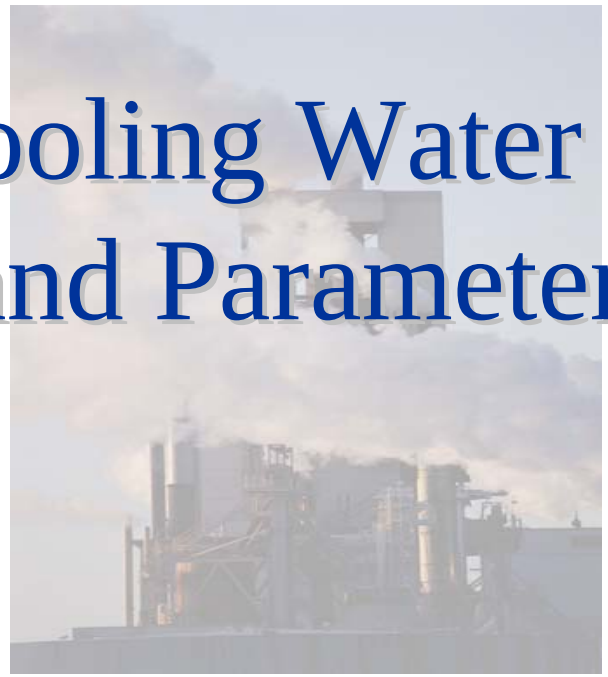
Boiler/Cooling Water Processes and Parameters



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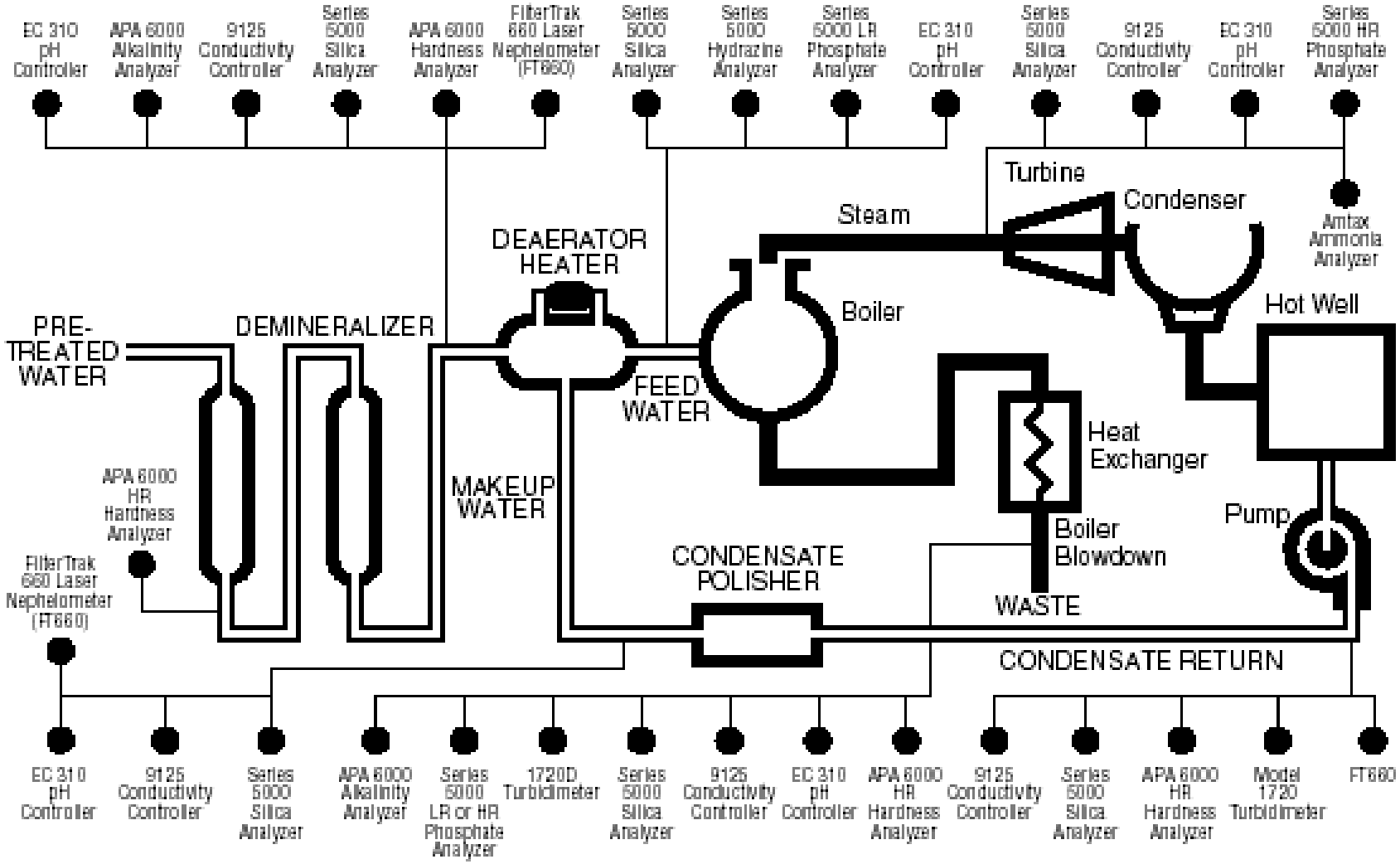
Steam Generation Flow Diagram



