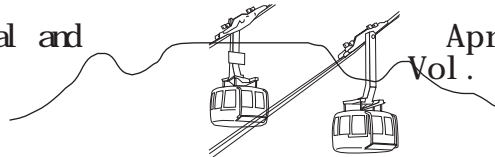


WCB ENGINEERING BULLETIN

The Institution of Certificated Mechanical and
Electrical Engineers
Western Cape Branch (WCB)

P. O. Box 504, Rondebosch 7700



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Vol. 5 no. 2



MISSION STATEMENT : 1. To uphold the image and status of the Certificated Engineer. 2. To represent the Certificated Engineer at ECSA and other decision-making bodies concerning legislation, safety & health standards, the environment and the machinery regulations. 3. To promote continued education and training of its members and future engineers. 4. Promote fellowship in the engineering profession.

Editorial

The Engineering Council of SA (ECSA) is busy on the very important task of transforming the vocation of the future Certificated Engineer into a profession. This is a laudable objective and recognises the vital part that CEs play in the safe maintenance of machinery. From the humble beginnings of being only one of the many Certificates of Competency required in the mining industry to being placed side by side with other engineering qualifications the GCC has indeed come a long way. Not only has the standard of the examinations been steadily raised by the Commission of Examiners (comprising Labour and Mines) but the performance in general of CEs has made them worthy of emulation with other recognised engineers. Many CEs have risen to managerial positions and most have been a valuable asset to their companies.

The letter to the editor of The Certificate of February 1999 by TPT Page is thought-provoking. It is true that CEs are almost expected to be Jacks of all trades, and often are. It is true that they sometimes have to tackle problems beyond their knowledge or experience. It is true that they might end up doing administrative work and lose touch with the practical side. It is true that some do move across a variety of industries. And it is also true that some employers see them as a legal imposition. So what? Do any of these impressions detract from the vital niche which he fills? He is a unique animal: not only has he a trade or other speciality to offer but he has to know the safety law. His task mainly is to see that machinery is safe to operate and in co-operation with production management that it is safely operated. His grasp of the fundamental principles of engineering is his forte. He also knows that certain health laws exist and can advise management to call in specialists if needed.

What person is on top of every aspect of his job? Even company heads make wrong decisions. Who lives risk-free? Who never reaches the level of his incompetence? Some will accept their limitations while others may try to improve on them. A new problem could well be seen as an opportunity for a new line of experience. Are there any perfect engineers? I know of only One.

o

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Affiliate Member

We welcome Steve Drinkrow, from Medi City in Stellenbosch, as our 24th Affiliate.

Local Branch News

Our year got off to a shaky start in that the first event that we arranged did not happen. The presentation by Mr. Nsengana, Chief Executive of Eskom in Bellville on "The Restructure of Eskom and Function of the National Electricity Regulator" did not take place at the last minute due to an unfortunate incident in Mr. Nsengana's private life. We were unable to notify members who intended to attend as (dare I say it?), most had not replied to our secretary. Our sincere apologies to all affected! The talk will take place at a later date though.

On 18 March 1999, a group of 9 members and 12 guests enjoyed a visit to the premises of SEW Eurodrive in Montague Gardens. It was extremely interesting to see what process they follow and how well organized their workshop and store is. A great pity that only 9 members could find the time to attend!

The planned programme for the next few months is as follows.

20 April- Talk on electrical safety at Edgemoor test and demonstration centre

18 May - Technical visit to Ratanga Junction

22 June - Talk on "The Implications of the proposed Mega City" at Edgemoor

Your support at the functions which we arrange would really be appreciated!!

I would also like to welcome Steve Drinkrow, from Medi City in Stellenbosch, as an affiliate member of the Western Cape Branch.

A matter of great concern to us is keeping you, our member, informed about the happenings. To do so we need to have your latest and most convenient address. So please drop us a line or phone our branch secretary, Crystal, @ 021 531 0193 when making any change.

Cheers for now!

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SURVEY AND EVALUATION OF HARMONIC CURRENT SOURCES IN TERMS OF IEC 1000-3-2 (1995)

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ABSTRACT

In this paper harmonic measurements were conducted on equipment having an input line current of 16 A or less per phase. The measurements have been evaluated in terms of the IEC 1000-3-2 standard which prescribes limits for individual harmonic current components. It further provides that for the purpose of harmonic current limitation, equipment is differentiated into a particular class with specific limits which may not be exceeded. A survey was conducted enabling classification of equipment into the four prescribed classes so that the full standard could be applied. The purpose of the survey and the application of the standard was to determine whether equipment being used in South Africa or exported from South Africa to Europe complies with the IEC Standard which is internationally recognised.

