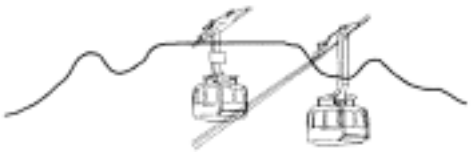
WCB ENGINEERING BULLETIN

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

P O Box 504, Rondebosch, 7700



DECEMBER 2007

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

Welcome to another edition of the Western Cape News Bulletin.

It sure is hard to believe that we are at the end of another year! I trust that you have all had a good year and that you have achieved your goals set for the year.

We would like to wish all our readers a blessed festive season and a prosperous 2008.

In this bulletin we have the normal GCC examination questions and answers together with a comment on the examinations by Jorge Pereira, who tutors Plant Engineering.

Part 3 of the extract from the Appendix of a book compiled by one of the former City of Cape Town Electrical Engineers, Mr. Dennis Palser.

An article by SafeNet on the “Entrance qualifications of persons undergoing training to operate lifting machines”.

We would welcome any contributions or letters from our readers to include in the bulletin so that we could start debates on any subject that you may have an interest in. Also, should one of you out there have a question the answer to which tickles you, please share it with us so that we can make use of the combined minds of our membership to find the answer! We look forward to hearing from you.

I trust that you will find the content of this news bulletin interesting enough to pass on to your colleagues and friends.

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LOCAL BRANCH NEWS

Activities of the branch since last news bulletin were as follows:

On 23 October we had a very interesting presentation on VSD’s attended by 10 members.

Unfortunately the planned visit to the RMS St Helena in November did not take place. We are currently discussing dates for either April or May next year. Necessary invitations will be sent out.

The next few months events planned are:

February 2008 – Branch AGM and a talk, the subject still to be decided.

We look forward to seeing you at one of our functions.
Ciao for now!

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SAFENET THOUGHT FOR THE DAY

23 November 2007

Entrance qualifications for persons undergoing training to operate lifting machines

As far back as the 8th of April 2005 we reported in a Safety Thought that the Department of Labour has published a "National Code of Good Practice for Training Providers to Lifting Machine Operators". From the number of inquiries we received regarding the entry qualifications for lifting machine operators it would appear as if many companies currently do not comply with the minimum legal requirements. This could result in lifting machine operators being regarded as incompetent, even though they are in possession of valid certificates of training. It may therefore be necessary to again discuss these legal requirements.

Driven Machinery Regulation 18(11) states *"The user shall ensure that every lifting machine is operated by an operator specifically trained for a particular type of lifting machine: Provided that in the case of lift trucks with a lifting capacity of 750 kg or more and jib cranes with a lifting capacity of 5000 kg or more at minimum jib radius, the user shall not require or permit any person to operate such a lifting machine unless the operator is in possession of a certificate of training, issued by a person or organisation approved for this purpose by the chief inspector".* It is clear from above mentioned legal requirement that certain types of lifting machines may only be operated by persons who hold valid certificates of training for the operation of:

1. Lift trucks with a lifting capacity of 750 kg (Forklifts);

2. Jib cranes with a lifting capacity of 5000 kg or more at minimum jib radius; and / or

3. Lifting machines as listed in the code of good practice (Lifting machines such as overhead cranes controlled by pendant, radio and / or cab). The code contains diagrams of all lifting machines for which formal training is required.

The accreditation of training providers for lifting machines is now the responsibility of TETA (Transport Educational and Training Authority). It became necessary for the Department of Labour to bring the provisions of the OHSA in line with the provisions of the skills development legislation and therefore the promulgation of this code. The National Code of Good Practice for Training-Providers to Lifting Machine Operators was published under the Driven Machinery Regulations, 1988 and therefore has the same legal standing as the provisions in the Driven Machinery Regulations. The code was published in Government Gazette No. 27292 dated 18 February 2005 and can be purchased from the Government Printers.

Most of the provisions contained in the code deals with the requirements that training providers must comply with. The code do however also prescribed the minimum entrance qualifications lifting machine operators must comply with prior to being sent for training. Unfortunately the code places the onus on the learner and therefore effectively on the employer to provide the training provider with the required information and documentation. This may be the reason why so few training providers actually ask for the required information and documentation prior to providing the training. Perhaps it is time that employers stop using training providers who do not inform them about the legal requirements. We often find that a forklift driver is in possession of a valid certificate of training but the other entrance qualifications as per the code were not complied with. Should the forklift driver cause an incident and injure someone the training certificate will be regarded as invalid as the other legal requirements as per the code were not complied with.

