ALTRET Industries Private Limited

Attention low pressure boiler owner: -

"We have softening plant for boiler so water treatment chemicals are not require"

"We fed D.M. water and water quality is superior so scale & corrosion does not exist in our boiler!"

"We used 90 % condensate water so no need of any chemicals treatment"

"Why we bare extra cost even we run pretreatment throughout boiler operation"

These beliefs are common in many industries. No doubt pretreatments such as D.M. plant, softening pant operation minimized the scaling tendency of feed water but no assurance of prevention of scale & corrosion in boiler. Even with sophisticated external treatment plant, some impurities always enter the boiler either through feed or condensate. Therefore, there is need for the internal treatment in some form to particularly boilers. The amount and type of chemicals used depends on plant operating condition and the feed water analysis.

The boiler water treatment programme aims at control of seven broad classifications of impurities, which are mentioned as below:

1. Suspended solids: -

Suspended solids accumulate on the surface film surrounding a steam bubble and make it tougher. The steam bubble therefore resists breaking and may builds up foam. The minute the suspended particles become, the greater is their collection on the bubble. It is observed that many boilers operate with exceedingly high-suspended solids without carryover, while others have carryover with only a trace of suspended solids. This indicates that the type as well as the quantity of suspended solids can affect carryover.

2. Hardness: -

Water containing large amounts of calcium and magnesium minerals, which are "hard to wash with." The calcium and magnesium compounds react with soap to form a curd in the water. These compounds are referred to as water hardness. The amount of hardness in natural waters may vary from several ppm to over 500 ppm. Because calcium and magnesium compounds are relatively insoluble in water, they tend to precipitate out, causing scale and deposit problems. The hardness of the water source is an important consideration in determining suitability of the water for steam generation. Boiler water

hardness should be nil to control scaling in boiler. In ion exchange process the residual hardness (remaining hardness) after ion exchange vary with the water analysis, the regenerant dosage and application method and the arrangement of the units in the system. Same way in softening plant operation T.H. may vary depends on brine quantity and regeneration time. In R.O. plant operation the degree of purification may varies with membrane characteristic and operating practice.

3.Silica

A high silica deposit is very hard, similar to porcelain. The crystals of silica are particularly small, develop a very dense, solid scale. This scale is very brittle, very difficult to pulverize and not soluble in hydrochloric acid. To control silica scale maintains minimum pH of boiler water 10.5. Silica is removed by ion exchange process only by strong base anion regenerated with caustic with D.M. residual as low as 0.01 ppm can be achieved. Softening plant cannot control silica. High silica may effect on membrane life and performance of R.O. system.

4.Alkalinity: -

Particular amount of alkalinity is desired in boiler water; so complete removal alkalinity from boiler make is rarely practiced except in demineralization. Some alkalinity is also needed to provide optimum pH in the feed water to prevent corrosion of pre boiler system such as piping and equipment. In D.M. water & R.O. water alkalinity will be reduce at any desired result while in soft water alkalinity will be slight higher compare to input water due to exchange of Na ions.

5. Total Dissolved Solid: -

Some treatment processes increase dissolved by adding soluble by product to water like sodium zeolite softening process. Dissolved solid can be control by effective operation of R.O process and D.M. ion exchange process. The reduction of dissolved solid is varies with different cation and anion exchange process in D.M. plant. In R.O. system Control of T.D.S is varies with membranes characteristics and operation practice.

6. Organic Matter: -

Organic matter as a general classification is only a qualitative term. It includes a wide variety of compound that are seldom analyzed a specific material. Problems in boiler system attributed to organic matter have often been traced to organic material from plant process in return condensate.

7. Dissolved Gases: -

D.M. plant, softening plant and R.O. system cannot control dissolve gases. To control dissolve gases mechanical devices or chemical treatment should be require.

Degasifiers are commonly used to remove gas mechanically rather than chemically. Oxygen is highly reactive gaseous element. In the presence of steel, the corrosion rate of oxygen dissolved in water doubles for each 30^0F rise in temperature. Boiler system conditions are perfect for oxygen corrosion. As dissolved oxygen corrodes boiler metal, it dissolves the iron surface. This weakens the metal site, but more importantly, sends dissolved iron into the boiler iron deposits in boiler tubes can cause overheating and tube failures.

When steam laden with carbon dioxide starts to condense, some carbon dioxide dissolves in the condensate forming carbonic acid. Carbonic acid being a weak acid dissolves iron from the condensate piping. The iron can then pass to the boiler where it can deposit and cause blown tubes.
Carbon dioxide has a high vapor/liquid (v/L) ratio, which means it will be present in all areas of the steam system. Also, intermittently operating parts of a steam system are especially susceptible to carbonic acid attack. As stagnant condensate cools, its solubility for carbon dioxide increases and corrosion is accelerated.

Feed water quality is a matter both quantity and nature of impurities. Some impurities such as hardness, iron and silica, for example, are of more concern than sodium salts. The purity requirements for any feed water depend on feed water consumption as well as boiler design (pressure, evaporation rate, etc.) can tolerate. Feed water quality requirements can vary widely. A low-pressure fire tube boiler can usually tolerate higher feed water hardness, with proper chemical treatment, while almost all impurities must be removed from the water used in most modern high-pressure boilers.

Chemical treatment of water inside the boiler is essential with or without pretreatment. Internal treatment, therefore, complements external treatment by taking care of any impurities entering the boiler with the feed water (hardness, oxygen, silica, iron) regardless of whether the quantity is large or small.

In some cases, external treatment of the water supply is not necessary and the water can be treated by internal methods alone. Internal treatment can constitute the sole treatment when boilers operate at low pressure, large amounts of condensed steam are used for feed water or the raw water available is of good quality. However, in moderate and high-pressure boilers, external pretreatment of the make-up water is mandatory for good results. With today's higher heat transfer rates, even a small deposit can cause tube failures or wasted fuel.

Excellent internal water treatment program can carry out with following internal treatment characteristics: -

1.) To react with incoming feed water hardness and prevents it from precipitating on the boiler heat transfer area as scale or deposit.

2.) To condition any suspended matter such as hardness sludge in the boiler and make it no adherent to the boiler metal.

3.) To provide antifoam protection to permit a reasonable concentration of dissolved and suspended solids in the boiler water without foaming.

4.) To eliminate corrosion by scavenging oxygen from the feed water.

5.) To provide appropriate alkalinity to prevent boiler corrosion

In addition, a complete treatment program should prevent corrosion and scaling of the feed water system and protect against corrosion in the steam- condensate systems.

"**Improper and nonexistent feed water treatment is the major factor causing boiler failure, which ultimately results in boiler down time and costly maintenance.**"

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