We're Going Global

ASH

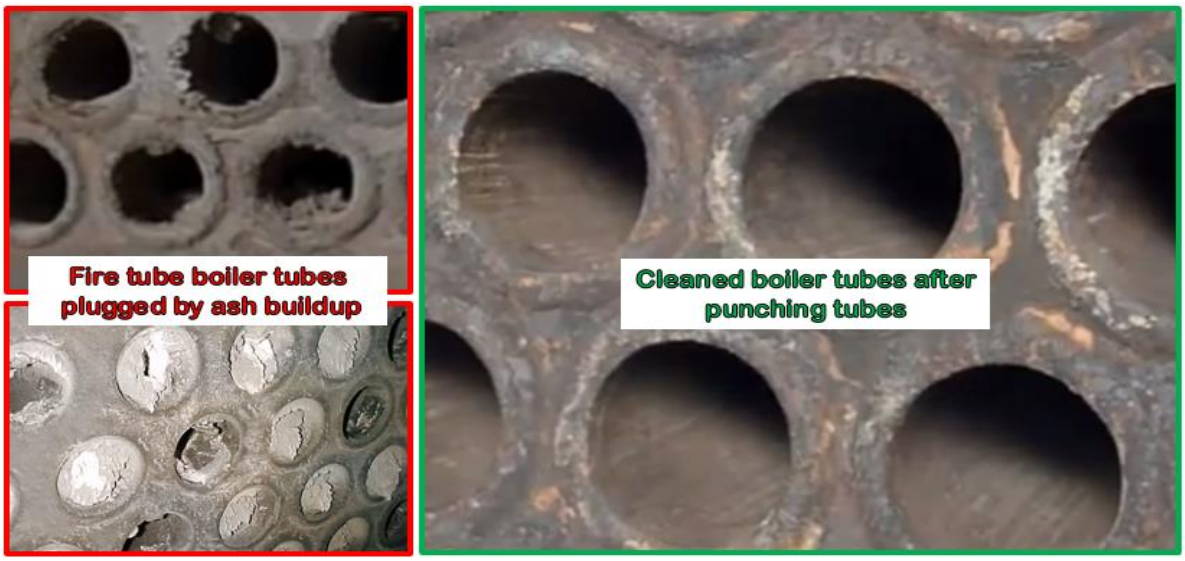
Ash is the residue that remains after the combustion of oil. The test method covers the determination of ash in the range 0.001-0.180 wt%, found in distillate and residual fuels, gas turbine fuels, crude oils, lubricating oils, waxes, and other petroleum products.

Where Does the Ash Come From?

There are impurities and foreign materials present in oil. They come from the crude oil itself, the refining process and from transportation, shipping and handling.

Sources of Ash

1. Oil-soluble, organic-metallic compounds in the crude oil. During combustion, the organics are burned and the metallic portion deposits as ash.
2. Water-soluble inorganics such as sodium chloride upon combustion form oxides and ash.
3. At the refinery, scale, rust, dirt and catalyst are noncombustible and produce ash. Small amounts of catalyst can be carried over into slurry oil during the Fluid Catalytic Cracking process.
4. Product transportation presents many opportunities for contamination with seawater, dirt, scale and rust.
5. Corrosion product such as inorganic salts, result from the reaction of acidic compounds in the oil with metal surfaces in vessel, pipelines, storage tanks and refinery equipment.
6. Caustic used during the refining process can form inorganic salts that are noncombustible and produce ash.

