




WATER TREATMENT

For Condensing Economizers



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**Presented by:
Dan Lodge, P.Eng., CEM**



Topics

- **Introduction**
- **Economizer Types/Configurations**
- **Feedwater Economizers - Water Issues**
- **Condensing Economizers - Water Flows**
- **Condensing Economizers - Water Issues**
- **Function & Waterside Reactions**
- **Usage Considerations**
- **Equipment & Chemical Requirements**



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Complete Water Management Services



Project Management

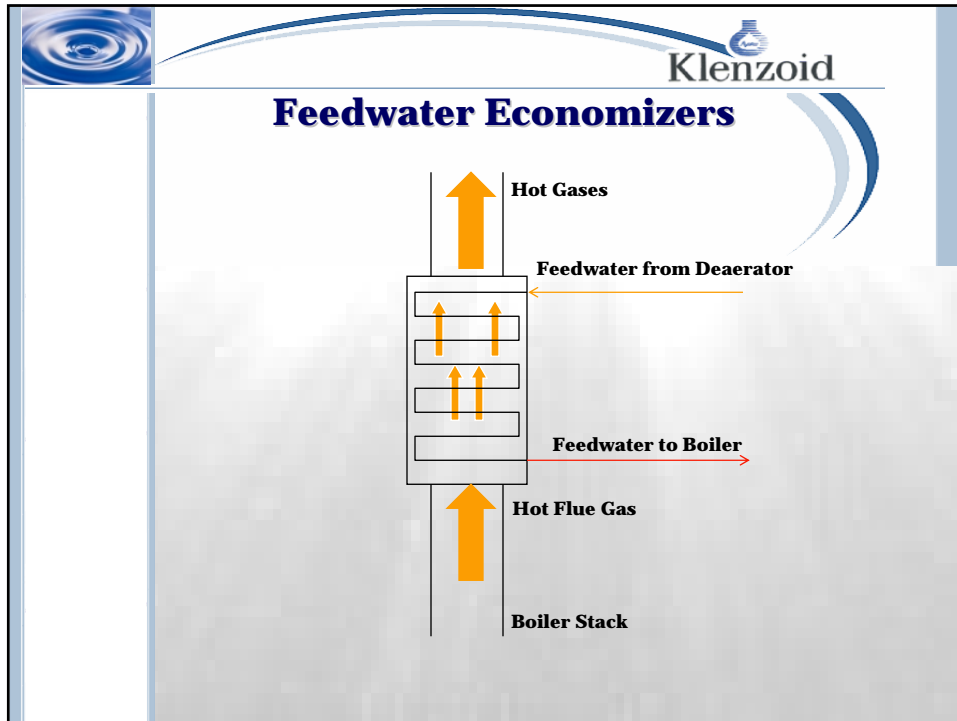
Equipment Design & Service

Chemical Water Treatment

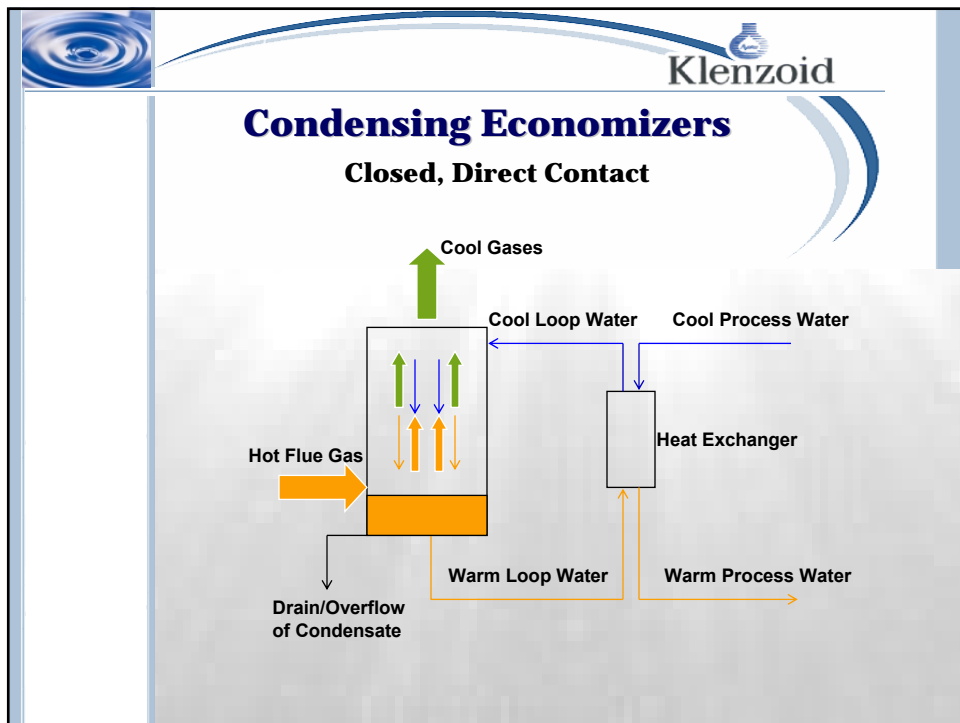
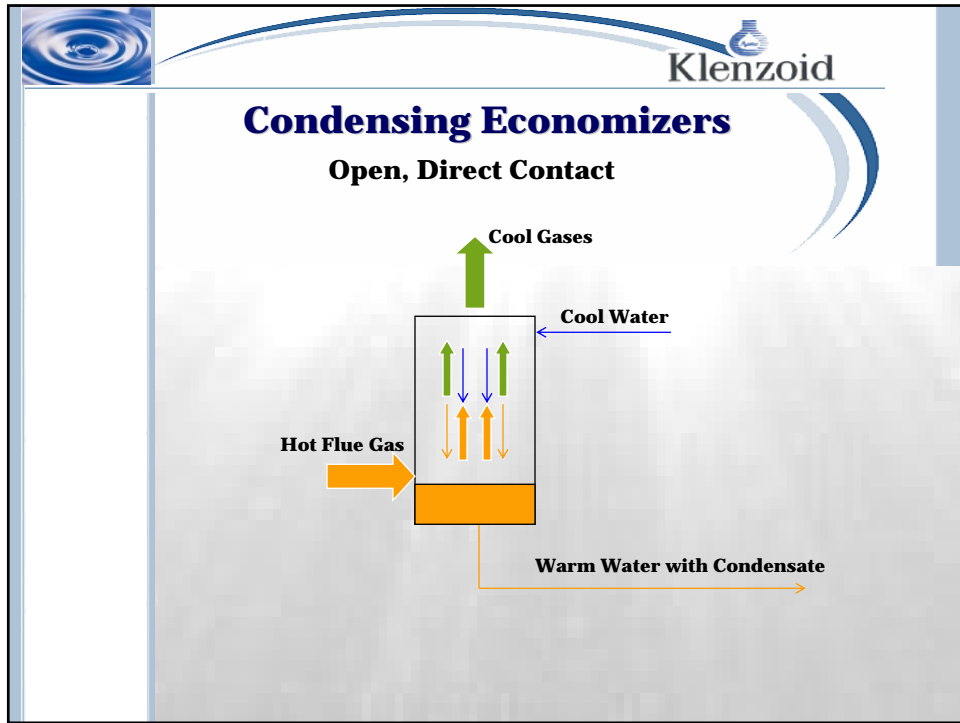