1. INTRODUCTION

Harmonics are sinusoidal voltages or currents having frequencies that are multiples of the frequency at which the power supply system operates.

Harmonics are created by non-linear loads termed harmonic sources. These sources generate harmonic currents even if the applied voltage to a source is sinusoidal. These currents flow back into the system and if severe enough cause voltages to be distorted.

The standardisation committees are now striving towards the reduction of current harmonics injected into low voltage distribution networks by connected consumer equipment by means of prescribed limits as laid out in the IEC 1000-3-2 Standard.

In SA the new NRS 048 standard controls quality of supply. It controls voltage distortion only. No provision is made for current harmonics. The European IEC 1000 series controls both voltage and current distortion. Should SA manufacturers be developing equipment for the European market then they need to be aware of these standards. Equipment imported from Europe which meets the IEC current standards will ensure that the local NRS 048 voltage standard should not be exceeded.

2. IEC 1000-3-2 STANDARD

Equipment is classified as follows:

- (a) Class A: Balanced 3 phase equipment and all other equipment, except that stated in one of the other classes.
- (b) Class B: Portable tools - eg electronic drilling machine, welding machines, etc.
- (c) Class C: Lighting equipment including dimming devices.
- (d) Class D: Equipment having an input current falling within

a specified (almost square) "special wave shape" and an active input power of up to 600 W.

3. ANALYSIS

(a) In Class A equipment Variable Speed Drives (VSD) were tested. For the purpose of this paper only results of testing done on a 7,5 kW 6-pulse diode input VSD are illustrated.

(b) Numerous types of Class B equipment were tested. These included an electronic drilling machine, portable DC welding machine and an angle grinder amongst others.

(c) In Class C equipment various types of lighting equipment were tested. This included a light dimming circuit under the specific test conditions laid down by the IEC 1000-3-2 standard.

(d) Requirement for equipment to fall within Class D is that it must have a wave shape of almost square shape and have an active input power of less than 600 W. Personal Computers (PC) use Switch Mode power supplies and generally take less than 600 W and have an almost square wave shape.

The Table shows the results of the tests compared to the maximum allowable prescribed limits.

4. CONCLUSION

It is evident from testing done on Class A equipment that it is the VSDs that have a tendency to exceed the prescribed limits. This is particularly true of the larger VSDs tested although small VSDs have high percentage values for the same harmonic components as the larger VSDs as well as many more higher order harmonic components. The small VSDs comply only by virtue of the fact that they have lower currents, and hence the magnitudes of individual harmonic components are low enough to comply.

It is interesting to note that if the prescribed limits for Class A equipment were to be expressed in percentage values similar to Class C equipment, then many of the small VSDs would also fail to comply with the standard.

In testing done on Class B (portable tools) and Class D (personal computers), the equipment tested complied with the standard on an individual basis, but the impact of an entire building's lighting load or computer network will cause the individual harmonic components to increase dramatically.

The Class C (lighting, dimming equipment) also failed to comply with the prescribed limits of the standard. The light dimmer in particular did not comply with the standard for any of the odd percentage harmonic current values obtained. The cumulative effect of relatively common equipment such as lighting will certainly cause the problems normally associated with harmonics to occur.

As illustrated by the test results, only Class A and Class C equipment failed to comply with the IEC 1000-3-2 standard. It may therefore only be necessary in SA to implement a standard applicable to Class A and Class C equipment. The emphasis is on limits expressed in percentage current values, thus ensuring that small VSDs are also forced to comply with the standard.

[We wish to thank the Cape Technikon for permission to use the above paper. Further information may be obtained from Mr G Atkinson-Hope, PO Box 652 Cape Town 8000]○

(See table on top of page 3)