As an employer it would be important to ensure that the following legal requirements are complied with prior to sending staff for lifting machine or re-certification training:

1. The operators of lifting machines must be 18 years of age or older;

2. The lifting machine operator must be physically and psychologically fit to operate this type of equipment. The employer is required to provide the training provider with a declaration stating that the employee is physically and psychologically fit. In the event of an incident the employer will have to submit proof that the employee at the time of the training was physically and psychologically fit. The OHSA states that only Occupational Health Practitioners will be regarded as competent to conduct these medical tests. For this reason it could be assumed that only a medical certificate of fitness issued by an Occupational Health Practitioner will be acceptable. As the lifting machine training certificate is only valid for two years the employer will be required to send these operators for medical testing at intervals not exceeding two years and at least prior to them receiving the training;

3. The person undergoing the training must be in possession of an optometrist certificate which confirms that the trainee has adequate day / night vision and depth perception. It is clear from this legal requirement that any tests done in your clinic or even the screening tests done by outside companies will not ensure compliance unless these tests were done by an optometrist who issued a certificate declaring the person suitable for the operation of the type of lifting machine. The certificate issued by an optometrist will however not be required if the trainee has a valid Professional Driver's Permit;

4. The person undergoing the training should have been issued with the required personal protective equipment. The code does not specify which safety equipment to be issued but General Safety Regulation 2 as promulgated under the OHSA requires that the employer must conduct a risk assessment as to determine the need for and types of safety equipment to be issued to staff. Personal protective equipment should then only be issued should the employee be exposed to a high risk of sustaining injuries should he not wear the required safety equipment. It could even be found after conducting the risk assessment that forklift drivers need not be issued with safety boots and / or hard hats due to the low risk of foot or head injuries; and

5. The trainee must be in possession of at least a General Educational and Training Certificate Grade 9 (Standard 7). An equivalent ABET qualification will also be accepted. It should be noted that this requirement only applies to new entrance and not staff who were in possession of valid training certificates prior to the 18th of February 2005.

The team at SafeNet

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EASIER PLANT ENG. EXAM PAPERS

Plant Eng. Exam papers are definitely being made easier for the candidate to pass nowadays.
Since I have been lecturing this subject, from 1999, at the College of CT, Pinelands Campus, I noticed that for the last two years or so the questions of this exam paper are definitely being made easier compared to the past questions in the sense that the questions are repeated with the same values etc. from past Plant Eng. papers.
In the past exam papers, as far back as I could go, the questions presented in the Plant Eng. exam papers where never ever the same regardless of the topic.

They could have been similar but never the same, with always some or other addition or emission, with different values etc.
Lets look at some of the questions of the latest 15th of Nov. 2007, Plant Eng. exam paper for Factories.

Q.1.3 Heat Transfer
Same as June 2003 (1.1) (10)
Q. 2.1 Single Phase Transformer
Same as Nov. 97 (7) (c) (14)
Q. 5.1 Centrifugal Compressor
Same as Nov. 87 (3) (10)
Q.6 Induction Motor
Same as June 92 (7) (20)
Q. 7.1 Symmetrical Fault Levels
Same as Nov. 2002 (7) (b) (10)
Q.8.1 Hoists
Same as June 92 (3) (b) (10)
The total is 74%.
When I say "Same as …", I mean the same not similar.

$$Ss/c = \frac{60}{0{,}719} = 83{,}45\,MVA$$

$$I\,s/c = \frac{60\,000}{\sqrt{3}\,x\,22\,x\,0{,}719} = 2190\,Amps$$

If this trend of compiling future exam papers continues, it will be interesting to see, if this method is the answer to our long problem of the shortage of Cert. Engineers in our country.

I leave it to the reader to make his or her mind on weather the above, copy and paste, decision by the Dept. of Labour is going to be beneficiary to the country in the long run or not.

I did all the above questions on the board in detail every semester since June 2003 and therefore the students that did study the above problems will have a very good chance to pass this time.

