. The inherently lower reactance of ring types, however, make them more attractive for the sensitive earth fault applications since the mismatch or "spill" current of ring types is generally less than half of that obtained with wound primary types at otherwise equivalent performance.

If wound primary types are not applied with care, the sensitivity gain through the use of lower ratios can often be lost due to the greater spill current.

### 3.4 STANDING LEAKAGES:

Traditionally it has been pre-supposed that standing leakages are relatively high on overhead transmission lines within the voltage range being considered.

In practice, ESCOM (R. & O.F.S. Undertaking) have found that the total residual current measured, on an average, lies between 1mA and 5mA.

This measured residual current obviously includes

- That due to mismatch in the three C.T.'s.
- The reflected standing leakage currents.

Considering again an average system using 150/5 ratio current transformers, and further, considering an extreme condition of perfectly matched C.T.'s, this would represent standing leakage currents of between

$$1\text{m.A.} \times \frac{150}{5} = 1\text{m.A.} \times 30 = 30\text{m.A.}$$

and

$$5\text{m.A.} \times \frac{150}{5} = 5\text{m.A.} \times 30 = 150\text{m.A.}$$

It is highly unlikely that there would be no residual current at all due to C.T. unbalance. Should there in fact have been any degree of mismatch between the current transformer sets, this would in fact mean the average standing leakages in practice could be LOWER than the above figures.

Die gebruik van hierdie gevoelige relés met 'n residuële verbinding het 'n interessante gevolg gehad naamlik die onmiddellike uitwys van 'n foutreël of swak aangepaste stroomtransformator in 'n stel.

Terwyl so 'n toestand ongemerk sou gebly het met gewone aardfoutrélés, sal die gevoelige eenheid dadelik klink.

Die residuële stroom van drie hoë kwaliteit stroomtransformators (beveiliging klas X of selfs klas 15 VA - T10) is tipies tussen 1mA en 5mA.

### 3.3 KEUSE VAN STROOMTRANSFORMATOR TIEPE:

As 'n algemene reël vir gevoelige aardfoutbeveiliging moet ringtipe transformators gebruik word. Vir kernbalans is daar geen alternatief tot die ringtipe nie.

Ring of gedraaide primêre tipes kan gebruik word in 'n residuële verbinding. Die inherente laer reaktansie van die ring tipe maak dit egter meer aantreklik vir gevoelige aardfoutbeveiliging aangesien die probleem van aanpasbaarheid of residuële stroom gewoonlik slegs die helfte is van die van 'n gedraaide tipe met ekwivalente werkverrigting.

Indien gedraaide primêre tipes nie met versigtigheid gebruik word nie, kan die voordele van 'n laer verhouding dikwels verlore gaan as gevolg van hoër onbalans strome.

### 3.4 STAANDE LEKKASIE:

Dit is in die verlede aanvaar dat die staande lekkasie op bogrondse transmissie lyne teen die spannings hier beskou redelik hoog was.

In die praktyk het EVKOM (R. & O.V.S.) onderneming gevind dat die totale sekondêre stroom, soos gemeet, tussen 1mA en 5mA is en sluit in:-

- die stroom a.g.v. transformator onbalans.
- Gereflekteerde staande lekkasie stroom.

Beskou weereens 'n gemiddelde stelstel met 150/5 stroomtransformator en aanvaar 'n ongewone perfekte transformator balans, dit lewer dus 'n lekkasie stroom van tussen:-

$$1\text{m.A.} \times \frac{150}{5} = 30\text{m.A.}$$

en

$$5\text{m.A.} \times \frac{150}{5} = 150\text{m.A.}$$

Dit is hoogs onwaarskynlik dat daar geen residuële stroom as gevolg van transformator onbalans sal wees wat bostaande lekkasie strome laer maak nie.

In die algemeen stel EVKOM (R. & O.V.S.) onderneming sy hoogs-gevoelige aardfoutrélés in vir 'n Primêre foutstroom van 500mA. Teen hierdie instelling word feitlik geen lastige of onnodige relé werking ondervind nie.

In general, ESCOM (R. & O.F.S.) preset their high sensitivity earth fault relays for a PRIMARY fault sensitivity of 500mA. At this level, very little trouble is experienced due to nuisance tripping.

A little risk of increasing nuisance tripping, except under extreme conditions, it thus appears that, if necessary, primary fault sensitivity settings could easily be reduced to levels as low as 200 to 300mA.

This is still well within the range of the available relay and associated current transformers.

#### 3.3 TIME DELAY:

The charging currents of a line described in 2.3 preceding, in practice appear to have a duration varying from about 1 to 3 seconds.

A time delay setting of 4 seconds has been found to be adequate in overriding most transient conditions.

#### 4. ESCOM FIELD EXPERIENCE.

##### 4.1 INSTALLATION:

For practical ease of installation the majority of High Sensitive Earth Fault Relays installed by ESCOM, are simply connected in series with the existing earth fault relay in the residual current transformer circuit.

This leads to two main advantages.

i) Selectivity between the definite time setting of the Sensitive Relay and Inverse Time response of the existing relays which should trip instantaneously under conditions of relatively high earth fault currents. (Should these occur.)

ii) Retention of back up in the standard protection in the unlikely event of total voltage collapse, since the inverse time Earth Fault Protection is independent of voltage, if an independent tripping source is provided. Due to the High Fault currents required to collapse the voltage, the inverse time Earth Fault Devices should in any event, clear the fault.

##### 4.2 PARALLEL FEEDERS:

It has been found necessary to take feeder switches of sensitive earth fault protection when carrying out linking or switching in the networks for load transfer purposes or when energising circuits. If this is not done, the feeder switch may trip on sensitive earth fault, due to the unbalance caused due to differing contact resistances between the various phases, in the interconnecting circuit.

Obviously, such unnecessary interruption of supply should be avoided.

These low level unbalance currents are not normally associated with relay tripping, and unless such conditions, steady - state or transient, are anticipated, apparently unexplained tripping conditions, on Sensitive Earth Fault Relays could result in time consuming and wasted maintenance effort.

These "unbalance" currents could in fact cause tripping on the less sensitive conventional relays.

##### 4.3 LIGHTNING ARRESTERS:

It is well known that lightning arresters can withstand only a limited number of strokes and when approaching the end of their life, show an increase in standing leakage.

Historically, it has been accepted practice to allowing ageing lightning arresters to remain in service since no immediate danger was introduced to either the system or consumers.

Location of faulty arresters has conventionally been made by visual examination after the arresters had blown up.

Sensitive Earth Leakage Protection no longer allows this convenience since tripping will obviously result once the leakage exceeds the setting of the relay.

It is arguable whether this is in fact a disadvantage or an advantage, since the loss of saleable power through a leaking arrester, over a period, could be considerable.

If we consider a leakage of 500mA which is at the average primary protection level of the sensitive relays, on an 11kV system, this represents a power loss of  $\frac{1000}{\sqrt{3}} \times 0.5 = 3175$  watts.

This could be equivalent to  $24 \times 3.175$  or 76.2 Kilowatt hours per day.

The danger to persons in the vicinity of the arrested earth connection is a more important consideration overriding any possible service continuity advantage.

##### 4.4 INSULATOR LEAKAGE:

In addition to the leakage discussed above, lightning arresters, as well as post insulators are subject to leakage due to atmospheric pollution, rain, mist, condensation etc. The problems of power loss and cost are similar.

The inclusion of sensitive earth fault relays has introduced an early warning system, pointing not only to surface tracking on post insulators, but also to potentially dangerous conditions arising out of damage to insulators, not normally visible to an inspection crew.

Typical faulty insulators have been found to have been damaged by lightning, which, in several cases has resulted in neat holes being drilled down the centre of the insulators, without any other visible or obvious damage. Cracks in insulators and lightning arresters due to vandalism and the elements are also not uncommon.

The amount of leakage current in these instances is usually variable and dependent upon environmental conditions, particularly mist and rain.

##### 4.5 FAULT LOCATION:

A pre-requisite to rapid fault location is good field communication together with experienced supervisory and field staff who have a

Indien nodig kan die primêre sensitiviteit dus verhoog word na 200 tot 300mA. met slegs 'n klein risiko van 'n toename in lastige relê werking.

Dit is nog binne bereik van die beskikbare relê en stroomtransformators.

##### 3.5 TYDVERTRAGING:

Die laastrome van 'n lyn soos beskryf in 2.3 het die praktyk 'n tydruimte van tussen 1 en 3 sekondes.

'n Tydvertraging instelling van 4 sekondes is dus voldoende gevind vir meeste organgstoeande.

#### 4. EVKOM ONDERVINDING IN DIE VELD:

##### 4.1 INSTALLERING:

Om praktiese redes word die meeste gevoelige aardfoutrelê's deur EVKOM geïnstalleer, in serie met die bestaande aardfoutrelê's verbind in die stroomtransformator residuële baan.

Die lei tot twee hoof voordele:

i) Selektiwiteit tussen die vaste klinktyd van die gevoelige aardfout relê en die bestaande omkeringsydrelê wat onmiddellik sal klink onder relatief hoë foutstrome (indien dit sou voorkom).

ii) Die bestaande relê's word behou as 'n reserve in die geval van totale hulpspannings verlies gedurende 'n fout, aangesien die relê onafhanklik is van spanning ('n onafhanklike klink bron word altyd voorsien). Aangesien slegs 'n hoë foutstroom totale spanningsverlies sal veroorsaak, sal die bestaande relê in elk geval klink.

##### 4.2 PARALLELE LÏNE:

Daar is gevind dat dit noodsaaklik is om die gevoelige aardfout gevoeligheid af te skakel wanneer verbinding tussen twee lÏne, op las, gemaak word vir die doel van las oordrag. Indien dit nie gesoen word nie mag die brekers klink as gevolg van onbalans tussen die 3 fases veroorsaak deur verskille in kontakweerstand van skakels op ooreenstemmende fases wat nou in parallel verbind word.

Sulke onnodige kragonderbrekings moet oglopwend vermy word. Onbalans strome van hierdie aard word nie normaalweg geassosieer met relê werking nie, maar indien sulke toestande, hetsy 'n organgsverskynsel of konstant, nie voorsien word nie kan sulke onskynlik onverklaarbare gevoelige aardfoutrelê werking lei tot tydvermorsende en onnodige onderhoude werk.

Hierdie balans strome kan selfs die bestaande, minder sensitiewe aardfout relê's laat klink.

##### 4.3 WEERIGAFLEIERS:

Dit is welbekend dat weerigafleiers slegs 'n beperkte aantal ont-ladings kan weerstaan en wanneer dit die einde van hul leeftyd nader, neem die staande lekstrome toe.

Dit is aanvaarde praktyk om verouderde weerigafleiers in diens te hou aangesien dit min gevaar vir beide die stelsel en die verbruiker inhou.

Foutiewe weerigafleiers was gerieflikheidsshalweg gevind deur inspeksie nadat dit gefaal het, wat gewoonlik op 'n afstand sigbaar is.

Gevoelige aardfoutbeveiliging bied egter nie hierdie gerief nie, aangesien dit sal klink sodra die lekstrome die relê instelling oorskrei.

Dit bly 'n oop vraag of hierdie eienskap werklik 'n nadeel is, aangesien die verlies aan verkopbare energie deur 'n lekkende blitsafleier, mettertyd 'n aansienlike bedrag kan beloop.

Beskou 'n lekstrome van 500mA. aan die primêre kant van die beveiligingsbane in 'n 11kV stelsel. Dit verteenwoordig 'n drywingsverlies van  $\frac{1000}{\sqrt{3}} \times 0.5 = 3175$  Watt, wat ekwivalent is aan 24 x

3,175 of 76,2 Kilowatt uur per dag.

Van deurslaggewende belang egter, is die gevaar vir personeel in die omgewing van die aardverbinding van 'n lekkende blitsafleier; 'n omgewing wat enige moontlike voordele, ten opsigte van onderbroke kragvoorsiening, in die skadu stel.

##### 4.4 ISOLATORIE KRAKASIE:

Afgesien van die lekkasie hierbo bespreek is daar ook nog atmosferiese besoedeling, reën, mis, kondensasie ens., waarvan beide isolators en blitsafleiers onderhevig is. Die probleme ten opsigte van drywingsverlies en koste is soortgelyk.

Die gebruik van gevoelige aardfoutrelê's versak 'n vroeë waarwagging stelsel wat oppervlakte geleiding op paalisolators aandui, asook gevaarstoestand wat ontstaan as gevolg van skade aan isolators, wat nie normaalweg by inspeksie opval nie.

Dit gebeur soms dat isolators deur weerlig beskadig word, op so 'n wyse dat netjiese gate deur die middel van 'n isolator ontstaan, sonder enige uitwendige sigbare of opvallende skade. Krake in isolators en blitsafleiers, as gevolg van vandalisme of die elemente, is ook taamlik algemeen.

Die mate van lekstrome in sulke gevalle is gewoonlik veranderlik en afhanglik van omgewingstoestand, veral mis en reën.

##### 4.5 FOUTLOKALISERING:

'n Voorvereiste vir snelle foutlokalisering is goeie veldkommunikasie gepaargegaande met ervare toetsighoudende en veldpersoneel, met 'n deeglike kennis van die geografie van die netwerk en paale.

'n Blywende fout kan gewoonlik gelokaliseer word deur selektiewe skakeling in die netwerk en uiteindeelik deur visuele inspeksie en die gebruik van 'n isolasietoets.

Onderbroke foute is moeiliker om te vind. Hulle is gewoonlik die

through knowledge of the geographical network and the roads.

A solid fault can usually be repaired by selective switching in the network and finally located by visual inspection and use of an insulation tester.

Intermittent faults are more difficult to locate. These usually emanate from a loose connection, or a high resistance fault caused by a cracked insulator or faulty lightning arresters. The problem is further aggravated when faults develop during rainy conditions and then apparently disappear in warm sunlight.

Location of these troublesome intermittent faults has encouraged the Rural Electrification Division of ESCOM to measure and record the normal out of balance current in the earth fault protection circuit of each feeder.

This has been found to be approximately 2 to 5 milliamperes secondary current, which when referred to the primary side represents some 50 to 200 milliamperes of standing leakage.

Armed with this knowledge it is a relatively simple matter to monitor and record the deterioration of insulation resistance in a system by the increasing earth leakage currents.

The use of selective switching for fault location in a network can, in this manner be extended for location of deteriorating earth faults not yet high enough to actually cause trip out.

#### 4.6 FALLEN CONDUCTORS:

The limitation of earth fault currents with broken conductors lying on the ground, in the first instance, is determined by the contact resistance between the conductor and the ground as well as the earth return resistance which varies considerably, depending upon the terrain.

This combination of conditions is further aggravated due to burning of grass and small plants adjacent to the fallen conductor.

A progressive drying-out process starts with an inverse time effect in which the earth fault current reduces exponentially with time.

Such conditions would seem to preclude protection devices having inverse time characteristics, because of the divergence of the two time conditions.

#### 4.7 AUTO RECLOSE:

The application of High Sensitivity Earth Fault Relays to ESCOM's Rural Distribution Network has not resulted in any need to modify the accepted auto reclose cycle.

In general, this demands that the circuit be "dead" for at least 10 seconds before auto reclose.

A maximum of three auto-reclose attempts are allowed before lockout-giving the standard 30 second cycle.

As seen from para. 4.6 above, the earth fault current invariably decreases with successive reclosures, in the case of a fallen conductor. Where standard earth fault protection is used, this could often result in a tripout in the first instance, followed by a successful reclosure with the live conductor lying on the ground.

#### 4.8 A BONUS:

Fairly soon after the introduction of High Sensitivity Earth Fault Relays, ESCOM found that a number of tripouts occurred due to operation of these relays, where no actual earth leakage was found. Some of these were attributed to transient type faults such as falling branches or bark of trees lying across the line.

Further investigation however showed that associated with these tripouts, there was a high incidence of broken conductors not touching the ground and broken or loose connections in jumpers in the run of main lines or well loaded "TEE" circuits.

It was ultimately deduced that an unbalanced zero phase sequence current had been detected, arising out of the loose or broken connection in the line.

Since all transmission lines have a shunt capacitance to earth, the probability existed that the normal vectorial balance of the leakage currents through the three equal shunt capacitances to earth had been disturbed. This would have occurred due to the apparent difference in length between the conductors, resulting from the break in the line.

The shunt capacitance of a transmission line can be shown to be:-

$$C = 10^{-9} \frac{18 \log_e \frac{D}{a}}{a} \quad \text{Farads per metre}$$

where  $a$  is the diameter of the conductor and  $D$  is the Geometric Mean Spacing between the conductors.

$$D = \sqrt[3]{D_{ab} \cdot D_{bc} \cdot D_{ca}}$$

If we consider extreme conditions for ratio  $\frac{D}{a}$  of say 10 to 1 000, this would yield values of  $C$  as 0.024 microfarads per Kilometer to 0.00805 microfarads per Kilometer.