TABLE – MEASURED VS MAXIMUM PERMISSABLE CURRENT VALUES

HARMONIC ORDER n	CLASS A 7.5kW VSD		CLASS B 750 W Electronic drill		CLASS C 600 W Light dimmer		CLASS D Personal computer	
	Measured Value [A]	Maximum Harmonic Current [A]	Measured Value [A]	Maximum Harmonic Current [A]	Measured Value [%]	Maximum Harmonic Current [A]	Measured Value [A]	Maximum Harmonic Current [A]
2	0.41	1.08	0.09	1.62	0.2	2	0.01	-
3	0.04	2.30	0.38	3.45	43.9	30xλ*	0.09	2.30
4	0.39	0.43	0.04	0.65	0.2	-	0.01	-
5	2.89	1.14	0.20	1.71	14.5	10	0.07	1.14
6	0.22	0.30	0.02	0.45	0.00	-	0.00	-
7	2.51	0.77	0.05	1.155	13.8	7	0.05	0.77
8	0.17	0.23	0.02	0.345	0.1	-	0.00	-
9	0.10	0.40	0.04	0.6	9.1	5	0.02	0.40
10	0.16	0.184	0.01	0.276	0.1	-	0.00	-
11	1.92	0.33	0.03	0.495	8.5	3	0.01	0.33
12	0.12	0.153	0.01	0.23	0.1	-	0.00	-
13	1.43	0.21	0.01	0.315	6.2	3	0.01	0.21

* λ is the circuit power factor

OCCUPATIONAL HEALTH & SAFETY ACT No 85 of 1993

Issue No 17 General Safety Regulations (GSR) *continued*

GSR 6 Work in elevated positions must be performed from a ladder or scaffold.

GSR 7 Danger of engulfment. A safety belt and rope must be provided and a person in attendance outside keeping worker under observation.

GSR 8 Stacking of Articles

GSR 8(4) Unsupported stacks of sacks, cartons and such like must be layed up header and stretcher fashion with corners bonded and stepped back half the depth of a single container at least every fifth tier or with sides vertical if the total height does not exceed three times the smaller dimension of the underlying base.

GSR 8(5) An inspector may approve free-standing stacks which are built with the aid of machinery under certain provisions.

GSR 9 Welding, flame cutting, soldering and similar operations.

GSR 9(2) Confined spaces must be effectively ventilated or the persons provided with safe breathing air in masks or hoods.

GSR 9(3) When electric welding exceeding 50 volts is used in wet places or inside metal vessels the following is required:

- good insulation
- completely insulated electrode holder
- welder completely insulated by boots, gloves or rubber mats
- another person is in attendance.

GSR 9(4) Welding, etc. in a completely closed vessel or which contains explosive, dangerous or poisonous substances is not permitted unless a person who is competent to do so certifies in writing that the dangers have been removed. ○

To be continued

66 kV Flash-over Incident

Injured Person: Labourer Daniel with 10 years experience mostly as a fitter's mate.

Three years in Distribution gang but one week with this gang.

Scene: High Tension substation out in open. Links on 66 kV steel structure open on substation side. Structure not taped off with warning tape.

Work being done: Stepdown transformer being cleaned, insulators rung out for cracks and general maintenance.

Gang: Rigger with five labourers under supervision of chargehand electrician.

Occurrence: While supervisor was busy on radio and rigger was organising earths on isolated equipment, Daniel and another labourer climbed up 66 kV structure to ring out insulators with spanner. He was ahead of his colleague, stood on an arm and as he raised spanner a flash-over occurred and he fell 5,2 m to ground. Burns on arms, hand and chest requiring skin transplants. Switchgear tripped on earth leakage at 400 amps in 0,3 sec, reclosing after 10 sec.○

OH&S Act Update

Amendment to the Vessels Under Pressure Regulations Gazette No 19657 No R1 dated 8 January 1999

From 8 January 2000 only Registered Competent Persons (Boilers) and Registered Competent Persons (Pressure Vessels) may carry out statutory inspections and tests on boilers or pressure vessels.

Amendment to the Major Hazard Installation Regulations Gazette No 19568 11 December 1998

No R 1610

Exemption is granted from the obligation to carry out a risk assessment until 31 December 1999.

No R 1611

All exemptions under S 54 of the Factories Machinery and Building Work Act 1941 and S 32 of the Machinery and Occupational Safety Act 1983 will only be valid until 11 December 1999. ○

DANGER ALOFT!

Three banners had been erected in a city street on a Saturday at the request of a sign company. They were hung below the lowest steel cable which carried the illuminated flower shapes.

On the ensuing Monday morning the Municipal supervisor on his way to work noticed the banners hanging askew and upon arrival at his depot he gave orders for it to be rectified.

The team which normally works in that street was given the job and proceeded to carry it out. They first parked the truck on which the hydraulic platform was mounted on the island side of the road and then moved to the left hand side. The vehicle was parked in the left hand lane. The vehicle itself was protected by marker cones but the basket was positioned beyond the demarcated area above the right hand side of the middle lane of three lanes.

Two workmen were fastened by harnesses in the conveyance aloft busy adjusting the banners. A double-dekker bus came down a side street and turned right into the main road. The right-hand front corner of the bus struck the left hand front bottom corner of the basket in which the men were standing. They were both projected out of the basket and hung in their safety harnesses after the bus had passed. The bus stopped a considerable distance beyond the point of impact.

