

**LECOL** SWAS series ACC and DCC analyzer

## After Cation Conductivity (ACC) and De-gassed Cation Conductivity (DCC) analyzer

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- Cation conductivity
- De-gassed Cation conductivity



**LECOL** Luchan Enterprises Co., Ltd

## After Cation Conductivity

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The chemical reaction inside Cation resin column

Contains Ammonia

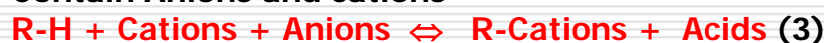


(Conductivity reading here (1) should be as low as the original pure water.)

Contains Salt



Contain Anions and cations



(Conductivity reading here (2) & (3) will be getting higher as a chemical preamplifier because of the anions or salt.)

In normal operation of a boiler, if, "after the cation ions conductivity" reading is higher than expected, it could mean that it may be contaminated or a possible leakage for Anions or salts somewhere in condenser. That is a upset condition which may cause the boiler corrosive, many boiler suppliers have the limitation for the after cation conductivity reading in their warrantee repair conditions.

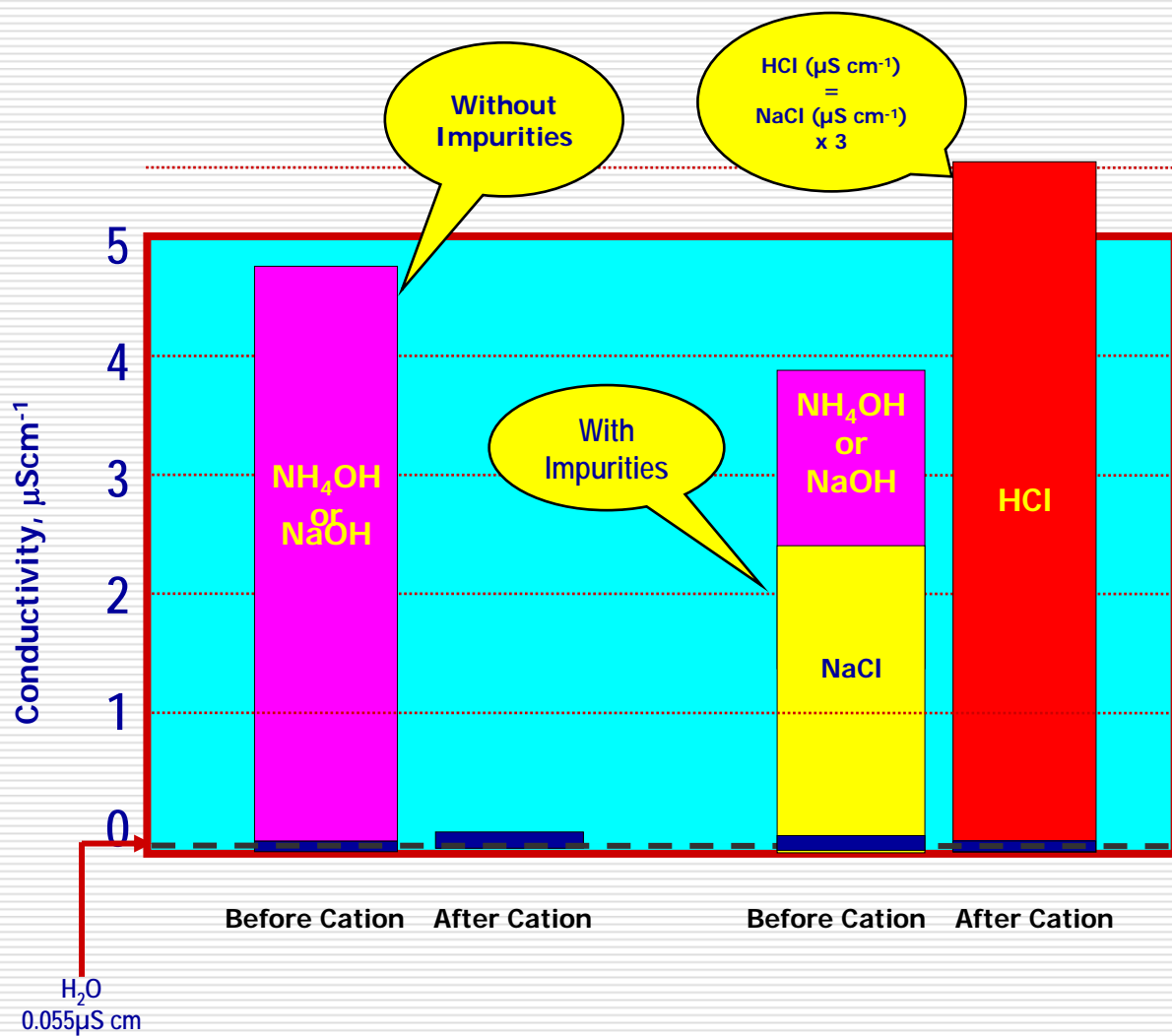
The above reason makes the after cation conductivity be measured in the boiler steam and water analysis very common. In most of the power plant or co-generation plant. The after cation conductivity measurement become a critical equipment as a condenser leakage detector.

