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Understanding TDS Blowdown in Steam Boilers: Importance, Best Practices, and Solutions

Introduction

Total Dissolved Solids (TDS) blowdown plays a pivotal role in maintaining the optimal performance of steam boilers. It is the process of controlling the accumulation of dissolved solids in the boiler water by periodically discharging a small volume of water, which helps prevent harmful effects such as scaling, corrosion, and efficiency loss. Properly managing TDS blowdown not only enhances the reliability and lifespan of the boiler but also ensures the efficient use of water and energy.

What is TDS Blowdown?

TDS refers to the collection of inorganic and organic materials that are dissolved in water, which can include minerals like calcium, magnesium, sodium, and silica. These solids enter the boiler through the feedwater and gradually concentrate in the system as water is converted into steam. Without proper management, high TDS levels can lead to the formation of scale on the boiler's heat exchange surfaces, which reduces heat transfer efficiency and increases fuel consumption.

Blowdown is the controlled process of removing a small portion of water from the boiler to manage the TDS concentration. Regular blowdown ensures that the TDS level remains within a safe range, minimizing the risk of scaling and corrosion while optimizing boiler efficiency.

Why is TDS Blowdown Important?

1. Scaling Prevention

When dissolved minerals in the boiler water become concentrated, they can precipitate out, forming scale on internal surfaces such as tubes and heat exchangers. This scale acts as an insulating layer, reducing the efficiency of heat transfer and increasing fuel usage. Research indicates that just 2 mm of scale on heat exchange surfaces can result in an increase of 7-15% in fuel consumption. Effective TDS blowdown is essential to manage this buildup and prevent such inefficiencies.

2. Avoiding Corrosion

High TDS levels can lead to the accumulation of corrosive compounds, particularly chloride ions, which can erode the boiler's components. By controlling TDS levels through blowdown, corrosion can be minimized, which extends the lifespan of the boiler and reduces maintenance costs.

3. Improved Boiler Efficiency

Regular blowdown ensures the boiler operates at peak efficiency by maintaining the proper heat exchange surfaces and preventing scale buildup. This leads to improved heat transfer, reduced fuel consumption, and lower operational costs.

4. Reducing Resource Waste

While blowdown involves discharging some water, it must be done in a controlled manner to prevent excessive water and energy wastage. The goal is to strike a balance between maintaining optimal TDS levels and minimizing the amount of blowdown, helping to conserve both water and energy.

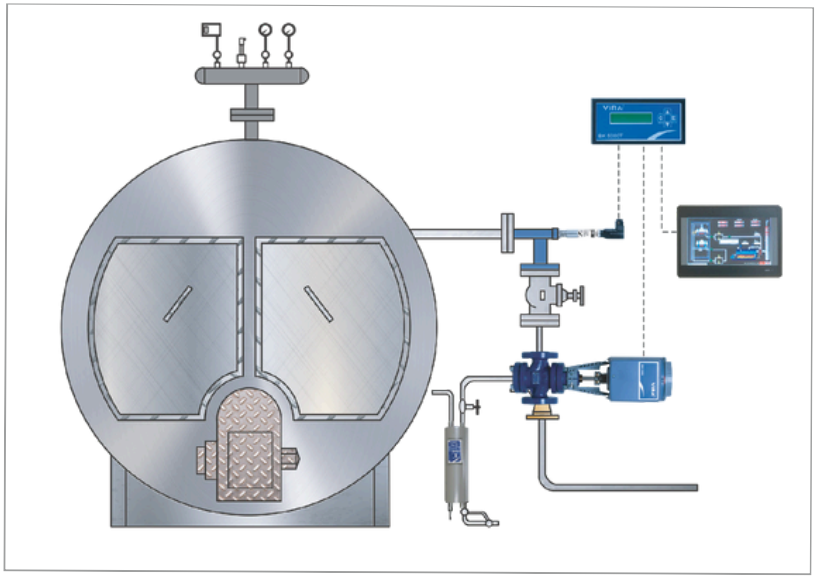


Figure 1 : Automatic Continuous Blowdown System Application Example

How is TDS Blowdown Performed?