By applying these shunt capacitance values to an 11 kV line, it will be seen that shunt leakages varying from 50mA per Kilometer to 16mA per Kilometer could be expected.

Thus it can be deduced that for line lengths exceeding about 20 to 30 Kilometers, Sensitive Earth Fault Relays having a primary sensitivity of 500 milliamperes, will also behave as phase failure relays, by detection of the out of balance shunt capacitance of the line.

resultaat van 'n los verbinding, of 'n hoëveerstand fout, wat veroorsaak word deur 'n gekraakte isolator, of foutiewe blitsafleier. Die probleem word vererger wanneer foute ontstaan gedurende reënweer en dan oënskynlik verdwyn in warm sonlig.

Opsporing van sulke onderbroke foute het EVKOM se Plattelandse Elektrifikasiedepartement aangespoor om die normale onbalansstroom in die aardfoutbeveiligingsbaan van elke voeder te meet. Dit het geblyk tussen omtrent 2 tot 5 milliamp, te wees. Verwys na die primêre kant verteenwoordig dit 'n staande lekstroom van 50 tot 200 milliampere. Toegerus met hierdie kennis, is dit 'n betreklike eenvoudige saak om die verswakking van isolasieveerstand in 'n stelsel, aan die toename in aardlekstroom te monitor.

Die gebruik van selektiewe skakeling by foutlokalisering in 'n stelsel kan op hierdie wyse uitgebrei word tot die lokalisering van toeneemende aardfoute, wat egter nog nie groot genoeg is om uitklink te veroorsaak nie.

#### 4.6 GELIERS WAT NEERGESTORT HET:

Die beperking van aardfoutstrome by geliers wat op die grond lê, word bepaal deur die kontakweerstand tussen die geliers en die grond, asook die aardterugvloei weerstand; beide faktore wat wissel afhanglik van die omgewing.

Hierdie samevoeging van omstandighede word verder vererger deur die verbranding van gras en klein plante in die omgewing van die geleier. 'n Toeneemende uitdrogingsproses neem 'n aanvang, met 'n omgekeerde tydfeffek, waarin die aardfoutstroom eksponensieel afneem met tyd.

Sulke toestande sluit die gebruik uit van beveiligingstoestelle met omgekeerde tyd eienskappe, as gevolg van die sameloep van die twee outoherstellers.

#### 4.7 OUTOHERSLUIT:

Die aanwending van hoë gevoeligheid aardfoutrelés in EVKOM se Plattelandse Verspreidingsnetwerk het geen nodigheid laat ontstaan vir veranderings aan die outoherstelsels nie. In die algemeen word verreis dat die lyn "dood" sal wees vir ten minste 10 sekondes, voordat hersluiting plaasvind. 'n Maksimum van 2 hersluitingspogings word toegelaat voor uitsluiting. So ontstaan die standaard 30 sekondes siklus.

Soos blyk uit paragraaf 4.6 neem die aardfoutstroom in die geval van 'n geleier wat neergestort het, normaal weg af met opeenvolgende hersluiting. Waar standaard aardfoutbeveiliging gebruik word, kan dit gebeur dat uitklink gevolg word deur 'n suksesvolle hersluiting, met die lewendige geleier op die grond.

#### 4.8 BONUS:

Spoedig na die ingebruikneming van hoë gevoeligheid aardfoutrelés het EVKOM gevind dat uitklink, as gevolg van die werking van hierdie relés soms voorgekom het, sonder dat 'n aardfout gevind kon word. Sommige hiervan was toegeskryf aan organieke soorte van foute soos vallende takke, of bos of bome wat oor die lyn lê.

Verdere ondersoek egter het aan die lig gebring dat hierdie uitklinkings dikwels geopaard gegaan het met gebreke geleiers, wat nie die grond raak nie en gebreke of las oorleidings in die loop van die hooflyn, of swaar belaaide "T" bane.

Die uiteindelige gevolgtrekking was dat nul fase-ord strome, wat ontstaan het as gevolg van die los of gebreke verbinding in die lyn oopspoor was.

Aangesien alle transmissielyns 'n parallel-kapasitansie na aarde besit, bestaan die moontlikheid dat die normale vektorbalans van die lekstrome deur die drie gelyke kapasitansies na aarde, versterk was. Dit sal gebeur as gevolg van die waarskynlik verskil in lengte tussen die geleiers nadat een lyn geleier gebreek het.

Dit kan getoon word dat die parallel-kapasitansie van 'n transmissielyn gegee word deur:-

$$C = \frac{10^{-9}}{181 \log_e \frac{D}{a}} \text{ farad/meter.}$$

Waar  $a$  die deursnee van die geleier is en  $D$  die geometries gemiddelde spasiering van die geleiers.

$$D = \sqrt[3]{D_{ab} \cdot D_{bc} \cdot D_{ca}}$$

Beskou die twee uiterste waardes van 10 en 1000 vir die verhouding  $D/a$ . Die ooreenkomstige waardes van  $C$  is 0,023 en 0,00805 mikrofarad per Kilometer respektiewelik.

Met hierdie twee kapasitansiewaardes in 'n 11kV stelsel kan lekstrome van 50mA. en 16mA. per Kilometer respektiewelik verwag word.

Dit blyk dus dat Gevoelige Aardfoutrelés met 'n primêre gevoeligheid van 500mA. by lynlengtes van meer as 20 tot 30 Kilometers, ook sal optree as fasefalrelés, deurdat hulle die uitbalans in die parallel-kapasitansie van die lyn, sal oopspoor.



#### 4.9 ANALYSIS OF FAULTS:

During the period November 1970 to November 1973, an analysis of tripoints due to operation of Sensitive Earth Fault Relays was made by the Rural Electrification Dept. of ESCOM's Rand and O.F.S. Undertaking, confined mainly to 6.6 KV and 11 KV lines.

The summary reproduced below is not intended to represent a complete record of tripoints over the period concerned, since a large number of similar faults were cleared by the standard overload or earth fault protection, before the discriminating period allowed by the Sensitive Earth Fault Protection.

The recorded tripoints were due only to operation of the Sensitive Earth Fault Protection and excluded the operations in the Western Area of the Undertaking.

Table I classifies the types and description of causes of fault, whilst Table II gives an analysis of the actual recorded faults.

TABLE I

Fault Classification.	DESCRIPTION OF FAULT
A	Breakdown of Apparatus including Insulators, gang operated isolators, fuses and transformers.
B	Broken or loose connections on jumpers in the run of main lines or well loaded "TEE" circuits.
C	Broken conductors caused by lightning or trees and danger to persons and animals if circuit remains alive.
D	Faulty lightning Arresters. s.
E	Defective Relays or protection circuit and/or Incorrect operation.
F	Miscellaneous faults caused by broken-poles, crossarms, guardnets, trees, wire throwing etc.
G	Consumer Fault (nor buffer transformer).
H	Unaccounted for Transient faults probably caused by bark and branches or trees and birds which fall clear.

Fault Classification	December 1970 to Oct. 1971		January 1972 to Dec. 1972		January 1973 to Nov. 1973		3 year Average	
	No. of Faults	% TO-TAL	No. of Faults	% TO-TAL	No. of Faults	% TO-TAL	PER-CENT	
A	13	30	10	31.6	25	28.4	30%	
B	7	16	11	19.3	10	11.4	15.6%	
C	7	16	5	8.8	6	6.8	10.5%	
D	-	-	7	12.3	10	11.4	7.9%	
E	6	13	2	3.5	2	2.3	6.2%	
F	1	2.5	6	10.5	7	7.9	7%	
G	1	2.5	-	-	-	-	0.9%	
H	9	20	8	14	28	31.8	21.9%	
TOTAL	44	100%	57	100%	88	100%	100%	

The increase in recorded faults over the three year period considered arises largely from the greater coverage of installations having High Sensitive Earth Fault Relays.

There is an obvious reduction in tripoints due to defective relays and incorrect operation, due to improvements in equipment and techniques arising out of field experience.

A remarkable consistency in the percentage of tripoints due to the various types of fault is beginning to emerge, and this can be clearly seen in Table II.

#### 4.9 FOUTANALISE:

Die Plattelandse Elektrifikasie Departement van EVKOM se Randse en Oranje Vrystaatse Onderneming, het gedurende die periode vanaf November 1970 tot November 1973, 'n analiese gedoen van uitklinkings deur Sensitiewe Aardfout relés, op 6,6kV en 11kV voerders.

Die opsomming wat volg, bied nie 'n volledige beeld van uitklinkings gedurende die betrokke periode nie, aangesien 'n groot aantal soortgelyke foute afgesonder is deur die standaard oorlas en aardfoutbeveiliging voordat die diskrimineer tyd van die Gevoelige Aardfoutbeveiliging verloop het.

Die opgetekende uitklinking was almal te wyte aan Sensitiewe Aardfoutbeveiliging, maar sluit nie gevalle in van die Westelike Area van die Onderneming nie.

Tabel I klassifiseer die tipes en oorsake van foute, terwyl tabel II 'n analiese bied van die werklik geregistreerde foute.

TABEL I

Fout Klassifikasie	FOUTBESKRYWING
A	Onklaarraking van apparaat insluitende isolators, gekoppelde skakels, sekerings en transformators.
B	Gebreekte of los verbindings aan oorleidings in die loop van die hooflyn, of swaar belaste "T" bane.
C	Gebreekte geleiers, veroorsaak deur weerlig of bome, wat ook gewag inhou vir mens en dier indien die kring lewendig sou bly.
D	Foutiewe Blitsafleiers.
E	Defektiewe relés of beveiligingsbane en/of verkeerde werking.
F	Verseke foute as gevolg van gebreekte pale, dwarsarms, skermnette, bome, draadgooiery ens.
G	Verbruikersfout (Geen buffertransformator)
H	Onverklaarde oorgangsfoute, waarskynlik veroorsaak deur boombas en takke of bome en voëls wat vry val.

TABEL II

Fout Klassifikasie	Des. 70 - Okt. 71		Jan. 72 - Des. 72		Jan. 73 - Nov. 73		Gemiddeld 3 jaar	
	Aantal Foute	% Totaal	Aantal Foute	% Totaal	Aantal Foute	% Totaal	3 jaar	%
A	13	30	10	31,6	25	28,4	30	
B	7	16	11	19,3	10	11,4	15,6	
C	7	16	5	8,8	6	6,8	10,5	
D	-	-	7	12,3	10	11,4	7,9	
E	6	13	2	3,5	2	2,3	6,2	
F	1	2,5	6	10,5	7	7,9	7	
G	1	2,5	-	-	-	-	0,9	
H	9	20	8	14	28	31,8	21,9	
TOTAL	44%	100%	57%	100%	88%	100%	100%	

Die toename in die aangetekende foute oor die driejaar tydperk wat in oenskou is, kan grootliks toegeskryf word aan die meerdere gebruik van installasies met Hoëgevoeligheidsaardfoutrelés.

Verbeterde uitrusting en tegnieke uit gebruiksondervinding gebore, het 'n ooplopende vermindering van uitklinking as gevolg van foutiewe relés of verkeerde werking meegebring.

Dis is merkwaardig hoe 'n vaste patroon in die persentasie klinkings as gevolg van die verskillende soorte foute te voorskyn tree soos duidelik blyk uit Tabel II.

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## 5. SOME INTERESTING CASE HISTORIES.

### 5.1 FALLEN LINE:

One of the earliest cases of a fallen transmission line that was subject to a concentrated investigation is recalled.

In 1967, prior to the installation of High Sensitive Earth Fault Protection a 6.6 KV overhead line on the Witwatersrand was struck by lightning.

The controlling circuit breaker in the substation tripped on earth fault and single phase overload.

The circuit breaker was manually reclosed, and stayed in.

Following a no lights report later, an inspection crew, found that two of three conductors of the 6.6 kV overhead transmission line had been severed by lightning and were lying on the ground – alive.

Adjacent to the fallen lines, small plants and grass showed signs of burning.

A large number of dead frogs were found in the immediate vicinity of the fallen conductors, apparently having been electrocuted by the potential difference between their legs.

Tests were taken shortly afterwards and under wet conditions, the earth fault current was found to be 8 amperes.

This was far below the setting of the earth fault relay which was 20% on 500/5 current transformers i.e. an earth fault setting of 100 amperes.

A 20mm diameter copper spike was then driven 0.6 metre into the wet ground.

The earth fault current with one line down increased to 20 amperes – still far too low for the existing protection.

Later, under dry conditions, the earth fault current, with a fallen line was checked in the same area. In this case, the maximum earth current measured was 0.9 amperes.

In an additional test on this line it was found that with the fallen line, an initial earth current of approximately 6 amperes dropped rapidly to 2.5 amperes, reducing almost to zero within 20 seconds, due to the drying out of the surrounding vegetation.

### 5.2 FAULT TO STAY WIRE:

A case recorded in the dry winter months in the Transvaal, again involved a 6.6 KV line, on which one phase touched the earthed stay wire. The earth surrounding the faulted stay wire had been glazed and recorded earth current 0.4 amperes.

For comparative purposes, the fault was transferred to a healthy stay wire, buried approximately 2 metres in a cement block, and located about 100 metres from the sub-station.

In this case the recorded earth fault current was 9.5 amperes.

### 5.3 SIMULATED TEST:

The figures as recorded in Tables I and II are confirmed by a test conducted by ESCOM on a 6.6 KV line near Pretoria in February, 1968.

In this case a fallen line was simulated with something over 50 metres of 70mm<sup>2</sup> conductor lying on the ground in a sandy terrain.

Recorded earth current 0.9 amperes approximately 12 Kilometres from the sub-station.

### 5.4.2.2 KV LINE:

In November 1969, a report was received that a cow had been electrocuted against a stay wire on a 2.2 KV private line in the northern O.F.S.

The line was approximately 4 Kilometres long off wooden poles and was protected by a time delayed earth leakage protection device of nominal 375mA sensitivity.

Subsequent simulated test on this line by dropping approximately 20 metres of fallen conductor onto the dry grass showed that the maximum recorded earth fault was 400mA tailing off rapidly to approximately 200mA due to light burning of the grass in contact with the fallen line.

This line was finally protected at 70mA and 2 seconds delay with little or no transient tripping during the summer storms.

Here again, the animal was probably electrocuted due to the potential gradient between its fore and hind legs while rubbing itself against the faulted stay wire.

Middlecote in his paper "Earth Leakage" presented at the 31st Convention of the A.M.E.U. in Margate,<sup>2</sup> gave figures for the Potential Gradient area of an earth electrode.

It was shown that about 90 percent of the total earthing resistance voltage drop takes place over the potential gradient area, which for a rod electrode is the area of a circle having the electrode as centre and radius equal to 1.5 times the depth of the electrode.

For the case cited above, assuming the stay wire to be 2 metres deep, volt drop at a point 3 metres from the stay wire would have been

$$\frac{2200 \times 0.9}{1.732} = 1143 \text{ Volts.}$$

If the distance between the cows legs was 1.5 metres this would have represented a potential gradient of  $1143 \times \frac{1.5}{3} = 570$  Volts.

## 6. APPLICATION TO LOW VOLTAGE LINES:

The problems arising from limitation of earth fault currents obviously increase as the system voltage becomes lower.

An investigation was carried out into the possibilities of applying similar High Sensitivity Earth Fault Relays to urban 380 Volt Overhead Distribution Lines.

### 6.1 SELECTIVITY:

A pre-requisite to the application of Sensitive Earth Fault Protec-

## 5. ENKELE INTERESSANTE GESKIEDKUNDIGE GEVALLE.

### 5.1 Gevalle lynne:

Een van die vroegste voorbeeld van 'n gevalle transmissielyn wat die onderwerp van intensiewe ondersoek was, word in herinnering gebring. In 1967, voordat Gevoelige Aardfoutbeveiliging in gebruik geneem is, is 'n 6,6kV bogronde lyn aan die Witwatersrand deur weerlig raakgeslaan.

Die behorende kringbreker in die substasie het op aardfout en enkel-fase oorstroom geklink.

Die kringbreker is met die hand hersluit en het ingesakkel gebly.

Na klages van die drie ligte het 'n later ondersoekspan gevind dat die weerlig twee van die drie geleiers van die 6,6 lyn afgeslaan het – en dat die drade lewendig op die grond bly lê het.

Struik en gras naby die gevalle drade was verskroei.

'n Groot aantal dooie paddas is in die onmiddellike omgewing opgemerk, oënskynlik doodgeskok deur die spanningsverskil oor hulle pote.

Toets was 'n klein rukkies later gedoen is, het 'n aardfoutrroom van 8 amperes onder na toestand gepeleer.

Dit was ver onder die aardfoutrle instelling van 20% op 500/5 stroomtransformators, dit is 'n aardfoutrinstelling van 110 amperes.

'n Koperpen, 20mm dik is daarna 0.6 meter diep in die nat grond ingeslaan.

Die aardfoutrroom met een lyn onder droë toestande is later in dieselfde omgewing gemaak. Die hoogste lesing was 0,9 amperes.

