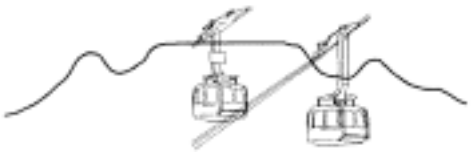
WCB ENGINEERING BULLETIN

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

P O Box 504, Rondebosch, 7700



SEPTEMBER 2005

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 finalization of the Continued Professional Development (CPD) in May of this year by ECSA is going to have a long reaching effect on all Registered Professionals in the Engineering field. The timetable for implementing the policy starts as from 1 January 2006, with a phased in approach relating to when one was originally registered as a Professional by ECSA.

Those of us who are registered need to take heed of the conditions of the policy as should we not adhere to the conditions we will loose our registration. I wish to point out that all the relevant information is clearly available on the ECSA website, www.ecsa.co.za and should there be any questions please do not hesitate to give me a call and assistance will be given. It would also be a good idea for all of you to remind anyone you know who is a registered professional about the CPD, as quite a number of Engineers practicing out there are not affiliated to one of the Institutions.

We are of the opinion that the CPD policy presents opportunities for our Institution to get involved actively in the accreditation of papers and presentations for Registered Professionals in order to qualify for credits for renewal. The terms for credits are well spelt out in the policy and active participation in the operation of the Institution also counts.

You may wonder how this will affect you if you are not registered. Well, another development that has already traveled a long way is the “Identification of Engineering Work”. ECSA established a Steering Committee (IDoEW-SC) in November 2004. This steering committee has done a lot of work and we have been party to a workshop about this subject earlier on in the year. The final report was expected to be presented on 5 September 2005. At the time of writing this editorial, I am not aware whether this actually took place.

The main objective of this steering committee would be to identify engineering work that may only be performed by registered persons, who in fact take responsibility for that work. An interim report was submitted to ECSA Council in August 2005 and certainly makes interesting reading. Thus once the final report is accepted by ECSA and made into a policy, most practicing Certificated Engineers will need to take note and get the necessary Professional Registration.

We will arrange necessary talks on the two matters discussed above should there be a request for such. So please do not hesitate to call us and we can make the necessary arrangements.

Chris Schnehage

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LOCAL BRANCH NEWS

We have had a bit of a slump in our production of this newsletter due to a number of reasons and events. Firstly, our editor Jerome has left to spend two years in England and thus we have fallen around to find a replacement. Secondly, the untimely passing of one of our dear committee members, Fanie Venter in June also affected our visit and talk schedule.

However, I am pleased to tell you that all is back on track once again! We have convinced Henriette Venter, Fanie’s widow, to take over the reins as the editor and we have decided to cut the number of editions per annum down to 4 rather than the original six. Hopefully all of you will understand this change.

Since June we have offered the following event for our members: Talk on Continued Professional Development by Rod Harker, member of ECSA Council on 16 August 2005. This was a most enlightening talk and should you want to get the gist of what was said, you should read the article by Du Toit Grobler in the latest Vector magazine. Should anyone like any further information, please visit the ECSA web site and browse around.

Proposed activity list to the end of the year 2005 is as follows:
25 October 14h00 – Visit to SA Radiators
November – Onsite visit to talk on “On site Alignment on Ships”
Late November / early December – year end bring & braai

We have started to work on our programme for 2006 already and should anyone have any ideas for talks or visits, please let us know, and we will eagerly follow up.

Ciao for now!

Chris Schnehage

COMMERCIAL MEMBERS

Globe Engineering Works (PTY) Ltd Tel 021 448-4640

Drake & Scull (PTY) Ltd Tel 021 683-7056

Sappi Cape Kraft (PTY) Ltd Milnerton. Tel 021 552-2127

New South African Fuel Gauge!

WATER TUBE BOILER EXPLOSION

Contribution by Mike Jaffe

This is a description of a boiler incident taken from the records of the Marine Safety Division of the Ministry of Transport, London. The inquiry was done in terms of the Boiler Explosions Act, of 1882 & 1890. The explosion occurred on the 19 February 1961 shortly after 22h00. There was only one fatality. A stoker was severely burnt and scalded on the face and hands, and was taken to hospital where he died the following day.

