

REPLACEMENT COMBUSTION SYSTEM FRAME9/E GAS TURBINE

APPENDIX 1 TO TECHNICAL SPECIFICATION

GENERAL DESCRIPTION OF AUTOTUNING DEVICE

Autotuning Device

Properties such as ambient conditions, fuel composition, and hardware condition change over time which influence emissions and combustion dynamics. To avoid negative effects, it is required to tune gas turbines regularly.

An Autotuning Device is an AI powered tool to increase turbine efficiency; it uses machine learning to operate gas turbines at the “sweet-spot” by adjusting the fuel splits (and flame temperatures) based on load, acoustics, and emissions. The Autotuning Device system requires some soft- and hardware to be implemented; however, as an Autotuning Device is an add-on system, currently implemented systems will remain operational. Once implemented and activated, an Autotuning Device will keep turbines operating within pre-set operational limits.

An Autotuning Device has a learning mode in which it expands the neural network model to fill in blanks of information on turbine operability. In the mapping mode, it will send biases for adjustable variables (flame temperatures, fuel splits) to the controller, after which it will let the system stabilize. It records all the effects on combustion dynamics and emissions and learns when to apply which adjustable settings.

In the control mode, it uses the information from the learning mode to manipulate the flame temperatures and fuel splits. As the effects of different biases on the system have been recorded, it will adjust the turbine operation depending on sensory output from acoustics, NOx emissions, and CO emissions.

Benefits

An Autotuning Device continuously ensures the turbines are within allowable, and even at optimal, operating ranges. Thus, there is a reduced need for manual/seasonal tuning and the number of trips is decreased.

An Autotuning Device corrects fuel properties, changes in ambient conditions, etcetera, increasing efficiency and maximizing output.

The implementation reduces combustion dynamics and emissions and allows for better management of operational range during the year. The result is extended hardware life and improved operability while complying with emission-regulations.