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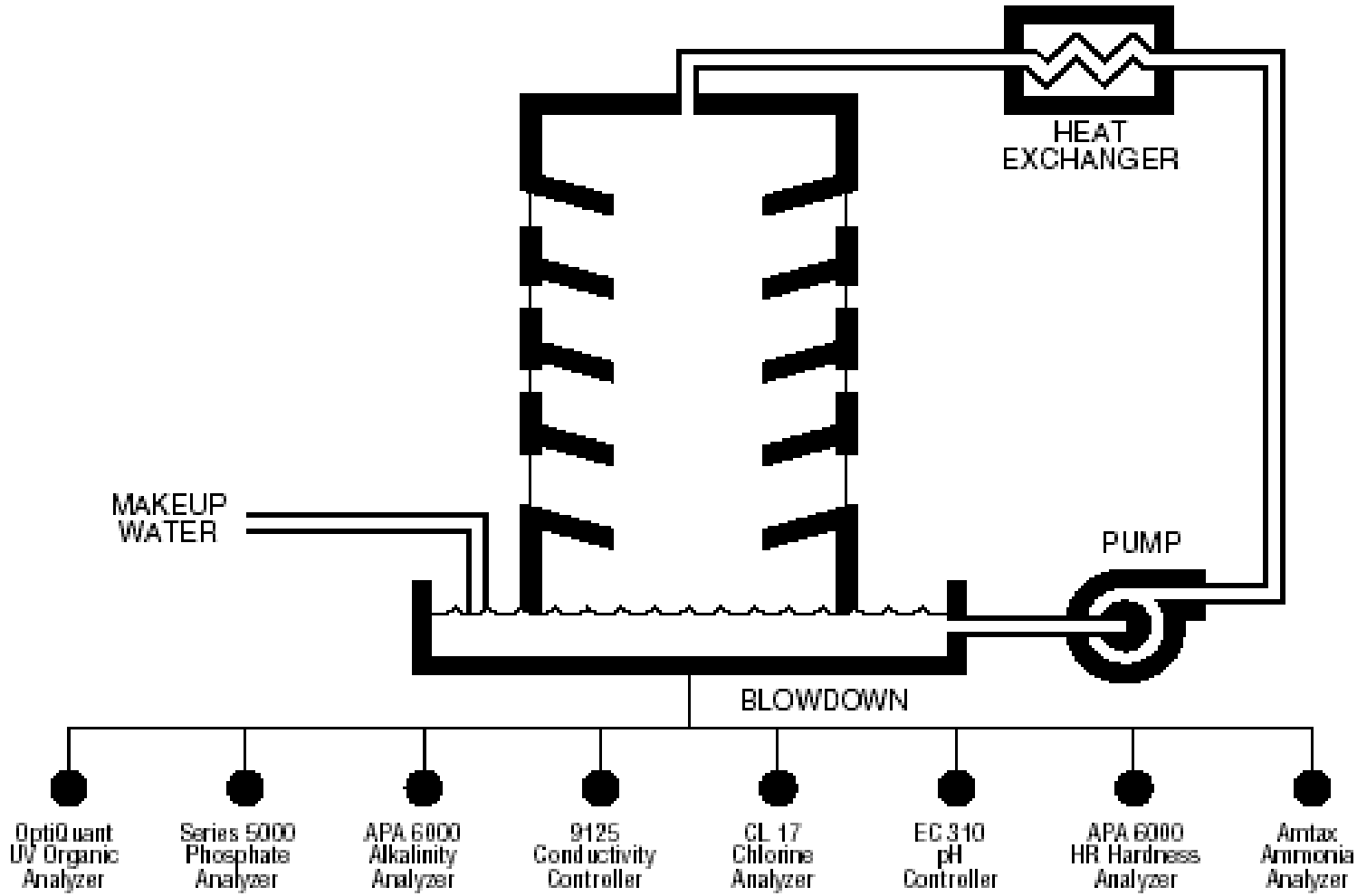
Cooling Water Flow Diagram



Outline

- Feedwater
- Internal Boiler Water
- Condensate
- Blowdown
- Cooling Water
- Process Water

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Feedwater

- Objectives of boiler feedwater treatment:
  - Prevent introduction of contaminants into boiler
  - Control addition of conditioning chemicals
- Control of feedwater:
  - May eliminate scaling, corrosion, carryover, embrittlement
  - May reduce operating costs

Feedwater

- As boiler pressure increases, higher quality feedwater is necessary
- Feedwater sources:
  - Varies from all makeup water to all condensate water – and everywhere in between

