

FACTORS AFFECTING EFFICIENT BOILER OPERATION

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We talk about boiler efficiency, but how important is this factor really.

The dictionary defines "EFFICIENCY" 'as the ratio of useful work done to total energy expended or to heat taken in' and "EFFICIENT" 'Satisfactory in use'.

So we have two words, commonly used when talking about boiler houses, and both closely related.

Briefly boiler efficiency can be related to, the cost of producing steam in the most efficient way and efficient boiler operation to the most satisfactory way of producing this steam.

As a result of the low cost of energy we have traditionally experienced in South Africa, efficiency has tended to be disregarded and the boiler plant has been considered acceptable as long as the availability was such that steam could always be obtained when it was required.

We have a Government Act on the safety of boiler plant and an Act on the water and air pollution, and generally the majority of boiler owners operate within these Acts.

The "Air and Water Pollution" Acts are looking to the "future", and strive to preserve the environment for generations to come. I am sure most of you will agree that there is a great need for concern.

One hears and reads about water pollution and acid rain experienced in Europe, and on our own doorstep an early wintersday arrival at Jan Smuts Airport, lets one see clearly the blanket of smog caused by both industrial and residential emission and linked closely to efficient use of fuel.

In the majority of boiler houses working in the manufacturing industry around us, the boiler supplies steam which is one of the ingredients used by the manufacturer of an end product which the industrialist then has to sell.

He has to sell his product at a competitive price and the end cost to him, and consequently the consumer, depends very much on the price of the materials he has to buy in for his manufacturing process. He obviously wants to purchase all his materials at the lowest cost effective price, but it is a fact that steam, being one of these cost centres is very often not produced in a most cost effective boiler, thereby increasing the price of the end product.

With this in mind one must then look at the "EFFICIENT BOILER OPERATION".

The boiler house should be an area which is clean and well maintained and of which Management is proud enough to take visitors.

One hears from Engineers who have visited Overseas Factories, that one of the first places they are taken to see is the boiler house is located in a clean well decorated area and in fact often the walls are tiled or glassed. These boiler houses are fitted with modern and efficient boilers. Granted the majority of boilers are oil or gas fired.

We do have some boiler houses in South Africa which are of the same high standard as overseas installations, but we have many that are in such a poor state of repair that one hesitates to take visitors to them.

Because of these poor environmental conditions every one involved in maintaining these installations tends to keep away from the area which means that the boilers become neglected due to lack of maintenance.

They become a nuisance area and often when the operator reports a fault, he receives a rude reception and consequently he will tend to avoid reporting faults or strange noises to Senior Staff.

Thus we have a situation which gets progressively worse.

The Engineer, Maintenance Staff and boiler operators should be fully trained on the operation of the particular boiler under their charge.

Some factories have already their own in-house training scheme to train and upgrade boiler operators.

Some of the known training centres who are doing outstanding work in training of boiler operators are:-

John Thompson part of the N.E.I. Group at their Bellville Works.

The Sugar Association Training Centre at Mount Edgcombe

The Kwa Zulu Government Department of Works at Umlazi.

(Mainly to train their own staff)

These well trained operators then become an asset to the Company and will operate the boiler house more efficiently, therefore taking a large load off the Engineer and Maintenance Staff.

The maintenance costs generally are greatly reduced.

There is also a substantial tax concession in all staff training programmes.

I know of cases where a staff member is sent to the boiler house as punishment for some minor offence and obviously in this situation he has lost interest in the boiler before he has even started.

I am sure you will agree that this is not the correct procedure to obtain motivated boiler house staff.

If one looks at the cost of a new road haulage vehicle and the driver training given, a few significant facts arise.

1. By law the driver must be qualified to handle his vehicle, be tested and certified as competent.
2. In order to pass the test he would in most cases undergo training at one or other intensive driver training school.
3. He would be expected to be a responsible person, and to ensure that his vehicle was kept clean and in a good state of repair.

Industry on the other hand invests far greater sums of money on a boiler and plant, and these are left in the hands of untrained operators.

The Company executive would be the first to complain if his staff car was dirty or badly maintained, and yet he tolerates a situation in his boiler house which could at any time affect the production of his factory through lack of training of his staff.

FUEL

All fuel costs have increased dramatically over the last few years, but most significant has been the rise in the oil price.

This has forced many industries and Manufacturers to change to coal fired boilers.

Because of the considerable saving, changing from oil to coal fired boilers no steps have been taken to investigate further savings by operating the boiler house even more efficiently.

A 10 000 kg per hour coal fired chain grate boiler costs in the region of R250 000. Operating for a period of 330 days per year, at a load factor of 70% it produces 55,440 tons of steam from feed water at a temperature of 40^o C and consumes 7663 tons of coal at an overall boiler efficiency of 70%.

At an average coal price of R37,61 per ton, coal would cost R288 221 per year.

An overall efficiency improvement of 10% would reduce this fuel bill to 6705 tons at R37,61 per ton to R252 193 per year which amounts to a saving of R36 028 per annum.

The fluidised bed boilers coming on the market are capable

of burning anthracite duff and at the same overall efficiency i.e. 80% would burn coal presently costing R26,00 per ton.

The bill would then be reduced to R173 348 per year and there could be a saving of R78 851 per annum.

It can therefore be seen that as well as negotiating the best coal price per ton it is vitally important to increase the overall efficiency of the boiler operation, and look into the type of plant being currently used.

Combustion efficiency can be improved by ensuring that dampers are set correctly in relation to the chain grate speed.

New technology is available, and more use should be made of this as well as Technical Advisers from the boiler and chain grate manufacturers and coal suppliers. The experience and expertise of these people could be of great value and result in considerable saving to your Company.