Incidentally, **Q.2.1** above was submitted to ICMEE by me and published on one of the past Bulletins.

I chose **Q7.1** to give the answer here.

A generating station has four 15 MVA, 11 kV generators, each having 12,5% reactance. Determine the initial symmetrical short-circuit current and the corresponding MVA at the end of a cable feeder, 15 km long and 225 mm² cross section, feeding through

an 11/22 kV, 12 MVA transformer. The percentage reactance of the cable is 0,243% per km on a 10 MVA base and that of the transformer is 7,5% on a 12 MVA base. Use a percentage reactance base of 60 MVA in your calculations.

Answer:
The four alternators are in parallel and their reactance is 12,5% each at 15 MVA. At 60 MVA = 0,5 pu. each and the total reactance in parallel is 0,125 pu.
The transformer reactance is 0,375 pu. at 60 MVA.
The total cable reactance is 0,00243 x 15 x 6 = 0,219 pu. at 60 MVA.
The total reactance of the system is = 0,125 + 0,375 + 0,219 = 0,719 pu.

In this exam paper, question 2.2 is a compulsory theory question for 6 marks. I thought interesting to also give the answer here.

Q. 2.2 Name SIX markings that will be displayed on the drums or reels for electric cables. (6)

Answer:
Marking on drum flanges should be clear, stenciled or burned into the wood and should include the following information:
(1) Manufacturers name or trade mark
(2) Rated voltage, rated area, number of cores and specification
(3) Length of the cable in meters
(4) Year of manufacture
(5) Gross mass in kilograms
(6) The instruction: “NOT TO BE LAID FLAT”
(7) Serial number or other identification
(8) On each flange an arrow with the words “ROLL THIS WAY”
(9) SABS Mark if applicable

Jorge Pereira (Cert. Eng.)

ELECTRICITY IN CAPE TOWN

Part 3 of the extract from a document titled “A Historical Record commemorating the Centenary of the City of Cape Town Electricity Undertaking 1895 to 1995” by Denis Palser.

Extension No.2 (1912)

In 1912 the 150 kW Bumpsted and Chandler set, moved here in 1904 from Dorp Street, was in the process of being removed to make way for the following new 1 700 kW turbo-alternator set.

1 - Turbo-alternator set.
Apparently Curtis type turbine.
British Thomson-Houston, UK.
1 700 kW (2 300 HP), 11 000 V, three-phase.

Commissioned June 1913

This was the first turbo-alternator installed by the City. The new 11 000 V three-phase system was soon to become the standard that is still in use today.

This set remained in service until around 1925 when it was removed and stored in the Claremont substation prior to sale. Although in good working order it was no longer of value because of its small size and low efficiency. Incidentally, the removal of this set, along with the removal of another similar 1 700 kW BTH set installed around 1914, provided space to install a third and last 7 500 kW Metropolitan Vickers set in 1927.

Station total installed engine capacity 6 000 HP

Station total installed generating capacity **4 350 kW**

Extension No.3 (1913)

1 - Turbo-alternator set.
Apparently Curtis type turbine.
British Thomson-Houston, UK.
1 700 kW (2 300 HP), 11 000 V, three-phase.

Commissioned (about) June 1914

This set remained in service until around 1925 when it was removed and stored in the Claremont substation prior to sale. Although in good working order it was no longer of value because of its small size and low efficiency. The removal of this set, along with the removal of another similar 1 700 kW BTH set installed around 1914, provided the space to install a third and last 7 500 kW Metropolitan Vickers set in 1927.

Station total installed engine capacity 8 300 HP

Station total installed generating capacity **6 050 kW**

A further large Babcock and Wilcox boiler, with mechanical stoker, was installed during the year.

Two new Babcock and Wilcox marine-type land boilers were commissioned in October 1915. Each boiler was rated at 15 000 pounds of steam per hour at a pressure of 160 psig. With the installation of these new boilers it became possible to take the other land based boilers off the range for cleaning.

A motor convertor set was installed in 1914, evidently the No.2 set.

New coal and ash handling plant was commissioned in November 1916.

Extension No.4 (1918)

1 - Turbo-alternator set.
Apparently a Curtis type turbine.
British Thomson-Houston, UK.
3 000 kW (4 000 HP), 11 000 V, three-phase.

