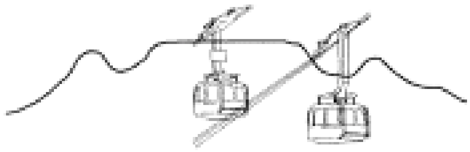
WCB ENGINEERING BULLETIN

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

P O Box 504, Rondebosch, 7700



SEPTEMBER 2006

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

In our last edition we presented an article about the GCC examinations by the Principal of Veasey's Engineering College and we have had feedback from one of our members, Mr. Adrian Wyntje from our Western Cape branch. This feedback is copied and presented elsewhere in this bulletin. Mr. Wyntje further proposes that we hold branch meetings to solicit comment from you, our members. However, it would be equally effective should anyone of you who have an input to make simply send your comments to me and I will place these in the next bulletin. So let's hear from you out there!

This edition of the WC Bulletin also has some feedback from a different source about the preparation of candidates for the GCC examinations and the effectiveness of the answering of the papers for these examinations.

The penultimate article on the Steenbras hydroelectric power station and the normal questions from past examinations are also in this edition.

An item of note for Registered Engineers and Candidate Engineers. ICMEESA is recognized as a Voluntary Association by ECSA and as such our members enjoy a discount in the fees payable to ECSA. However, should you not have been a fully paid up ICMEESA member as at 30 June 2006, the discount will not be effective. Should you have paid your fees after this date, your discount will NOT be recognized for this year! It is therefore very important that your ICMEESA membership fee for next year must be fully paid by 30 June 2007 for discount in fees to count for the next ECSA financial year.

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

Chris Schnehage

Editor: Henriette Venter   email: vencon@netactive.co.za

LOCAL BRANCH NEWS

During the past few months we have had the following activities put on for members.

Tuesday 20 June – 10 members and guests attended the talk on shipwrecks on our coast.

Thursday 3 August – 10 members and guests visited the yard of Veecraft - who build small craft. There were 2 craft in near completion which we were able to climb on and look at the type of construction carried out. This was an interesting visit.

Tuesday 22 August – 10 members and guests enjoyed a presentation on the capabilities of modern machines used for laser processing, punching cutting & shaping work pieces from sheet metal.

The next few months' events planned are:

September – We are trying to arrange a visit to the Wind Power Generation field near Klipheuwel.

October – Visit to the Amalgamated Beverages Canners in Epping

November – A talk on large generator set maintenance issues

We look forward to seeing you at one of our functions.

Ciao for now!

Chris Schnehage

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COMMENT ON GCC EXAMINATIONS

The Department of Labour in conjunction with the Department of Minerals and Energy held a workshop on 29 June 2006 with the Training Service Providers who provide training to candidate engineers in preparation for the GCC examinations. Amongst the issues discussed was the fact that the success rate of candidates stays rather low – in the order of 9%.

From this meeting the view points of someone who attended this work shop are as follows:

"The mental approach of the candidates is wrong. Legal Knowledge. They think that this is the law, with a legal book and therefore study this book. They get home at night and study the law and try to memorize everything. The next day they go to work and do their job and then again at night study law. This is the incorrect approach, what the candidates should be doing is try to relate what they have learnt in theory to their work. This will teach them to practice making use of the theory to apply to their everyday working environment. In this way what they study starts to make sense.

The above applies to Plant Engineering as well. Candidates should be questioning why shafts are sized as they are, why is it so thin or thick, what size pump is used for a certain job etc. the theory books do not necessarily mention all the angles, this they must experience at work by questioning why, where, what & how.

Hereafter he/she can go and study past papers and books. In this way he/she is able to relate the practical with the theory and thus fully understand what he/she is studying. The examiners do not want to test the knowledge of theory as this has been tested in studies leading up to acceptance as a candidate, but rather the application of this theory.

The above reasons certainly relate as to why candidates are being unsuccessful in their examinations. One cannot treat the GCC examinations as simple theory examinations and the sooner that this is understood, the sooner one would see an increase in pass rate."

Comment from members would be welcome!

Adrian Wyntje PR.Cert.Eng
Occupational Health & Safety act
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31 July 2006

The Editor
ICMEE WC Bulletin
PO Box 504
RONDEBOSCH
7700

Please find my typed copy concerning the GCC examination.

What about having a branch meeting on the subject with input from members?
This we should submit to our President.
Reading his News letter, March, 2006 concerning skills shortages, he may be inclined to submit our and his views on the GCC to the commission of Examiners, as the Institute's contribution to beat the shortage of Certificated Engineers.

