



Steam Turbine – SB3-16-5073-ST-EN-01

Service Bulletin

Assessment and performance evaluation of water-cooled condensers

Machine Type	
Steam Turbine	SST5-3000 / 50Hz HE
Current / old product name	SST6-3000 / 60Hz HE
	SST5-4000 / 50Hz DN
	SST6-4000 / 60Hz DN
	SST5-5000 / 50Hz KN
	SST6-5000 / 60Hz KN
	SST5-6000 / 50Hz HMN
	SST6-6000 / 60Hz HMN
Timing for Implementation / Urgency	
	None / At customer discretion
Minimum Outage Type	
	Minor Inspection

It is the sole responsibility of the user to carefully consider the information and recommendations included in this Bulletin to determine if the information is appropriate to the user's specific product, component or services in a particular circumstance, and to exercise reasonable care and skill in the implementation of this Bulletin including any recommendations. If there are any questions regarding its contents, or if further information is required, Siemens should be consulted.

The condenser assessment evaluates the current condenser performance in comparison to the predicted design values. In-service condensers often no longer achieve the predicted values.

The heat consumption and output of the turbine generator are greatly affected by condenser performance. The main criteria for evaluating the condenser are the condenser pressure, condensate subcooling and oxygen content in the condensate. The lowest possible condenser pressure and a low oxygen content in the condensate as well as a condensate subcooling of “zero Kelvin” are desirable. However, corrosion, erosion, fouling and mechanical wear can have a significant negative impact to the condenser performance, and therefore power output of the power plant.

TECHNICAL INFORMATION

Various factors can negatively influence the condenser performance, which cause significant reduction of power output of a power plant (see Figure 1). Three major areas have been identified:

- Cooling water side
- Steam side
- Air extraction

The cooling water side is not a closed system and therefore there is a danger of contamination. Corrosion can occur due to insufficient conditioning of the cooling water. Furthermore, calcification, coarse soiling and especially biofouling can worsen the effectiveness of cooling systems significantly and continuously.

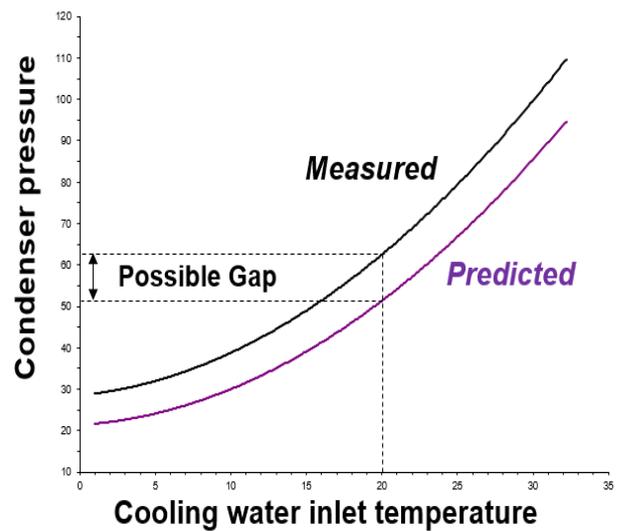


Figure 1: Example of condenser assessment

Corrosion or erosion in the steam space have less influence on the performance than on the availability of the power plant. Contamination or eroded components can cause damage to the steam dome internals, potentially resulting in unscheduled power plant outages.

The functionality of the air extraction system is another significant part that is of fundamental importance for effective condenser operation. In addition to various seals, wear on pumps and bearing play are also a significant element in ensuring a stable vacuum.

Figure 2 provides an indication of potential output reduction per mbar.

ST-type	ST-output	ST-output reduction
HE/ SST-3000	132 MW	~ 170 kW/mbar
DN/ SST-4000	176 MW	~ 150 kW/mbar
KN/ SST-5000	247 MW	~ 230 kW/mbar
HMN/ SST-6000	611 MW	~ 640 kW/mbar

Figure 2: Reduced output for typical steam turbine configurations

RECOMMENDATIONS

This bulletin recommends a modular approach to detect and eliminate power losses caused by the condenser:

- (1) Assessment of existing operational data
- (2) Inspection on cooling water side
- (3) Inspection on steam side
- (4) Air-in leakage measurement
- (5) Optimization recommendation

POTENTIAL BENEFITS

- Realtime condenser performance analysis with digital services
- Calculation of performance loss caused by condenser performance delta (measured vs. predicted condenser vacuum pressure)
- Identification of potential root causes for condenser efficiency reductions

- Continuous performance optimization of the power plant operation
- Up to 13 MW recovered power output as a result of condenser and its auxiliaries' optimization has been achieved previously
- Further potential for improvement by optimization of the condenser tube layout.

NOTES

It is recommended that all assessments and inspections be performed by Siemens authorized personnel only.

Please contact your Siemens representative for further information and/or you have any question in relation to the contents of this Bulletin.

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