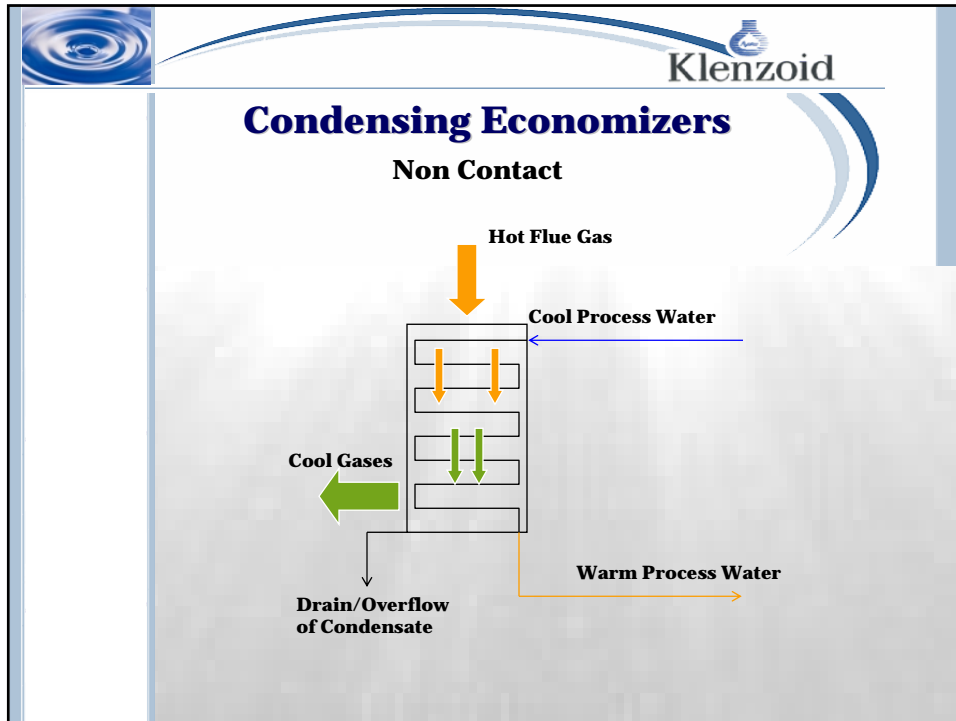
Economizer Types/Configurations

- 1. Feedwater Economizers**
- 2. Condensing Economizers - Open, Direct Contact**
- 3. Condensing Economizers - Closed, Direct Contact**
- 4. Condensing Economizers - Non Contact**



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- ## Feedwater Economizers
- **No Condensate Formation, flue gas temperature maintained above dewpoint**
 - **Feedwater is being heated, will already be treated for boiler vessel**
 - **Construction is generally mild steel**
 - **Subject to Oxygen Pitting, General Corrosion due to low pH, deposit/scale formation**
 - **Will generally experience problems due to water chemistry before the boiler vessel**





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Condensing Economizers

Water Issues

Unlike Feedwater Economizers, Condensing Economizers can have 1 or 2 “Water Side Surfaces”

- Condensate from flue gas
- Water stream absorbing heat from the flue



Condensate from the flue is predominantly a product of combustion:

$$\text{CH}_4 + 2\text{O}_2 + 7.52\text{N}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} + 7.52\text{N}_2 + \text{heat}$$

~300mL / 1000 m³ Natural Gas

Depending on the type of condensing economizer, this condensate can be classified as:

- Dilute Condensate
- Concentrated Condensate



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Condensing Economizers Water Issues

**Non Contacting & Closed-Direct Economizers:
Produce Concentrated Condensate**

- Flue gases dissolve into the condensate, creating acids:
 - Nitrogen Oxides (NO_x) → Forms Nitric and Nitrous Acid
 - Carbon Dioxide (CO₂) → Forms Carbonic Acid
 - Sulphur (oil fuels) → Forms Sulphuric and Sulphurous Acid
 - Chloride (Cl⁻) & Fluoride (F⁻) – Form Acids and accelerate corrosion

**Open Direct Contacting Economizers:
Produce Dilute Condensate**

- Flue gases dissolve into the condensate, however this volume of water is diluted into the heat sink volume, minimizing the corrosive forces





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Condensing Economizers Waterside Reactions

Concentrated Condensate



- Water treatment cannot be realistically applied inside the economizer, therefore materials selection (Metallurgy) is very important for economizer success
 - Non-contacting economizer condensate can be neutralized with alkaline chemicals, or boiler blowdown, prior to being discharged to drain
 - Closed, Direct contact economizer condensate and process water requires ongoing pH neutralization and controlled volume bleed, to prevent corrosion of downstream equipment

Condensing Economizers Waterside Reactions

Dilute Condensate

- Water quality inside economizer is closer to that of the heat absorbing stream, Ie. Makeup water. Typically oxygen corrosion potential dictates metallurgy selection. Proper softening/dealkalization is required to prevent mineral fouling inside economizer
- pH neutralization may still be required after the economizer with an automatic control system, to prevent damage to downstream equipment, Ie. Deaerator
- When natural gas is used as the fuel, contaminants from combustion are minimal

Pre-treatment and Chemical Treatment

All Condensing Economizer Types:

