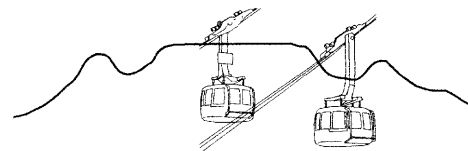




WCB ENGINEERING BULLETIN

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

P O Box 504, Rondebosch, 7700



OCTOBER 2009

- 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.

This quarter we have our normal articles in this news bulletin. GCC exam questions and answers and Part 5 of the article on the Electrification of Cape Town, titled "Lighting up the Fairest Cape 1895 to 1995".

Further, we wish to call your attention to two articles / incidents which are worthy to note but have very large document sizes, and as such – should anyone want a copy of the said documents, please contact me and I will forward to you.

The first is the "Accident at Russia's Biggest Hydroelectric" power point or pdf presentation. This presentation is 5Mb big and therefore too big to send to dial up connections.

The second is a copy of the new "Pressure Equipment Regulations" referred to in the two SafeNet Africa articles in the bulletin. Its size is 1.5Mb.

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

Chris Schnehage

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LOCAL BRANCH NEWS

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

Things have been a bit hectic the last few months and presentations and visits that were being arranged did not take place due to various reasons (again!).

June 30 – talk on "the current trends in solar energy options, the benefits and technical options plus examples of some of the applications (large scale down to domestic) that are being implemented in SA and abroad". 11 members attended. Very interesting topic.

July 28 – presentation on infrared testing of critical electrical machinery. 15 members attended.

Planned events that did not happen:

August – a visit to a water purification systems manufacturer in Strand – GrahamTech.

September – talk on pump selection and solutions.

The following are items that are being planned for presentation:

The above two items in October and November respectively.

October 13 - Talk on an energy saving technology called "Power Optimisa".

Should any of our members receive this news letter by snail mail and would like to get it electronically – or you notice that you are not getting invitations to our talks and visits, please be so kind as to forward your email address to me to the email address below. Thank you!

If you know of a presentation or technical visit that we could arrange for our members, please also pop me an email and we will see what we can do.

Ciao for now!

Chris Schnehage

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SAFENET THOUGHT FOR THE DAY

31 July 2009

New Pressure Equipment Regulations

On the 15th of July the Department of Labour promulgated new Pressure Equipment Regulations, 2009 which will replace the existing Vessels under Pressure Regulations (VUP Reg) as promulgated on the 4th of October 1996. The bulk of the new requirements will come into effect on the 1st of October 2009.

In this Safety Thought we will attempt to highlight some of the more important or new provisions contained in Government Gazette notice number R734 dated the 15th of July 2009:

1. Currently the regulations require that pressure vessels be inspected and tested by Department of Labour Approved **Registered** Persons. Any person with the necessary training or experience could register for this purpose and it is not uncommon to find that most of these companies are very small and may even consist of the registered person, an assistant and their "bakkie". The current legislation also makes provision for the registration of Department of Labour **Approved Inspection Authorities** (AIA's) for pressure vessels. These AIA's are normally regarded as more competent and their services would therefore mainly be used when making modifications to vessels, overseeing the manufacturing process and when having to perform more complex inspections and / or tests. The Department of Labour regards these AIA's so competent that employers could approach them for exemption from some certain legal requirements contained in the old VUP Regulations. This in all other health and safety regulations would be a task that may only be performed by the Department of Labour.

The new regulations only makes provisions for AIA's and no mention is being made of the Registered Persons. It could therefore be assumed that some Registered Persons will

register to become AIA's. To be registered as an AIA one needs to be accredited by an international or South African Accreditation Authority such as SANAS. The cost and paperwork associated with such an accreditation process may just be too much for most persons currently registered as Registered Persons and the most likely outcome would be that some Registered Persons will start performing tasks under the supervision of an existing AIA. It is however my opinion that some currently approved Registered Persons would most probably leave the industry;

