Sootblower Optimization Solution

Features

- Delivers optimal cleanliness, resulting in heat rate improvements of up to 0.5%
- Customizes modes of optimization to allow plants to meet both emissions and efficiency goals
- Optimizes sootblowing dynamically through ongoing changes in load levels
- Reduces opacity, allowing a plant to meet and exceed EPA environmental regulations
- Continually manages the trade-off between minimal opacity and maximum boiler efficiency
- Operates not only with Ovation™, but also with any other modern distributed process control system

Introduction

Deregulation, environmental compliance and technology issues have significantly impacted the U.S. electric utility industry. Today, plants must maximize heat transfer rates in order to remain competitive and profitable. However, they must also consider the best way to maintain environmental and regulatory compliance.

Over time and through inefficient burning of fuel, a boiler will accumulate excess soot, which can clog boiler walls and heat exchanger surfaces, inhibiting heat transfer. While the common solution is sootblowing, the typical fixed sootblowing schedule can actually waste resources. By failing to clean surfaces when heat transfer rates are degrading or by wasting steam through unnecessary sootblowing, plants miss opportunities to improve efficiency and profitability.

Additionally, if the sootblowing schedule is unbalanced, unwanted opacity spikes can result, discharging unsightly carbon into the atmosphere.

Plant Goals

- Maintain clean heat exchanger surfaces
- Minimize soot accumulation
- Maximize plant efficiency
- Improve heat transfer
- Avoid excessive sootblowing
- Avoid unnecessary steam usage
- Balance blowing sequences
- Avoid opacity spikes and generate steam savings
- Avoid forced outages caused by soot accumulation
- Avoid steam temperature overshoot

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Challenges

- Identifying areas of the boiler where heat transfer rate can be improved through cleaning
- Avoiding excessive sootblowing that can waste valuable steam and erode plant equipment
- Balancing the need for boiler cleanliness and heat transfer with plant efficiency and emissions requirements
- Optimizing as plant changes through load levels

Sootblower Optimization

The sootblower optimization solution is offered as part of the Ovation™ advanced power applications optimization technology suite created by Emerson. Using an intelligent modeling tool, the sootblower optimization solution develops boiler section heat absorption models that accurately reflect the numerous interrelationships of various heat transfer sections. Once modeled, the optimization controller delivers sequenced sootblowing control that efficiently manages steam and energy while avoiding opacity spikes.

This solution develops strategic sootblowing sequences, ensuring that a plant only blows soot when needed and only in necessary locations, thus reducing opacity and thermal NOx while improving overall heat rate and boiler efficiency.

The sootblower optimization solution has the ability to dynamically calculate the cleanliness factors of the process at all times, even while the plant is moving through load ranges. This feature produces significant advantages over steady state packages, which are executable only when boiler load is stable and other parameters, such as the effect of radiation absorption at load levels, are known.

The optimized recommended sequences can be used in advisory mode, or they can be transferred directly to the distributed control system for automatic online process optimization. If implemented in advisory mode, a display will indicate recommended sequence signals. If the package is integrated in closed-loop mode, new advisory sequences are automatically distributed to the DCS. The result is a balanced sootblowing sequence, where heat rate is minimized and environmental compliance is maintained, without compromising efficient plant performance.

Modes of Operation

As part of a comprehensive solution, the Emerson team carefully collects data on ideal and actual heat absorption rates. This analysis produces a dynamic cleanliness factor calculation (DCF) within the application. The DCF is constructed with actual plant performance data using neural network technology. To further achieve a balance between emissions, heat transfer and steam savings, the sootblower optimization solution can operate in either efficiency/heat rate mode or opacity reduction mode. Depending on plant preference, either mode will be chosen. Specific rules select optimal sequences based on boiler type and design.

In efficiency/heat rate mode, the objective is to avoid unnecessary sootblowing and prevent excessive desuperheater spraying. The model characterizes the relationship between cleanliness factor and unit heat rate change for each boiler section and weighs these relationships to determine the optimal cleanliness factor for each section. An ideal blowing sequence achieves a balance between maximum cleanliness and minimal steam expenditure.

In opacity reduction mode, the emphasis is on the uniformity of the blower sequence. In this mode, the model characterizes the relationship between each boiler section's cleanliness factor and overall opacity change, predicting the impact of all possible blowing sequences on opacity, identifying sequences that maximize cleanliness and minimize opacity.

Software and Hardware Requirements

The sootblower optimization solution executes on a PC with a Windows® operating system.

Components

Components	Function
PC	Hardware platform for software development and solution execution.
Model Builder Software	Tool used to develop heat absorption model.
Sootblower Operation Advisory (SOA)	Executable software for on-line heat absorption modeling and optimization
DCS Interface	Hardware and software links between PC and existing DCS.
Custom Displays	Operator interface to Ovation solution.

Project Execution

Emerson's strategy of implementing the sootblower optimization solution centers around a proven methodology. A typical installation involves the following project implementation steps executed by the project team:

1. Site evaluation and information gathering
2. Sootblower sequence grouping
3. Data collection
4. Heat absorption modeling
5. Customized strategy development
6. Installation of run-time models
7. Advisory mode operation
8. Closed-loop mode operation
9. Final commissioning and performance benchmarking