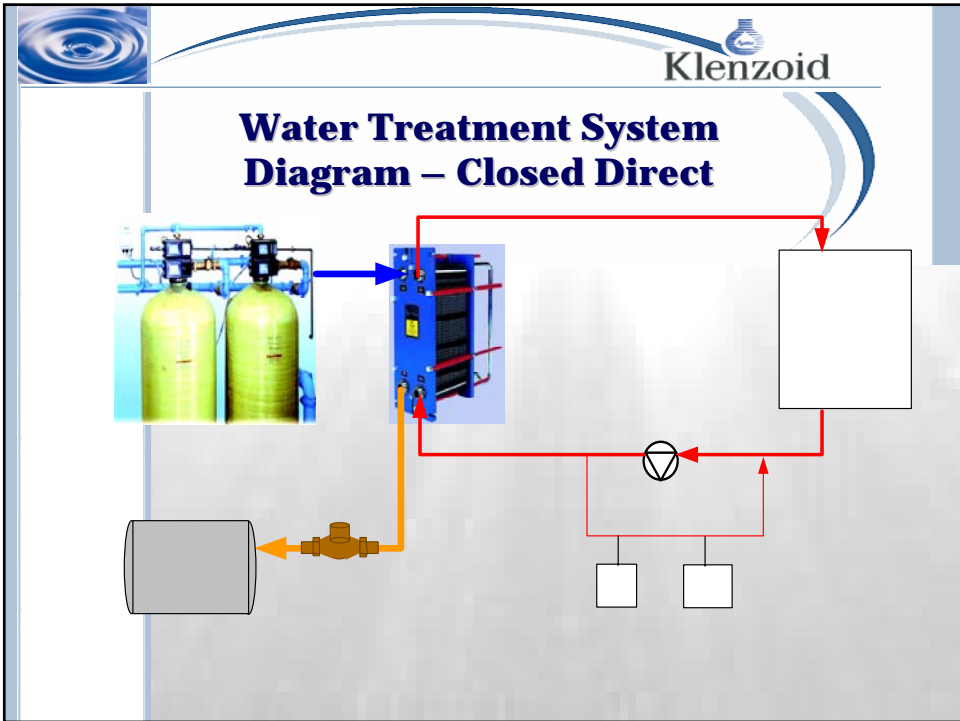
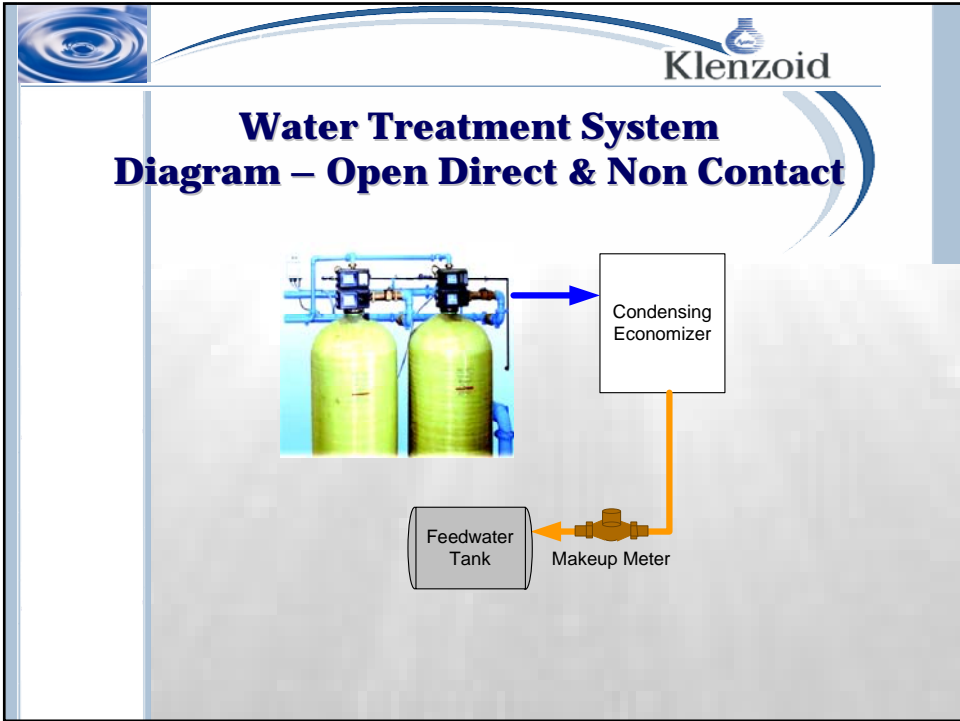
- **Vulnerable to mineral scale, requires upstream softening (minimum)**


Closed Direct Contact:

- **Build of up acidic contaminants, requires downstream pH neutralization**
- **May also require microbiocide treatment**
- **Usually requires a controller**


Mild steel rarely used for economizer which eliminates the necessity for oxygen removal upstream. However, standard boiler water treatment is applicable downstream.

Condensing economizer may provide ideal feedwater temperature optimum Reverse Osmosis (RO) operation.





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