2. The definition of a pressure vessel has been changed substantially in that it now states that it is any housing designed and manufactured to contain a pressure equal or greater than 50kPa. Although the new legislation excludes certain vessels such as aerosol dispensers, tyres and air receivers on vessels it is clear that many more vessels will now have to be subjected to inspections and tests due to them being regarded as pressure vessels. A typical example would be hot water cylinders with a water capacity of more than 450 liters which operates at a maximum pressure of 600kPa or more;
3. A boiler is now referred to as a steam generator;
4. The old regulations required that only vessels manufactured according to certain international standards may be sold and used in South Africa. The regulations then listed a number of codes which included International, French, Japanese and other codes. The new regulations require that all pressure equipment sold and used in South Africa must conform to the requirements contained in the South African National Standard 347. The only exclusion to this rule would be imported vessels that were manufactured in compliance with the full ASME (American Society of Mechanical Engineers) Code of Construction;
5. According to the new regulation the importer assumes the liability and responsibility of the manufactures in terms of these regulations. This in effect means that the company selling equipment that does not conform to the requirements as stated in the point above could be held liable by the Department of Labour should it be found after an incident that they sold equipment which did not conform to the minimum legal requirement;
6. Manufactures of pressure equipment now also has a legal duty to inform the Department of Labour should they become aware of any latent defect in equipment manufactured and sold by them. A typical example would be when they were informed of the rupture or failure of pressure equipment manufactured or sold by them. The notification given to the Department of Labour should also state the measures implemented by them as to correct the defect;
7. The new regulation requires that the user (Person who uses and gets the benefit from the use of the equipment) must ensure that a certificate issued by the manufacturer which certifies that the equipment was designed and manufactured in accordance with the relevant health and safety standards is available on site. Legislation can normally not be made retrospective and it could be assumed that pressure equipment manufactured according to the previously incorporated codes of good practice would still be regarded as safe for use.

What about the older pressure equipment for which no manufacturer documentation is available? The new regulation makes provision for a verification certificate to be issued by an AIA. It could therefore be assumed that employers who lost or just never obtained these documents

will have to obtain the services of an AIA to issue a certificate stating that the pressure equipment has been manufactured to acceptable standards and is safe for use. Although the new regulations states that some of the new requirements will not apply to pressure equipment installed prior to the promulgation of these regulations, no mention is made that this specific regulation does not apply to older equipment. Time will tell whether or not this was the intention on the part of the Department of Labour; and

8. The same would apply to any gas system (Assembly of tubes, pipes or similar ducts, fittings and valves for the reticulation, circulation and conveyance of gas). A typical example would be the gas piping system installed in a laboratory, kitchen or other workplace. Again the new regulation does not exclude older installations and it could therefore be assumed that these certificates are also required for older installation. Again time will tell whether or not this was the intention on the part of the Department of Labour.

In our next Safety Thought we will discuss the new regulations further with special attention being given to the new requirements pertaining to inspections and pressure testing of pressure equipment.

The team at SafeNet
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SAFENET THOUGHT FOR THE DAY

6 August 2009

New Pressure Equipment Regulations

In last weeks Safety thought we started discussing the more important legal requirements contained in the new Pressure Equipment Regulations, 2009 as promulgated by the Department of Labour in Government Gazette notice number R734 dated the 15th of July 2009. I may have confused some in that I in last weeks Safety Thought referred to Registered Persons as those persons conducting the bulk of the tests and inspections on pressure vessels used in industry. These persons are also referred to as Competent Persons or "CPs" as this is the terminology used by the South African Institute of Welding (SAIW). SAIW has been tasked by the Department of Labour to set the examinations and register these persons. On proof of registration with the SAIW the Department of Labour will register them on their database and regard them as competent to perform certain tests and inspections on pressure systems. The new regulations however refer to these persons as Authorized Persons. Irrespective of the terminology used these are the persons who currently do the bulk of all inspections and tests on pressure systems. Currently there are only 5 AIAs in the Western Cape compared to the many Authorised / Competent / Registered Persons active in the Western Cape.

The following requirements as per the new regulations may also be of importance:

1. The provision in the old Vessel under Pressure Regulations, 1996 which required that all steam generators (Boilers) and pressure vessels be inspected and tested after installation and before use remain unchanged;
2. The new regulations requires that all piping (Pipes, tubes or flexible pressure hose elements intended for the transportation or distribution of any fluid at a pressure of 50kPa or more) must be inspected and be tested by the manufacturer / installer after manufacturing, installation,

modifications or repairs were done. Category 1 equipment as categorized in the South African National Standard 347 is excluded from this provision. This in effect will mean that many piping systems will have to be pressure tested after installation and before commissioning;

3. The old regulations require that all pressure vessels irrespective of the type be inspected and pressure tested every 36 months. The new regulations require that:
 - a. Fire-tube steam generators be subjected to an external inspection at intervals not exceeding **12 months**. A hydraulic pressure tests and crack detection test of all critical welds must be performed at intervals not exceeding **36 months**; and
 - b. All other pressure vessels and steam generators must be subjected to an internal, external inspection and hydraulic pressure tests at intervals not exceeding **36 months**.