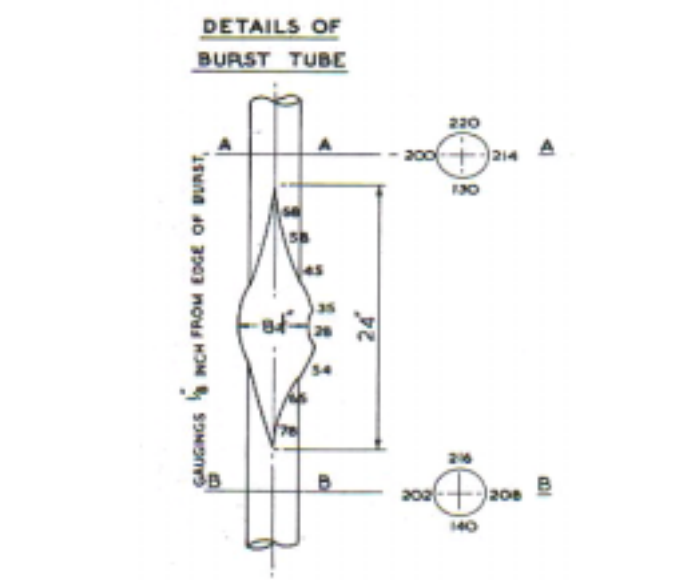
The boiler was a Babcock and Wilcox, W I F type comprising two steam and water drums joined at the back and front by solid drawn steel tubes to twelve generating elements each having eight inclined tubes expanded into the headers. Superheater elements were fitted between the top row of generating tubes and the steam and water drums. The temperature of the steam at the outlet was about 600° F (315°C). The two spring-loaded safety valves were set to lift at a pressure of 275 PSI (1 900 kPa). The designed thickness of the two bottom rows was 3 BIWG (0.252 inch) and the remainder 6 BIWG (0.192 inch).

The boiler was installed new in 1943. Many generating tubes in the lower rows had been replaced on four occasions between 1950 and 1959. The need for these repeated renewals was the appearance of blisters on the tubes. An inspector of an insurance company had examined the boiler periodically. This is a requirement of the various insurance companies before boilers can be insured for the following year. (Pity the South African short term insurance industry does not follow the same requirement before renewing the annual insurance!)

The local thinning of the underside of the tube by external erosion, so that it was not capable of withstanding the normal working pressure, caused the explosion. The erosion was caused by the impingement of the jet of steam from the soot blower fitted in the right hand wall of the furnace. Five manually operated soot blowers were fitted in various passes of this boiler supplied with steam from the superheater.

This boiler, one of two, supplied steam to the pumping machinery as well as a generator for supplying power to pumps and for station lighting. After installation of the boiler, the boiler was soot blown about once every two days but in recent years, because of the poor quality coal used and the need to keep a chimney in a rural area clear of smoke, soot blowing was increased to every four hours but later extended to eight hours.

On the evening of the incident a loud hissing noise was heard. At that moment the station was plunged into darkness as the turbine driven generator dropped off load due to loss of steam pressure. The now deceased was shouting for help. On getting him out of the boiler house an ambulance was summoned and he was taken to hospital.



It was found that a tube in the second bottom row had burst. All the tubes were inspected. It was found that the burst tube had thinned to a minimum of 0,028 inch close to the edge at the centre of the burst. The wastage of the tube material had taken place externally and was localized in extent. Adjacent tubes had suffered similarly but to a lesser degree.

Steps taken to prevent erosion on the tubes were to reduce the steam pressure to 100 PSI (690 kPa) and consequent velocity of the jet.

In the accompanying sketch of the burst tube, thickness is in thousandths of an inch.

Plant Eng. Goods Hoist Problem

Contribution by Jorge Pereira

A loaded cage has a mass of 1230 kg. The rope passes over the drum to a balance mass of 440 kg. The drum has a diameter of 1,2 m and a radius of gyration of 530 mm and its mass is 670 kg. The frictional resistance to the movement of the load is 410 N and that to the movement of the balance mass is 390 N. The frictional torque on the drum shaft is 280 Nm. Find the Torque required on the drum and also the power required at an instant when the load has an upward velocity of 3,5 m/sec and an upward acceleration of l,4m/sec^2.