Let us act before we are confronted with some unreal set of draft regulations.

Kind regards,

Adrian

THE ENGINEERS' CERTIFICATE OF COMPETENCY (G.C.C.)

The G.C.C. is the engineers' passport in the world of industry.

He will be instrumental in preserving health and safety of employees. He will oversee the safe use and operation of materials and machinery. In this role he will also protect the employer from possible litigation. He will also be eligible for registration with the EC-SA

The low pass rate of 13 % keeps urgently needed engineers from entering the ranks. The syllabus is not at fault by necessity and questions are set within its boundaries.

The answer is that the candidate has to ingest and process the task in 3 hours, which by all standards is an almost impossible task, to achieve a 50 % pass. A bit of luck is most often the deciding factor in success. However what does this tell one about competence?

How did the system work pre-1979 under the Factories, Machinery and Building Work Act, 1941? When pass rates of 35% were not uncommon. The E-regulations, governing the examination, split the syllabus in Parts A and B of this old Act.

A pass in any part remained as credit for two years within which one had to pass the other part in order to be awarded the Certificate of Competence.

The 5 subjects of the syllabus were as follows :

1 Power Plant.
2 Strength of materials and design of structures (elementary and advanced).
3 Electrical Engineering (elementary and advanced).
4 Driven machinery.
5 Factory Plant.

The elementary and advanced forms were options for the electrical or mechanical candidates respectively. How could such a system be implemented and what rules should be applied to achieve its objectives? The basis of such a system is the incremental approach and to abandon the present one of all or nothing.

Here is my view.

1. Candidates must have achieved a pass in the examination of the Occupational Health and Safety Act.
2. Candidates must have accepted candidate status.
3 Candidates may request to be examined in one or more of the above subjects.
4. Duration of each subject shall be not less than 2 hours.
5. Credit shall be given for each subject passed.
6. Any credit shall remain valid for not less than 5 years.

It should be acknowledged that the above rules are entirely in line with those of other tertiary education institutions.

To summarise the benefits of this proposed system.

1 Standards are maintained. The 5 part syllabus is the present 1 part syllabus.
2 The candidate is judged rather by his knowledge than by his speed.
3 The candidate is able to build up credit. This is an incentive to complete all subjects.
4 The candidate is tested for 10 hours instead of 3 hours.
5 Candidates may write the advanced subject of one or the other.
6 An increased pass rate of 25 % as expected will double the number of engineers entering the industry.
7 An employer may have the option to employ either a mechanical or electrical candidate to suit his needs.
8 The employer could apply for an exemption to employ a candidate who has already earned some credit.
9 The proposed system will encourage many eligible persons to become certificated engineers

For too long have we tried the worst system. Would it not be sensible to institute a modified system which promises much better results. Only by testing a system will we find out the extent of the improved results.

A. Wyntje
Pr. Cert.Eng August 2000

MEMBERS' FEEDBACK

The article by Adrian Wyntje refers: This article has been circulated to members of the Council of ICMEESA and one email of feedback follows.

Quote:

I remember the facts, they were not as stated by Adrian. I obtained my GCoC in 1977 writing in the system as stated, parts A and B, with three subjects in each. Even in those days very few candidates passed. Rumors abounded that the pass rate was determined by the number of engineers that were required by the industry. Passing both parts first time was considered an envious achievement.

I recollect one colleague that had been a learner engineer for some time when I joined those ranks. After many years and numerous attempts, this poor fellow never managed to pass and was removed from the scheme. The question is, should A have ever been in engineering? Probably not.

So was it not the low pass rate that prompted the change to the present system?

I believe that the main problem today is that we have engineering candidates that do not inherently aspire to be engineers. The primary objective is to find work, any work. The secondary objective is to get a job with status and earn big bucks.

The seventies were the days of psychometric testing and training excellence being part of the company ethos. So I would imagine that no matter which examination system was in place, results would have improved.

Today, well psychometric testing is considered biased and unfair. Adequate practical training is available to a privileged few.

So where does the real problem lie? In the selection and training of the candidates. It took me 3.5 years as an apprentice, one year as an artisan and 2 years as a learner engineer to obtain the GCoC. Almost 7 years, and I did well, in the fast lane, being one of the privileged few to pass first go.
Today, you will be writing the exam after two years of practical and perhaps some vacation work in-between.

I doubt that changing the examination format is going to resolve the problem. Passing the exam is one thing. It is becoming an engineer able to add value to the safety and productivity is another.
End quote

HEALTH & SAFETY

Government plans to merge health and safety units.