All of the above inspections and tests must be performed by Department of Labour Approved Inspection Authorities as explained in our previous Safety Thought. It should however be noted that this legal requirement will only come into effect on the 1st of April 2011. The reason for this is merely to give companies the opportunity to register and become SANAS accredited within a reasonable time. It will also allow the Department of Labour some time to facilitate this process and issue registration documents.

Category 1 equipment as categorized in the South African National Standard 347 may however be inspected by the user (Owner or person who gets the benefit from the use of the equipment). As per the previous regulations a record which will contain detail on the inspections, tests and modifications done should be kept and be available on site;

4. As with the old regulations, users of pressure vessels which contain a non corrosive substance can still approach a Department of Labour Approved AIA for permission not to conduct any internal inspections and pressure testing on these vessels. Typical examples will be vessels filled with refrigeration substances. The new regulations however states that the permission granted will only be valid for a period not exceeding 9 years. It could therefore be assumed that the owners of these vessels will be required to every 9 years drain the liquid for the vessels and get an internal inspection and pressure test done;
5. All piping and pipe lines must be inspected at intervals as prescribed by the relevant in-service health and safety standard or as per the risk based inspection program implemented. Equipment classified by the South African National Standard 347 as Category II equipment and higher could be inspected and be declared safe by the Competent Person for Machinery (Factory Engineer or Maintenance Manager) as appointed under General Machinery Regulation 2(1);
6. Employers may as an alternative to the 36 monthly inspections implement a risk-based inspection management system which should conform to the safety standard incorporated under the regulation. In the absence of having studied the safety standard in full it is not 100% clear what such a risk-based inspection management system will entail. It is however my opinion that it may be an option only exercised by larger employers as the regulations states that such a risk-based inspection management system must be verified by an accreditation body such as SANAS and be accredited in terms of ISO 17021;

7. As with the old regulations employers will be required to keep record of all the above mentioned inspections, tests or exemptions granted; and
8. The manufacturer or importers of pressure equipment are legally obliged to when selling equipment provide the client with the instructions and safety information relating to:
 - a. Mountings, including the assembling or different pieces of the equipment;
 - b. Putting the equipment in service; and
 - c. Maintenance, including checks to be performed.

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OHSAct Nov. 04 [8.1] and [8.2]

- 8.1 An employee is required to work in a refrigerated environment in which the actual dry-bulb temperature is below 0°C.
 - 8.1.1 State THREE items of protective clothing the employee must be provided with.
Answer: ER 2 (2) (b) (i) to (vi)
 - 8.1.2 What is the maximum exposure of the employee where the temperature is between 0°C and -18°C.
Answer: ER 2 (2) (a) No Limit.
 - 8.1.3 what is the maximum exposure of the employee where the temperature is between -18° and -34°.
Answer: ER 2 (2) (a) 50 min/hour
- 8.2 With a view to the emergency evacuation of indoor workplaces without natural lighting or where persons habitually work at night, the employer shall provide emergency sources of lighting in such workplaces.
 - 8.2.1 What is the minimum illuminance required during emergency evacuation.
Answer: ER 3 (4) 0,3 Lux
 - 8.2.2 To determine whether the illuminance complies with the prescribed requirement, where will you take the measurement of the illuminance referred to in QUESTION 8.2.1?
Answer: ER 3 (4) At floor level.
 - 8.2.3 What must the minimum illuminance be where machinery or a process has to be shut down before evacuating the workplace?
Answer: ER 3 (4) 20 Lux.
 - 8.2.4 How soon must the emergency source of lighting be activated?
Answer: ER 3 (5) Within 15 seconds
 - 8.2.5 How long must the emergency source of lighting last?
Answer: ER 3 (5) (b) To last long enough for evacuation.