In 'n bykomstige toets op hierdie lyn is gevind dat die aanvanklike stroom van sowat 6 amperes met die geleiers op die grond vinnig afneem tot 2,5 amperes en binne twintig sekondes daal tot feitlik nul a.g.v. verskroeiing van die omgewende plantegroei.

### 5.2 FOUT NA ANKERDRAAD:

In 'n geval wat gedurende die droë wintermaande in die Transvaal aangeteken is, het een geleier wat 'n 6,6kV lyn met 'n ankerdraad in aanraking gekom. Die grond naby die ankerdraad was verglas en aardfoutrroom van 0,4 amperes is gemaak.

Vergelykenderwys is die fout oorgegaa op 'n gesonde ankerdraad wat sowat 2 meter diep aan 'n sementblok geset is, ongeveer 100 meter van die substasie af.

Aardfoutrroom van 9,5 amperes is aangeteken.

### 5.3 NAGEMAAKTE TOETS:

Die syfers in Tabele I en II aangeteken, word bevestig deur 'n toets wat EVKOM in Februarie 1968 op 'n 6,6kV lyn naby Pretoria gedoen het.

In die geval is 'n gevalle lyn nagemaak deur iets meer as 50 meter 70mm<sup>2</sup> kaaldraad wat oor sandrige grond gele is.

0,9 Amperes aardstroom is sowat 12 kilometer van die substasie af gemaak.

### 5.4 2,2KV LYNE:

In November 1969 is berig ontvang dat 'n koei wat met 'n ankerdraad op 'n 2,2kV private lyn in die noordelike O.V.S. in aanraking gekom het, doodgeskok is.

Die houtpaallyn van sowat 4 Kilometer was beskerm deur 'n tydvertraagde aardlekbeveiligingstoeliet met 'n nominale gevoeligheid van 375mA.

Foute op die lyn is later nagemaak deur 'n 20 meter lengte geleier op die droë gras onder die lyn te laat val. Die hoogste aardfoutrle aangeteken was 400mA en dit het gou gedaal tot sowat 200mA a.g.v. ligte verskroeiing van die omgewende gras.

Die lyn is uiteindeklik beveilig teen 70mA en 2 sekondes vertraging met min of geen uitklinking a.g.v. oorgangverskynsels gedurende somerstorms.

Hier weer, is die dier waarskynlik gedood deur die spanningshelling tussen die voor- en agterpote terwyl sy haar teen die lewendige ankerdraad geskuur het.

Middlecote het in sy referaat "aardlekkaasie" wat hv by die 31ste Konvensie van die V.M.E.O te Margate voorgedra het, waardes vir die Spanningshellingsgebied van 'n grondelektrode aangedui.

Hy het aangetoon dat omtrent 90% van die totale aardingsweerstandspanningsval plaasvind oor die spanningshellingsgebied, wat in die geval van 'n penelektrode die oppervlakte van 'n sirkel met die pen as middelpunt en straal gelyk aan 1,5 keer die diepte van die pen is.

In die onderhawige geval, aangeneem dat die anker twee meter diep is, sou die spanning by 'n punt 3 meter van die ankerdraad af  $\frac{2200 \times 0.9}{1.732} = 1143$  Volt wees.

As die afstand tussen die dier se pote 1,5 meter was, sou dit 'n spanningshelling van  $1143 \times \frac{1.5}{3} = 570$  Volt verteenwoordig.

## 6. GEBRUIK OP LAAGSPANNINGSLYNE:

Die struikelblokke wat uit die beperking van aardfoutrstrome voortvloei vererger natuurlik namate die stelselspanning laer word.

Ondersoek is ingestel na moontlikheid om Hoëgevoelighedsaardfoutrleë soortgelyk aan die voorafgaande op stedelike 380 V bogronde verspreidingslyne te gebruik.

### 6.1 SELEKTIEWITHEIT:

'n Voorwaarde vir die gebruik van Gevoelige Aardfoutrbeveiliging

tion to 380 Volt Distribution Lines is that each consumer associated with the protected line, have individual 20mA Instantaneous type Earth Leakage Protection fitted, covering each entire installation, this however is not always practical for consumers other than domestic consumers.

This would however obviate the obvious inconvenience of tripping out the entire circuit upon the occurrence of an earth fault on any of the consumer's premises.

A further advantage arising out of individual consumer protection would be that a definite limit would be placed on the standing leakage contribution from the individual consumers.

#### 6.2 STANDING LEAKAGE:

In addition to the standing leakage contribution from consumers on the line, it must be expected that there will be a certain contribution to the standing leakage due to atmospheric pollution on the pole insulators.

The total standing leakage will obviously depend upon the geographical location, environmental conditions, length of line and the number of consumers on the line, and could be expected to vary between approximately 50 milliamperes and 200 milliamperes.

#### 6.3 TEST AT PIETERMARITZBURG:

Tests were conducted on the Mayor's Walk 380/220 Volt line fed from the Bale Street substation in Pietermaritzburg during February 1973, on a hot sunny day.

At 300 metres from the substation with 25 metres of conductor lying on dry grass the measured fault current from the fallen conductor was only 280mA.

This increased to 550mA when the end of the bare wire was pushed into the ground.

When the fallen conductor was moved on to the tarmac road the measured leakage was only 50mA.

An increase of about 20% in the measured earth fault currents was seen with the test repeated 75 metres from the substation.

The maximum earth current detected with the dropped line solidly buried to a depth of 250mm was 1,4 amperes.

#### 6.4 DURBAN CORPORATION:

Tests conducted at Durban Corporation's Kwa Mashu Substation on a circuit confined to streetlighting showed even more disappointing results.

Earth Leakage under normal conditions 145mA

At a position 300 metres from sub.

a) on grass 150mA

b) on tar road 155mA

At a position 200 metres from sub.

i) on grass 160mA

ii) on tar road 155mA

#### 6.5 OBSERVATIONS:

The application of High Sensitive Earth Fault protection to low Voltage Overhead Lines is complicated not only by the very low earth fault currents generated by the contact between the fallen line and the ground, but also due to the standing leakage currents being comparable in magnitude with the actual earth fault currents.

#### 7. CONCLUSIONS:

Several years of successful field operation of High Sensitivity Earth Fault Relays, applied particularly to High Voltage (i.e. 6.6 KV, 11 KV and 22KV) Overhead Transmission Lines has proven that a highly satisfactory protection system is possible even when faced with extreme topographic and environmental conditions, such as found on the South African Highveld.

It should be noted that in the event of the fallen conductor being on the "dead" side of the break the resulting fault current is so low due to the limiting effect of additional series impedances, that even this high sensitivity earth fault protection cannot operate.

This satisfactory High Sensitive Earth Fault Protection System provides freedom of nuisance or transient operation and is easily adaptable to co-ordinated selective tripping schemes.

The Electricity Supply Commission is to be commended for their interest and positive action in the solution of these problems particularly on their Rural Distribution Systems.

Over the several years of installation of these devices, there is no record of an undetected fallen transmission line where these high sensitive devices had been fitted.

This enviable safety record suggests the elimination of the need for hundreds of Kilometres of guard netting, without detracting from, but in fact achieving an improvement in safety.

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op 380 V verspreidingslyne is dat elke verbruiker wat van die lyn gevoed word met 'n eie afsonderlike 20mA Oombliklike Aardlekbeveiligingsreël toegerus moet wees wat elke afsonderlike installasie geheel en al dek. Met die uitsondering van huishoudelike verbruikers is dit egter nie in alle gevalle uitvoerbaar nie.

Waar aan bestaande vereiste voldoen word, word die ongerief, wat die uitklinking van die netwerk in sy geheel meebring wanneer 'n aardfout op 'n enkele verbruiker se perseel voorkom, vermy.

'n Bykomende voordeel van die beveiliging van afsonderlike verbruikers is die vasgestelde perk op elke verbruiker se bydrae tot die staande lekkasie.

#### 6.2 STAANDE LEKKASIE:

Benewens die staande lekkasie van die verbruikers afkomstig, kan 'n bydrae tot staande lekkasie a.g.v. lugbesoedeling oor die isolators verwag word.

Totale staande lekkasie sal natuurlik van aardrykskundige ligging, omgewende toestande, lynlengte en die aantal verbruikers op die lyn afhang. Daar word verwag dat dit van sowat 50 tot 200mA sal wissel.

#### 6.3 TOETSE TE PIETERMARITZBURG:

Op 'n warm dag in Februarie 1973 is toetse in Pietermaritzburg op die Mayor's Walk 380/220 volt lyn gedoen. Die lyn word deur die Balestraat substasie gevoed.

300 Meter van die substasie af was die foutstroom met 25 meter kaaldraad op droë groen gras slegs 280mA.

Die foutstroom het tot 550mA gestyg toe die end van die geleier in die grond ingedruk is.

Met die gevalle geleier op die teerpad was die aardlekassie slegs 50mA.

75 Meter van die substasie af het die aardfoutlesings met sowat 20% toegeneem bo die voorafgaande lesings.

Met die gevalle geleier, goed vasgestamp, 250 mm ondergronds, is 'n maksimum grondstroom van 1,4 ampere aangeteken.

#### 6.4 STADSBESTUUR DURBAN:

Uitsaai van toetse wat by Durban Stadsbestuur se Kwa Mashu substasie op 'n kring, tot slegs straatverligting beperk uitgevoer is, was nog ontmoedigender.

Staanlekkasie onder gewone omstandighede 145mA

Met fout by 'n punt 300 meter van substasie:

a) op gras 150mA

b) op teerpad 155mA

Met fout by 'n punt 20 meter van die substasie:

a) op gras 160mA

b) op teerpad 155mA

#### 6.5 OPMERKINGS:

Die gebruik van Hoogsgevoelige Aardfoutbeveiliging op laagspanning bogronde lyne word bemoeilik nie alleen deur die lae aardfoutroume a.g.v. die kontak tussen die gevalle lyn en die grond nie maar ook omdat die staande lekstrome met die werklike aardfoutroume in omvang vergelyk.

#### 7. GEVOLGTREKKINGS:

Verseke jare se suksesvolle gebruik van Hoogsgevoeligheidsaardfoutrourelis op veral hoogspannings (d.i. 6,6, 11 en 22KV) bogronde transmissielyste het bewys dat 'n baie bevredigende veiligheidskema moontlik is, nie te staanste uitere topografiese en omgewende toestande soos op die Suid-Afrikaans Hoëveld nie.

Hierdie bevredigende Hoogsgevoelige Aardfoutroureliskema is sonder las van oorbodige klinking of uitklinking a.g.v. oorgangsverskynsels. Ook kan dit maklik by selektiefgraderde klinskemas aangepas word.

Die Elektrisiteitsvoorsieningskommissie moet gloef word vir hul belangstelling in die probleme en die besliste optrede, veral deur hul Plattelandse Elektrieseafdeling, om 'n oplossing daarvoor te vind.

Oor die verskeie jare waarin Hoogsgevoelige Aardfoutroureliskema's reël in gebruik was, is geen geval aangeteken waar 'n lyn met die reël toegerus ongesiens geval het nie.

(Daar dien egter opegetel te word dat as die gevalle geleier aan die "doeie" kant van die breek is mag die aardfoutrourelis so laag wees a.g.v. die bykomstige serie-impedansie dat selfs die Hoogsgevoelige Aardfoutrourelis nie kan werk nie.)

Die bydenywaardige Veiligheidsgeskiedenis skyn die gebruik van honderde kilometers veiligheidsnet oorbodig te maak sonder om afbreuk te doen aan die veiligheid van die lyn - intedeel, dit is eerder byzonderlik daarvoor!

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– EVKOM Departement Elektriese Toetse, Simmerpa, wat verantwoordelik was vir die aanvanklike voorafkrite asook daaropvolgende laboratorium en gebruiktoetsing van die relés.

– EVKOM (R & O.V.S.) Onderneming, Departement Plattelandse Elektriese Toetse vir hul bydrae aan registers en inligting m.b.t. gebruiktoetsing asook die toestemming om die inligting te publiseer.

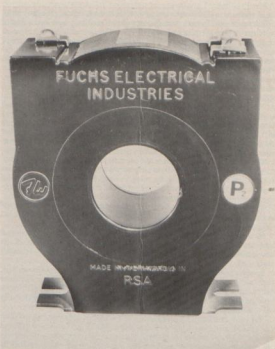
– Elektrieseafdeling Pietermaritzburg, vir hul hulp met die uitvoering van gebruiktoetse.

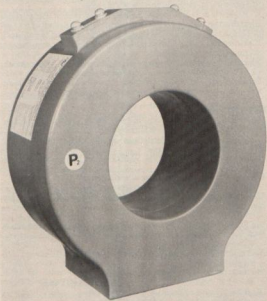
– Elektrieseafdeling, Durban Stadsbestuur vir hul bydrae asook vir hul hulp met toetse op gevalle laagspanningslyne.

– Personeellede van Fuchs Elektriese Nywerhede wat behulpsaam was met die gebruiktoetsing, redaksie, tikwerk ens.

#### VERWYSINGS:-

- 1 Die referaat "Sensitive Core-Balance Earth Leakage Protection Applied to Overhead Lines on High Voltage Systems". – deur H.P. SMITH – Verrigtinge van die VMEO 1967 Vol. I
- 2 Die referaat "Earth Leakage". – deur A.A. MIDDLECOTE VMEO 31ste Konvensie Margate 1967.
- 3 Referaat "What you should know about ground fault protection". – deur J.L. BLACKBURN Westinghouse Electric Corp.
- 4 Memorandum "Besonderhede i.s. Foutopsporing in Plattelandse Netwerke". – EVKOM.
- 5 Die Boek "Electrical Transmission And Distribution Reference Book". – Westinghouse Electric Corp.
- 6 Die Boek "Protective Relays Application Guide" – English Electric Corp.
- 7 Die Boek "Electric Power Transmission" – deur M.D. WEINBACH Uitgewers McMillan, NY 1948.
- 8 Die Boek "Transmission Lines and Networks". – deur Johnson Uitgewers McGraw-Hill.





**Mnr. G.C. Theron** (Vanderbijlpark): Mnr. die President, die probleem wat aanleiding gegee het tot die ontwikkeling van die apparaat deur mnr. Cohen bespreek in die Referaat, is seker een van die Munisipale Ingenieurs se grootste nagmeries.

As die apparaat homself in die praktyk in alle opsigte suksesvol bewys soos in die Referaat in vooruitsig gestel, dan moet die vereniging gerus 'n ere-lidmaatskap aan die skrywer oorweeg, en laat ek sommer dadelik byvoeg dat ek dit geensins skertsend bedoel nie, maar met die eerlike oortuiging, van die gemeoedsrus tot suksesvolle toepassing daarvan vir die Munisipale ingenieur sal beteken.

Mr. President, The equipment described in the paper was developed from the now well known sensitive earth leakage relay, generally used in domestic and factory installations. I can recollect how enthusiastic we were five to six years ago about this relay, visualising the piece of equipment to prevent all electrical accidents in the future, and some of us even thinking of doing away with all earthing in domestic installations but, our good friend Mr. Pat Middlecote warned us to "hamba gashle". Today we are older and wiser, we know that the perfect relay has not yet appeared on the market, and at the international level no agreement on many important aspects are yet in sight.

The author refers in the reference list to a paper read by Mr. Smith in 1967. The equipment which forms the basis of Mr. Smith's paper was experimentally installed at Vanderbijlpark and is still in service although not in its original form. It certainly operated very successfully on the overhead feeder where it was installed, except that the sensitivity was such that it could not be used for direct tripping purposes.

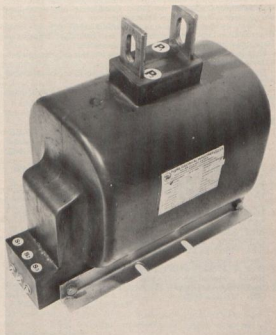
The big problem was during the summer months where every lightning discharge through a lightning arrester caused it to operate, we tried using the high sensitivity relay in conjunction with the reclosing circuit breaker, but obviously this could not be allowed to keep reclosing indefinitely and locking out occurred far too often.

The time-delay feature built into the equipment described by the author may be the answer, but I find no information in the paper that tripping does not happen due to transient lightning dischargers.

In my own house I have an earth leakage relay of the magnetic amplify type, I am fully aware of the reasons why it was taken off the market but I still consider it to be one of the most reliable units ever produced.

In the application of earth leakage relays described by the author, bulk and cost of within limits, not important, I personally would have favoured a magnetic amplify type of relay instead of the electronic equipment in this power application. Are electronic components really all that immune to transient spikes?

Mnr. die President, die skrywer moet werklik hulde gebring word vir die ontwikkelingswerk deur hom gedoen. Dit is geen klein bydrae tot die publiek se veiligheid en ons gemeoedsrus nie, en ons is dankbaar dat hy die toerusting op 'n duidelike en oortuigende wyse onder die Munisipale Ingenieurs se aandag gebring het. Die cordeelkundige



aanwending van die apparaat kan baie daartoe bydra om die verspreidingsreël veiliger te maak.