There was an article in the Engineering News (page 26 June 30 – July 6 2006) which speaks of the South African government planning to effect a merger between the two departments of health and safety that are located within the Department of Labour and the Department of Minerals and Energy.

There will be a change in the legislation where the OHS Act and the MHSA will disappear and a new Act (apparently based on the MHSA) has already been drafted which will be a common Act for all health and safety issues and that it is envisaged that the regulations would be an area where specifics relating to a sector would be more detailed. The idea is to also incorporate the Merchant Shipping Act.

The Department of Labour believes that such a merger would facilitate a more holistic approach to health and safety.

Any comments? Please let us know what your opinion is by emailing the editor with your thoughts.

OHSAct, Exam Paper Nov. 2001 (3)

In terms of the Electrical Machinery Regulations, state in point form:

(a) Any FIVE of the seven requirements that must be complied with in respect of enclosed premises housing switchgear and transformers (10)

Ans: EMR 5 (1), a,b,c,d,e,f,g

(b) FOUR requirements that a portable electric light must comply with when the operating voltage exceeds 50 V. (4)

Ans: EMR 10 (1), a,b,c,d

(c) One additional requirement if the portable electric light is to be used inside metal vessels (1)

Ans: EMR 10 (2), a,b

(d) TWO requirements that must be complied with when an electric fence is installed along a public road or in an urban area (2)

Ans: EMR 11 (6), a,b

(e) THREE prohibiting requirements that must be adhered to where the fence energiser of the electric fence receives its energy from an electric power system (3)

Ans: EMR 11 (3), a,b,c

Jorge Pereira (Cert.Eng.)

Plant Eng. Nov. 88 (5) (b)

A solution must be heated from 20° C to 80° C at a rate of 2,1 ton/hour in a tubular contra-flow heat exchanger. Hot air enters the exchanger at 350° C at a rate of 2,36 ton/hour. Calculate:

(a) the number of 25 mm inside diameter tubes required if the solution velocity is limited to 17 mm/sec.

(b) the length of the tubes

The specific heat of the hot-air is 1,05 kJ/kg K. The heat transfer coefficient, gas to metal, is 34 W/m² K and, metal to water is 6,2 kW/m² K. The temperature drop through the metal may be neglected. The specific heat capacity and density of the solution are 3,8 kJ/kg K and 1,21 ton/m³ respectively.

Answer:

Rate of solution = 2,1t/h = 0,583 kg/sec.
Rate of hot-air = 2,36 t/h = 0,656 kg/sec.

(a) to find the no. of tubes (n):
Assuming no heat loss in the exchanger:
Heat added to solution = Heat removed from the hot-air.
0,583 x 3,8 x (80°-20°) = 0,656 x 1,05 x (350° - t2). Then t2 = **157° C** and Q = **132,92 kW.**

Now: Q = U. A. LMTD

$$U = \frac{1}{\frac{1}{u1}+\frac{1}{u2}} = \frac{1}{\frac{1}{34}+\frac{1}{6200}} = \underline{33,815\ W/m^2}$$

$$\therefore Total\ Area = \frac{132,92 x 10^3}{33,815 x 196} = 20\ m^2$$

Also total area = π d ℓ

$$Length\ of\ tubes = \ell = \frac{20}{\pi x 25 x 10^{-3}} = \underline{254,65 m}$$

continue:

Now:
Area of Flow = area/tube x no. of tubes

Also:

$$Area\ of\ flow = \frac{volume}{velocity} = \frac{mass}{density\ x\ velocity}$$

$$\frac{mass}{density\ x\ velocity} = \frac{\pi}{4} x\ d^2\ x\ n$$

$$n = \frac{0,583\ x\ 4}{1,21\ x 17\ x \pi\ x \left(25\ x 10^{-3}\right)^2} = \underline{57,74\ tubes}$$

$$Say : n = \underline{58\ tubes}$$

(b) *to find the length per tube :*

Therefore :

$$length\ per\ tube = \frac{254,65}{58} = \underline{4,4\,m\ per\ tube.}$$

Jorge Pereira (Cert. Eng.)

ELECTRICITY GENERATION IN CAPE TOWN Part V

From: John Davidson

STEENBRAS CIVIL ENGINEERING WORKS

The pumped-storage scheme comprises an intake works situated in the upper Steenbras Dam, upstream of the original Steenbras Dam, connected by a series of tunnels through the mountain and a steel pipe penstock to the power station and lower reservoir some 300 m below. A cross section of the scheme is illustrated in Figure 5. The items will be dealt with in more detail below.