Answer

Let (T1) and (T2) be the tensions on the rope.
T1 = force to raise + force to acc. + friction force.
T1 = m1.g + m1.f + F
T1 = (1230 x 9,81) + (1230 x 1,4) +410
T1 = **14,198 kN**

T2= m2.g - m2.f - F
T2 = (440 x 9.81) – (440 x l,4) - 390
T2 = 3,31kN

T1 – T2 = **10,888 kN**

Torque to acc. loads - (T1 - T2).r = 10,888 x 0,6= 6,533 kNm

Torque to acc drum = (mk^2 x acc/r)xTf = [(670 x $0{,}53^2$) x 1,4/0,6] + 280 = **719,14 kNm**

Total Torque = 6533 + 719,14 = **7252,14 Nm**

Power = Total Torque x V/r
Power = 7252,14 x 3.5/0,6 = **42,3 kW**.

ALTERNATIVE SOLUTION

Equivalent mass of drum = mk^2/r^2 = 670 x $0{,}53^2/0{,}6^2$ = **522,8 kg**

Mass to be accelerated = 1230 + 440 + 522,8 = **2192,8 kg**

Total friction force to overcome rope = 410 + 390 + 280/0,6 = **1266,7 N**

Force of balance mass = 440 x 9,81 = **4316,4 N**

Force on cage = 1230 x 9,81 = **12066,3 N**

Force to accelerate = 2192,8 x 1,4 = **3070 N**

Equivalent tension in rope = 1266.7 - 4136,4 + 12 066,3 + 3070 + **12086,5 N**

Total Torque = F x r = 12 086,5 x 0,6 = **7252 Nm**

Power = F x v = 12 086,5 x 3,5 =**42,3 kW**

OHSAct June 97 (3) (a) (b)

(a) State the guarding prescribed by regulation for the following machinery:

(i) the saw blade of a portable power-driven circular saw
(ii) the grinding wheel of as power driven grinding machine where the work piece is applied by hand
(iii) dangerous moving parts and the door of a mixing machine
(iv) the outer door of a centrifugal extractor which is of double cylinder construction and of which the inner cylinder rotates
(v) the nip of a set of rolls turning in the opposite direction and which are 50 mm apart (10)

(b) A factory is supplied with high-tension electricity. There is an enclosed brick built switch house. State seven regulation requirements to which the switch house must comply. (10)

Answer to question 3:

(a) (i) DMR 3 (2)
(ii) DMR 8 (5)
(iii) DMR 11 (1) and (2)
(iv) DMR 13 (a) and (b)
(v) DMR 12 (a) and (b)

(b) EMR 5(l) (a) to (b)

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extract from

Hermanus Magnetic Observatory (HMO) annual report:

Contribution by David Wright

The Earth's magnetic field is presently decreasing at a phenomenal rate, which has evoked the suggestion that a reversal of the geomagnetic field may have commenced. Two prominent patches of reverse magnetic polarity, which can account for almost all of the present-day decrease, have been identified at the core/mantle boundary. The most intense reverse patch is beneath the southern tip of Africa. Since the establishment of the Hermanus Magnetic Observatory (HMO) in Hermanus in 1941, the total field intensity has decreased by 20%, which is greater than the decrease at any other magnetic observatory. Research on this phenomenon has commenced in collaboration with researchers at the GeoForschungsZentrum, Potsdam, Germany, using data from ground-based stations in southern Africa and from the German CHAMP satellite. This research will facilitate a better understanding of geomagnetic field behaviour, the coupling to other geophysical processes, and the implications for society. The existence of the geomagnetic field has numerous important benefits for society; for example, two such benefits are its shielding against the damaging radiation from space and its implementation in navigation systems.

As part of the investigation of the rapid decrease of the geomagnetic field it was proposed that HMO's network of 10 secular variation field stations distributed over southern Africa should be increased to 40 field stations. The 40 field stations have been identified and beacons and azimuth marks repaired or erected. Surveys will be carried out at all of these field stations during 2005.

On 18 July an article on the pending magnetic field reversal of the Earth and the research done in southern Africa at the HMO in this regard appeared in the Sunday Times. This sparked unprecedented public interest, resulting in several live interviews with Dr Pieter Kotzé on radio (RSG, Cape Talk and Radio 702), followed by a live telephone interview on Monday 26 July on TV (SABC Africa). Several newspapers, e.g. Die Burger and Hermanus Times, published articles focussing on the scientific activities at the HMO and aiming to inform the general public.