Dit is ook verbyldend om te verneem van die daadwerklike samewerking tussen die nuwerbede en die verbruikers, soos deur mnr. Cohen aan ons verduidelik.

In conclusion, Mr. President, we want to thank the author for presenting a paper and off the cuff method of presentation which held our attention after such an excellent lunch.

**Mr. V. Cohen** (Fuchs Electrical): Mr. Theron speaks of the problems of spikes of surges on these systems. I think one of his questions was: Are electronic components all that immune to transient spikes? Well the answer to that one is a very, very simple one. Electronic components, per se, are not immune to transient spikes. The immunity to transient spikes has to be designed into the electronic equipment. It is up to the designer of the electronic equipment to ensure that these spikes to which Mr. Theron refers are taken care of and ensure that the damaging possibilities of these spikes do not enter electronic equipment. Provided the electronic equipment is designed properly with this borne in mind, Electronics—as we've seen from the paper this morning, can be used in rather more sophisticated systems than this relatively unsophisticated system we have just discussed.

The final proof of that can only be in the operation, of not only these systems but the many hundreds of thousands, the many millions of similar earth fault protection systems that are in use, not only in this country but around the world.

Mr. Theron further referred to his preference for a magnetic amplifier type of system which he has had, from the sound of it, reasonably good experience over these past many years. This is a device that made its appearance on the S.A. market back in 1957. Mr. Theron may be interested to know, that the difference between that magnetic amplify device, which he has found such tremendous satisfaction, and the electronic devices of today are in effect relatively small. Magnetic amplify device, by and large, relied on semi-conductor solid state components for its operation. It happens to be that one of the components was this P.O. of magnetic cores, that P.O. of magnetic cores has been replaced by a semi-conductor, but the other components in the system are no different from what is being used today, again it is the design on the application and the intelligent usage of the advantage which has been given to us by this wonderful invention of solid state electronics.

I don't know if that is what Mr. Theron wanted, again I can only repeat — it is the usage of these systems that proves the reliability which I think is the main point that is worrying Mr. Theron.

**Mr. D.H. Fraser** (Durban): Mr. President, I would like to congratulate Mr. Cohen on the text of his written paper, and the easy manner in which he presented it. Mr. Theron must have been looking the wrong way but I think it was a little too easy for some of the people around my quarter. They seem to drift off into wonderland.

There can be no doubt that the development of sensitive relays

suitable for use with a core balance C.T. or in a residual circuit of C.T.'s in each phase, has been a tremendous step forward in regard to public safety, and has relieved electricity supply authorities of a great deal of anxiety over fallen high-voltage lines.

A polarised sensitive balanced armature type relay with a definite and adjustable time delay capable of adjustment down to 2 or 3% of the C.T. secondary current, as the author indicated, was introduced over 10 years ago and has proved extremely reliable in service. In the Durban supply area we have installed 164 such relays with highly low long fixed time delays to serve as back-up protection on 6.6 or 11-kV lines, with the total route of being about 500 km.

To my knowledge no fallen conductor in contact with earth on the supply side has remained alive on circuits so protected. Where the line is down on the load side, however, the earth leakage current is generally insufficient to operate the relay, and the hazard of contact with the live wire remains. It is noted that even with the more sensitive solid state relay, this problem is not overcome, as a standing leakage current necessitates setting the relay at a relatively high value. Does Mr. Cohen see any prospect of solving this difficulty?

With regard to leakage currents on high voltage lines the following test results on a 16 km. 6600 V line on the Natal coast, about 25 km north of Durban may be of interest.

I'll quote the residual earth leakage in the transformer neutral under varying conditions of three-phases of the line energised then with two phases only energised and then with one phase only energised, and we took these tests under dry conditions and during a rainy morning.

Now with the three-phases energised, where there was a balance condition so far as capacity currents and leakage was concerned; under dry conditions we registered a leakage, this is a primary leakage of 60 milliamps and during rainy conditions 72 milliamps. When we took out one phase so that there were only two phases of the line energised, under dry conditions the residual leakage was 1,86 amps and under rainy conditions 1,87; and with one phase only energised 3,72 amps under dry conditions and 3,74 amps when it was raining.

Now it's surprising that the separate tests on a dry day with a strong south/easterly wind and on the following day under heavy rain conditions gave practically the same results. The higher residual leakage currents when one or two phases only are energised, can result in the operation of sensitive earth leakage relays, in the case of an open jumper connection or during single phase switching operations, and Mr. Cohen did make reference to this.

In referring to auto-reclosing, the author states that the application of higher sensitivity earth fault relays has not required any modification to the normal auto-reclose cycle. Is it accepted practice to auto-reclose after a sensitive earth fault trip which one might expect would result from a permanent fault on the line in view of the long time delay used. However, the experience on Escom's Rand & O.F.S. Undertakings, from 1970 to 1973 from Table II, quoted in the paper, does reflect a fairly high percentage, that of 21,9% of sensitive earth fault trip-outs on transient faults. Perhaps Mr. Cohen could comment on this?

While I do not presume to deprive the importance of guarding against fallen high-voltage conductors remaining alive, I would say that the greater hazard results from live low voltage lines down. This would of course depend on the proportion of high- and low voltage lines and the environment, but without a doubt this is the case in Durban.

In a twelve month period to September 1973, out of a total of 480 wires down - 50, that is about 10%, were 6.6 kV and above, while 333 were low voltage and streetlighting mains and 93 were earth wires.

Streetlighting overhead mains alone accounted for 206 of the fallen lines, representing 43% of the total.

These are particularly dangerous as the smaller size conductors used have less mechanical strength and are more susceptible to burn down through arcing. Furthermore, as a broken streetlighting wire does not result in loss of supply to consumers, prompt reporting of the failure is unlikely. This is particularly noticeable in non-European townships where telephones are few and far between and where the danger of electrocution is greater due to higher number of pedestrians, particularly children. We had the misfortune of an electrocution in Durban in an Indian residential area some years ago, when a live streetlight wire rested on shrubs and long grass for three days without being reported until someone walked into it late one night with tragic consequences.

Mr. Cohen states in his paper, his written paper, he didn't quite say this in his verbal summary of the paper that enormous scope exists for applying this relay on low-voltage overhead lines. But then he goes on to indicate the various factors which seem to preclude this application on low voltage circuits in the same manner as on high voltage circuits. The main problem substantiated by tests made in Durban to which the author has referred, is the low earth leakage current resulting from the fallen low voltage conductor in contact with the ground, due to higher contact resistance, coupled with a relatively high standing leakage current on line insulators and in consumers' premises. I would be grateful if Mr. Cohen could say whether in fact he does see a practical application of the relay to low voltage overhead distribution, and if so, how the snags he has listed, are overcome.

Some experimental work has been undertaken in my department on a protective scheme designed to detect an open-circuit condition on the live or the neutral conductor or the earth wire, in single-phase overhead streetlighting circuits. Essentially by monitoring the standing current flowing to earth through a permanently connected resistor

between live and earth at the end of the circuit. Field trials on a limited scale has shown this scheme to be workable and stable. An apparent mal-operation of the relay was after investigation found to be due to an open jumper. The device is not adaptable to normal three-phase low tension distribution circuits, however, or to streetlighting circuits sharing the neutral of a low voltage circuit.

Furthermore, the protection of branches off a main circuit has to be specifically catered for. So that each installation has to be tailored according to the layout. This represents a rather serious practical disadvantage, owing to the periodic changes that are necessary in low voltage distribution circuits.

Mr. President, in conclusion I'd like to thank the author for his very valuable contributions to the proceedings of this Association.

**Mr. V. Cohen (Fuch Electrical):** The first query as far as the protection of high voltage lines with a line fall on the load side, this is an extremely difficult one, there is no positive solution to this one at this time.

The problem arises from the fact that when the line falls on the load side of the system, in other words, the so called dead side of the break, the additional impedances in the circuit by virtue of the load impedance are such that the resulting currents being limited by the additional load impedance are so very low that they cannot be detected due to the preset sensitivity levels of these devices which had been decided in order to overcome the spurious trip relation. Obviously an improvement in the situation could be achieved by setting the primary sensitivity to a more sensitive level. The trade-off here would be a nuisance tripping. Whether Escom's level of 500 milliamps is the optimum, we don't know, Escom are apparently satisfied with this and the result it gives is protection under the majority of the faulty conditions which they have found. It is not to say that we could not go more sensitive as the relay and its associated current transformers certainly are capable of moving to higher sensitivities. Possibly this is a condition that it would have to be examined in relation to particular areas and in the areas where the standing leakages are shown or proven to be lower than the levels that we're talking about, there is no reason why these lines could be protected at a more sensitive level. In the text I think I described a relatively low voltage line, that was a 2200 Volt line in the Free State that was protected some four or five years ago, eventually at 70 milliamps, initial attempts were made to be even more ambitious during the rainy season particularly due to leakage over the sheds under wet conditions. But in fact we were able to achieve the protection level at 70 milliamps with a minimum of nuisance tripping, I'm not suggesting we go to 70 milliamps it was merely quoted as an example.

But here the possibility lies that this protection can be improved, not so much with time but improved by going to higher sensitivity levels. The ultimate solution to this problem is a question for further development. I think it is in the hands of the manufacturers and other interested people such as supply authorities to continue their work on this one and hopefully a solution one day may be found.

This leads directly on to the question of protection of low voltage lines. Here again there is the problem of sensitivity related to the standing leakage on the systems. The sensitivity for these devices is no problem, it is no problem whatsoever, in fact, there is as you probably have noticed in the descriptive leaflets before you, there is a version of this device available which is known as a direct reading version in which the measured time resistivity can be achieved from 10 through 100 milliamps. These very, very high levels of sensitivity would certainly make possible tripping conditions on low voltage protection systems. The problem is a standing leakage. The standing leakage rises out of two main conditions, the major of these being the leakage at individual consumer's premises, the next one is the question of leakage across insulators which is aggravated and increased by environmental pollution, rain, mist and so forth. I think the immediate possibility of improving these conditions, lies in reducing the controllable part of that leakage across the isolators and the stand of insulators. The leakage here is on the individual consumer's premises, no doubt the moves to regularise the installation of earth leakage relays, will certainly help in this regard by reducing the overall contribution from each consumer. Obviously with each consumer individually protected a lot of existing faults will immediately be obvious, they will be detected and the consumers will in effect be forced to clear the faulty appliances and by and large, faulty installations. So, at this time, all I can say, is that this will lead to an improvement in the condition, it will bring the application of these devices to streetlighting slightly closer, it is not the solution yet and again it is a subject for intensive development. Here we have achieved an improvement on the traditional methods of protection; we have gone a long way, we have not reached our goal, there is a long way to go yet and we, the manufacturers certainly, will be working to that goal. The last question, the question of auto reclose, is not really a question for me to answer. I think this is something for the ESCOM people to comment on. I have quoted the results of ESCOM's experience, their analysis over 4 years of application of these devices to their systems, had led them to the conclusion that there was no modification required to their traditional systems. This possibility, possibly is a compromise between the continuity of service and the prospective danger during the reclosure period and ESCOM have found statistically, that during the relatively short periods involved, the statistical chances of anyone being hurt at those times, has proven from their practical abdications, to be relatively low, so here

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again is something of a compromise which I suppose we live with all our lives and this is the deduction of the ESCOM people that has been conveyed to me at this time.

There was another remark made by Mr. Fraser regarding the small difference in his test results during dry and rainy conditions. It is my opinion that the reason for this is peculiar to Mr. Fraser's environmental area again if these tests had been done on the Highveld, the chances are his tests would not have shown the same results. In the Coastal areas, particularly in the almost sub-tropical areas of Natal, when they speak of dry and rainy conditions, I think this is a relative comparison, dry (Natal), is probably extremely wet for Transvaan and we probably find that their soil retains a lot of moisture arising out of their humidity as much any other conditions, so I would say that it is difficult under uncontrolled conditions to analyse results such as this, but my conclusion would be that the retained moisture in the ground is the reason for the lack of difference under those tests. Mr. Fraser, I hope that has answered your questions.

**Mr. I.H. Hess** (Cape Town): Mr. President, I would like to subscribe to Mr. Fraser's remarks. I thought this was a remarkably well-presented paper. I really felt that Mr. Cohen put his points to us extremely well indeed. I got a few figures from ESCOM in the Western Cape, to our conditions perhaps a little bit different. We are rather subject to heavy pollution in summer periods when we have no rain and therefore have rather extensive or greater leakage problems on particularly higher voltage lines. ESCOM did in fact install one of these devices on a line to Brackenfell. They had 300 trips in a 3-month period, so obviously from their experience there, this has serious limitations, but I personally feel that from Cape Town's own point of view, if this device could, in conjunction with the present move to make earth leakage mandatory for household installations, then I think this device, possibly on the low voltage side, may have quite a big future.

If we can control the leakage on the consumer's side with earth leakage relays, then I think that possibly this device may assist us considerably. In our dry summer periods, we do get the occasional line down. On the H.V. side we have only had four occasions. I think over the last 10 years for 11 kV lines, where we have had no trip due to very dry conditions, but we have had numerous conditions on numerous occasions on the L.V. side mostly due to two things, one deliberate which is wire throwing to put out the lights, not so much the streetlights but the lights in the houses. This is mainly in non-European housing estates; the skollie-element that you very well do find there, or kiteflying, quite innocuous occupation, but a dangerous one, as far as I'm concerned, so we do get these lines down and we have had quite a number of fatalities and if we can develop a device that will protect us for these occasions, then I think it is worthwhile pursuing. Mr. President, I would like just to take this last opportunity to thank you Sir and to thank all members of the Association for the very happy association I have had with them in the very short term I have had with this Association.

**Mr. President:** Thank you Mr. Hess. I was going to refer later to your impending retirement, but as you have mentioned it yourself I would now take the opportunity of thanking you on behalf of the Association for all that you have done for it. I am sure all that you did in Cape Town in connection with the Convention we had there, is still fresh in the minds of most of us. You did a great deal on that occasion in arranging the Convention, and we are very grateful to you for that. There are other retirements too coming off, which I will refer to later, but I wish you now on behalf of the Association a long and happy retirement. Are there any other contributions to the discussion on Mr. Cohen's paper?

**Mr. C. Lombard** (Germiston): Mr. President, I may have overlooked it, but I can't find any details of the V.A. burden of this relay in the pamphlet or in the written paper. Could Mr. Cohen perhaps tell us what the value of the V.A. burden is?

**Mr. V. Cohen** (Fuchs Electrical): Mr. Lombard it is true that there is no mention, I don't remember any mention in the pamphlet. In the written paper, I do believe I did mention this. When we talk of burden, there are two kinds of burden, the one if the burden of the monitoring relay on its associated current transformers and that burden, as close as the measurements we can make, is in the order of 0.01 V.A. The burden on the supply system is approximately 4 V.A. in the quiescent condition and 6 V.A. in the trip condition.

**Mr. F.J.W. Barnard** (EVKOM - Randse en Vrystaats Onderneming): Dié van u wat al betrokke was by die bedryf van plattelandse netwerke, dié sal met my saamstem dat een van die groot probleme is, die handhawing van die delikate balans tussen koste aan die een kant en veiligheid en betroubaarheid van die netwerk aan die anderkant. Hierdie is twee punte wat heeltemal uitmekaar trek. Die koste aan die eenkant gee 'n man slaapproesheid; die veiligheid aan die anderkant, veral met die gedagte aan die ontmoeting met mnr. Wanneburg se mense, nagmerries. Hierdie onderneming van EVKOM het oor die afgelope 20 jaar, plattelandse netwerke gebou met houtpale, kruisarms, lang toevoerders, soms tot 150, 200 km, met dungeleiers, gebasseer alles op 'n skakelaar. Dan het die onderverinding ons geleer, soos waarna ook in mnr. Cohen se lesing verwys is, dat geleiers soms op die grond val sonder dat die bevestiging werk. Dit het by ons ingenieurs 'n gevoel van magtelosheid en frustrasie gewek omdat die alternatiewe so duur was en nie eers oorweeg kon word nie.

Daarom verwelkom ons die bestaan, die inwerkingstelling van hierdie relas.