Jorge Pereira (Cert Eng)

A hollow drive shaft is to be used when it is connected to a water pump delivering 1 120 kW at 115 r/min. The maximum allowable shear stress for the shaft material is 54 MPa and the maximum torque to be transmitted by the shaft is 1,3 times the mean torque. The modulus of rigidity, $G = 80 \text{ GPa}$. Calculate the following:

4.1.1 The internal and external diameters for a diameter ratio of 2:1 [8]

4.1.2 The twist in the shaft over a length of 3 m when transmitting the maximum torque [4]

We will have to make use of the Torsion Equation.

$$\frac{T}{J} = \frac{G\theta}{\ell} = \frac{\tau}{R} \quad \text{where:}$$

$T = \text{Torque (Nm)}$

$J = \text{Polar Moment of Inertia (m}^4\text{)}$

$$J = \frac{\pi}{32}(D^4 - d^4) \quad \text{for hollow shafts}$$

$G = \text{Shear Modulus (GPa)}$

$\theta = \text{Angle of Twist (Radians)}$

$\ell = \text{Length of Shaft (m)}$

$\tau = \text{Shear Stress (MPa)}$

$R = \text{Radius of Shaft (m)}$

$$\text{From: } P = 2\pi NT$$

$$T_{\text{mean}} = \frac{1120 \times 60}{2\pi \times 115} = 93 \text{ kNm}$$

$$T_{\text{max}} = 1,3 \times 93 = 121 \text{ kNm}$$

Using the above equation and substituting

(R) for $\frac{D}{2}$ we get:

$$\frac{121 \times 10^3}{\frac{\pi}{32}(D^4 - d^4)} = \frac{54 \times 10^6}{\frac{D}{2}} \quad \text{and } D = 2d$$

$$\text{Hence we get: } d = 115 \text{ mm}$$

$$\text{and } D = 115 \times 2 = 230 \text{ mm}$$

4.1.2: Angle of Twist (θ):

From the above formula:

$$\frac{80 \times 10^9 \times \theta}{3} = \frac{121 \times 10^3}{\frac{\pi}{32}(0,23^4 - 0,115^4)}$$

$$\text{hence we get: } \theta = 0,0176 \text{ radians}$$

$$\therefore \theta = 0,0176 \times \frac{180^\circ}{\pi} = 1^\circ$$

Jorge Pereira (Cert Eng)



Sayano-Shushenskaya – 2009 August 17

By:

Euler Cruz - Consulting Engineer – Turbines

Rafael Cesário - Mechanical Engineer

Brasil – 2009 Aug 24

Objective

This presentation aims to disseminate some technical and general aspects of the accident. A long and detailed work must be done in order to provide understanding about what happened, in order to help all Owners to prevent such accidents.

Note

This is a preliminary analysis made based only on pictures and films, done no longer than one week after the accident. Only hypotheses are formulated.

For full presentation (5Mb) please request directly from chris@icmeewc.co.za

Introduction taken from the following web site:

[www. http://www.poweroptimisa.com/](http://www.poweroptimisa.com/)

What does the Power Optimisa technology do:

The Power Optimisa offers FREE, GREEN ENERGY SAVINGS. This unique technology will save you significant amounts of electricity energy and reduce your carbon emissions - both by around a 8% to 15% or better range. The savings we generate for you will more than pay for the technology - hence it pays for itself. The Power Optimisa technology includes highly efficient and reliable voltage power optimising methods, which automatically manage and regulate your facility's electricity power that you receive into the optimal level you require.

The Power Optimisa is a one-stop energy saving solution which also:

- Reduces your maximum load demand (Kva)
- Protects all your equipment from major power 'spikes' and lightning strikes
- Extends the life of your lighting and other equipment often by more than twice its average lifespan
- Improves your power quality and power factor
- Lowers your maintenance costs for lighting, motors and other electrical equipment
- Lowers the operating temperature of your motors without affecting their efficiency
- Reduces phase voltage imbalances and thus improves the efficiency of AC motors
- Suppresses harmful harmonics (THD's) that damage sensitive electronic equipment

How it works

All incoming electricity supply voltages will fluctuate up and down in a specified range within which all electrical equipment will operate to their specification. One of the Power Optimisa's functions is to simply remove the excess voltage levels very **efficiently** and **reliably**, and in the process deliver the optimal safe voltage level to efficiently run a facility. The Power Optimisa then continually monitors and adjusts your power and voltages within a series of custom pre-set intervals (known as 'taps') up to 100 times per second. In this manner the technology removes wasted and unnecessary energy you would otherwise have received but did not require. The Power Optimisa is strictly set to operate well within voltage service levels set by the power utility.

A Power Optimisa installation will typically yield energy savings of around 8% to 15% or better; it will also deliver a reduction in reactive power of over 15%; an improvement in voltage phase balancing; reduced neutral currents; and an improvement in power factor of between 4% - 10%. For most sites, the installation will more than pay for itself from just the generated energy savings within 3 years or less, which represents a return on investment of greater than 33%. This return on investment (ROI) is unsurpassed in the industry for a quality technology that will continue to save for 35 to 50 years - maintenance free. Nor do we include or calculate in this ROI all the derivative savings you will achieve - equipment maintenance savings, lower labour maintenance costs, etc..

