

# ACID MANAGEMENT FOR CARBON STEEL PICKLING

# ZERO EFFLUENT DESIGN

Zero Effluent for Pickling Lines & Acid Regeneration has been developped by TENOVA to reduce costs and environmental impact.

Many years of experience and know-how in the field of acid regeneration and pickling lines for steel strip enabled Tenova to develop a complete compact package to provide optimised, tailored and an all-comprehensive solution for pickling lines with dedicated acid regeneration units.

The increasing market demand for small size and low cost pickling lines, as well as increasing costs for energy, water and environment requires a new approach and a new concept for this kind of application.

In a conventional design, the excess rinse water containing chlorides is sent to a plant for neutralization which are losses and lead to:

- 1) costs for fresh make up acid
- 2) water costs (demi water or condensate) for rinsing use
- 3) costs for neutralisation

The Tenova concept for ZERO EFFLUENT is the answer to this new demand with an energy saving design and innovative use of water in the plant, permitting producers to operate without any acid effluents, a large advantage in areas where water is scarce. Even operation without waste water treatment is possible.

The ZERO EFFLUENT concept includes Acid Regeneration and stands for total recovery (99.9%) of (metal) chloride solution based on pyrohydrolysis. This process obtains as a by productqhigh-quality iron oxide as powder suitable for sale to the ferrite and pigment industries or in a granulated form for reuse in steelmaking.

This concept has been applied by Tenova assuring the following benefits:

Investment saving:

- . No need for a waste water treatment plant for acidic effluents;
- Only one combined scrubber system for the ARP & Pickling Line. Operation costs:
  - . Efficient use of water, combined Rinse & Offgas scrubber system;
  - . No neutralisation costs chemicals/sludge disposal, etc;
- . losses of HCl practically zero.

Environment:

. Respect of strict emission values (imposed not only in European Union).

Tenovaç ZERO EFFLUENT concepts recently supplied consists of an effective two-tank pickling system (suitable for capacities up to 300kt/y or 500 kt/y with 3 tanks) and an innovative rinse system, including als chloride containing water from the tank fumes scrubber. This scrubber has a dual function and it is engineered to clean:

- . the offgas coming from the Acid Regeneration Plant; and
- . the fumes collected by the Pickling Tank suction ducting.



### This new concept consists of

- 1) Tank farm to optimize operation of regeneration plant and the pickling section
- 2) sprayroasting reactor equipped with nozzles for waste acid injection
- 3) high efficiency venturi circulation system
- 4) high efficiency absorption system to obtain 18% regenerated acid at constant level
- 5) off gas cleaning system to reach lowest possible emission values

## **Acid Regeneration Process Cycle**



TENOVA Zero Effluent Concept





PICKLING TANK DESIGN

Fig. 2 ARP on Rack during erection



Fig. 3 ARP with full Automation





Fig 4&5 Pickling Tanks Shallow Design



## **COST FACTORS**

#### STANDARD PICKLING CONCEPT







### Benefits of of TENOVA Acid Recovery:

- environmental benefit
- No acid to be neutralized
- Acid losses minimized
- Rinse Water & Scrubber water utilisation
- Cost saving
- No Waste Water Treatment plant necessary
- Essential when limited ressources (water, effluents,..)

The design assures the respect of strict emission values without any use of alkaline chemicals. The acidic water from the rinse section and the scrubber can be fully used in the Acid Regeneration Plant in the absorption step.

With such a compact plant, it is possible to achieve the highest environmental standards and product quality with minimum investment, energy and consumption values.

In conclusion, Tenovac experience demonstrates that the full integration of all the technologies and techniques applied in Annealing and Pickling Lines enables the successful implementation of challenging projects with excellent results for both large steel producers or small service centres.

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