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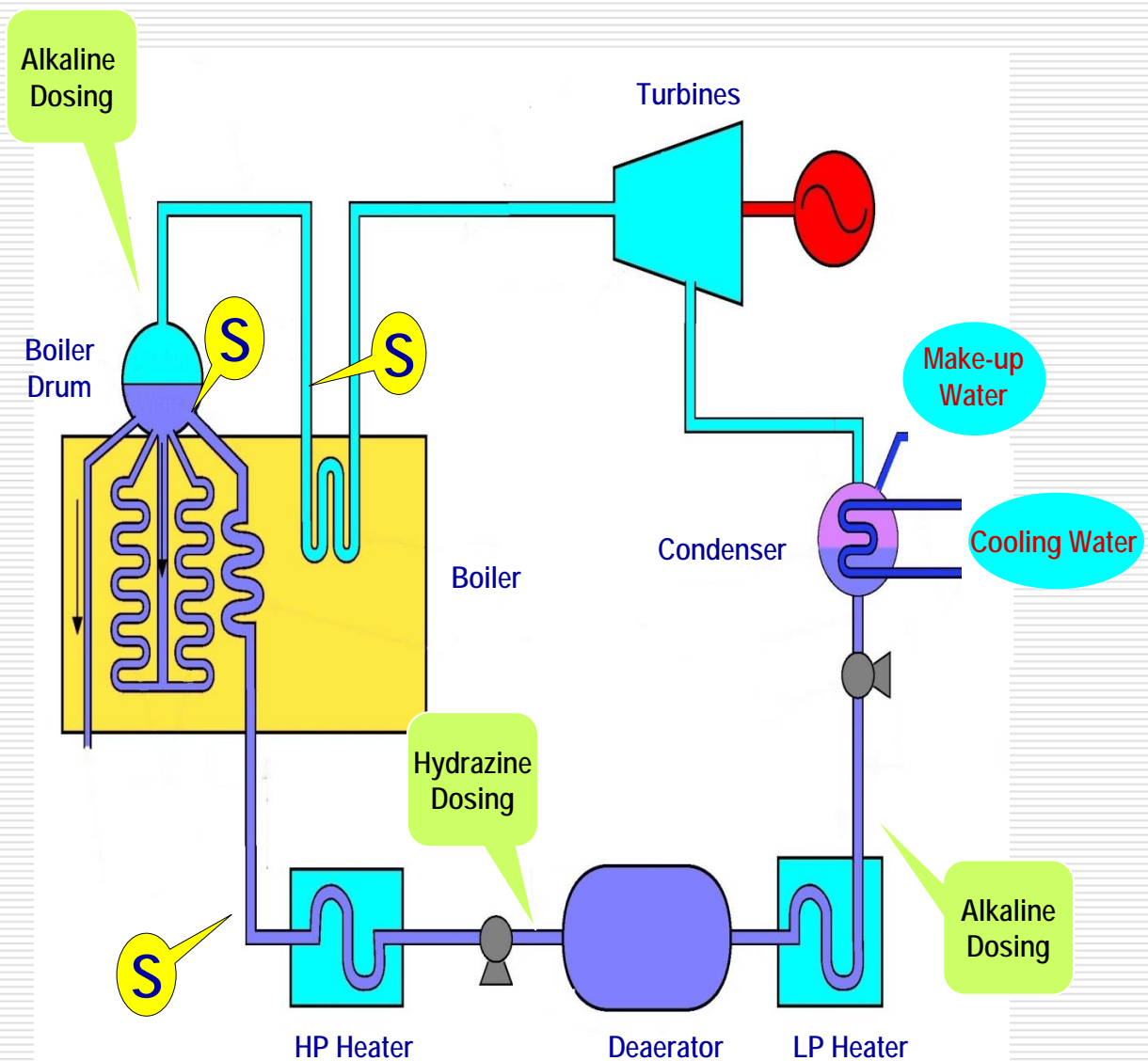
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## Conductivity - After cation exchange resin