Mr. President, with the installation of sensitive earth leakage relays, certain steps had to be taken and certain procedures had to be laid down to avoid maloperation of the relays and to give our staff certain guide lines to enable them to distinguish between dangerous and conditions which can be left unattended for the time being. I want to give you a few of these. The one, I think, was mentioned by Mr. Cohen in his paper, and that is that we disconnect or switch off the sensitive earth leakage protection during switching and leaking operations on the network. Now this reflects on our consumers; while before we could allow consumers to have their main switches on normal overload and earth-leak protection, we now have to insist on them installing sensitive earth protection as well. I am obviously referring to those consumers who take high voltage bulk supplies from us. The second guide line we give our operating staff is that, if and when they notice that after a trip and auto reclose, the out of balance is considerably higher than the normal they have to inspect immediately, because we then suspect a fault and as I say, inspect immediately irrespective of the time of the day or the night. Mr. President, after a trip lock-out and the completion of the auto reclosing cycle, we tried a feeder breaker in once, and once only. If the feeder proofs faulty, we would then carry out a quick inspection to ensure that the line isn't dangerous. We would then switch in again, or before that we would increase the setting of the sensitive earth-leak protection and we would be happy to switch in and operate the circuit until we can isolate the faulty section. Mr. President, one of the speakers referred to the auto reclosing facilities. We carried out some experiments on this. Our standard set-up is that we have a two stroke, 30 cycle CAM relay, giving us a dead time of 10 seconds between trip and auto reclose. At a certain substation with four feeders, we tried a couple of variations on this one. I will give them to you:

The first one then, was the standard two-shut with a 10-second dead-time. The second one, was a two-shot cycle with 10-second deadtime period followed by 1-minute deadtime period, followed by a further normal two-shot cycle, before lockout. The third one, was a 20-second dead period after a trip, followed by a one-shot reclosure and the fourth one, a 20-second dead period after a trip, followed by a normal two-shot auto reclose cycle. We experimented on this basis for roughly fifteen months and we came to the conclusion that our standard way with the two-shot CAM 10-second deadtime, is quite adequate and gives us no problems whatsoever even when used in conjunction with the sensitive earth leakage relay referred to by Mr. Cohen. Mr. President, in conclusion, I think we can safely say as a Rand Undertaking, that we are very pleased and privileged to have been associated partly with the development and certainly with the implementation of this relay and we want to thank Mr. Cohen for his paper and for the way he presented it here today and for all the work he put in developing this very, very valuable device.

**Mr. V. Cohen** (Fuchs Electrical): Mr. Barnard, thank you for those words, and in return I must through you, express my Company's gratitude to ESCOM for their enormous co-operation in the preparation of this paper and as I did say earlier, I would like to repeat that ESCOM is to be commended on the very ambitious and forward-looking steps that they have taken in the application of these devices.

**Mr. E.L. Lynch** (Salisbury, Rhodesia): Salisbury has had extensive experience in the development and operation of very sensitive earth fault relays and is fully aware of the problems, as outlined by Mr. Cohen, which led to this development, for the climatic and physical conditions in the Salisbury area are in many respects similar to those encountered in the highveld of South Africa.

The first design of a Zero Sequence Relay was made in 1958. It was of the core balance type and had a maximum sensitivity of 30 milliamperes primary current. The design of this relay and some of the theoretical aspects of broken conductor faults together with operational experience of the relay's application to 11 kV overhead lines were fully explained in Papers Nos. 15 and 16 presented by Mr. N.I. Creasy B.Sc. (Eng.), C. Eng., M.I.E.E., and Mr. J.S. Asherson B.Sc. Tech., C. Eng., M.I.E.E. at the Electrical Research Association Conference held in Nairobi and Salisbury in 1963. I understand that Mr. Cohen is fully aware of these early contributions to the art as he has had discussions with some of the Salisbury engineers on this subject, and I am therefore rather surprised that no acknowledgement was made of this work in the historical section of his paper.

Fifty Type ZS3 relays were manufactured by the Salisbury Electricity Undertaking and just over forty of these have been installed on the system to date.

The relays incorporate both low and high set elements. The low set element primary current settings are 30, 60, 120 milliamps or OFF with time settings of 30, 35, 40, 45, 50 seconds or infinity. The high set element primary current settings are 1, 2, 1.2 amps or OFF with time settings of 3, 4, 5, 6, 7 seconds or infinity.

These settings were adopted after careful consideration of the various operational parameters of the Salisbury network, the infinity setting being useful when earth current readings from the indicating ammeter only are required. The very sensitive settings are normally used in monitor mode only but the trip mode has been successfully utilised on 60 and 120 milliamps low set settings.

It is conservatively estimated that the ZS3 relay currently in use with the Salisbury Undertaking will detect nearly all broken conduc-

tors falling to ground on the 'source' side with a 200 milliamper primary current setting and 95% of those falling to ground on the 'load' side with a 100 milliamper primary current setting. As the relay described by Mr. Cohen apparently cannot be used for detecting fallen conductors on the 'load' side of the break due to restricted sensitivity, it is assumed that ESCOM have been fortunate in having all their fallen conductors go to ground on the 'source' side.

The lower settings available on the ZS3 relay (i.e. down to 30 milliamper primary current) are extremely useful for monitoring the state of overhead lines which may have suspect insulators or trees in close proximity that require pruning, but it is imperative that caution be used in utilising such settings in the trip mode to avoid unnecessary line outages.

Finally, I am very pleased that Mr. Cohen has seen fit to air again a matter that has seriously troubled distribution engineers who operate supply undertakings in unfavourable environmental conditions, but I would like to correct any impression that may have been given that the relay described by him has in any way pioneered the field of sensitive earth fault devices in Southern Africa.

**President:** Thank you Mr. Lynch. Would anybody else like to say anything on this paper? Well if not gentlemen, I would just like to round it off by thanking Mr. Cohen very much indeed for presenting this paper and I must apologise to him for the rather limited time that he was given in which to prepare it.

I am sure that you gathered from what has been said from the floor, that the general opinion is that there is a big future for this device and I am glad that you continued your work in the field of earth leakage up to this stage and I hope it will continue still further in the future. Thank you, Mr. Cohen.

Now gentlemen, we have one or two other reports here that we haven't dealt with yet and one that we have dealt with, I believe there are some further comments that the people would like to make and that is the report on the C.S.I.R. Advisory Committee for Electrical Engineering which was given by Mr. Von Ahlfen. I think the C.S.I.R. would like to say something about that.

**Mr. J.D.N. Van Wyk (W.N.N.R.):** Mr. die President, ek wil net graag kortliks verwyk na een item in die Verslag wat net so aan geraak is en dit is nl. die probleem wat bespreek is by ons jongste vergadering in verband met die energie-krisis en battery-aangedrewe voertuie. Daar is op daardie vergadering besluit om 'n klein onder-komitee van die Advieskomitee saam te stel om op hierdie saak in te gaan. Byna gelyktydig is 'n komitee deur die Kabinet gestig, die sg. Petroleumbesparingskomitee, wat onder voorsitterskap van Dr. Rieker fungeer het, die Ekonomiese Adviseur van die Eerste Minister. Nou, die Petroleumbesparingskomitee het besluit om ons subkomitee te vergoet in dié komitee gevra om aandag te gee aan die hele saak van battery-aangedrewe voertuie. Die aanvanklike opdrag aan die komitee was om eersens te bepaal wat die status quo in die Buiteland is, wat dit in Suid-Afrika is en om sekere kort- en langtermynaanbevelings te maak. Nou, dit is waarskynlik dat die Petroleumbesparingskomitee sy taak afgehandel het en dat hy waarskynlik sal ophou fungeer, maar dit is ook baie waarskynlik dat hierdie Komitee, waarvan ek die Voor-sitter is, wat oor batteryvoertuie handel, sal voortgaan met sy taak.

Ons het naamlik, in verband met sekere van die aanbevelings, is daar sekere werk wat aan die gang gestig is en word daar sekere ontwikkelingswerk onderneem by die Universiteit en ook by die W.N.N.R.

Ek moet beklemtoon, daar is geen planne om 'n voertuig as sulks te ontwikkel nie, maar sekere sub-sisteme, word ondersoek. Een aanbeveling van die Komitee wat ek dink u vermenig digk raak, is die feit dat, wanneer sulke voertuie in redelike hoeveelhede in die land gebruik word, dan gaan 'n mens natuurlik te kampe kry met die inslag daarvan op jou kragvoeringsnetwerk en ons het dan 'n ondersoek-groep aangewys om hierdie saak te bespreek en te ondersoek, hoofsaaklik die twee aspekte; die een van interferensie wat dit moontlik kan hê met toerusting, veral noudat ons televisie vermag, en die ander een, die invloed wat dit op lasfaktor kan hê. Nou, die verteenwoordiger van EVKOM op die Komitee is gevra om saam met u organisasie die saak vir u te ondersoek. Ons het gedink ons kan sommer daarmee bawerkstellig dat EVKOM en die V.M.E.O. eenkeer saamwerk en nie teen mekaar werk nie en ons wag dan nou ook die verslag in. Daar is 'n ander aspek wat ons graag ook onder u aandag wil bring. Dit is ook die taak van hierdie Komitee om op hoogte te bly van ontwikkelings, veral in die Buiteland en ook hier, en as enige van u bewus raak van ontwikkeling in die land, wat die moete werd is, laat vir ons daarvan weet. Aanselief, filtreer dit eers 'n bietjie dat ons nou nie al die onmoontlike

voorstelle kry nie, maar ons sal graag iets wil weet van die werklike bewoende ontwikkelings. Dan net een laaste kommentaar hieroor wat ek graag wil noem, en dit het betrekking op die langtermyn lasfaktor. Ek was beindruk om te sien in Frankryk hoedat hulle hulle in gebruik-neming van batteryvoertuie vooruit beplan, hulle aanvanklike gedagte is, soos almal, om met loodsurbatterye iets op die pad te kry. Hulle is van plan om die loodsurbatterye te optimaliseer vir hierdie soort van gebruik en dan as 'n tweede fase is die gedagte om sinklug-batterye te gebruik, waar soos u weet, dit moontlik is om die sink wat die aktiewe element is, in die elektroliet te sirkuleer en dat 'n mens dan byna, soos met gewone petrol, vulstasies sou kon hê, waar jy elektroliet kan inneem.

Maar wat ons veral raak, is die feit dat Frankryk veral vermag om, soos meeste ander lande wat na kernkrag toe oorslaan, en hulle is besig om dit nou te versnel met die energie-krisis, vermag hulle om probleme met hulle lasfaktor te hê, hier na 10 jaar van nou af, en een van die gedagtes wat hulle het om in die af-piek-periodes, energie op te berg is, om waterstof te vervaardig en is hulle dan baie aktief op die oomblik besig om waterstof-suurstofsel te ontwikkel, en is dit dan die gedagte om dit in die toekoms te gebruik vir voertuig-aandrywing. Die een probleem met waterstof op die oomblik is dat jy hom moet opberg onder hoe druk in bottels, maar daar is heelwat deurbraek gemaak al om dit in die sogenaamde hidrides op te berg. U weet die rare aarde soos paladium kan byvoorbeeld 900 keer sy eie volume waterstof absorbeer en dit is ongelukkig 'n baie duur element, maar ek het verneem dat sekere magnesium-alooie byvoorbeeld ook dieselfde kan doen, en dat hulle vermag dat dit dan die opbergsisteme van die toekoms gaan wees. Before I sit down, may I just, on behalf of the C.S.I.R. thank you again for the privilege of attending your technical discussions. We enjoyed it very much and were pleased to learn what is happening in the real world, and to Mr. Hotes and his group, our thanks for their hospitality.

**President:** Thank you Mr. van Wyk. I can assure you we are always very glad to have a representative of the C.S.I.R. here. They have always been extremely helpful to us.

**Dr. R.B. Anderson (C.S.I.R.):** Mr. President just one small point before talking about counters. The High voltage symposium that was referred to in the report, will be held on the 18th and 19th November of this

terest to your Association. I just read some of the main headings of the sessions: "Measurement and Testing", "Transmission Systems", "External Insulation, Internal Insulation", "Machines and Transformers, Switchgears, Cables and Insulators", and I am sure that the members of your Association will find this extremely valuable. Regarding Lightning Counters, firstly very briefly the reason; we have been searching for a means to measure the number of strikes. Lightning strikes to ground per square kilometre throughout the Republic and in five years we have come up with a counter which is a very simple device, battery-operated, it has a vertical aerial, it stands about 5 metres high only requires reading, the battery should last the whole season and requires a bit of space for installation, a little distant from power lines, buildings and trees and so on. We have a sub committee who is trying to get these things installed before the next lightning season. Mr. Von Ahlfen, as he told you, is a member of this committee, also ESCOM, C.S.I.R., Railways, Post Office and the Weather Bureau. We are trying to raise a sum of about R50 000 to pay for about 500 counters, which we hope will then be handed to whomever is prepared to install them and read them daily throughout the lightning season. We would very much like your Association to help us here - it is not easy to get places and people to look after these counters, but I can assure you the information which we will get from them will be a very great practical value to our assessment of where and when we should put in more or less lightning protection for our systems, so that if there are any volunteers on this, I would be very grateful to hear of them and this will be communicated to the sub committee, who are now working out plans of getting these arrestors away. One final mention of lightning, and that is lightning arrester failures. You may have been approached regarding any statistics regarding arrester failures on your system. We are trying to assess how serious this is and if anybody has any statistics on surge arrester failures, would they kindly fill in a questionnaire which is available from your Association or from me as to these arrester failures.

**President:** Thank you Mr. Anderson. I have two reports here submitted by Mr. W. Barton. One on the South African National Committee on Illumination. Would he like to comment on that one?

## REPORT OF THE SOUTH AFRICAN NATIONAL COMMITTEE ON ILLUMINATIONS - TWENTIETH ANNUAL GENERAL MEETING

The twentieth annual general meeting of S.A.N.C.I. was held in the City Hall, Pietermaritzburg from 25th to 27th April 1973.

Ninety members and visitors were present. The President, Mr. R.S. Yates was in the Chair.

## VERSLAG VAN DIE TWINTIGSTE ALGEMENE JAARVERGADERING VAN DIE SUID-AFRIKAANSE NASIONALE KOMITEE INSAKE VERLIGTING

Die twintigste Algemene Jaarvergadering van die S.A.N.K.V. is vanaf 25 tot 27 April 1973 in die Stadsaal, Pietermaritzburg, gehou.

Negentig lede en besoekers was teenwoordig. Die President, mnr. R.S. Yates, het die Voor-sitterstoel ingeneem.

## OPENING:

After the President had welcomed all delegates and visitors, the meeting was officially opened by His Worship the Mayor of Pietermaritzburg, Councillor Wood.

In a witty speech, Councillor Wood expressed his Council's pleasure in offering Pietermaritzburg as the venue for the annual general meeting. He referred to the role of lighting in various applications such as art galleries, museums, historical buildings, sports fields, airfields and of course streetlighting. He expressed appreciation for the very significant contribution of S.A.N.C.I. to the art and science of illumination.

## PRESIDENTIAL ADDRESS:

Mr. Yates, in his address entitled "The Lighting Engineer in South Africa" sketched the various avenues open to the aspirant lighting engineer. He listed the various fields such as research, design, consulting, sales, the lighting technician and the environmental engineer. He made a plea for the encouragement of schoolleavers to enter the profession directly, make a complete study of the subject and thus become leaders in the field at a much earlier age. He described the status of the profession in the Republic today as something which leaves much to be desired.

Mr Yates paid tribute to the influence of the S.A.N.C.I. over the past twenty years in coping with the problem. He welcomed the establishment of the Institute of Lighting Engineers of South Africa which he hoped would improve the image of the lighting profession.

The challenges of the future were such that only the best would be good enough.

## PAPERS:

The following seven papers were read and discussed:

1. "Applied Lighting Research" by Dr. S.K. Guth, guest speaker from the General Electric Co., U.S.A.  
"The overall purpose of lighting research is to tell us how people can be expected to respond to a lighted environment. It provides the lighting designer with information which enables him to decide how to deal with the various factors that are involved once he has determined their relative importance to the ultimate use of the space."

The author illustrated this theme by reference to and description of the various factors concerned, such as threshold contrast, field factor (visibility level), contrast rendering (veiling reflections), disability glare transient adaptation, chromatic contrast, subjective differences, age effects, human performance, ease of seeing, visual comfort (discomfort glare), luminance ratios, colour rendering, and pleasantness.

2. "Windows and the environment" by Dr.W.M.H. Rennhackkamp.

The paper described the problem associated with the prediction of window sizes in relation to the three environmental aspects, namely, noise, heat and light. Sound and heat insulation properties of various glazing materials were given. A method of calculating the glare experienced from windows was described.

3. "Colour photography for the lighting engineer." by Mr. A. Chalmers.

The author showed that, while the use of 35 mm colour slides as an aid to the communication of new ideas and developments in the lighting field was commendable, there are many pitfalls for the unwary. The colour rendering capabilities of any film, are dependent upon a large number of variables which are not easily controlled.

The paper was very effectively illustrated by means of demonstrations and photographic examples.

4. "Lighting and the night environment" by Mr. H. Carpenter, Director of Lighting and Electrical Services, Blackpool, England.

In a most comprehensive and well presented paper the author summarised the policies and diverse problems associated with environmental lighting schemes of many types, both functional and decorative.

He described steps being taken in the United Kingdom, including some at Government level, to encourage the use of light in an integrated night environment which includes the lighting of civic buildings, parks and gardens etc.

An outstanding collection of colour slides was shown, including many of the famous Blackpool illuminations.

5. "Lighting and Safety" by Mr. G. Clark.

