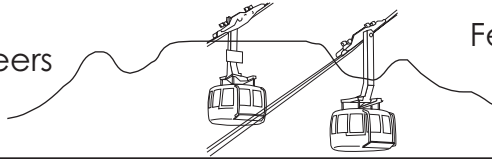


WCB ENGINEERING BULLETIN

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

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

The Professional Certificated Engineer

The Certificated Engineer has come a long way. From an Engineer's Certificate of Competency for mining machinery, then to include factory machinery to professional status in the ECSA stable, has been a magnificent and well-deserved progression. Not that the competence has changed. It is the recognition that has changed. The Certificated Engineer is probably the only engineering category that requires an examination in industrial health and safety to be passed. This category also requires a minimum of two years practical experience in mechanical or electrical engineering. Even a graduate engineer who wishes to become certificated must prove two years of practical experience and write the Occupation Health and Safety Act of 1993.

Industrialists in general do not seem to be aware that the only engineers who are legally qualified to superintend the safe use of machinery and the hazard to health in the workplace are the Certificated Engineers. This was the case even before they were recognised as professional engineers.

There was a time when the Department of Labour employed Certificated Engineers and Health Inspectors to enforce the Occupational Health & Safety Act. But no more. When serious industrial accidents occur the official investigations are conducted by often poorly qualified and often inexperienced inspectors. Evidence is not taken under oath and inspectors do not prepare charge sheets to guide public prosecutors. It is in this area of accident investigation that a Certificated Engineer is the best person to conduct the enquiry. Having been trained in the basic principles of mechanical and electrical engineering and knowing the requirements of the law for the prevention of accidents and threats to health, he will be able to pinpoint the causes and recommend prevention measures. He will also be able to identify contraventions of the Act for the institution of legal steps by the courts against indifferent employers.

The recent train accident in which 26 people, mostly schoolchildren, were killed has prompted the Minister of Transport to consider the necessity of having an independent rail safety authority to administer the safety of rail travel. This is now the second multi-fatal rail accident in recent days and something must be done

Local Branch News

Hello once again everybody.

We are well into the new year already. This year we would like to see a greater number of our members attending functions that we arrange. How about that?

On 26 February we hold our AGM together with a talk on "Outsourcing in the Engineering World" by one of our members, Richard Murphy. I also need to appeal to you once again to please consider joining the committee. We need to have a new member or two.

The programme for the next few months is as follows. (Note that these are subject to confirmation)

- March Talk on Productivity management.
- April Canal network & CBD development (Cape Town partnership Mr. Farr)
- May Wind project visit – near Darling

Best regards to you all!

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urgently to prevent or minimize further occurrences. A similar authority could be considered for industrial accidents. (Recently a man had his hand amputated at the wrist on a guillotine, which is normally well protected by almost foolproof devices.) An independent occupational safety authority with representation in all provinces would go a long way to reduce accident compensation claims, but more importantly to minimize the trauma that strikes a family when the breadwinner is put out of action. ICMEESA is perfectly placed to launch and head such a body.

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Treat a grindstone with respect

On 21 September 1970 at a Farmers' Co-op an accident occurred in the workshop when a 19 year old worker we shall call David was injured. David usually worked in the windmill section but on that day the artisan's assistant was off sick so David was asked to relieve him. At 11:45 artisan van der Merwe rushed into the works manager's office and reported that David had been struck at the grindstone. He said he was not unconscious but had suffered a broken cheekbone. He had been taken to a doctor, then to the Malmesbury Hospital and then to Rondebosch Hospital.

In 14 years this was the first grindstone accident. The stone broke into two pieces. It was a Norton A36Q5VBE ASA Code B7.1; 300 mm dia, 50 mm wide and 25 mm bore, max speed 2070 rpm. The shaft speed was measured as 2105 rpm. It was a new stone which had been in use one week.

A few months' earlier a cracked stone had been discovered, the firm had claimed against the supplier and a new stone was supplied.

David resumed work on 8 Dec 1970, 10 weeks later. Mr van der Merwe was a blacksmith and welder. He stated that the stone had been put on by himself two weeks before the incident. He showed David how to grind the 30 mm by 12 mm iron and just as he turned round he heard something bang and when he looked around David was on the floor. The stone was in two pieces. The grindstone had a shield with an opening of about 175 mm above the rest to the shield because large irons were ground. The tool rest was close to the wheel.

David testified that he relieved a sick workman. He was knocked unconscious and came to that evening at home. He was treated at the Swartland hospital for two or three days and then the Rondebosch Cottage Hospital for 6 weeks and 3 days. His jawbone was broken on both sides and his right eye muscles injured. He saw double because of his right eye. He was expecting the doctor to tell him when his eye could be treated. He had experience with grinding work

An official enquiry was held on 17 Dec 1970.