UPPER RESERVOIR
About 10% of the capacity of the upper dam (Fig. 5, item 1) with retaining wall (Fig. 5, item 2) is required for the pumped-storage scheme, the remainder being additional storage capacity to supplement the city's water supply. The daily operation of the pumped-storage scheme causes the level in the upper reservoir when full, to rise and fall by less than one metre at normal operating levels.

INTAKE WORKS
The intake works (Fig. 5, item 3) in the upper reservoir comprises a fan shaped screening chamber tapering to two control gates at the head of the tunnel system through the mountain. The control gates can be shut in an emergency by remote control from the power station.

TUNNEL SYSTEM
The tunnel system comprises a horizontal low pressure tunnel (Fig. 5, item 4) connected by a vertical shaft to a horizontal high pressure tunnel lower down the mountain. The low pressure tunnel, vertical shaft and the greater portion of the high pressure tunnel (Fig. 5, item 6) are concrete lined and average 5 m in diameter.

Approximately the last third of the high pressure tunnel is steel lined, the thickness of the steel lining increasing as the rock overburden decreases to contain the pressure of the water.

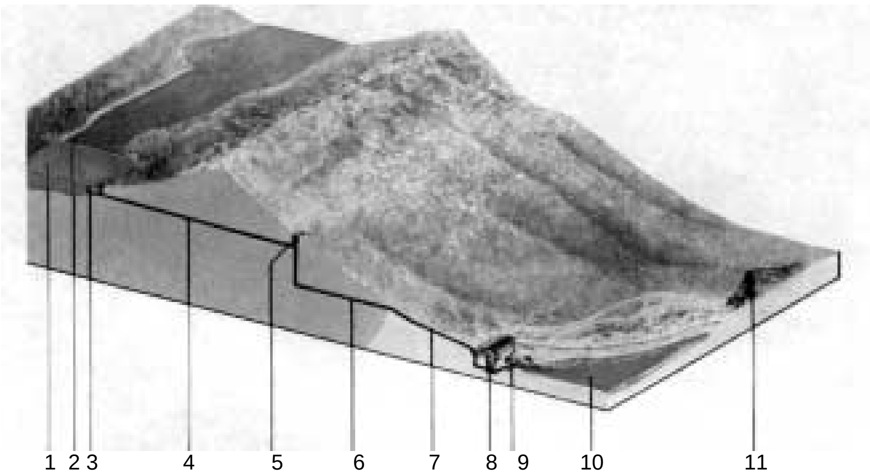

Figure 5: Cross section of Scheme 1

To provide working access to the low pressure tunnel while the upper reservoir was filling, an access shaft with its inlet above water level was constructed. This shaft is also used for routine maintenance purposes and, as a secondary means of accommodating water surges occasioned by changes in plant operating conditions.

SURGE SHAFT AND TANK
Load rejection for whatever reason, in the generating or pumping mode, causes surges in the water conduit system. The primary means of controlling water surges is by a surge orifice, shaft and tank (Fig. 5, item 5) constructed immediately above the vertical shaft that interconnects the low and high pressure tunnels. The surge shaft opens to the atmosphere on the upper slopes of the mountain.

PENSTOCK
The outlet of the high pressure tunnel is connected to the power station by means of a steel pipe penstock (Fig. 5, item 7), approximately 3,5 m in diameter and buried below ground to reduce its environmental impact. Just behind the power station building the penstock bifurcates into two separate steel pipes, each of which in turn further divides into two to form four individual pipes, one to each of the four machines installed in the power station. The steel pipe penstock was refurbished with a new epoxy lining in early 1997.

POWER STATION
For geological and economic reasons, the four 45 000 kW machines are located in two shafts (Fig. 5, item 8) rather than in a single large underground cavern. These shafts, each of which is 20 m in diameter and 46 m deep, give the necessary submergence below the minimum water level of the lower reservoir to ensure proper hydraulic operation of the machines.

The two machine shafts are straddled by the power station building (See figure 6 for general arrangement). The columns and gantry for an overhead travelling crane are fabricated steel sections while the adjoining transformer annexe and electrical annexe are of conventional reinforced concrete beam and slab construction.