## Measuring points for after cation conductivity

- Typical measuring points for after cation conductivity



## The features of after cation conductivity

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### **The Reasons why it is necessary to measure after cation conductivity**

1. To eliminate the effect of adding chemicals for conductivity such as NH<sub>3</sub> or NaOH etc. Theoretically, the ACC should be as low as a original pure water without contaminant.
2. To detect the corrosive anions concentration such as Cl<sup>-</sup>, S<sup>-</sup> or other kind of salts. The conductivity will be increased about 3 times of contaminate conductivity because they convert to the acid form.
3. Acts as a chemical preamplifier from the anions or salts.

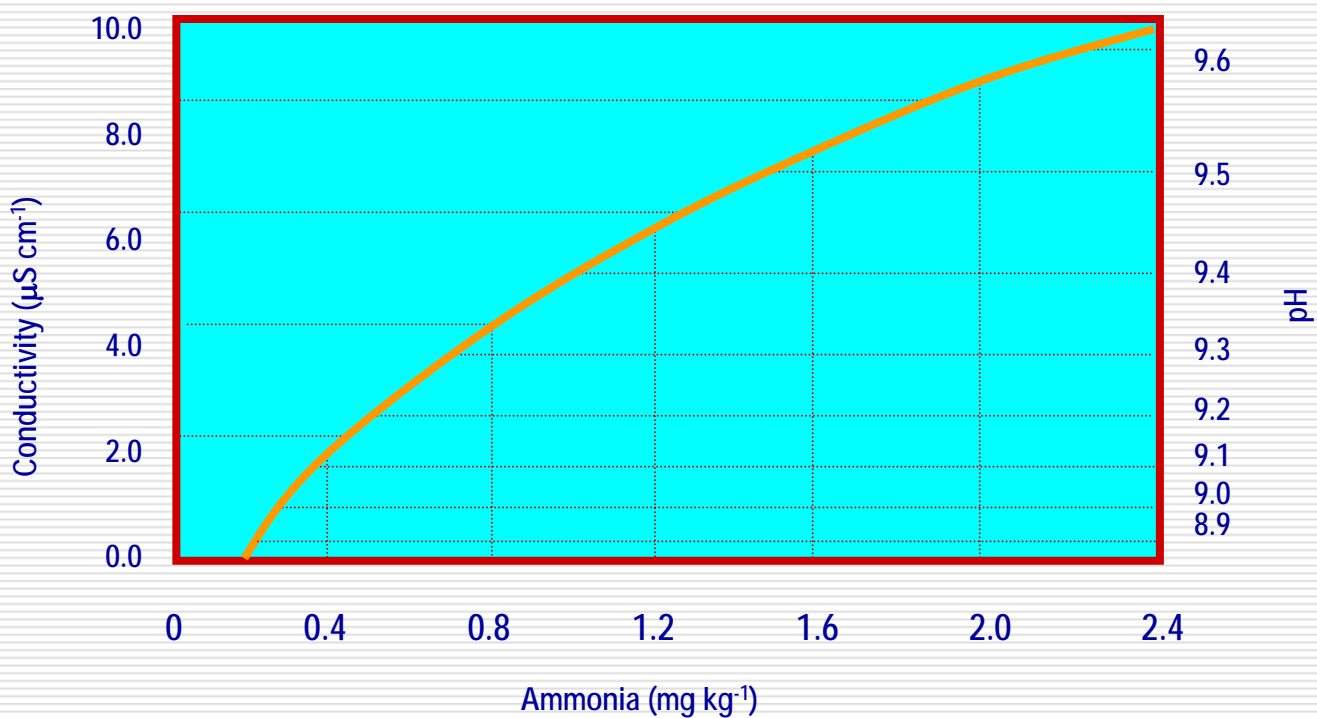
### **Before and after of cation exchange resin conductivity measurement**

