ACID MANAGEMENT FOR CARBON STEEL PICKLING

ZERO EFFLUENT DESIGN

Zero Effluent for Pickling Lines & Acid Regeneration has been developed 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 byproduct high-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).

Tenova’s 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

\[ 2\text{FeCl}_2 + 2\text{H}_2\text{O} + \frac{1}{2}\text{O}_2 \rightarrow \text{Fe}_3\text{O}_4 + 4\text{HCl} \]
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

- SCRUBBER
- SUCTION PICKLING LINE
- NaOH
- WASTE WATER TREATMENT
- WASTE ACID
- REGEN ACID
- ENERGY
- FRESH ACID PURCHASE 32%

TENOVA SMART WATER CONCEPT

ZERO EFFLUENT

- SCRUBBER
- SUCTION PICKLING LINE
- WATER
- WASTE ACID
- REGEN ACID
- ENERGY
- WATER
- ACID CONTROL
- ARP
- HCl LOSS
- FRESH ACID PURCHASE 32%
Benefits 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 resources (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, Tenova's 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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