Remember too, your equipment lifetimes will now also be extended (lighting normally by over 200%) by optimizing the power and by cutting out (or attenuating) significant amounts of harmful harmonics.

ELECTRICITY IN CAPE TOWN

Part 5

GRAAFF ELECTRIC LIGHTING WORKS

A Glimmer of Light

The reason for the relatively late introduction of electricity supply to the municipality of Cape Town itself could well have been due to a number of factors. Firstly, there was a well-established gas lighting system in the City that was introduced as far back as 1847, and secondly, the more well-to-do citizens of the day presumably resided in the southern suburbs. Perhaps more importantly was the apparent opposition displayed to this new form of lighting by a number of prominent and influential citizens holding public office in the City at the time.

Be that as it may, the initial idea of providing electricity for lighting purposes in Cape Town appears to have first been mooted back in 1880 by the then Hydraulic Engineer of the Cape Colony, Mr John Gamble. On being requested to investigate the various sources of water supply he suggested that water turbine-driven generators could make use of the power in the water that would flow down into the City's main service reservoir in Oranjezicht from a proposed new catchment reservoir to be constructed on the top of Table Mountain. This idea was supported by Sir John Woodhead who also proposed that an interconnecting tunnel be constructed through the mountain. But another fifteen years was to pass before this early idea came to fruition on a windy Saturday evening in April 1895.

For it was on the evening of this historic day, the 13 April 1895, just one hundred years ago, that the then Mayor, Mr George Smart, officially inaugurated the City's first power station on the banks of the Molteno service reservoir in Oranjezicht, on the lower slopes of Table Mountain, thereby also effectively

establishing the City's electricity undertaking and embarking upon an ambitious scheme to light the City by means of electricity.

Although the practical implementation of this scheme was apparently initiated by a councillor of the time, Chevalier T J O'Reilly, it was mainly through the efforts of another councillor while Mayor, namely the Hon D P De Villiers Graaff, that the scheme was eventually undertaken despite strenuous opposition from some quarters, particularly from another prominent and wealthy citizen of the day, Mr J C Hofmeyr. Mr Hofmeyr served as a councillor for some 30 years and was Mayor in 1878. He was well-known for his thrifty nature and inevitably opposed any expenditure that he considered would lead to an increase in rates. But notwithstanding this opposition the scheme was finally adopted. In view of the valuable services and unsparing devotion of time and attention displayed by the Hon D P De Villiers Graaff in getting this scheme off the ground the Council unanimously resolved that the works be named the Graaff Electric Lighting Works in his honour.

The Inaugural Ceremony

The inauguration of the new Graaff Electric Lighting Works was extensively reported on in the local press of the day, and the following are a few extracts from the Cape Times of Monday, 15 April 1895.

On Saturday evening the ceremony of turning on the electric light for the first time took place with some display of civic pomp. The initial part of the proceedings was enacted at the Generating Station, near the Molteno Reservoir, where at about a quarter to seven o'clock, a small assemblage gathered, headed by Mr George Smart, the Mayor of Cape Town.

Owing to the station being a considerable distance from the town, and to the fact that a south-easter of medium strength was blowing, the gathering was not so large as otherwise would doubtless have been the case.

After one or two short speeches the Mayor formally named the works "The Graaff Electric Lighting Works", by which title he declared he wished the works thereafter to be known.

The Mayor at this stage broke a bottle of champagne over one of the turbines. ... The act of christening was greeted with applause, amidst which the machinery was slowly set in motion, and the Mayor having briefly explained the nature of the works, the assemblage, amidst mutual and warm congratulations, adjourned to the Town House in Greenmarket Square.

The party arrived at the Town House at about half-past seven, and the vicinity of the Town House was crowded by a very large assemblage of citizens, while the steps and parapet were lined with a guard of the Fire Brigade, who lent to the scene a picturesque appearance.

At a given signal the front and interior of the old and historical building were lit up by a blaze of light. Above the balcony was displayed the legend 'Success to the Graaff Electric Lighting Works', and the whole scene, during which cheers were given by the multitude for the Mayor, was one of much splendour.

The Mayor, in addressing the huge assemblage, said that the installation of the electric light that evening constituted the first part of that memorable programme introduced to the citizens of Cape Town during the Mayoralty of the Hon. Mr Graaff.... Well they now had the initial part of the installation; but he would tell them that during the present year fifty additional lamps would be erected in the city, while a further fifty were to be added in the year 1896.