Calculation between before and after cation conductivity measurement can infer the pH value which can compare to the existing pH analyzers, this can only use in Ammonia dosing, it is not suitable for phosphate dosing application since the phosphate cause too many interference for calculation.

### **It contains the components such as**

1. Sample cooler – to cool down the process by using cooling water or chilling water.
  2. Pressure reducer – adjust the process liquid pressure or flow rate to the proper design pressure and flowrate.
  3. Back pressure relief valve - provide safety relief of the tube line or a certain of pressure to every analyzers.
  4. Cation exchange resin – To eliminate the effect of cations or adding chemicals, such as Ammonia.
  5. Conductivity analyzer - Provide the conductivity reading.
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## Inferred pH by using before and after cation conductivity



## Inferred pH by using before and after cation conductivity

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### Applications of usage:

- ❑ Only use in all volatile treatment (AVT) i.e. Ammonia, Hydrazine  
 $\text{pH} = \text{Before cation Conductivity} - \text{After-cation Conductivity} (0.055\mu\text{S cm}^{-1})$
- ❑ All Volatile Treatment (AVT) with Impurities  
 $\text{pH} = \text{Before-cation Conductivity} - (\text{After-cation Conductivity} / 3)$
- ❑ Solid Alkali Treatment (SAT) or Caustic Treatment (CT) with Impurities i.e. Sodium Hydroxide NaOH  
 $\text{pH} = \text{Before-cation Conductivity} - (\text{After-cation Conductivity} / 3)$

### Limitation of usage:

- ❑ Can not use in Phosphate dosing applications  
Phosphate dosing will cause the Phosphoric Acid which effect conductivity reading.  
Tri-sodium phosphate in solution  $\text{Na}_3\text{PO}_4 + 3\text{H}_2\text{O} = 3\text{NaOH} + \text{H}_3\text{PO}_4$   
After-cation Conductivity  $3\text{NaOH} + \text{H}_3\text{PO}_4 + \text{R-H} = \text{R-Na} + 3\text{H}_2\text{O} + \text{H}_3\text{PO}_4$
- ❑ Can not use in organic chemicals dosing applications  
Organic chemicals will cause CO<sub>2</sub> which effect the conductivity reading.  
Using De-gassed Cation Conductivity equipment to eliminate the error.

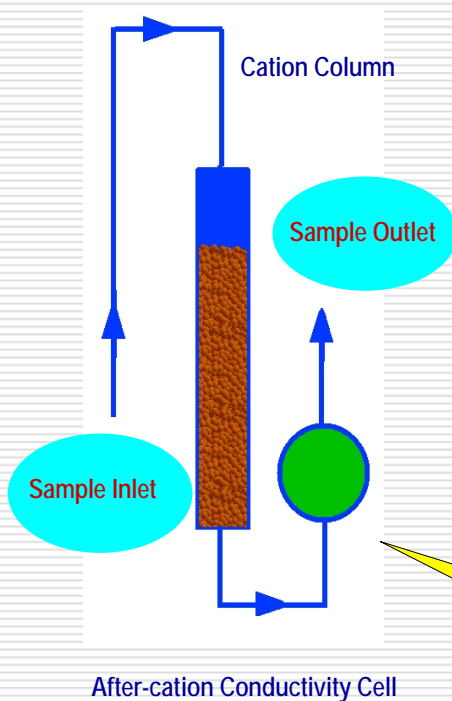
\* Warning: Inferred pH is not a substitute for direct pH measurement

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## De-gassed Cation Conductivity measurement

Where the CO<sub>2</sub> comes?

