



Internal conditioning is treating the water after feeding into the boiler. An internal treatment is accompanied by adding an appropriate chemical to the boiler water either (a) to precipitate the scale forming impurities in the form of sludges, which can be removed by blow down operation or (b) to convert them into compounds which will stay in dissolved form without causing harm to the boiler.

Internal treatment methods are, generally, followed by blow-down operation, so that accumulated sludge is removed. Important internal conditioning/treatment methods are

➤ **Carbonate conditioning:**

Scale forming salts like  $\text{CaSO}_4$  present in the water adheres more strongly on the surface of the boiler. This can be prevented by precipitating Ca as  $\text{CaCO}_3$  which gives rise to a loosely adhering scale, by adding  $\text{Na}_2\text{CO}_3$ .



**Disadvantage / Limitation:**

1. Applicable only for low pressure boiler
2. Causes caustic embrittlement and corrosion in high pressure boilers as the un-reacted  $\text{Na}_2\text{CO}_3$  will be converted in to  $\text{NaOH}$  and  $\text{CO}_2$ .

➤ **Phosphate Conditioning:**

In high-pressure boilers, scale formation can be avoided by the addition of sodium phosphate to the water sample. Here, calcium (and also magnesium) ions (responsible for hardness) are precipitated as their phosphates (sludges) and can be removed easily by filtration. Three types of phosphates conditioning— mono, di and trisodium phosphates are employed in phosphate conditioning.

The advantages of phosphate conditioning over carbonate conditioning are (i) it can be applied to high-pressure boilers and (ii) it can be used for softening / conditioning acidic, neutral or alkaline water sample.

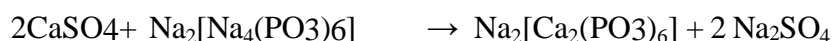




If acidic water is to be conditioned, trisodium phosphate can be used. For neutral and alkaline water samples disodium phosphate and monosodium phosphate can be used respectively.

➤ **Calgon conditioning:**

It is the process of addition of *calgon or sodium hexametaphosphate* to the boiler feed water. The calcium ions (responsible for scale / sludge formation) are complexed by calgon to form a soluble complex and hence prevented from their scale forming action.



This phenomenon of complexing of the ions is called sequestration. Calgon is the sequestering agent used. The other internal conditioning agents used are ethylenediamine tetracetic acid (EDTA) and sodium aluminate ( $\text{NaAlO}_2$ ). EDTA functions by sequestration phenomenon whereas sodium aluminate functions by precipitation phenomenon.