PLANT

We all know that in time, plant becomes outdated, inefficient and even redundant.

In the factory outdated equipment is scrapped to make way for machines with greater efficiencies and greater throughput for the same floor space, but the boiler house is usually the "cinderella" of the factory, and boilers are only repaired when they are condemned or damaged beyond repair.

The boilers should be seriously looked at to obtain the best operating efficiency.

1. They should be lagged.
2. There should be no steam leaks.
3. Is the most efficient coal burning equipment fitted.
4. Is the boiler running fully automatically, thereby giving the best combustion efficiency and maintaining steam pressure to the factory.
5. What is the carbon in ash loss in the ash. Can this be brought down by using a better quality coal or by updating the combustion or even replacing equipment.
6. Is the CO₂ or O₂ and stack temperatures within the recognised limits. A high stack temperature and low CO₂ can point to low combustion efficiency, or dirty boiler. If you do not have the equipment to check this, it will be worth the expense to purchase one or else call in someone at regular intervals to check this.
7. Is the water treatment adequate? Are the correct and most effective chemicals used? A heavy deposit on the tubes and combustion chamber can reduce heat transfer drastically. Boilers should be opened

regularly for inspection.

8. Is the feed water at the highest possible temperature? Can all the condensate be returned to the feed water tank, or even if possible returned direct to the boiler with a condensate booster pump.
9. Is the correct type and size of boiler used to suit the factories steam needs.

INSTRUMENTATION

This is a very neglected area and yet one of the most important. We have two areas of instrumentation.

1. Boiler Combustion Controllers

One finds in many cases that the boilers are running on manual control or even worse with the linkage removed and being controlled by hand or even tied up with wire.

The stoker is found running at a fixed speed, with pressure drop and then next the S.V. Floating, or even worse red hot coals are coming off the end of the grate.

These situations could all be rectified with the latest combustion control equipment on the market.

2. Recording Equipment

In order to be able to do a simple heat efficiency calculation of the boiler plant one has to know the heat inputs and heat outputs. To monitor this continuously, recording instruments must be fitted,

and their recordings logged on a regular basis. In that way the cost per kg. of steam can be determined. With these costs one can then go about trying to maintain or sometimes even lower the cost of steam. Which gives one a great sense of achievement.

LOG SHEETS

A log sheet is very necessary and should be set out so to enable one to calculate the efficiency of the boiler plant, and to operate and plan maintenance and cleaning intervals.

A continuous running steam flow chart would also be of great advantage with a continuous totaliser.

In summing up I would like to say to those who have done so much in training their operator and improving their boiler house efficiencies, congratulations, carry on with the good work and maybe you would like to give a talk or paper on your efforts.

To those who are about to start on boiler house upgrading and efficient operations, do give it a try. It is most rewarding and would also like to hear of your efforts. Should you require any assistance there are numerous people and companies only too willing to assist you. Give a little thought to the morale of the boiler house operating staff. Try to instill in them a sense of pride in their working area.

Give them the confidence to strive for some incentives. I am sure you will be paid back with great improvements in your boiler house efficiency.

And lastly should you despair of producing steam with its problems, do contact us and we will take the hassle off your shoulders and supply you steam.

NAVORSING EN OPLEIDING OP DIE GEBIED VAN LUGBESOEDELINGSBEHEER AAN DIE UNIVERSITEIT VAN PRETORIA

Die departement Chemiese Ingenieurswese aan die Universiteit van Pretoria is besig om sy bedrywighede op die gebied van die studie van die bestryding van lugbesoedeling uit te brei.

Gedurende Januarie 1984 is daar 'n drie-dae kortkursus in lugbesoedeling gehou wat deur ongeveer 60 persone uit die nywerheid en die openbare sektor bygewoon is. Eenvoudige dispersieberekeninge, ontwerpmetodes vir bestrydingstoerusting, metingsmetodes en gesondheidsaspekte is onder die onderwerpe wat behandel is deur sprekers verbonde aan die Universiteit en die nywerheid. Dit word beoog om hierdie eerste kursus, wat bedoel was as 'n algemene inleiding en opknapping, op te volg met kursusse wat sekere aspekte van lugbesoedeling in meer diepte sal behandel.

Vanaf 1964 is dit ook moontlik om 'n honneurskursus in Lugbesoedeling in die departement by te woon. Die kursus dien as 'n vak vir 'n honneursgraad in ingenieurswese, maar

kan vir nie-graadopleindes deur belangstellendes bygewoon word. In die kursus word pluimdispersieberekeninge en die ontwerp van bestrydingstoerusting in besonderhede behandel terwyl studente deur werkstukke verplig word om die teorie op praktiese situasies toe te pas.

'n Navorsingspoging om die toepassing van gruisfilters op die bestryding van besoedeling wat eie aan die Suid-Afrikaanse nywerheid is te ondersoek word beoog. Met die doel voor oë is reeds sekere meettoerusting bekom en 'n laboratoriumskaal-gruisfilter opgestel, waarmee tans metings op vliegass uitgevoer word.

Die departement is verder vanaf 1985 betrokke by navorsing na die oorsprong van hoë swaeldioksiedkonsentrasies op die oostelike Hoëveld van Transvaal. In besonder word beoog om die bydrae wat smeulende afvalhope by steenkoolmyne tot hierdie probleem maak wiskundig te modelleer om daardeur die mees ekonomiese gebruik van meetapparaat te bevorder.

Indien verdere besonderhede aangaande enige van die bykorsusse of projekte verlang word kan met die hoof van die departement, prof Uys Grimsehl op telefoon 420-2475 of met mnr Gerrit Kornelius op 420-2199 geskakel word.