While showing that one of the main purposes of nearly every lighting installation is the safety of persons and property, the author

## OPENING:

Nadat die President al die afgevaardigdes en besoekers verwelkom het, is die vergadering amptelik ge-open deur Sy Agbare, die Burge-meester van Pietermaritzburg, Raadslid Wood.

In 'n luimige toespraak het Rdl. Wood sy vreugde uitgespreek omdat hulle Pietermaritzburg kon aanbied as vergaderplek vir die Algemene Jaarvergadering. Hy het verwys na die rol wat verligting op verskillende gebiede speel, soos bv. by kunsgalerye, museums, geskiedkundige gebou, sportvelde, lughawens en natuurlik by straatverligting. Hy het sy waardering uitgespreek vir die aansienlike bydrae van die S.A.N.K.V. tot die kuns en die Wetenskap van verligting.

## PRESIDENTSREDE:

In sy toespraak onder die titel, „Die Verligtingsingenieur in Suid-Afrika", het mnr. Yates 'n oorsig gegee van die verskillende rigtinge wat daar vir die aspirant-verligtingsingenieur oop is. Hy het 'n lys gemaak van die verskillende terreine, soos bv. navorsing, ontwerp, raadgewende dienste, verkope, die verligtingstekniese en die omgewingskonde-ingenieur. Hy lewer 'n pleidooi dat die skoolverlater aangemoedig moet word om direk na skool tot die professie toe te tree, 'n deeglike studie van die onderwerp te maak en sodoende op 'n veel jonger ouderdom 'n leier op dié gebied te word. Hy spreek die mening uit dat die kwessie van die status van die professie vandag in Suid-Afrika veel te wense oorlaat.

Mnr. Yates bring hulde aan die invloed wat die S.A.N.K.V. die afgelope twintig jaar uitgeoefen het om die probleem die hoof te bied. Hy verwelkom die totstandkoming van die Instituut van Verligtingsingenieurs van Suid-Afrika en spreek die hoop uit dat hierdie Instituut sal meehelp om die beeld van die verligtingsprofessie te verbeter. Die uitdagings van die toekoms is sodanig dat net die beste goed genoeg sal wees.

## REFERATE:

Die volgende sewe referate is gelewer en bespreek:-

1. "Toegepaste Verligtingsnavorsing" deur dr. S.K. Guth, gaspreker van die General Electric maatskappij van die V.S.A.  
"Die hoofdoel van die verligtingsnavorsing is om ons te sê hoe mense na verwagting op 'n verligte omgewing sal reageer. Dit voorsien die verligtingsontwerper van inligting wat hom in staat stel om te besluit hoe om die verskillende faktore wat betrokke is, te hanteer sodra hy hul relatiewe belangrikheid ten aansien van die uiteindeelike gebruik van die ruimte bepaal het."

Die spreker het hierdie tema geïllustreer deur te verwys na en 'n beskrywing te gee van die verskillende faktore wat betrokke is, soos bv. drumpel-contrast, veld-faktor (sig-vlak), contrast-skepping (die versuiering van weerkaatsings), onbequaam makende blikkering, kortstondige aanpassing, kleurcontrast, subjektiewe verskille, ouderdomsuitwerking, menslike prestasies, gesigsgemak (ongemaklike blikkering), luminansieverhoudings, kleurweergawe en aangensaamheid.

2. „Vensters en die Omgewing." deur dr. W.M.H. Rennhackkamp.

In hierdie referaat is 'n beskrywing gegee van die probleme wat ondervind word by die bepaling van venster-groottes in verhouding tot die drie omgewings-faktore, nl. geraas, hitte en lig. Die isolasie-eienskappe van die verskillende glasurmateriale sover dit klank en hitte betref, is aangee en 'n beskrywing is gegee van 'n metode om die blikkering vanuit vensters te bereken.

3. „Kleurfotografie vir die Verligtingsingenieur." deur mnr. A. Chalmers.

Die spreker het aangetoon dat, alhoewel die gebruik van 35 mm kleurskopies as 'n hulpmiddel vir die oordra van nuwe idees en ontwikkeling op die gebied van verligting aan te bevele is, daar tog slagrate vir die onversigtige is. Die vermoë van enige film om kleur te weergee hang af van 'n groot aantal wisselende faktore wat nie maklik beheer kan word nie.

Hierdie referaat is op baie effektiewe wyse geïllustreer by wyse van demonstrasies en fotografiese voorbeelde.

4. „Verligting en die nag-omgewing" deur mnr. H. Carpenter, Direkteur van Verligting en Elektriesiteitsdienste, Blackpool, Engeland.

In 'n uiters omvattende en goed aangebode referaat, het die spreker 'n opsomming gegee van die beleidrigtinge en die uiteenlopende probleme verbonde aan omgewingsverligting-skemas van allerhande soorte, funksioneel sowel as dekoratief.

Hy het 'n beskrywing gegee van die stappe sommige waarvan wat, op Regeringsvlak in die Verenigde Koninkryk gedoen word om die gebruik van lig in 'n geïntegreerde nag-omgewing aan te moedig, met inbegrip van die verligting van burgerlike geboue, parke, tuine, ens.

'n Uitstaande versameling kleurskopies is vertoon, insluitende sommige van die beroemde verligtingskemas van Blackpool.

5. „Verligting en Veiligheid" deur mnr. G. Clark.

Hoewel hy aangetoon het dat die hoofdoel van besone elke verligtingsinstallasie die veiligheid van persone en eiendom is, het die spreker

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dealt more specifically with safety problems of light fittings used in factories, supermarkets etc. Various types of emergency lighting equipment were described. The necessity for considering the safety aspect of an installation at the design stage was well illustrated.

**6. "Angle flux, a new concept for the photometric evaluation of fluorescent fittings"** by Dr. H. Einbron.

The "Angle Flux" values (in lumens per radian) of a disymmetrical source, such as a fluorescent fitting, from a link between its intensity-values and its flux or sector flux-values. The angle flux is useful for the photometric evaluation and documentation of fittings. It facilitates the understanding of disymmetrical sources.

**7. "Is lighting more than illumination"** by Mr. T. Jarman.

The author, who is an architect, commences by saying that "The designer of successful illumination systems for the built environment must be convinced that people form the most important element in any building and that good illumination is complementary to them and their role". He portrays the function of light in a building and relates it to the other architectural properties. He sums up by saying that light is as much an architectural material as structural elements and must be employed with the same skill and understanding as any other design element.

### DISCUSSION GROUPS

The meeting split into two groups for discussions on the following topics:-

- (a) "Luminous advertising signs and the environment" Convenor Mr. E. Opeka.
- (b) "Floodlighting" contribution to lighting for living" Convenor Mr. L. Foster.

Group (a) covered the whole gamut of advertising signs and road information signs, and discussed such practical aspects as legal liability in case of injury to persons or damage to property, rules and regulations in manufacture and erection, the roles of town planners and architects, the life of ballasts in fluorescent signs, internal illumination versus external, and interference with traffic lights.

A new method of illumination for signs and markers using small glass vessels filled with tritium gas and lined internally with a phosphor was described. These are completely self-powered and have an estimated life in excess of 20 years.

Group (b) centered its discussions around some 46 slides of floodlighting installations. It was felt that while some American examples had excessive numbers of lights with unnecessarily high light levels, South African installations would have to be improved, especially in view of television requirements. It was acknowledged that British, American and German authorities spend phenomenal sums of money on floodlighting which could not be countenanced in the Republic because of the much smaller population.

It was emphasised that more co-operation between consulting engineers and lighting engineers in the early design stages was a prime necessity. The role of floodlighting in enhancing the architectural features of buildings was discussed. It was decided to recommend to the S.A.N.C.I. Executive that the Committee should be formed to examine all historical buildings in the Republic with a view to illuminating them as is done in overseas countries.

In view of the interest shown it was suggested that a symposium be held on the lines of the streetlighting symposium sponsored by S.A.N.C.I. and I.L.E.S.A. in February 1973.

### REPORTS OF COMMITTEES:

Reports of a number of S.A.N.C.I. technical committees were tabled, as well as reports by correspondents on C.I.E. technical committees. With few exceptions these had been extremely active and reported progress. Of specific interest to A.M.E.U. members were the following:-

### SPORTS LIGHTING

A sports lighting manual is to be issued in loose leaf binding which will contain a number of general recommendations and codes of practice. These will be added to from time to time. A large number of sports will be covered.

### STREET LIGHTING AND ACCIDENTS:

C.I.E. Committee T.C. 4-6 is to bring Publication No. 8 up to date and assemble specific data relating to motorways. It is proposed to make a study on a section of motorway in Germany using 3 different lighting levels.

meer spesifiek aandag gewy aan die veiligheidsprobleme verbonde aan verligtingstoebereid in fabriek, supermarkte, ens. gebruik word. Daar is 'n beskrywing gegee van verskillende soorte noodverligting. Die noodsaaklikheid daarvan om die veiligheidsaspekte, selfs in die ontwerp stadium, noukeurig te oorweeg, is duidelik geïllustreer.

**6. „Hoekvloed, 'n Nuwe Konsep vir die Fotometrieë Evaluasie van Fluoreserende Armature.“** deur Dr. H. Einbron.

Die „hoekvloed“-waardes (in lumens per radiaal bereken) van 'n onsimmetriese bron, soos bv. 'n fluoreerende armatuur, vorm 'n skakel tussen sy intensiteitswaardes en sy vloed- of sektorvloedwaardes. Die hoekvloed is nuttig by die fotometriese evaluasie en dokumentasie van armature, aangesien dit die begrip van onsimmetriese bronne vergemaklik.

**7. „Is verligting meer as Illuminasie“** deur mnr. T. Jarman.

Die spreker, wat 'n argitek is, begin deur te sê dat, 'die ontwerper van suksesvolle verligtingstelsels vir die opgeboude omgewing, moet daarvan oortuig wees dat mense die belangrikste element in enige gebou is en dat goeie illuminasie slegs bykomstig is tot mense en die rol wat hulle speel.' Hy gee 'n beeld van die funksie van lig in 'n gebou en skets die verhouding van lig tot die ander argitektoniese eienskappe. Opsommenderwys sê hy dat lig net so 'n argitektoniese materiaal is as strukturele elemente en met dieselfde kundigheid en begrip as enige ander ontwerp-element gehanteer behoort te word.

### BESPREKINGSROEPE

Die vergadering het in twee groepe verdeel met die oog op die bespreking van die volgende onderwerpe:-

- (a) "Liggewende advertensietekens en die Omgewing" - Sameroeper Mnr. E. Opeka.
- (b) "Die Bydrae van Vloedverligting tot Verligting vir ons Lewenswyse" Sameroeper - Mnr. L. Foster.

Groep (a) het die hele reeks advertensietekens en padinligtingstekens gedek en het in hul besprekings aandag gewy aan sulke praktiese aspekte soos regspraaklikheid in gevalle van skade aan eiendom of die besering van persone; reëls en regulasies met betrekking tot vervaardiging en oprigting; die rol van stadsbeplanners en argitekte; die lewensduur van ballas in fluoreerende tekens; interne teenoor eksterne verligting en belemmering van die werking van verkeersligte.

'n Beskrywing is gegee van 'n nuwe verligtingsmetode vir tekens en merkers, whereby gebruik gemaak word van klein glasvatte wat met tritiumgas gevul en van binne met fosfor uitgevoer is. Hulle verskaf hul eie krag en het 'n beraamde lewensduur van meer as 20 jaar.

Groep (b) se bespreking het gesentreer om sowat 56 skyfies van vloedverligtingsinstallasies. Die mening is gehuldig dat, alhoewel sommige Amerikaanse voorbeelde te veel ligte met 'n onnodig hoë intensiteit het, Suid-Afrikaanse installasies verbeter behoort te word, veral met die oog op die behoeftes van beeldradio. Daar is toegegee dat die Britse, Amerikaanse en Duitse owerbiede fenomenale bedrae geld aan vloedverligting bestee, wat in Suid-Afrika, vanweë sy veel kleiner bevolking, nie bekostig kan word nie.

Daar is nadruk op gele dat groter samewerking tussen raadgevende (ingeniërs en verligtingingenieurs in die vroeë ontwerp stadium) van die grootste belang is. Bespreking is gewy aan die rol wat vloedverligting kan speel by die verheffing van die argitektoniese kenmerke van geboue. Daar is besluit om by die Bestuur van die S.A.N.K.V. aan te beveel dat 'n komitee in die lewe geroep word om alle historiese geboue in die Republiek te ondersoek met die oog daarop om hulle te verlig, soos in oorsese lande gedoen word.

Met-die oog op die groot belangstelling wat getoon is, is daar aan die hand gedoen dat 'n simposium gereël word, soortgelyk aan die simposium oor straatverligting wat in Februarie 1973 deur die S.A.N.K.V. en die I.V.I.S.A. aangebied is.

### VERSLAE VAN KOMITEES:

Verslae van 'n aantal tegniese komitees van die S.A.N.K.V. is ter tafel gele tesame met verslae deur korrespondente wat in tegniese komitees van die C.I.E. dien. Met enkele uitsonderinge was hierdie komitees besonder aktief en het vordering gemaak, die volgende is van spesifieke belang vir lede van die V.M.E.O.:-

### SPORTSVERLIGTING:

'n Handboek insake sportsverligting sal in losbladform uitgegee word en sal 'n aantal algemene aanbevelings en gebruikskodes bevat. Dit sal van tyd tot tyd aangevul word en 'n groot aantal sportsoorte word gedek.

### STRAATVERLIGTING EN ONGELUKKE:

C.I.E.-komitee no. T.C. 4-6 sal Publikasie nr. 8 op datum bring en spesifieke data met betrekking tot snelweë versamel. Daar word beoog om 'n studie te maak van 'n snelweë in Duitsland waar van drie verskillende verligtingsvlakke gebruik gemaak word.

#### **LIGHTING AND ROAD TRAFFIC SIGNS:**

It was considered that all signs ought to be lit or reflectorised. The working group will summarise existing recommendations and work out proposals.

#### **LUMINAIRES:**

C.I.E. Committee T.C. 2-4 has issued a final draft "Photometry of Streetlighting luminaires."

#### **CODES FOR INTERIOR AND STREET LIGHTING:**

The S.A.B.S. Committees have completed their work on the two codes and they are being prepared for publication.

#### **S.A.N.C.I. EXECUTIVE REPORT**

In delivering this report for 1972/73, the President stated that good progress had been made. Following the C.I.E. congress in Barcelona, new South African representatives had been chosen for many of the C.I.E. expert committees following an Executive Committee decision to limit the number of representations per person. South Africa was honoured by being selected to act as co-ordinating country for C.I.E. Study Group B, the group instituted to investigate the need for a permanent committee on Light and Architecture.

Seventeen new members were attracted to S.A.N.C.I. during the year and the growth in work was such that the appointment of a full-time Secretary would be necessary in the not too far distant future.

The study group convened to investigate the lighting requirements of the various races in Southern Africa was making progress and hoped to report at the next C.I.E. Congress in 1975.

The President referred to the highly successful SANCI/ESA Symposium on Streetlighting held in February and said that it was hoped to have similar symposia in the future on various aspects of lighting and possibly in other centres.

#### **ELECTION OF EXECUTIVE COMMITTEE**

Mr. D.W. Young was elected as President for the ensuing year. Two AMEU members were re-elected, namely, Mr. K.G. Robson (as country member) and Mr. J.K. von Ahlfen.

#### **GENERAL:**

Once again S.A.N.C.I. proved highly competent at providing an A.G.M. of great interest and considerable value. Great credit is due to all concerned.

Copies of the various papers and reports are available for perusal by those interested.

## **WORLD ENERGY CONFERENCE REPORT**

The Annual Meeting of the South African National Committee of the World Energy Conference was held at Escom Centre, Johannesburg on the 23rd February, 1974 under the Chairmanship of Dr. R.L. Straszacker.

Among the many items of interest on the Agenda were the following:-

#### **INTERNATIONAL EXECUTIVE COUNCIL MEETING - 1973**

The meeting of the I.E.C. was held in Buenos Aires, Argentina, from 1st to 3rd October 1973, and was followed by a study tour lasting until 11th October. It was attended by Dr. Straszacker, Mr. Jan H. Smith and Mr. M.T.S. Vos, al of SCOM. Thirty three countries were represented by ninety three delegates.

The Agenda consisted largely of administration matters. Progress was noted in the world-wide survey of energy resources. The setting-up of a conservation Commission was agreed to. The principal objective of this Commission would be to consider, relative to the progressive scarcity of fuel in the years ahead, whether capital expenditure on fuel-saving projects should be drastically increased. Seen in the light of the sudden flare-up of the oil crisis in November, 1973, this Commission would seem to be of major importance.

Progress in the preparation of a list of standardised terms in the field of energy and energy economy was noted. Dr. R.L. Straszacker offered the assistance of S.A.N.W.E.C. in this work.

A survey of energy resources in the Argentine was very well presented. One-third of the population lives in Buenos Aires, the rest of the country being relatively primitive. Energy production in the future would be mostly from hydroelectric schemes on very large rivers and from atomic energy based on extensive deposits of Uranium.