One of the workmen suffered severe head injuries. The other who was uninjured shouted to the person below who was manning the hydraulic controls to lower the platform to the ground. With the help of a passerby the uninjured workman uncoupled the injured man and he was carried to the pavement. When the ambulance arrived they ascertained that the injured man was dead.

COMMENT

The bus driver directly caused the incident by not keeping a sharp lookout as he turned the corner. He either did not see the elevated platform or saw it too late to take avoiding action. Avoiding action would have been tricky because there was limited room to accommodate the bus between the stationary truck and the elevated platform. The distance the bus travelled from the point of

PLANT ENGINEERING

November 1992 Question 7(a)

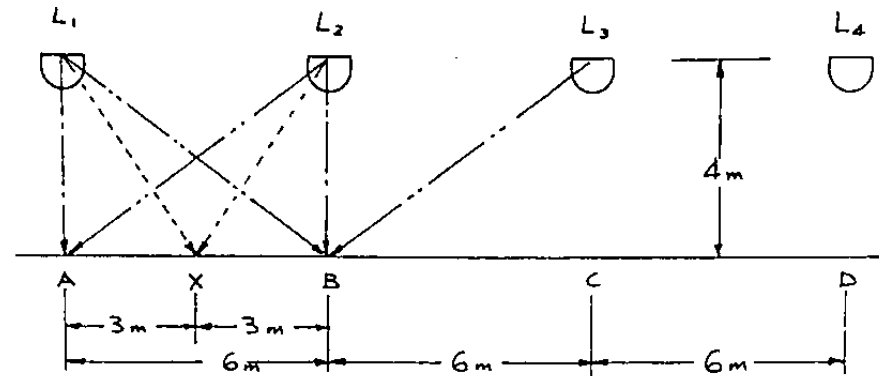
The illumination of a passage is provided by ceiling luminaires, 4 m above the floor, each with a uniform lighting intensity of 800cd, with a distance of 6m between units.

The candidate is permitted to discount the light provided by any unit more than 6m from a point considered and is required to determine the lighting intensity at floor level,

- immediately below any unit and
- halfway between any two units.

(10 marks)

ANSWER TO QUESTION NO 7(a)



Question 7 (a)

$$(i) \text{ Length } LB = \sqrt{4^2 + 5^2} = 7,2 \text{ m}$$

$$\text{Illumination at A due to } L_1 \text{ where } \theta = 90^\circ = \frac{I \cos \theta}{r^2} = \frac{800}{4^2} = 50 \text{ lux}$$

$$\text{Illumination at A due to } L_2 \text{ where } \theta_1 = \cos^{-1} \frac{4}{7,2} = \frac{I \cos \theta_1}{(LB)^2} = \frac{800 \cdot 0,5556}{7,2^2} = 8,5734 \text{ lux}$$

$$\text{Total illumination at A due to } L_1 \text{ and } L_2 = 50 + 8,5734 = \underline{58,5734 \text{ lux}}$$

Note:

$$\text{Illumination at A due to } L_1 = \text{illumination at B due to } L_2 = 50 \text{ lux}$$

$$\text{Illumination at A due to } L_2 = \text{illumination at B due to } L_3 = 8,5734 \text{ lux}$$

$$\text{Thus, illumination directly below B} = 8,5734 + 50 + 8,5734 = \underline{67,147 \text{ lux}}$$

$$(ii) \text{ Length } L_1X = \sqrt{4^2 + 3^2} = 5 \text{ m and } \theta_2 = \cos^{-1} \frac{4}{5}$$

$$\text{Total illumination at X} = 2 \left[\frac{I \cos \theta_2}{L_1 X^2} \right] = \frac{2 \cdot 800 \cdot 0,8}{3^2} = \underline{51,2 \text{ lux}}$$

collision to where it stopped indicated that the bus was picking up speed after it turned the corner of the island. The road was wet and braking had to be done smoothly.

The basket had been positioned over a traffic lane which had not been closed off, thus exposing its occupants to the very danger which occurred. The action of the foreman in placing the basket there was a contributory cause of the incident.

As there were no height restrictions for electric signs and banners under the Machinery and Occupational Safety Act in force at the time, a prosecution under Common Law for culpable homicide could be recommended. ○

ERRATA

The Editor apologises for the incorrect

version of the name of Ken Peacocke in

Old Soldiers Never Die in Bulletin Vol

5 No 1 issue. ○