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IN THE NAME OF GOD

Efficiency in steam boilers

- Energy conservation According to one of the laws of physics, energy is always conserved.

In the combustion process, chemical energy is converted into thermal energy.

If the energy contained in the steam, exhaust gas, boiler radiation and other energies coming out of the boiler are added together, their total Exactly equal to the gas energy that has been burned.

In other words:

The energy in the fuel (gas, diesel, etc.) = the energy in the steam + heat loss, the efficiency of the boiler, the percentage of gas conversion or Gasopil is full of energy. Usually, the best calculation method of boiler efficiency is to estimate the amount of energy loss. For this purpose, the percentage of energy loss in sectors It is calculated differently and deducted from 100%.

The remaining number will show the boiler efficiency.

In other words: Boiler efficiency = (heat loss - 100)%. - Sources of heat loss Most of the energy loss occurs through the chimney.

In the worst case, about 30 to 35% of the total primary energy through the chimney goes out Energy loss through the chimney includes the following:

- A- Heat loss due to dry gas.
- B- Heat loss due to moisture in the fuel.
- C- Heat loss due to water caused by hydrogen combustion.

The amount of thermal energy loss depends on the temperature and volume of the gas that leaves the boiler, so the reduction of each of the two mentioned items It can reduce heat loss.

Preventing heat loss in the chimney to the extent of 100% will not be practically possible, unless The temperature of the exhaust gas from the chimney is not suitable for the temperature of the exhaust gas below 300 oF, because a lower temperature causes the formation of acid vapors.

Sulfurized, which eventually causes severe corrosion.

Four major strategies for minimizing energy loss from chimneys are described is below:

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A-Minimizing excess air

B- Keeping heat transfer surfaces clean

C- Use of heat recovery equipment

D- control of air penetration into the boiler When the volume of excess air decreases, as a result, the volume of gas in the chimney decreases, and the temperature of the gas exiting the chimney also decreases. will find Because the speed of the exhaust gas is reduced and due to the reduction of the speed of the exhaust gas, the possibility of gas heat absorption in the boiler is considered The increase in the time spent inside the exit path increases. The benefit from the reduction of wastage is so significant that for every reduction of 15 % of excess air, 1/3% reduction in oxygen and 40% reduction in the temperature of the exhaust gas from the chimney, it is possible to reduce the efficiency of the boiler by 1% increased .

Table No. 1 - Heat loss rate of steam boilers with proper insulation

Heat loss in the form of radiation (%)	Boiler size (kilograms of steam per hour)
0/5	10000
0/7	50000
0/9	25000
1	10000

Among other areas that cause heat loss, we can mention the trickle method to remove dissolved solids.

Removing these materials means removing the energy absorbed by them. This type of equipment should be produced for boilers at least 250 Kg/h commercial steam is available.

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- Operators' checklist for boiler maintenance Continuous monitoring of boilers hourly and at least twice a day is very important. As a very simple example can be lost thermal insulation of the exit pipes from the steam boiler. The amount of heat loss from an uninsulated pipe with a diameter of 5 cm and a length of 33 cm It contains steam with a pressure of 150 psi, equivalent to one ton of coal per 12 days. Therefore, the following should be continuously monitored:

- Uniform distribution of air
- Air penetration
- Insulation
- Steam meeting
- Steam pressure

Table No. 2 – Sheet work for checking and reading twice in one night

Friday		Thursday		Wednesday		Tuesday		Monday		Sunday		Saturday		description
PM	AM	P M	A M	P M	A M		AM	P M	AM	PM	AM	P M	A M	
														water level
														vapor pressure
														Feed pump
														pressure Feed water
														temperature The
														temperature of the distilled
														water column
														Water level glass
														feed pump
														Distilled vapor tank
														Burner function



FUEL SUPPLY										WATER TREATMENT				
														fuel supply
														water treatment
														Boiler cover
														Attendant presence
														considerations

PM: The second half of the day

	Considerations
	Attendant
	feed pump
	Boiler cover
	water treatment
	fuel supply
	Burner function
	Distilled vapor tank
	Water level glass
	water column
	Water level control
	Outlet gas temperature
	The temperature of the distilled vapor
	Feed water temperature
	Feed pump pressure
	vapor pressure
	water level
	Time (hours) water level

[illegible]

- Economizers

Cylindrical type usually It has pipes of different diameters that can have pipes that are in contact with hot surfaces, generally made of low carbon steel. they become Because steel will be subject to corrosion even in the vicinity of a liquid with low oxygen, so the water in the system should be practically 100% without free oxygen. In central stations and other large complexes, it is common to use oxygen separators (deerator) are used.

Today, high efficiency engines are available in the market, which are very expensive, but their efficiency is also high, and thus the time It shortens the return on investment. For example, if the

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cost of each kilowatt hour of electricity is 1200 rials or more, such engines are justified They will be economical.

Table No. 4 - shows the efficiency of such engines in a simple manner

Engine size (horsepower)	efficiency (percentage)
5 - 10	85
15 - 40	85
50 - 150	85
UP - 200	85

Usually, the installed engines have more power than what they have to do, in other words, they have extra power Larger sizes are chosen, which increase the cost. The surveys show that more than 60% Industrial engines are often chosen too large.

Energy audit

General and all energy saving solutions in: - Steam production systems - Keep excess oxygen below 5%. (less than 8% for furnace burners) - Bring the chimney outlet temperature to less than 220 OC.

- Minimize the amount of combustible materials in the exhaust gas from the chimney and ash left over from combustion.
- Keep the temperature of the fuel storage source at the lowest possible temperature.
- Check the fuel-air ratio regularly.
- Reduce the water flow to less than 1% and the steam flow to less than 0.5% at the outlet of the aerator.
- Automatically control the inlets and outlets of steam in steam boilers.
- Minimize the consumption of stabilizing fuels because this type of fuel is expensive.



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- Use heat exchangers in the undercoat part.
- Distribute the load between boilers well.
- Check the exhaust gas passage for air leakage.
- Constantly monitor boiler efficiency.
- Optimize the dust removal schedule.
- Minimize the discharge pressure from the boiler feeding pumps.
- Steam production systems .
- Return all condensed water to the feed water system.
- Prevent steam leakage. - Insulate non-consumable steam path pipes.
- Completely insulate all steam and condensate passages.
- Recycle the wasted steam as much as possible.
- Use the storage source in the condenser system to recover low pressure steam.
- Reduce hot steam pressure in hot weather.

Compilation:
BoKhar gostar Tabaristan Company
(metal Boiler)