Blowdown is typically performed using a system that monitors the TDS levels and adjusts the blowdown rate accordingly. The general process includes:

1. TDS Monitoring

To effectively monitor TDS levels, a conductivity probe or sensor is installed in the boiler. This sensor continuously measures the water's conductivity, which correlates to the TDS concentration. Vira's **BD 5600-T Conductivity Probe** is designed to provide accurate, real-time measurements of TDS levels, ensuring that blowdown is triggered at the correct threshold.

Figure 2 : BD 5600-T Conductivity Probe

2. Blowdown Valve Control

When the TDS concentration exceeds the set limit, the control system automatically opens the blowdown valve to release a controlled amount of water from the boiler. Vira's **BKV 5400 TDS Blowdown Valve** is engineered for efficient and precise blowdown control. By regulating the discharge of high-TDS water, this valve helps maintain the desired TDS concentration and supports optimal boiler performance.

Figure 3 : BKV 5420 Continuous Blowdown Valve

3. Feedwater Replacement

After blowdown, fresh feedwater is introduced into the boiler to replace the lost water and maintain the system's water level. It is important to ensure that the feedwater is properly treated to maintain low TDS levels and prevent further buildup of solids in the system.

4. Adjusting Blowdown Rate

The blowdown rate is typically adjustable based on the boiler's load and water quality. Vira's **BK 5000-T Temperature Compensation Type Conductivity Controller** can be used to ensure that blowdown is performed with precision, compensating for temperature variations that may otherwise affect TDS readings. This ensures that the blowdown process remains consistent and accurate, regardless of fluctuating temperatures.

Figure 4 : BK 5000-T Conductivity Controller

Manual vs. Automatic Blowdown: A Comparison

Blowdown can be carried out manually or automatically. Both approaches have their pros and cons, and understanding the differences helps operators choose the best method for their specific needs.

· Manual Blowdown

Manual blowdown requires the operator to open the blowdown valve periodically based on visual inspection or periodic TDS testing. While this approach may be sufficient for smaller systems or less demanding applications, it relies heavily on operator judgment and can lead to inconsistent blowdown practices. Manual blowdown may result in too much water being discharged (over-blowdown), or in insufficient blowdown, which could allow harmful solids to accumulate.

Disadvantages of manual blowdown:

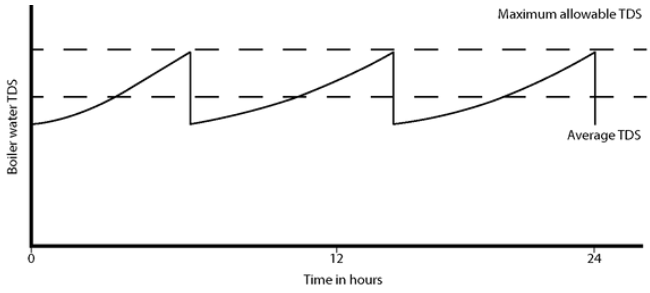
- Potential for human error in determining the appropriate blowdown frequency.
- Risk of excessive water wastage or insufficient blowdown.
- Labor-intensive and may not be efficient in larger or more complex systems.

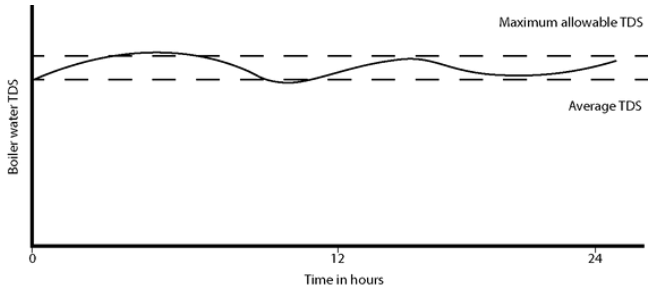
• Automatic Blowdown

An automated blowdown system continuously monitors the TDS levels in the boiler water and adjusts the blowdown rate in real time. By using sensors like the **BD 5600-T** and controllers such as the **BK 5000-T**, automatic systems can ensure precise control, minimizing the risk of over-blowdown or under-blowdown. Automated systems provide more consistent and efficient operation, reducing water and energy waste and improving the boiler's overall efficiency.

