

NAWTEC14 Speaker Abstract: MARTIN Reverse-Acting Grate System – The Challenge of High Heating Value Fuels

Ralf Koralewska

MARTIN GmbH für Umwelt- und Energietechnik

P.O. Box 40 12 29, 80712 Munich / Germany

Telephone +49 89 / 3 56 17 - 246, fax +49 89 / 3 56 17 - 299

Ralf.Koralewska@martingmbh.de

<http://www.martingmbh.de>

Recent years have seen significant increases in the average heating values of wastes in Central Europe. Essentially, this can be attributed to recycling measures, separate recovery of waste streams, and treatment and processing procedures in modified waste management concepts. As a result of the above and due to the increasingly frequent application of energy recovery procedures for commercial waste, the fuel input to waste-to-energy plants combusting household waste has been significantly influenced. In response to the associated increased thermal load, water-cooled systems using various technologies were developed and used for air-cooled forward-acting grate systems.

Through its agitating motion towards the front grate end and intimate mixing of the fuel, the MARTIN reverse-acting grate always ensures good thermal protection for the grate bars due to the "insulating" fuel and ash layer on the grate surface. The combustion control system makes automatic adjustments to deal with different heating values and can therefore be used to thermally treat the most varied fuels. Water-cooling of the grate bars is not necessary even in the case of high heating value ranges.

The MARTIN reverse-acting grate is inclined in the direction of transport with a slope of 26° from the feeder to the discharge area. It comprises stationary and moving steps in alternating order. The grate is divided into grate modules, each of which has 5 undergrate air zones over the length of the grate. The grate speed is determined by the waste quality and combustion behaviour rather than the combustion rate. Depending on the combustion rate required, 1 - 7 of these modules are assembled in a single grate. By means of the reverse-acting motion of the moving grate steps directed against the natural downward movement of the fuel bed on the grate, the waste is first pushed upwards towards the grate front end and then forced to make a downwards mixing motion. In this way, the fuel bed layers at the grate front end are therefore constantly mixed with red hot particles from the main combustion zone. Within the scope of a German project and in response to customer requests, MARTIN also developed and implemented on an industrial scale a water-cooled reverse-acting grate with an innovative, self-regulating circulation system. Experience with this system both with and without cooling has shown that the agitating motion of the reverse-acting grate in conjunction with intimate mixing of the fuel always ensures good thermal protection for the grate surface and consequently no increase in

grate bar temperatures. Water-cooling of the grate bars is therefore unnecessary for the heating value ranges generally used in MARTIN plants with reverse-acting grates. MARTIN®, MARTIN reverse-acting®, SYNCOM® are registered trademarks.

These experiences are further confirmed by investigations carried out within the framework of a research project to determine the fuel bed temperatures in two waste-to-energy plants combusting household waste. In this context, measurements were made on a MARTIN reverse-acting grate in both conventional combustion mode and in SYNCOM mode, during which the underfire air is enriched with oxygen. During the investigations, an infrared camera was used to determine the fuel bed surface temperature. Insertable thermocouples in the fuel bed, ball instruments and temperature probes added directly to the waste were also used. In-depth chemical and mineralogical analyses were also carried out on the bottom ash. To keep abreast of the trend for generating products from waste pretreatment processes, e.g. fractions with high heating values produced by mechanical or mechanical-biological waste pre-treatment, or by pretreatment processes for generating secondary fuels (Refused Derived Fuel), additional tests were carried out at a plant combusting household waste with a MARTIN reverse-acting grate. Fuels with heating values (LHV) of 13,000 kJ/kg (5,589 BTU/lb), 17,000 kJ/kg (7,309 BTU/lb) and 19,000 kJ/kg (8,169 BTU/lb) were combusted for periods of several days. The impact on the combustion system, the residues produced and the flue gas composition were examined. Operating parameters such as underfire air preheating and distribution, overfire air flow and distribution were adjusted to the relevant fuel heating values. Grate bar temperatures were measured at various points and were only approx. 20 K above the underfire air temperature (only minimal or no underfire air preheating was necessary). The MARTIN reverse-acting grate and combustion system could be operated continuously with full functionality in a reliable and problem-free manner. The experiences obtained and measurements performed conclusively proved that the MARTIN reverse-acting grate does not require water-cooling even for high heating value ranges.

The presentation describes the experiences obtained with the combustion of fuels with high heating values on the reverse-acting grate, use of the SYNCOM process and the water-cooled MARTIN reverse-acting grate, and the results of fuel bed temperature measurements carried out by MARTIN GmbH.

Ralf Koralewska studied Aviation and Aerospace Engineering at the University of the Armed Forces Munich, after which he served as a technical officer German Air Force. He studied Environmental Technologies and received PhD, Technical University of Munich. Since 1999 he has been project engineer in the Research and Development department of MARTIN GmbH Munich serving as project engineer. Mr. Koralewska has presented papers at international conferences and meetings with MARTIN partner companies.