Inspector's Report:

The shaft speed was slightly faster than the max speed of stone. The broken stone was not available. The side of the stone was not protected by a guard. The guard was severely bent as a result of the incident. If the stone had been more fully guarded the injury might not have occurred. It had not been observed by the artisan that the stone speed was marked for a lower shaft speed. The shaft speed was later lowered and the grindstone was required to be more effectively guarded. In spite of the contraventions prosecution was not recommend because the company had not had a serious accident for 3 years.

COMMENT:

General Machinery Regulation 8 stipulates the safety requirements for a grinding machine.

- the rated speed of the shaft must be clearly marked in a conspicuous place.
- a grinding wheel of more than 100 mm in diameter must

have the manufacturer's recommended operating speed marked on the wheel.

- a strong guard must enclose the wheel to withstand a wheel disintegration.
- an adjustable work rest not more than 3 mm from the wheel.
- a transparent shield on the machine or eye protection for the operator must be provided.
- a notice prohibiting an operator from using the machine without eye protection.

Had these regulations been complied with it is unlikely that these severe injuries would have occurred. Like electricity, a grinder is a familiar and useful tool but when not respected for its inherent dangers it will show its teeth and disrupt the smooth flow of industrial activity.

A further travesty was to expect an inexperienced replacement to use a machine which was already in a unsafe condition.

Steam for Processing

Power stations use superheated steam at pressures and temperatures suited to the type of turbine selected. The condition of the steam approaches the condition of a gas and the turbine is almost a gas turbine. Steam for process is an entirely different animal. The steam is saturated and its properties are described by a different set of tables.

Saturated steam is essentially a conveyor of latent heat which is given out to the product being heated. Water is boiled and the process of changing from liquid to vapour requires a large amount of heat. This heat is called latent heat because at this stage the temperature does not change – latent heat is not observed by a change in temperature.

An essential distinction between saturated steam and superheated steam is that saturated steam is produced in contact with its liquid, whereas to produce superheated steam the saturated steam must be removed from the liquid container and then heated further. The temperature will increase without increasing the pressure.

From the Saturated Steam Tables it will be noticed that as the steam pressure goes up the latent heat content reduces. Heat energy has been used to increase the temperature and the pressure so less heat is required to change the state from liquid to vapour. Because the process of heat transfer to the product, be it jam making or food cooking or space heating or drying, is merely by transfer of latent heat, it is advantageous to use low pressure steam, where there is a larger amount of latent heat per kg available than at higher pressure. The temperature required for say cooking is the criterion which decides what the steam pressure should be.

A further consideration for the pressure is the pressure needed to pump the condensate back to the boiler house. Additional pressure to overcome pressure drop in pipework must be added to the pressure at the product vessel.

Although process steam should be generated at as low a pressure as possible to get the benefit of large latent heat, there are other considerations which limit the bottom value. Low pressure requires larger pipes and valves which increases cost of installation.

Legal Knowledge:

Occupational Health & Safety Act 1993

November 2001

Question 3 for 20 marks

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)
- (b) FOUR requirements that a portable electric light must comply with when the operating voltage exceeds 50 volt (4)
- (c) One additional requirement if the portable electric light is to be used inside metal vessels (1)
- (d) TWO requirements that must be complied with when an electric fence is installed along a public road or in an urban area (2)
- (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)

Answer to Question 3

- (a) EMR 5(1)
- Ample size for operating and maintenance staff
 - Sufficient ventilation for equipment temperature
 - Proof against rodents, leakage, seepage and flooding
 - Adequate lighting
 - Doors or gates opening outwards
 - Suitable fire extinguishing appliances
 - Constructed so that persons cannot reach in and touch bare or live conductors
- (b) EMR 10(1)
- Handle must be non-hygroscopic and non-conducting
 - Live parts to be well insulated
 - Have a substantial guard
 - Robust cable
- (c) EMR 10(2)
- Approved earth leakage protection device OR
 - Lamp voltage not above 50 V with separately wound transformer windings
- (d) EMR 11(6)
- Installed to prevent inadvertent contact
 - Display warning notices
- (e) EMR 11(3)
- Installed where it cannot be tampered with
 - May not be installed on power or communication poles
 - Isolated from power supply by double-wound transformer

Occupational Health & Safety Act (no. 83 of 1993)

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Environmental Regulations for Workplaces (ERW)

ERW 5 Ventilation

Employer must ensure:

- safe air
 - time-weighted average concentration of carbon dioxide over an eight hour period, does not exceed one half percent by volume of air
 - carbon dioxide does not exceed 3% by volume of air
 - concentration of explosive or flammable gas, vapour or dust does not exceed lower explosive limit
- If the above cannot be ensured then respiratory protective equipment must be provided.