You might like to view our website. It is being updated at the moment because we are currently pursuing two new projects. The one involves an HF radar project at SANAE which measures Ionospheric Disturbances in the (South) Polar region and the other is our Science Outreach initiative aimed at filling a void in high school Physics where learners from High Schools in the Overberg Region come to our recently completed Science Centre and complete practical tasks involving Electricity, Magnetism and Electronics and gain hands-on experience. Our web-address is www.hmo.ac.za

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ELECTRICITY GENERATION IN CAPE TOWN

Contribution by John Davidson

HISTORICAL BACKGROUND

This is an extract from the original inauguration booklet for Steenbras Power Station originally printed in 1979, incorporated in electronic format and revised by the power station management in 2002.

The early history of electricity supply in Cape Town began in 1879, when Cape Town was visited by the "Scientia Studiosa" Company. The idea of employing electricity for lighting purposes in Cape Town was first proposed by Mr John Gamble, the then Colonial Hydraulic Engineer, who suggested that water turbine driven generators could make use of the power in the water flowing down into the City's main service reservoir from a reservoir to be built on Table Mountain. It was not until 1895 that this idea of lighting the City by electricity was finally brought to fruition with the establishment of the Cape Town Electricity Undertaking and the inauguration of its first power station on the banks of the Molteno Reservoir.

Because of the steadily increasing demand for electricity, it was found necessary in 1898 to increase not only the generating capacity of the Molteno power station, but also to convert the Dorp Street substation into a power station by the installation of further generating plant. The third power station was built in Dock Road and was known as the Central Electric Light Works. It was commissioned in 1904 with an initial coal-fired steam generating capacity of 1 850 kW. This capacity was progressively increased over the years to its ultimate capacity of 28 000 kW by 1927.

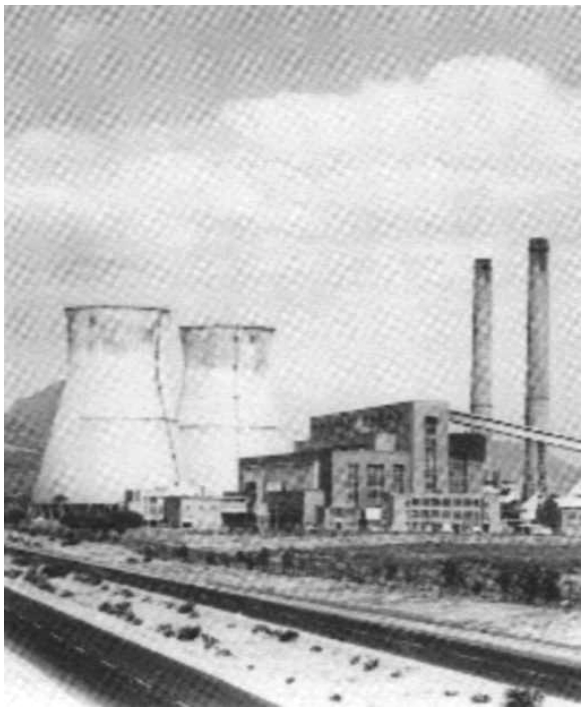
The next phase was the construction of another coal fired power station, with an initial capacity of 120 000 kW, adjacent to the Dock Road power station. In 1952, this new power station, known as the Table Bay power station, was increased to its ultimate design limit of 200 000 kW.

After considering a number of alternative sites the City's fifth power station was constructed in Athlone and the first stage, with an initial capacity of 90 000 kW, was commissioned in 1961. The capacity of the Athlone power station was increased to its ultimate capacity of 180 000 kW in 1967. To improve the security of supply to the City's consumers and to meet short peaks and other emergencies, a 40 000 kW gas turbine plant was installed at this power station in 1973.

The original intention was to extend the capacity of the Athlone power station by building yet another coal-fired power station on an adjacent site. After detailed investigation, however, it was resolved to meet the City's future power requirements by taking a bulk supply. A long term agreement was accordingly entered into with ESKOM in 1974.

Molteno – Cape Town's first Power Station

Dock Road Power Station – now demolished



Athlone Power Station

Table Bay Power Station