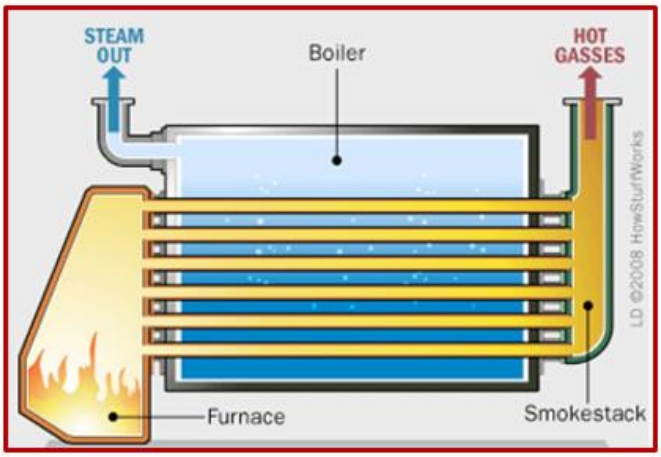


Problems Due to Ash

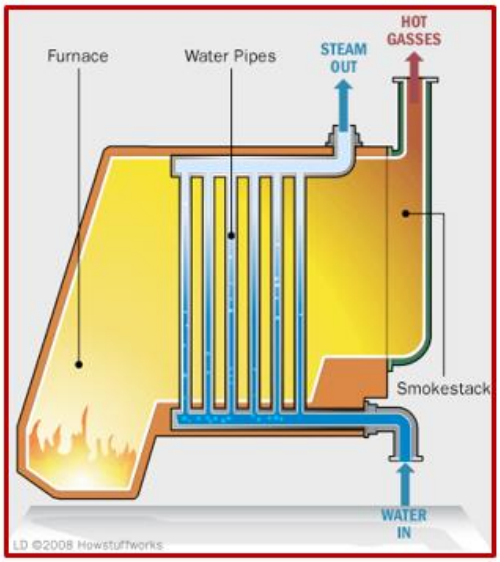
Ash accumulates and lays down on tubes and heating surfaces of commercial, industrial and marine boilers and causes loss of heat transfer. At high temperatures it produces slagging or fouling boiler tubes and severe corrosion on metal surfaces.
Fusion of the ash creates hard slags that can only be removed by chipping it from boiler tubes.
Vanadium compounds reacts with oxygen to form various oxides in the furnace. Vanadium pentoxide condenses within the furnace when gas temperatures approach its solidification point.
Molten ash can be absorbed into porous refractory surfaces. It expands and contracts causing the refractory to spall and break down.
Ash may affect the finished product in certain industrial processes, such as ceramic and glass manufacture.

The number of boiler passes represents the number of times the hot combustion gas travels across the boiler (heat exchanger). Thermal efficiency measures the ability of the exchanger to transfer heat from the combustion process to the water or steam in the boiler. Ash can severely impact this heat transfer.

Fire tube boiler: ash fouls the inside of the boiler tubes reducing heat transfer.



Water tube boiler: ash fouls the outside of boiler tubes reducing heat transfer.



Ash can also impact diesel engines. Diesel fuel injectors have extremely close tolerances and are very sensitive to any ash or abrasive material in the fuel. Depending on their size, solid particles can contribute to wear in the fuel system and plugging of the fuel filter and fuel nozzle. In addition, abrasive ash materials can cause wear within the engine by increasing the overall deposit level and adversely affecting the nature of the deposits.

ASTM D482 Ash from Petroleum Products

1. Weigh the sample to the nearest 0.1 g to yield no more than 20 mg of ash into a crucible.
2. Carefully heat the crucible with a burner until the sample can be ignited by the flame.
3. Using the burner and a hot plate maintain the temperature so the sample continues to burn at a uniform and moderate rate leaving only a carbonaceous residue when the burning ceases.
4. Heat the residue in the muffle furnace at 775 °C until all carbonaceous material has disappeared.
5. Cool the dish to room temperature in a desiccator, and weigh to the nearest 0.1 mg.
6. Reheat the dish at 775 °C for at least 20 min, cool in a desiccator and reweigh.
7. Repeat the heating, cooling, and weighing process until consecutive weighings differ by not more than 0.5 mg.
8. Calculate the mass of the ash as a percentage of the original samples as follows: Mass of ash, g divided by mass of sample, g.