COMMENT: This regulation is particularly applicable to wine vats which have to be cleared of grape skins. Carbon dioxide is much heavier than air and is odourless and colourless. The employer has a legal duty to ensure that the atmosphere is safe before sending in workers to sweep out or hose out the skins.

In fish food product factories waste water open settling tanks retain carbon dioxide and hydrogen sulphide gas and when drained and the solids removed by workers with shovels there is extreme danger of asphyxiation and poisoning.

ERW 6 Housekeeping

- 2,25 sq m of clear floor space must be allowed for each employee in a workplace
- housekeeping must be good with clean clear tidy spaces
- roof and wall sound and leakproof
- places into which or from which persons could fall must be covered or guarded
- where work is performed above where people walk the area must be fenced off or protected by catch platforms or netting.
- disposing of material from a high place must be done by hoist or chute.

ERW 7 Noise and hearing conservation

This regulation is applicable to a noise level of 85 dB(A) or higher.

The first step is to reduce the noise level below 85 dB(A). Otherwise:

- a noise zone must be demarcated and notices displayed
 - an approved inspection authority must approve the demarcation of the zone
 - only persons wearing hearing protectors may enter the zone.
- The hearing protectors are for personal use. Audiometric examinations must be conducted on persons working a noise zone as per section 7 of SABS 083.
- records must be kept of these examinations for 30 years after employment.
 - if works ceases before this time the records must be sent to the regional director

That strange question!

(There was no response to the invitation to supply an answer so the editor is offering a possible solution.)

Plant Engineering (factories) Nov 2001 Q1(a) compulsory question

Among the candidates applying to be trained as Boiler Attendants are the following:

- A man with tunnel vision
- A man who is colour blind
- A man born completely deaf
- A man who has had one hand amputated at the wrist.

State, giving reasons, which of the above candidates you would reject and how you would accommodate the others, bearing the requirements for employment equity in mind.
(8 marks)

Answer to Plant Engineering Question on employment equity for partially disabled boiler attendant.

LIST OF NORMAL DUTIES OF BOILER ATTENDANT

1. When taking over the shift, ask outgoing attendant about any unusual occurrences on his shift.
2. Check that stoker and fans are running and examine the state of the fire through rear peep hole.
3. Check that pressure on steam pressure gauge does not exceed red line set at maximum permissible operating pressure.
4. Blow down boiler water gauge glasses. Make sure the water level is visible in gauge glasses.
5. Check functioning of Mobrey control chambers by blowing them down. Ensure that feedpump cuts in and out and first low level alarm sounds and fuel cuts out and locks out on second low water Mobrey.
6. Check that there is sufficient boiler water treatment in the containers.
7. Open ash hole slide gate and fill wheelbarrow. Remove ash to ash dump.
8. Blowdown boiler at blowdown valve according to schedule.
9. Adjust coal bed thickness and grate speed according to steam demand.
10. Tick off logsheet requirements half-hourly.

1. ATTENDANT WITH TUNNEL VISION (TV)

Not having peripheral vision this man could bump into projections and side objects. He would need to wear thick protective clothing and a safety helmet to reduce injury to himself. He would need to be trained until he was thoroughly familiar with the location of the various items mentioned in the above list of duties. After that he should be able to carry out the bulk of the duties, but in an emergency such as low water or power failure, he may not

react smartly enough to correct the situation.

AVERAGE MARK: 75%

2. ATTENDANT COLOUR BLIND (CB)

This man would be able to cope with all the duties except ascertaining the condition of the fire because of his colour blindness. There are other ways of ensuring good combustion such as the CO₂ meter and the state of the ash which should help him to make adjustments.

AVERAGE MARK 95%

3. ATTENDANT COMPLETELY DEAF (CD)

Because of his deafness this man must receive written communications. He will not be able to hear alarms, but flashing coloured lights could be provided. He may not hear the safety valve blow off and here he would need some help. Everything else he could cope with.

AVERAGE MARK: 90%

4. ATTENDANT WITH AMPUTATED HAND (AH).

Presumably this man has one good hand which can do all he needs to do, including writing. He will, however, not be able to handle the ash removal wheelbarrow. For this he would need an assistant. Operating a valve will also be a problem unless he is provided with a custom made hook prosthesis.

AVERAGE MARK 90%

RESULTS:

TV - 75%

CB - 95%

CD - 90%

AH - 90%

Comment:

The man with tunnel vision must be rejected. The man who is colour blind can cope the best. The man who is completely deaf can be used satisfactorily with occasional supervision. The man with the amputated hand could be used if an assistant is on call when needed.

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