Since the initial contract was for the installation of 450 lamps these additional lamps would significantly add to the public lighting system in the City.

In continuing his speech the Mayor paid tribute to Mr Gamble, who had first suggested the construction of the reservoir on the top of Table Mountain, and Councillor Woodhead, who had suggested the construction of the tunnel down to the Molteno Reservoir.

And having carried out these works, and being thus in the possession of valuable 'power', a resolution was brought forward in the Council providing for the use of the power in installing an electric-lighting system. Now they claimed for Mr Graaff that from the time that resolution was adopted he set himself to work, heart and soul, to carry it out. He turned a minority to his way of thinking, and the result was that at last a tender for the works was accepted.

The Mayor then went on to complement the contractor, the firm of Siemens and Halske of Berlin, and the Council's electrical engineer, Mr E G Jones, who he mentioned "had come out from one of the best works in England". Apparently Mr Jones was appointed to the post of Electrical Engineer to the Council on 12 September 1894, some six months before the official opening in order to supervise the contract.

The Mayor also reminded the public that the works had cost the City nothing as regards engineering expenses as these had been borne personally by Mr Graaff in a spirit of "true civic patriotism". In his response Mr Graaff thanked the Council for its loyalty in supporting the scheme and for honouring him by associating his name with the works.

After several more congratulatory speeches the formal proceedings concluded, with Adderley Street and the surrounding thoroughfares illuminated for the first time by means of electric lamps. The crowd then dispersed and strolled through the streets "enjoying the welcome novelty of the new light".

The Power Station Plant

The power station plant initially consisted of two 150 kW direct current generators, more commonly known as dynamos, each being driven through a special clutch by either a water powered Pelton wheel or a reciprocating steam engine. In the early stages only the steam plant was used since a supply of water was not yet available. But on the completion of the catchment reservoir on top of Table Mountain in 1897 - appropriately named the Woodhead reservoir - water power became available for the first time to drive the Pelton wheels, or turbines as they were rather loosely referred to at times.

Construction of the Molteno service reservoir itself was started as far back as 1877 and was only completed in 1886. It was the third reservoir to be constructed in the area and by far the largest, with a capacity of 41 million gallons (about 186 megalitres) of water.

There were two buildings on the site, namely the main building housing the boilers and generating plant, and an adjacent smaller building bordering onto Molteno Road that was used for the storage of coal. The main building was divided into two sections, with one section containing the steam engines, dynamos and water turbines (southern end), and the other accommodating the boiler plant. A 35 metre high brick chimney stack stood adjacent to the boiler house wall, abutting onto the smaller coal store. A coco-pan rail interconnected the northern ends of the two buildings to facilitate the transport of coal from the coal store to the boiler house.

The plant was run for the first year by the contractor, Siemens and Halske, but on 11 April 1896 the Council elected to take over the operation of the works itself.

COMMERCIAL MEMBER

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

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Engineering Pick-Up Lines

- I won't stop bugging you until I get the address of your home page.
- You fascinate me more than the Fundamental Theorem of Calculus.
- Since distance equals velocity times time, let's let velocity and time approach infinity, because I want to go all the way with you.
- My love for you is like a concave up function because it is always increasing.
- Let's convert our potential energy to kinetic energy.
- Wanna come back to my room?... and see my 300MHz Pentium II?
- How about me and you go back to my place and form a covalent bond?
- We're as compatible as two similar Power Macintoshes.
- Why don't we measure the coefficient of static friction between me and you?
- Wanna see the programs in my HP?
- Your body has the nicest arc length I've ever seen.
- You're hotter than a bunsen burner set to full power!
- I'd like to browse through your clothes like I browse through Netscape.
- Hey baby, let's make a stress-strain curve together.

You Might be an Engineer If.....

- your three year old son asks why the sky is blue and you try to explain atmospheric absorption theory.
- your watch has more buttons than your telephone and more computing power than a 300 Mhz Pentium.
- you have a non-technical vocabulary of 800 words.
- you know the second law of thermodynamics but not your shirt size.
- someone tells you its a nice day, and you respond with "it's 70 degrees Fahrenheit, 25 degrees Celsius, and 298 degrees Kelvin."
- you know the ABCs of Infrared from A to B.
- you make 4 sets of drawings (with seven revisions) before making a bird bath.
- politically correct people call you "organizationally challenged."