Commissioned towards end of 1917

The two Bellis-Siemens 400 kW 2 200 V two-phase sets were still operational at the end of 1917, but by the end of 1918 they had been removed and sold to the municipality of East London.

A new 1 000 kW convertor, No.3, was installed about the end of 1917.

By the end of 1918 this then left operational one 3 000 kW (BTH) and two 1 700 kW (BTH) turbo-alternators, along with two 700 kW (Ferranti) and one 300 kW (Bellis) engine-driven dynamos.

Station total installed engine capacity 11 050 HP

Station total installed generating capacity **8 100 kW**

One of the 1 700 kW units was kept in reserve because of blade deterioration, limiting useful output to 6 400 kW. Replacement blading was on order in 1917. The set was run at full load on one occasion in 1918 when it failed completely and was taken out of service. The following was the position at the end of 1918.

Station total installed engine capacity 8 750 HP

Station total installed generating capacity **6 400 kW**

During 1917 a new Babcock and Wilcox marine-type boiler was delivered and erected, but only commissioned early in 1918.

The following year, in February 1919, this new 3 000 kW alternator burnt out. One of the 1 700 kW machines was also out of commission at the same time due to complete failure of the turbine blading. This reduced the plant available for service, the position at the end of 1919 being as follows.

Station total installed engine capacity 4 750 HP

Station total installed generating capacity **3 400 kW**

Extension No.5 (1921)

1 - Turbo-alternator set.
Apparently a Curtis type turbine.
British Thomson-Houston, UK.
3 000 kW (4 000 HP), 11 000 V, three-phase.

Commissioned July 1921

Station total installed engine capacity 15 050 HP

Station total installed generating capacity **11 100 kW**

One of the Ferranti 700 kW sets was removed and sold as scrap. The 150 kW Bellis engines were removed and stored at Claremont pending being offered for sale as running units.

Removal of these sets made room for the installation of a new 7500 kW Metropolitan Vickers turbo-alternator set, which was delivered and partially erected by the end of the year.

2 - Boilers.
Marine-type, with balanced draught, mechanical stokers.
Babcock and Wilcox.
35 000 pounds of steam per hour.

Commissioned: first unit September 1920
second unit February 1921

Two older land type boilers were removed to make room for these two new boilers, and then sold.

Apparently another old land type boiler was removed and a further new Babcock and Wilcox 35 000 pounds per hour boiler was installed and commissioned in July 1922.

By now all the old 20 000 pounds per hour boilers had been removed, which permitted the station steam pressure to be raised from the previous 175 psig to 220 psig in 1922.

Extension No.6 (1923)

1 - Turbo-alternator set.
Metropolitan Vickers, UK.
7 500 kW (10 000 HP), 12 000 V, three-phase.

To make room for this set the remaining 700 kW Ferranti engine-driven dynamo set was shut down, removed and sold as scrap. By this time all the other earlier reciprocating engine-driven sets had also been disposed of to make room for the more modern turbo-alternator plant now being installed.

Station total installed engine capacity 22 600 HP

Station total installed generating capacity **16 900 kW**

Extension No.7 (1926)

1 - Turbo-alternator set.
Metropolitan Vickers, UK
7 500 kW (10 000 HP), 12 000 V, three-phase.

Station total installed engine capacity 32 600 HP

Station total installed generating capacity **24 400 kW**

Extension No.8 (1927)

1 - Turbo-alternator set.
Metropolitan Vickers, UK
7 500 kW (10 000 HP), 12 000 V, three-phase.

This set was installed on the site of the first two 1 700 kW British Thomson- Houston sets which were shut down and removed to the Claremont substation before being sold. This turbo-alternator was the last generating set to be installed at the Dock Road power station.

The remaining operational sets were the two 3 000 kW British Thomson-Houston sets and the three 7 500 kW Metropolitan Vickers sets.

2 - Boilers.
Water-tube type.
each 50 000 pounds steam per hour.

These two boilers were installed in the space originally intended for, and at one time used as, a coal store.

Station total installed engine capacity 38 000 HP

Station total installed generating capacity **28 500 kW**

SOMETHING WRONG!!!!