



WATER TREATMENT GUIDE

Complete Guide for Industrial Steam Boiler Water Treatment

Proper water treatment is essential for the safe, efficient, and reliable operation of steam boilers. Untreated or poorly treated water can lead to scale formation, corrosion, foaming, carryover, reduced heat transfer, increased fuel consumption, and premature boiler failure.

An effective water treatment program helps maximize boiler efficiency, reduce maintenance costs, extend equipment life, and ensure consistent steam quality.

Objectives of Boiler Water Treatment

- Prevent scale formation
 - Minimize corrosion
 - Control dissolved solids (TDS)
 - Prevent foaming and priming
 - Improve heat transfer efficiency
 - Reduce fuel consumption
 - Extend boiler life
 - Maintain high-quality steam
 - Reduce maintenance and downtime
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Sources of Boiler Water

- Raw Water
- Borewell Water
- Municipal Water
- Surface Water

- RO Water
- Softened Water
- Demineralized (DM) Water
- Condensate Return

Common Water Impurities

Impurity	Source	Possible Problem
Calcium (Ca)	Hard Water	Scale Formation
Magnesium (Mg)	Hard Water	Scale Formation
Silica (SiO ₂)	Natural Minerals	Hard Deposits & Turbine Scaling
Dissolved Oxygen	Air	Pitting Corrosion
Carbon Dioxide	Air	Acidic Corrosion
Iron	Corroded Pipes	Deposits & Fouling
Chlorides	Natural Salts	Corrosion
Sulphates	Natural Minerals	Scale Formation
Oil & Grease	Process Contamination	Foaming & Tube Overheating
Suspended Solids	Raw Water	Sludge Formation

Boiler Water Treatment Process

1. Raw Water Storage

Collect and store raw water before treatment.

2. Filtration

Removes suspended solids, sand, and dirt.

3. Water Softening

Removes calcium and magnesium hardness using ion exchange resin.

4. Reverse Osmosis (RO) *(if required)*

Reduces dissolved salts, TDS, and silica.

5. Demineralization (DM) *(for high-pressure boilers)*

Produces high-purity water by removing dissolved ions.

6. Deaeration

Removes dissolved oxygen and carbon dioxide to minimize corrosion.

7. Chemical Dosing

Maintains boiler water chemistry and protects internal surfaces.

8. Boiler Blowdown

Controls TDS, alkalinity, and sludge concentration.

Common Boiler Treatment Chemicals

Chemical	Purpose
Oxygen Scavenger	Removes dissolved oxygen
Phosphate	Prevents hardness scale
pH Booster	Maintains alkaline conditions
Anti-scalant	Prevents scale deposition
Polymer	Keeps suspended solids dispersed
Condensate Treatment Chemicals	Protect condensate return lines
Neutralizing Amines	Control condensate pH
Filming Amines	Form protective corrosion-resistant film

Recommended Water Quality

Feed Water

Parameter	Recommended Value
Ph	8.5–9.5
Hardness	Nil
TDS	<100 ppm
Dissolved Oxygen	<0.02 ppm
Iron	<0.3 ppm

Boiler Water

Parameter	Recommended Value
Ph	10.5–11.5
Hardness	Nil
Phosphate	20–50 ppm
Sulphite	20–40 ppm
TDS	As per boiler pressure and treatment program

Common Boiler Water Problems

Problem	Possible Cause	Solution
Scale Formation	High Hardness	Improve softening and blowdown
Corrosion	Low pH or High Oxygen	Correct pH and oxygen removal
Foaming	High TDS or Oil	Control TDS and eliminate oil contamination
Priming	Poor Water Quality	Optimize treatment and blowdown
Carryover	High Dissolved Solids	Improve boiler water control
Sludge Formation	Suspended Solids	Improve filtration and blowdown

Best Practices

- Test feedwater and boiler water regularly.
- Regenerate softener resin as recommended.
- Maintain RO and DM systems properly.
- Operate the deaerator correctly.
- Monitor chemical dosing continuously.
- Control boiler blowdown based on water quality.
- Maximize clean condensate recovery.
- Calibrate water quality instruments periodically.
- Maintain records of all water quality tests.

Benefits of Proper Water Treatment

- Higher boiler efficiency
- Lower fuel consumption
- Reduced scale and corrosion
- Improved steam quality
- Lower maintenance costs
- Longer boiler service life
- Increased plant reliability
- Reduced unplanned shutdowns
- Lower operating costs

Engineering Note

The required water treatment program depends on the **boiler operating pressure, feedwater quality, steam application, and plant operating conditions**. For medium- and high-pressure boilers, treatment systems such as **RO, DM, and deaeration**, along with a well-managed chemical dosing program, are often necessary to maintain water quality within the recommended limits. Always follow the boiler manufacturer's recommendations and recognized engineering standards for water treatment and monitoring.