Our delegates' visit coincided with a change of government and the return to power of President Pinedon. Apparently matters were quite hectic, not to say hair-raising at times. However, attendance at these meetings is very important to maintain the Republic's contacts with various organisations.

#### **VERLICHTING VAN PAD- EN VERKEERSTEKENS:**

Die mening is uitgespreek dat alle tekens verlig of met reflektorsiers voorsien behoort te word. Die werkgroep sal 'n opsomming maak van bestaande aanbevelings en sal verdere voorstelle uitwerk.

#### **ARMATURES:**

C.I.E.-komitee nr. TC 2-4 het 'n finale konsep, „Die Fotometrie van Straatverligtingsarmature" uitgegee.

#### **KODES VIR BINNE- EN STRAATVERLICHTING:**

S.A.B.S.-komitees het hul werk aan die twee kodes voltooi en die kodes word tans vir publikasie voorberei.

#### **VERSLAG VAN S.A.N.K.V.-BESTUUR**

Toe hy hierdie verslag vir 1972/73 gelewer het, het die President gesê dat goeie vordering gemaak is. Na die C.I.E. kongres in Barcelona is nuwe Suid-Afrikaanse verteenwoordigers gekies vir 'n aantal van die C.I.E. se komitees van deskundiges, nadat die Uitvoerende Komitee besluit het om die aantal verteenwoordigings per persoon te beperk. Suid-Afrika is verer deurdat hy aangewys is as koördinerende land op te tree vir die C.I.E. se Studiegroep B, welke groep ingestel is om ondersoek in te stel na die behoeftes vir 'n permanente komitee insake Lig en Argitektuur.

Seventien nuwe lede het gedurende die jaar by die S.A.N.K.V. aangesluit en die werk het sodanig toegeneem dat dit in die voorsienbare toekoms nodig sal wees om 'n voltydse Sekretaris aan te stel.

Die Studiegroep wat saamgestel is om ondersoek in te stel na die verligtingsbehoefes van die verskillende rasse in Suid-Afrika, maak goeie vordering en hoop om by die volgende C.I.E.-kongres in 1975 verslag te kan doen.

Die President het ook verwys na die hoogs suksesvolle S.A.N.K.V./I.V.I.S.A. simposium insake straatverligting wat gedurende Februarie gehou is en het soortgelyke simposiums in die toekoms oor verskillende aspekte van verligting, wat moontlik in ander sentra gehou sal word, in die vooruitsig gestel.

#### **VERKIESING VAN UITVOERENDE KOMITEE:**

Mnr. D.W. Young is tot President vir die nuwe jaar verkies. Twee V.M.E.O. lede is herkies, nl. mnr. K.G. Robson (plattelandse lid) en mnr. J.K. von Ahlfen.

#### **ALGEMEEN:**

Die S.A.N.K.V. het weerrens bewys gelewer van sy vermoë om 'n hoogs interessante en baie waardevolle Algemene Jaarvergadering te reël. Groot dank is aan al die betrokkenes verskuldig.

Eksemplare van die verskillende referate en verslae is beskikbaar vir insae deur diegene wat daarin belangstel.

## **VERSLAG - WERELDKONFERENSIE INSAKE ENERGIE**

Die jaarvergadering van die Suid-Afrikaanse Nasionale Komitee van die Wêreldkonferensie insake Energie is op 23 Februarie 1974 in die EVKOM-sentrum, Johannesburg gehou en wel onder die voorsitterskap van Dr. R.L. Straszacker.

Onder die belangwekkende sake op die sakelyst was die volgende:  
**INTERNASIONALE UITVOERENDE KOMITEEVERGADERING - 1973**

Die vergadering van die I.U.K. is vanaf 1 tot 3 Oktober 1973 te Buenos Aires, Argentinië, gehou en is gevolg deur 'n studietoer wat tot 11 Oktober geduur het. Dit is bygewoon deur Dr. Straszacker, mnr. Jan H. Smith en mnr. M.T.S. Vos, almal van EVKOM. Drie-entertig lande is drie drie-entertig afdelingsdele verteenwoordig.

Die sakelyst het hoofsaaklik uit administratiewe sake bestaan. Daar is vordering met betrekking tot die wêreldwye opname van energiebronne gerapporteer. Daar is besluit op die skepping van 'n Bewaringskommissie, met die hoof-oogmerk om oorweging te verleen aan die vraag of kapitale uitgawes aan brandstofbesparingsprojekte drasties verhoog moet word met die oog op die progressiewe brandstofskaarste wat in die toekoms verwag word. Gesien in die lig van die skielike opvlaming van die olie-krisis in November 1973, wou dit voorkom asof hierdie Kommissie van groot belang sal wees.

Daar is ook kennis geneem van vordering met betrekking tot die voorbereiding van 'n lys van gestandaardiseerde terme op die gebied van energie en die ekonomie van energie. Dr. Straszacker het die hulp van die Suid-Afrikaanse Nasionale Komitee in hierdie verband aangebied.

'n Opname van die energiebronne in Argentinië is op 'n baie knap manier aangebied. Een-derde van die bevolking woon in Buenos Aires, terwyl die res van die land 'n baie betreklik primitief is. Die produksie van energie in die toekoms sal hoofsaaklik by wyse van hidro-elektriese skemas op die groot riviere geskied, sowel as uit kernkragsentrales wat op groot uraanresae gegrond is.

Ons afdelingsdele se besoek het saamgeval met 'n regeringsverandering en die bewindoorname deur Pres. Pinedon. Sake het blykbaar redelik wild, miskien self by tye sensasionaal, verloop. Die bywoning van hierdie vergaderings is egter baie belangrik met die oog op die behoud van die Republiek se verbinde met verskillende organisasies.

## ANNUAL REPORT - 1972

The Annual Report for 1972 of the World Energy Conference is available for perusal. It summarises the activities during 1972 of the various Committees of the W.E.C. and deals with contacts with other organisations such as the International Atomic Energy Agency.

## INTERNATIONAL EXECUTIVE COUNCIL MEETING - 1974

The next meeting of the I.E.C. will be held in Detroit, U.S.A. in September, 1974 and will be attended by Dr. Straszacker and Mr. Jan. H. Smith.

## NINTH WORLD ENERGY CONFERENCE

S.A.N.W.E.C. has sponsored three technical papers to be presented at the Ninth W.E.C. Conference to be held in Detroit, U.S.A. in September, 1974. These are:-

1. "The design of operation of a dry cooling system for a 200 MW turbogenerator at Grootvlei Power Station" by N.T. van der Walt, L.A. West, T.J. Sheer and D. Kuball, all of ESCOM.
2. "Pollution and the power industry in South Africa" by R.K. Dutkiewicz, of the University of Cape Town.
3. "A forecast of energy supply and demand in South Africa" by D.J. Kotze of the Department of Planning and the Environment.

This Conference will mark the fiftieth anniversary of the W.E.C. and, in view of the escalating energy problem, will be of especial significance. Several thousand delegates are expected to attend S.A.N.W.E.C. will be represented by Dr. R.L. Straszacker and Mr. Jan H. Smith.

## ENERGY UTILIZATION UNIT

An "Energy Utilization Unit" has been formed at the University of Cape Town to act as an inter-disciplinary, interdepartmental body for the study of all aspects of energy generation and utilization. Items which will be studied will include the economic implication of energy usage; the role of different forms of energy and their relationship; new forms of energy production pollution effects of energy usage, etc.

## ENERGY SECTION - DEPARTMENT OF PLANNING AND THE ENVIRONMENT

The Government has recently decided to embark on a comprehensive energy program for the country and has authorised the establishment of an Energy Section in the Department of Planning and the Environment. The functions of this Energy Section are mainly threefold and include, inter alia, determination of the extent of indigenous energy resources, assessment of the nature, distribution and magnitude of future energy requirements in the country, and the formulation of a national energy policy.

## INTERNATIONAL EXECUTIVE COUNCIL MEETING - 1978

S.A.N.W.E.C. has invited the W.E.C. to hold the meeting of the I.E.C. in 1978 in the Republic. The W.E.C. has not yet taken a decision on the matter.

R.W. BARTON  
REPRESENTATIVE

## JAARVERSLAG 1972

Die jaarverslag van die Wêreldkonferensie insake Energie vir 1972 is ter insake beskikbaar. Daarin word 'n oomsing gegee van die bedrywighede van die verskillende Komitees van die Wêreldkonferensie gedurende 1972 en van verbindeste met ander organisasies, soos by die Internasionale Atoomkrag-agentskap.

## INTERNASIONALE UITVOERENDE KOMITEEVERGADERING - 1974

Die volgende vergadering van die I.U.K. word gedurende September 1974 in Detroit, V.S.A., gehou en sal deur Dr. Straszacker en mnr. Jan. H. Smith bygewoon word.

## NEGENDE WÊRELDKONFERENSIE INSAKE ENERGIE

Die Suid-Afrikaanse Nasionale Komitee van die Wêreldkonferensie insake Energie het drie referate geborg vir voorlegging by die Negende Wêreldkonferensie insake Energie, wat gedurende September 1974 in Detroit, V.S.A., gehou word nl:-

1. "Die ontwerp en bedryf van 'n droë verkoelingsstelsel vir 'n turbo-opekker van 200m.w. by die Grootvlei-Kragentrale" deur N.T. van der Walt, L.A. West, T.J. Sheer en D. Kuball, almal van EVKOM.
2. "Besoedeling en die kragnywerheid in Suid-Afrika" deur R.K. Dutkiewicz, van die Kaapstadse Universiteit.
3. " 'n Voorspelling vir die voorsiening van en die vraag na energie in Suid-Afrika" deur D.J. Kotze van die Departement Beplanning en die Omgewing.

By hierdie Konferensie sal die vyftigjarige bestaan van die Wêreldkonferensie insake Energie herdenk word en, met die oog op die steeds erger wordende energieprobleme, sal dit van besonder belang wees. Na verwagting sal etlike duisende afgevaardigdes die Konferensie bywoon. Die Suid-Afrikaanse Nasionale Komitee sal deur Dr. R.L. Straszacker en mnr. Jan H. Smith verteenwoordig word.

## ENERGIE-BENUTTINGSEENHEID

'n Energiebenuttingseenheid is by die Kaapstadse Universiteit in die lewe groep met die doel om te dien as 'n interdisiplinêre, interdepartementele liggaam vir die bestudering van alle aspekte van die opwekking en benutting van energie. Sake wat bestudeer gaan word, sluit in die ekonomiese implikasies van die gebruik van energie; die rol van en die verwantskap tussen die verskillende vorms van energie; nuwe vorms van energie-produksie; die besoedelingsuitwerking van die gebruik van energie, ens.

## ENERGIE-AFDELING: DEPARTEMENT VAN BEPLANNING EN OMGEWING

Die Regering het onlangs besluit om 'n omvattende energie-program vir die hele land aan te pak en het goedkeuring verleen aan die skepping van 'n Afdeling vir Energie in die Departement Beplanning en die Omgewing. Die funksies van hierdie Afdeling is drievoudig en omvat onder andere die vasstelling van die omvang van inheemse energiebronne, die beplanning van die aard, verspreiding en omvang van die toekomstige energiebehoefes van die land en die formulering van 'n nasionale beleid met betrekking tot energie.

## INTERNASIONALE UITVOERENDE KOMITEEVERGADERING - 1978

Die S.A. Nasionale Komitee het die Wêreldkonferensie insake Energie uitgenooi om die 1978-vergadering van die I.U.K. in die Republiek te hou. Die Wêreldkonferensie het nog nie 'n besluit oor die saak geneem nie.

R.W. BARTON  
VERTEENWOORDIGER



MR. R.W. BARTON  
ELECTRICAL ENGINEER WELKOM

**Mr. R.W. Barton** (Welkom): Mr. President, all I want to say really is to apologise for the late appearance of both of those reports, SANCI and the World Energy Conference Report. It is the quality of manpower, there are only two engineers in my Department, one of them seems to be on leave or at a Convention or something most of the time which makes it a bit awkward. The other one if I can deal with it while I'm here, is the Recommendations Committee for New Electrical Commodities, where the more observant people would have noticed there is no report at all. The reason is that the Bulletins have been sent out to members quarterly, so there is nothing further that I can add. If there are any queries arising out of the work of the Committee, I would be pleased to deal with it, preferably some time in the future. Otherwise Mr. President if I may just say thank you to the members of that Committee for their interest and hard work during the year.

**President:** Thank you Mr. Barton. Any discussion on his reports gentlemen? If not then, I am not sure whether anybody else wanted to raise any matter in connection with the report on The Electrical Wiremen's Registration Board. I think there were one or two other comments that members wanted to make, but didn't have time.

**Mr. L.H. Hare** (C.O.T.T.): Mr. President, I have been very interested in some of the reports that have been submitted here and some of the comments that have been made by members of your Association. One of the things that has attracted my attention is the shortage of apprentices. Now I would like to draw the attention of members of your Association, that nearly 5 000 persons attained artisan status, that became qualified by passing a trade test last year and that there were an additional more than 500 wiremen who obtained registration. These people are qualified now by virtue of having passed an examination and in the cases of apprentices, this can be after a period of 2½ years. The very poor show as regards the electrical wiremen, I think there are two reasons for this. One is the conditions under which the average electrical wireman apprentice is trained, which is very largely on site on a building and they are trying to beat a deadline. The building contractors pushing them and there isn't really time to get down and train them to basics, in the basics of his trade rather. The other one, Mr. Wannenburg referred to earlier on, a large number of people who are qualified electricians or who have qualified by the lapse of time not by the passing of a trade test, are accepted by the Wiremen's Board for the examination by virtue of the fact that they are qualified artisans, electrical artisans, whereas in fact the large number never have received any really good training other than in getting conduit into decking or something like that. There is just one further comment I would like to make. We at the Trade Test Organisation are acutely aware of the difficulties which employs in all fields in training of apprentices. Part of the assistance that we can give is feedback of information regarding the trade test results. We test between 14 and 16 000 candidates a year. It is obviously impossible for us to give a complete comprehensive report on every test. In the case of electrical apprentices, an automatic report is sent to the employer and the Divisional Inspector of Labour in every case. There are very many other cases where the employer we know, would like to have more information. We can't send this automatically but we will be only too pleased to do this. If any employer or member of your Association would like further information on any trade test done by one of his apprentices, we will be only too pleased to give a detailed report of what actually happened during the test and in conclusion, before I say thank you, I would like to extend a cordial invitation to any member of your Association to visit the Trade Testing Centre at any time that they are in the area. This is rather important; we often get people telephoning us or writing to us saying: "Can you tell us what the content of the trade test is, what should our apprentices or candidates know about the trade test". Mr. President, the information you require, cannot be conveyed by telephone or a letter. Please come and visit us and bring a camera with you. In conclusion Mr. President, I thank you very much for the privilege of being able to address you here and for your invitation to attend this Meeting.

**President:** Thank you Mr. Hare. It was a pleasure to have you with us. Are there any representatives of the Electrical Contractors' Association still here? We have a letter addressed by the Association, to the A.M.E.U. by the Contractors' Association in connection with: Wastage of Fuel due to having to comply with the requirements of some electricity departments, in connection with sections 19 and 21 of the Act. Would you like to talk on it?

**Mr. D.F. Kneale** (Electrical Contractors' Association): In terms of the Electrical Wiremen and Contractor's Act, 1939, supply authorities are responsible for the day to day administration of the Act in certain respects. In this time and age we find it strange to observe that many of your members still have Electricity Bylaws which in our opinion, leads to the waste of petroleum fuels. We particularly refer to the administration of Sections 19 and 20 of the Act dealing with the registration of electrical contractors in the inspection of wiring work by suppliers and wish to make the following comment: Firstly, some suppliers will only issue a registration to an electrical contractor when the prospective electrical contractor presents himself personally at the office of the supplier. Secondly some suppliers require the electrical contractor to present themselves personally at the offices of the supply authority for an application for testing of wiring work when this has to be carried out. My Association would be interested to know what suggestion your members' forum could offer to overcome this present condition, which in our opinion, does not only lead to a waste of good time but is clearly not in the national interest. Mr. President, I would like to suggest that the initial contractor's licence be issued by the

Municipality in which the contractor has his business. The second contractor's licence or the National Contractor's Licence, would be issued by the Board. This would not take the right to take action against the Contractor away from the Municipality, but it would certainly solve a lot of our problems. Here on the Reef there are roughly 200 Municipalities. If a Contractor personally has to present himself to receive a Contractor's Licence in the various areas, he finds that this is a very onerous condition. Could we have your comments Sir?

**President:** Thank you Mr. Kneale. Would somebody like to comment on Mr. Kneale's remarks?

**Mnr. E. de C. Pretorius** (Potchefstroom): Mnr. die President, ek wil net noem dat die Hoëveld-Tak van hierdie Vereniging, het by sy vorige vergadering, eenparig besluit om by die Departement van Arbeid aan te bevel dat die registrasie van Elektrotegniese Aannemers 'n funksie van die Staat word.

