

## CHEMICAL TREATMENT OF WATER/STEAM SIDE OF WASTE TO ENERGY INCINERATORS

No 7/2015

Preoperational chemical treatment of water/steam side of 2 incinerators was performed for the Plant for Thermal Treatment of Municipal Wastes for Bydgoszcz – Toruń Metropolitan Region, Bydgoszcz, Poland. The work was done to the order of Sices Pensotti FCL in Legnano, Italy, subcontractor to Thermomeccanica Ecologia S.p.A. and Astaldi S.p.A., Rome, Italy. The work was performed by Ancora in cooperation with Vecom, Maassluis, the Netherlands and Marcor Jan Marjanowski, Gdańsk. Chemical treatment of the boilers including waste water neutralization and waste utilization was carried out during the time from 25.06.2015 to 17.07.2015. The work preparation was supervised by the Central Laboratory of the Polish Office for Technical Control (OTC) the institution that obligatorily inspects chemical treatment of the pressure vessels. Both Ancora Co. and Marcor have authorization from OTC to perform chemical cleaning of boilers. The cleaning technology that was applied was complying the documents: Aster Astaldi, TME, Technical Specification for Chemical Treatment and VGB PowerTech Guideline for Internal Cleaning of Water Tube Steam Generating Plants and Associated Pipe works, R513e (2006), Essen, Germany.

### Steps of chemical treatment

Pre-engineering work consisted of the project of chemical treatment technology for the incinerators that included designing of connection schemes and supporting installation montage. Laboratory tests were conducted to control pickling parameters and corrosion inhibitor efficiency with application of tube samples prepared from steels used for construction of the incinerators (Fig.1).



Fig.1. Pre-engineering laboratory testing of treatment parameters

Construction of temporary circuits started after collection of storage and circulation tanks (Fig.2),



Fig.2. Storage and circulation tanks containers for temporary laboratory and office, pumps, pipes, steam generator (Fig.3), fittings,



Fig.3. Steam generator with fuel tank

and chemicals. After each boiler pre-flushing to remove non adhering contaminations and to check leak tightness, the boilers were degreased with slightly alkaline solution containing wetting agent, and flushed. Marchery Nagel tests performed did not discover any fatty contaminants. Then pickling by circulation of inhibited hydrofluoric acid at elevated temperature was carried out with analytical spectral control of acid concentration, pH, iron in the solution, and corrosion inhibitor test. Complete removal of scale and rust was confirmed by parallel testing of samples inserted into circulation tank within the circuit (Fig.4-5).



Fig.4. Sample before cleaning



Fig.5. Sample after cleaning

When very clean metallic surface was obtained it was passivated in a slightly alkaline solution at elevated temperature until metal electrochemical potential change was of a remarkable value. The redox potential was regularly measured during the passivation step. A proper cleanliness was obtained so that the formation of a protective layer containing mainly magnetite was possible. The observations performed in the drum, at feed water inlet and the preheater showed that the steel was uniformly, superficially pickled (Fig.6-7).



Fig.6. Incinerator interior before cleaning



Fig.7. Incinerator interior after cleaning

The contaminations coming from the construction time, mill scale and rust were removed leaving incinerator passive surface over water-steam side. After work control and its full acceptance, both incinerators were hand over to the client in a very proper condition. On such technically favorable basis an operation of the steam turbine must be very successful. The temporary circuit was disassembled, equipment and not used up chemicals were evacuated.

**Waste water from boiler chemical treatment**

Neutralized waste water after pickling and passivation having pH over 6.6 and below 9.5, clear and separated from a sediment, was drained to the municipal sewage based on the contract with the Municipal Water Works and Sewages.

**Wastes sent for utilization**

The sediments (code 16-10-03\*) containing calcium fluoride, iron hydroxides and unreacted alkalis were collected in IBC containers and sent to the specialized company for utilization. The documents on waste quantity evidence and alteration by the utilization company were issued.

**Final reports**

The report on both boilers preparation for the operation, contained graphs and tables, presenting results of analytical control of the solutions from pickling and passivation phases, was fully accepted by Sices Pensotti FCL. The report on the chemical treatment of the boilers was send to the Office for Technical Control in Bydgoszcz stating that the water/steam side of the incinerators became ready for a control by OTC.

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