1. Following a start-up
2. Break down of organics introduced by condenser leaks
3. The use of Carbohydrazide as a oxygen scavenger
4. Any other abnormal chemical conditions



Organic acid will form CO<sub>2</sub> after cation exchange resin which will effect the conductivity measurement and cause the reading will higher than expected.



## De-gassed Cation Conductivity measurement

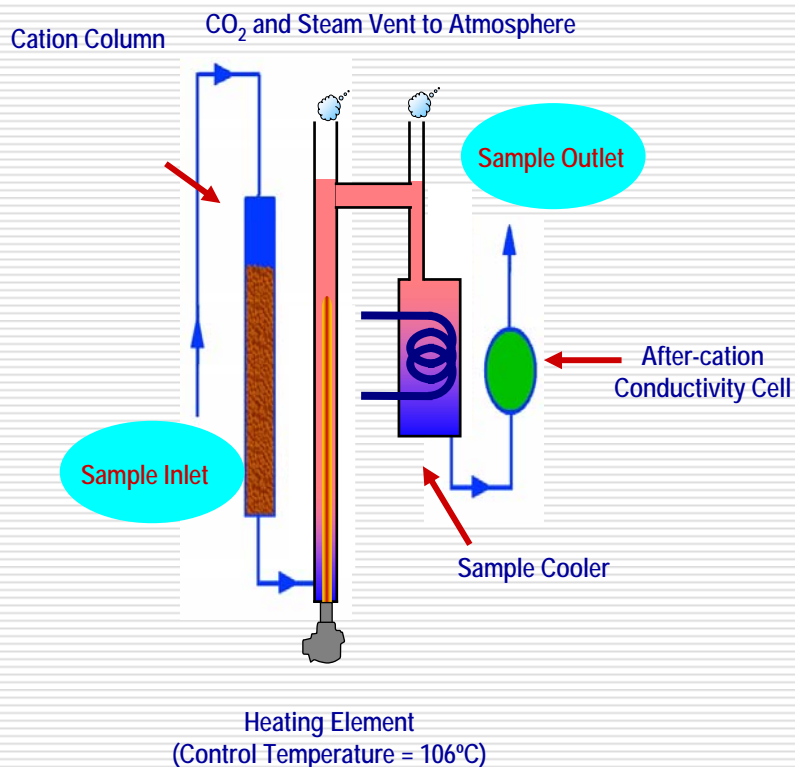
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### Benefits :

1. Degassed cation conductivity make more accurate for the detecting of the Anions or Salts, it can be a condenser leakage detector.
2. In some cases, when the cation conductivity reading to be a boiler warrantee reference data, it becomes critical and need to use de-gassed cation conductivity equipment if CO<sub>2</sub> may present in process.

### There are two kinds of De-gassed Cation Conductivity measurement

1. Heating to nearing boiling
2. Gas strip with Nitrogen



## Conclusion

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The corrosive effect of anions

Chloride > Sulfate, Formate > > Acetate > > CO<sub>2</sub>



The normally cation conductivity reading for boiler supplier recommendation is below 0.25  $\mu\text{s}/\text{cm}$  which means :

1. It will not get corrosive.
2. It will pass the interlock of start up.
3. It will be allowed by the requirement of warrantee

How can we do when the reading is not below 0.25  $\mu\text{s}/\text{cm}$  :

1. Use de-gassed Cation Conductivity equipment
  2. Purchase expensive ion chromatograph to detect the leakage
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