**Mnr. J.G. Wannenburg** (Departement van Arbeid): Mnr. die President, hy soek vir moelikhede. Ek wil net graag deur u aan Mnr. Pretorius en ander lede wat hier teenwoordig is, een ding se: Julle moet onthou dat op die oomblik het julle beheer oor kontrakteurs. As julle dit in ons hande gaan sit, dan verloor julle alle beheer oor kontrakteurs. Nou moet julle julle kies wat julle wil: wil julle beheer oor kontrakteurs hê, of wil julle dienaarlike beheer verloor. As julle dit nie self wil doen, ons dit maar self oorneem.

**Mr. D.F. Kneale** (Electrical Contractors' Association): Mr. President, I can see there are lots of problems, but you will ask me: How will a Municipality have the control over a contractor, say that comes from Johannesburg that come to Roodepoort. What control does he have now if the contractor doesn't report that he is carrying out wiring work. All we want is a national form of registration. We will undertake, or my Association will undertake to educate its members that they should report to Mr. Botes and his colleagues when they visit the various other Municipalities where they are going to carry out installation work. Please give this some consideration gentlemen. I think it is long overdue.

**Mr. J.G. Wannenburg** (Department of Labour): Now is the time to talk. I said it previously that we are going to work on this Act and it will probably be ready for presentation in Parliament in 1976. Let us have your comments, and let us have your difficulties that you have in administering this Act. You people are the people that administer the Act, not us. We can only change it to suit you. Now I want to repeat if you think that it should be national registration, I'm quite in agreement with that, but how you are going to retain your control that you have at the moment with national registration, that is a very good thing, but I don't know how you are going to retain your control. Those are the things that you must put forward to the Department and if you do so, all right, we can see what we can do about writing it into the Act, but I can foresee quite a few difficulties.

**Mr. W. Barnard** (Johannesburg): Mr. President, I found myself in a very unfortunate position in that I'm not a member of the A.M.E.U. but it has always been the views of the Staff of the Johannesburg Municipality that we are strongly in favour of maintaining control of Electrical Contractors in Johannesburg. We do not have any problems in Johannesburg, when he mentioned these problems. I for one, I have often seen messengers coming to our department and getting the licences for the contractors, and I think that particularly in a large system like Johannesburg, we need that close operation between the contractor and the local authority. Now once you move this to the higher level, to the Department of Labour, I think that direct communication is lost, and as Mr. Kneale said that without their co-operation, it will be virtually, in my opinion, be impossible to implement the requirements of the Act.

**Mr. K.G. Robson** (East London): Mr. President, I'm interested in Mr. Barnard's comments. I would assume that he is not a member of the Highveld Branch.

In other words he is excluding Johannesburg. But I must support Mr. Barnard, perhaps Mr. President, this word 'control' is an unfortunate one, because I've come to believe over many years that the Administration of this Act together with the Regulations, is really a joint relationship between supply authorities and contractors. I must say from my own personal experience that the numerous contacts that I've had through the association have been to my own particular benefit, throughout, and I'm a bit surprised at Mr. Kneale's comments in that, it can only be to the advantage of an individual contractor if he makes that contact with a supply authority in which he doesn't normally operate. If one considers the wiring regulations, throughout its pages one will see that a good deal is left to the Electrical Engineer and his supply authority in terms of the interpretations of these regulations, and it takes quite a long time before you can come to a joint agreement on many of these interpretations, when I say joint agreement I mean the supply authority and the contractor or the contractor's association, and I would say that we should jealously guard this control of installations in our own areas. I can't for the life of me see how my friend Mr. Wannenburg, who doesn't sit in his office. I must confess, very often, if he is not at a SANCI conference or an A.M.E.U. conference or a N.O.S.A. conference or judging some factory throughout the whole of South Africa, and checking up on his own inspectors, it seems to me to be an impossible suggestion to expect the Department of Labour to administer this kind of day to day operation, and I believe that any relaxation in this kind of, let's say supervision rather than control, of the standard of workmanship of our installations will only be to our



national detriment, and I would like to see perhaps a strengthening of the contractors association, and I would say that this is perhaps where their greatest task lies, because unfortunately the percentage of membership of their association is today very, very low indeed. If we can in some way together build up this kind of relationship, I'm quite sure it can only be to the benefit of the consumer and certainly to the national standard, so I would find myself unable to support the Highveld Branch in making any kind of representation that would transfer this supervisory function from supply authorities like ourselves, to the State.

**Mr. D.F. Kneale (E.C.A.):** Mr. President, first of all I'd like to assure Mr. Barnard that we enjoy very good co-operation from the Johannesburg Electricity Department, we've got no complaints at all, but it seems to me that the point has been lost here, we are not trying to go into another area without informing the Electrical Engineer concerned that we wish to carry out installation work in his area, all we want is after the initial licence has been issued, say in Johannesburg, in the case of my company, we would then be able to get a national licence from the Wiremen's Registration Board permitting us to go and carry out contracting work in an area of another municipality; and here I, by this I mean that we would go to the Electrical Engineer with our Notice of Commencement form, having already been registered. That is all we want Mr. President.

**Mr. J.K. Von Ahlften (Springs):** Mr. President, I'm amazed, in 1962 Mr. Lombard was a member of the Board. He will recall that the contractors asked for registration by local authorities, now they ask for national registration and no control by local authorities, I'm a bit surprised Mr. President.

**Mr. D.F. Kneale (E.C.A.):** Mr. President, we do want control at local level, but the actual contractor's licence, the second one, let's say, surely this should be issued by the Wiremen's Registration Board. In a lot of cases, I venture to say there are contractors that go into various municipalities now and carry out wiring work without even a contractor's licence. Possibly not complying with the requirements that they fill in a Notice of Commencement and Completion form, and the municipalities are none the wiser.

**Mr. J.G. Wannenburg (Dept. of Labour):** If it's a matter of recognition of one contractor from one municipality to another, surely, it could be done via your association, that a contractor who is registered in Johannesburg and goes to Mr. de Villiers in Rustenburg and can prove that he is registered in Johannesburg, for Mr. de Villiers to say - 'all right you are registered there, you can do work in my municipality as well or in my area', why must it be national registration then.

Just another thing, I've got to decide on a contractor who is down in Cape Town. I don't know whether he is good, bad or indifferent, we've just recently had, and those who don't want to believe me can ask Mr.

Hess, that we've had trouble with a contractor in Cape Town, and I was rather dubious and I took Mr. Hess amiss for what he did, but when he sent me a letter, and when I saw in photographs, what this particular person had done, there was no hesitation in cancelling this person's registration. This was only, yes, Contractor plus Wireman, if he could call himself that.

**Mr. D.F. Kneale (E.C.A.):** What Mr. Wannenburg suggested will suite us fine, we don't necessarily have to put this burden on the Wiremen's Registration Board, why not follow what he suggested in that we take our Johannesburg licence, say, and we go to Mr. De Villiers in Rustenburg, and we say - right, we're registered in Johannesburg, can we proceed? But is there any necessity for the issue of another licence in an area where we don't have our place of business?

**Mr. I.H. Hess (Cape Town):** I thought I really had my last say, but Mr. Wannenburg has driven me into this one. This really was a most shocking case, for Mr. Wannenburg's benefit it is still a shocking case. After a long, long battle we got this man deregistered. Believe me he is registered again, he is registered by ESCOM as a licensed wireman, and he is now about to work in the Cape Town area, and he really set us a problem. Where do you go from here? His work is impossible, and I just don't know what we are going to do next. This came to my notice the day before I came to this meeting and I really don't know where we're going to go to from here. I've instructed my Installation Engineer to prepare a draft report which we want to send to Mr. Wannenburg.

**Mr. D.F. Kneale (E.C.A.):** Why not suspend that contractor's licence, the initial one, wherever it may be. I believe his second registration was in Cape Town, not the initial registration, is that correct Mr. Hess?

I would suggest if he happens to come from Johannesburg and he happens to be that individual, his Johannesburg contractor's licence would be suspended by the Board.

**President:** Well Gentlemen, I think we've ventilated this matter pretty fully, it's obviously a long way from settlement though. The only other report I have here is the first draft of an amendment of Regulations to the Factories Act dealing with emergency lighting. I don't know where it came from or who sent it around. Do you know anything about it Mr. Wannenburg?

**Mr. J.G. Wannenburg (Dept. of Labour):** I handed it in at the start of this Meeting. It is the first draft regulations in connection with Emergency Lighting in factories, and it promises to be a very difficult one. Some people look upon that as already being a regulation, I just want to draw attention to it for those who have already received it through SEIFSA and other organisations in the country, that it is a first draft. We expect comment on that by the 30th June 1974. So any person who is interested, please contact me in Pretoria.



MNR. PIET BOTES handig 'n ruiker oor aan Mev. J.C. Waddy.

**Mnr. P.J. Botes** (Roodepoort): Thank you Mr. President for permitting me to say a few words before you close this Technical meeting.

Mr. President, it gives me great pleasure to congratulate you in the way you conducted this meeting, it was excellent, and I trust that you stay in Roodepoort was a happy one.

Mr. President, I want to thank a few members of my staff. Now first of all I just want to thank the Association and the Executive for allowing the Technical Meeting to be held in our humble town of Roodepoort. I hope we have not let you down.

Mnr. die President ek wil net graag mnr. J. Deale en Mevr. Ackerman van die Administratiewe Bestuurder se departement bedank vir al die reëlings wat hulle getref het. Ek wil ook my dank aan lede van my departement uitbring, naamlik, mnr. Gericks, Malan, van Wyk, Pretorius, en mev. Le Roux, Botma en Van der Walt wat so baie hard gewerk het die afgelope paar dae. Vername mnr. Gericks wat so goed georganiseer het. Dan wil ek ook, laaste maar nie die minste nie - I wish to thank old Joe Marsh the electrician who had the job of switching on and off the lights in the Town Hall and to provide the plug points and connections, thank you Joe.

Mnr. die President, baie dankie dat u almal hier teenwoordig was. Ek verneem ook eger dat daar 'n tragedie plaasgevind het op Potchefstroom. Hoe erg dit is, weet ons op hierdie stadium nie, maar ons vertrou dat dit darem nie so erg is soos die voorlopige verslag wat ons ontvang het nie, en ons wil graag ons meegevoel met mnr. Pretorius betuig.

**President:** Thank you for your kind remarks Mr. Botes, I can assure you from my point of view, your arrangements here have been more than satisfactory, they've been extremely good and I'm sure they couldn't have been bettered anywhere. Gentlemen, I would just like to mention, I believe several of our well-known members will be retiring before our next Convention. I've already referred to Mr. Hess, but I think the best known of the lot is Mr. Plowden who has done a very great deal of work for our Association, not only since he became General Manager, but I'm quite sure that behind the scenes, he did a lot even before then, and it will be extremely difficult to replace him on all the committees that he has worked on, and for his contributions at Conventions. So I'd like to wish him all the very best and to thank him on behalf of the Association for all that he has done.

Also, I believe that Mr. Chappel of Port Elizabeth and Mr. McNeil of Kokstad will be retiring before the next Convention. Mr. Chappel we haven't known very long at Conventions and Technical Meetings, but we have been very pleased to have him here and Mr. McNeil, he's been coming here for many years now, and we've heard from him occasionally. To both of these gentlemen, also on behalf of the Association, I wish them a very long and happy retirement, and to Mr. McNeil a complete restoration of health.

**Mr. J.L. McNeil** (Kokstad): Mr. President, I must thank you for those sentiments. It's invariably been a pleasure for me to attend these conferences, not only for the useful information acquired, but for the associations and the friendships. There will always be a pleasant memory for me. Ek is baie jammer, ek kan nie so praat in die Afrikaanse taal, maar ek hoop die Afrikaanse lede sal verstaan.

**Mr. D.C. Plowden** (Johannesburg): Mr. President, that will be the last time I shall have used these words at a gathering of this Association. I would too like to thank you very much indeed for the remarks you made. For my part I can only say that I thoroughly enjoyed the opportunity and the privilege I've had to attend gatherings of this Association. I have benefited from the attendances and my department through me have benefited.

Also, on the Executive Council, I've been very happy to work with the members of this Council. I found them easy to get on with, they co-operated well with me, I hope I have co-operated with them. I would like in particular to thank the members of this Council, who formed members of the sub-committee on the Technical Training Subcommittee of which I was a Convener, and finally Mr. President I would like to wish this Association every success in all its future meetings, and its activities.

**Mr. M.J.W. Chappel** (Port Elizabeth): Mr. President, my sincere thanks to you for your kind wishes. I haven't attended many of these

conferences, but I have enjoyed everyone I have and may I offer the Association my best wishes for the future success.

**President:** Well Gentlemen, I think it is now just time to close and I just want to say that from my point of view this has been a highly successful Meeting due entirely to the assistance that I have had from so many people. I hope you have found it worth your while in attending.

My impression is that two days is not really adequate for this type of meeting, I'm quite sure there was a great deal more that we could have and should have done if we had more time.

I'd like to thank the authors of the two papers that we've had - Mr. E. Baumann and Mr. V. Cohen, once again, and all those who contributed to the discussions of them. I'm sure we've gained a great deal from those papers under discussion.

Mr. Pretorius, the President Elect, has now almost come to the end of his apprenticeship and the time will come when he will have to take over the full responsibility, but in the meantime he has done a great deal to assist me and I'm very grateful to him for that, and of course Bennie van der Walt and his wife Annatjie. I don't need to tell you how much they've been doing, you've all seen for yourselves what he does. I would only like to pay a personal tribute to him and thank him very much indeed for assisting me as he has. Then of course a very big thank you to Piet Botes and all the members of his staff who have done so much to make this a successful meeting. I know what it is in preparing for this type of thing and that tremendous amount of work and worry involved in it, but he has carried it off very well indeed, and I said before I hope one day we'll be able to have a Convention here. I'm quite confident that if Piet is still here and the members whom he has been dealing with, it will be a highly successful Convention.

I must also of course acknowledge and thank the Deputy Mayor of Roodepoort C/R W. J. de Vos and C/R H.J. Hugo and all the other members of the Town Council who have invited us to come here and who have done so much for us since we've been here.

Other employees of this municipality, the Parks Department, the Transport Department and I think in particular Mr. Johan Deale who has been buzzing around here, there and everywhere, but at no time has he shown any sign of flapping, and I would particularly like to thank him for all that he has done.

Others who have assisted us, and whose assistance I would like to acknowledge are the Publicity Association of Roodepoort: Total S.A. (Pty) Ltd, who provided the folders and some of the stationery; Philips Service (Pty) Ltd, who provided the sound recording arrangements; Mr. Piet Conradie who has provided a very valuable service. I'm sure some of us wouldn't have been able to follow the proceedings of this Meeting without his interpretation service.

To Messrs. Siemens S.A. (Pty) Ltd, and Hawker Siddeley Electric ATM (Pty) Ltd, the two companies whose hospitality we enjoyed in the form of the two luncheons, I would like to thank once again, and all those who assisted with the catering in connection with the luncheons and the tea refreshments we enjoyed here. Rembrandt Company who provided the cigarettes. There may well be others who have done lots for us here who I can't think of off-hand, but if I haven't mentioned any, please accept my apologies.

In connection with the Ladies arrangements, I would like to just record my thanks to Messrs. Harry de Leeuw & Co. for the tour of the flower farm that was undertaken by the ladies, and last and certainly by no means least, as far as my gratitude goes, the Deputy Mayors for all that she has done for the ladies, and indeed for the men as well, and for the refreshments which she supplied for the ladies.

**Mr. R.W. Barton** (Welkom): Mr. President, if I may be permitted the privilege of the last word, I can't be sweet unfortunately I'm the wrong sex, but I will be short. You've very rightly thanked all those worthy people and organisations who contributed so much to the success which this Meeting certainly was, but I think the one that is most deserving of our thanks hasn't been mentioned, that is yourself Mr. President. On behalf of all of us here, particularly those on the floor, and the nameless ones who sit and listen, on behalf of all of us, thank you very much indeed for a magnificent job very well done.

**President:** Well Gentlemen, I now declare the Meeting closed and wish you all a safe journey home.

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 Bedfordview Village Council  
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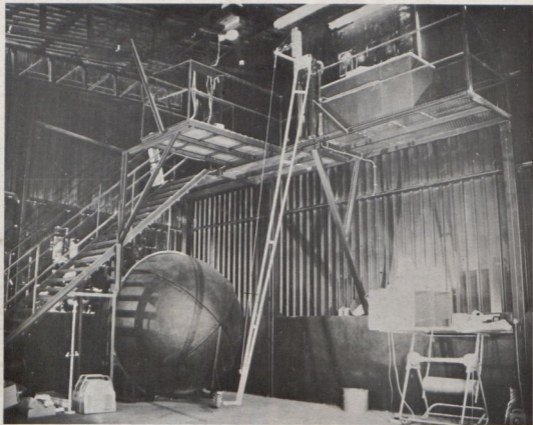
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