Feedwater

- Typical treatment of feedwater:
  - Low/Med pressure boilers
    - Zeolite softeners to reduce hardness – hardness used to determine when regeneration required
  - Higher pressure boilers
    - Demineralizers – monitor silica breakthrough to determine need for regeneration

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Internal Boiler Water

- Direct treatment of boiler water:
  - Prevents scale formation
  - Provides pH control
  - Prevents corrosion

Internal Boiler Water

- Scale prevention:
  - Calcium and magnesium which cause scale are controlled by:
    - Phosphate
    - pH
    - Chelant addition
    - Alkalinity

Internal Boiler Water

- Corrosion prevention is affected by:
  - Alkalinity
  - pH
  - Dissolved oxygen (oxygen scavengers)
  - Ammonia/amines

Internal Boiler Water

- High pressure boilers:
  - Maintain low silica level to prevent carryover into the steam and deposition on turbine blades

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Condensate

- Condensate – high purity water, commonly returned to the boiler in lieu of treated makeup water
- Amount and nature of contaminants in condensate may reveal carryover and corrosion problems and suggest treatment.

Condensate

- Common condensate contaminants:
  - Leaking in of cooling water from turbine condenser
    - Dissolved gasses, oils, ions, suspended metal
    - Condensate polishers used to reduce contaminants

Condensate

- Common condensate contaminants:
  - Leakage in from heat exchangers and condensers
    - Hardness, conductivity, turbidity
  - Corrosion problems
    - Iron, copper, dissolved oxygen
  - Carryover or condenser leakage
    - Sodium, silica

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Blowdown

- Removes precipitated sludge and dissolved solids from boiler water
  - BUT results in loss of heated water and treatment chemicals
- Control blowdown to maintain safe solids levels while minimizing chemical loss

Blowdown

- Typical monitoring parameters
  - Solids (to control blowdown)
  - Silica
  - Hydrazine, oxygen scavengers
  - Phosphate
  - pH
  - Conductivity

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Cooling Water

- Used in condensing steam, in water and air chillers, for process cooling
- Two types
  - Once-through
  - Recirculating

Cooling Water

- Once-through systems
  - Require chlorination to prevent biological fouling of heat exchangers
- Recirculating systems
  - Require more treatment because of solids buildup due to evaporation
  - Need to prevent scale formation

Cooling Water

- Chemical additives may be added to prevent scale due to hardness
  - Organic feed
  - pH control
  - Chelant addition
  - Phosphate, phosphonate

Cooling Water

- Parameters that affect corrosion
  - Dissolved oxygen
  - Carbon dioxide
- Typically controlled with:
  - Corrosion inhibitors – chromates, polyphosphates, molybdates, zinc, pH control, alkalinity, chlorine

Cooling Water

- In recirculating systems, turbidity is also monitored to control the filtration process.

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Process Water

- The water used for operations including metal plating, metal working, manufacturing activities
- Typically water is softened, pH adjusted, treated for corrosion control and slime inhibition.
  - Free of turbidity, color, iron, manganese

Process Water

- Typical industrial needs:
  - Wash/Rinse Water – Free of hardness
  - Beverage Water – Sterile, clear, taste/odor free
  - Brewing Water – Low hardness, alkalinity
  - Paper Processes – Low color, iron, manganese
  - Chlor-alkali Manufacturing – Monitor calcium in brine to prevent membrane fouling

Instruments we will Cover

- Series 5000 Silica Analyzer
- CL17 Chlorine Analyzer
- Surface Scatter 6 HR Turbidimeter
- 1720D LR Turbidimeter
- GLI pH/Conductivity

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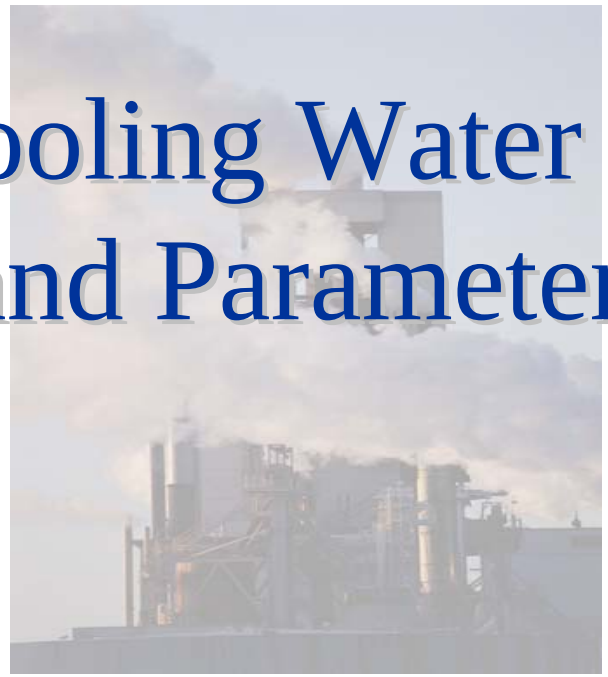

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