The upstream annexe of the power station accommodates the main transformers, together with the high voltage metalclad switchgear (Fig.6, item 7 & 8 resp.), while the downstream annexe, comprising three floors and accommodates the control and auxiliary electrical equipment. The unit equipment associated with each machine, such as the local control panels (Fig. 6, item 3), excitation equipment, contactor boards and pony motor starting resistors (Fig. 6, item 4), is located at ground level. The intermediate level is primarily a cable gallery (Fig. 6, item 5) while the top level accommodates all the auxiliary switchgear and batteries, the station control room and adjacent offices for operating staff (Fig. 6, item 2).

A separate building behind the power station accommodates an emergency diesel generator, fuel stores, main stores and electrical workshop. In 1987 a new mechanical maintenance workshop was constructed on the East end of the main building. During 1997 a new administration block, with six offices and small boardroom was constructed over the main north facing entrance of the power station building.

LOWER RESERVOIR AND CONTROL WORKS

Electrically operated gates (Fig.5, item 9) are provided to isolate individually the draft tubes connecting each of the pump-turbines to the lower reservoir (Fig.5, item 10). The 132 kV transmission line is indicated (Fig. 5, item 11).

The western side of the lower control works incorporate the chamber containing the cooling water and fire fighting pumps.

A one metre diameter overflow pipeline runs from the lower reservoir to the sea at Gordon's Bay. The original purpose of this pipeline was to empty the reservoir for maintenance purposes and to discharge water during periods when the upper dams were overflowing. This provided a measure of "free" generation.

In December 1997 the Cape Metropolitan Council commissioned a pumping station to transfer bulk water through a 1 675 mm diameter pipeline, to their water treatment plant at Faure, 18 km away. This pumping station draws its water from the original outlet provided for the overflow pipeline. The overflow pipeline has been retained for drainage water purposes for maintenance and operational requirements, but will no longer provide for spillage of excess water from the system during periods of high rainfall.

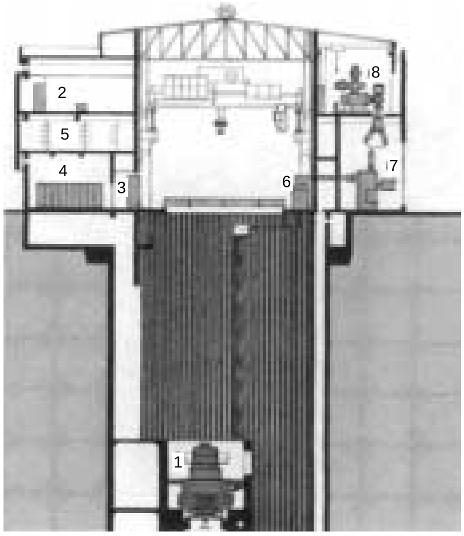

Figure 6: Section of power station structure

COMMERCIAL MEMBERS

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

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

Tailpiece:

FASCINATION WITH GADGETS

To the engineer, all matter in the universe can be placed into one of two categories:
1. things that need to be fixed, ……………..and
2. things that will need to be fixed after you've had a few minutes to play with them.

Engineers like to solve problems. If there are no problems handily available, they will create their own problems. Normal people don't understand this concept; they believe that if it ain't broke, don't fix it. Engineers believe that if it ain't broke, it doesn't have enough features yet.
No engineer looks at a television remote control without wondering what it would take to turn it into a stun gun.
No engineer can take a shower without wondering if some sort of Teflon coating would make showering unnecessary.
To the engineer, the world is a toy box full of sub-optimized and feature-poor toys

You are an engineer…………

- If you use a CAD package to design your son's soap box car
- If you have used coat hangers and duct tape for something other than hanging coats and taping ducts
- If you are convinced you can build a phaser out of your garage door opener and your camera's flash attachment
- If you have modified your can-opener to be microprocessor driven
- If you know the direction the water swirls when you flush
- If you have ever saved the power cord from a broken appliance
- If you still own a slide rule and you know how to work it
- If you rotate your screen savers more frequently than your automobile tyres
- If you have a functioning home copier machine, but every toaster you own turns bread into charcoal
- If you have more toys than your kids
- If you have a habit of destroying things in order to see how they work
- If your I.Q. number is bigger than your weight
- If the microphone or visual aids at a meeting don't work and you rush up to the front to fix it
- If you can remember 7 computer passwords but not your anniversary
- If you thought the real heroes of "Apollo 13" were the mission controllers
- If you spend more on your home computer than your car
- If you know what http:/ stands for
- If you've ever tried to repair a $5.00 radio
- If you have a neatly sorted collection of old bolts and nuts in your garage
- If your three year old son asks why the sky is blue and you try to explain atmospheric absorption theory