

# THE EFFECT OF FUEL COMPOSITION CHANGE ON THE PERFORMANCE OF A SATURATED STEAM BOILER

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**Abstract:** Industrial steam boilers can undergo fluctuations in fuel properties (composition and heating value) during which the steam boiler efficiency, safety and emissions are affected. Variation of fuel heating value leads to variations of flue gas temperature inside the boiler and consequently to variation of steam pressure. It depends on the boiler control system how fast it matches the heat input to the heat demand. During the adjustment, the combustion may occur with insufficient or with high excess air. Long-term operation at higher furnace temperature can damage the heat transfer surface [9]. An increase by 15% of the input heat (due to the increase of natural gas heating value) of a 30 t/h saturated steam boiler leads to furnace temperature increase with about 240°C (from 1097°C to 1341°C) and steam pressure increase from 9.2 to 19.8 bar.

**Keywords:** steam boiler, heating value, efficiency, emissions, control system.

## REFERENCES

- [1] Combustion Process Control Technical Review, Emerson Process Management, Industrial Systems and Control Limited, 2013 (<http://www2.emersonprocess.com/siteadmincenter/PM%20Central%20Web%20Documents/ISC%20Ltd%20-%20Combustion%20Process%20Control%20Technical%20Review.pdf>)
- [2] <http://www.eurotherm.co.uk/burner-combustion-control-for-boilers>
- [3] Saastamoinen J.J., Modelling of dynamics of combustion of biomass in fluidized beds, *Thermal Science: Vol. 8* (2004), No. 2, pp. 107-126.
- [4] Ion V.I., Crăciun S., Simulation of the boiler furnace's dynamic operation, *Modelling and Optimization in the Machines Building Field MOCM-99, Vol. 2, Bacău 2003*, pp. 143-148.
- [5] Pănoiu N., *Cazane de abur (Steam boiler)*, Ed. Didactică și Pedagogică, București, 1982.
- [6] Neaga C., *Calculul termic al generatoarelor de abur. Îndrumar (Steam boilers calculation. Guidebook)*, Ed. Tehnică, București, 1988.
- [7] Pop, G.M. ș.a., *Îndrumar. Tabele, nomograme și formule termotehnice (Guidebook. Table, nomograms and thermal equations)*, Ed. Tehnică, București, 1987.
- [8] [http://www.uni-magdeburg.de/isut/TV/Download/Kapitel\\_3\\_Combustion\\_Engineering.pdf](http://www.uni-magdeburg.de/isut/TV/Download/Kapitel_3_Combustion_Engineering.pdf)
- [9] Baukal C.E., *The John Zink Combustion Handbook*, CRC Press, Boca raton, 2001.
- [10] de Mello F.P., Boiler models for system dynamic performance studies, *IEEE Transactions on Power Systems, Vol 6, No. 1, 1991*, pp. 753-761.
- [11] Gaba R., Gaba A., mathematical model and computation program of the chamber furnace of boilers for air pollution reduction, *Environmental Engineering and Management Journal, March 2012, Vol.11, No. 3*, pp. 557-565.
- [12] Maffezzoni C., *Dinamica dei generatori di vapore*, Masson, Milano, 1989.
- [13] Ordys A.W., Pike A.W., Johnson M.A., Katebi R.M., Grimble M.J., *Modelling and Simulation of Power Generation Plants*, London, Springer-Verlag, 1994.
- [14] Iliev I., Kamburova V., Terziev A., *Industrial heat engineering and renewable energy sources*, Academic Publishing Centre of Ruse University, Ruse, 2014.
- [15] Roslizam J., Mizam M., Mokhtar M., Mahmoud K. A., Analysis On The Actual Variation Of Gas Fuel Quality And Its Impact On Tuanku Jaafar Power Station Gas Turbines, *Journal of Purity, Utility Reaction and Environment, Vol. 3, No.5, October 2014*, pp. 67-85.
- [16] Donfack P.K., César K., Guy N.E., Effect of Extrinsic Fuel Moisture Content on the Performance of Bagasse Boiler for Suspension Combustion, *Journal of Energy and Power Sources, Vol. 1, No. 5, 2014*, pp. 250-256.
- [17] Mann Ap, Predicting the effects of fuel properties on combustion performance, *Proceedings of the Australian Society of Sugar Cane Technology, Vol. 32, 2010*, pp. 629-637.
- [18] Mihoc D., Iliescu S.S., Făgărășan I., Țăranu Ghe., Matei G., *Automatizarea sistemelor electro- și termoeenergetice*, Editura Printech, București 2008.