Advantages of automatic blowdown:

- More precise control over blowdown frequency and rate.
- Reduced operator intervention, resulting in lower labor costs.
- Improved efficiency and fuel savings by minimizing unnecessary blowdown.
- Less risk of damaging the boiler due to improper TDS management.





Proper Sampling and Accurate Measurements

Accurate TDS monitoring relies on proper sampling techniques. When collecting water samples from the boiler, it is essential to ensure that the sample temperature is within the correct range for accurate measurements. For this purpose, the Vira NK 20 Sample Cooler is an excellent tool. It cools the high-temperature water sample to a safe and consistent level, ensuring that the conductivity readings are not affected by temperature variations, thus providing more reliable results.

The NK 20 Sample Cooler should be placed close to the sample extraction point to maintain sample integrity. This ensures that the samples accurately represent the water conditions inside the boiler, allowing for precise control and calibration over the blowdown process.

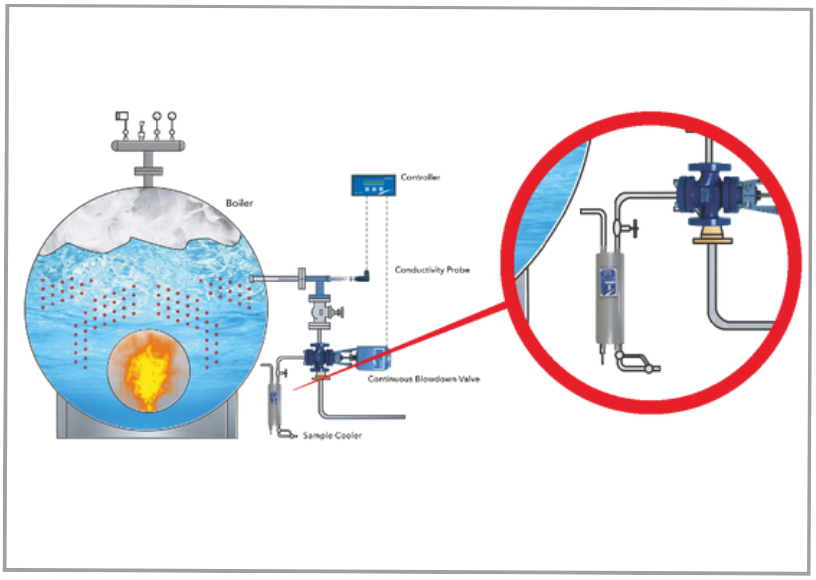


Figure 5 : Sample Cooler Application Example

Consulting the Boiler Manufacturer

It is essential to consult with the boiler manufacturer when setting the TDS threshold for blowdown. Each boiler system may have different requirements and tolerances based on design, material, pressure, and other factors. The manufacturer can provide specific recommendations for the TDS levels to be maintained to ensure optimal performance and avoid damage to the system. Following these guidelines ensures that the blowdown process is tailored to the particular needs of the boiler, optimizing its efficiency and extending its operational life.

Conclusion

TDS blowdown is a vital process in maintaining the efficiency, safety, and longevity of steam boilers. By effectively managing TDS levels through automated blowdown systems and using high-quality monitoring equipment like Vira's **BD 5600-T Conductivity Probe, BKV 5400 Blowdown Valve, BK 5000-T Controller**, and **NK 20 Sample Cooler,** operators can reduce scaling, corrosion, and fuel consumption. Automated blowdown systems, in particular, offer significant advantages over manual methods by ensuring more precise control and better resource management. Always consult with the boiler manufacturer to determine the ideal TDS set point, ensuring that the blowdown process is optimized for the specific boiler system in use.