



TECHNICAL IMPROVEMENTS IMPLEMENTED IN MIDREX® DIRECT REDUCTION PLANTS PROCESS WATER DEGASSER

TECHNICAL SOLUTION

The degassing of process water from CO₂ provides a significant improvement in the process water/slurry system of a Midrex direct reduction plant. The improved water quality results in lower operational and maintenance costs.

Dissolved gases, mainly CO₂, in the process water returning from the top gas scrubber weir and/or top gas scrubber cone are removed by a degasser system that was developed by Primetals Technologies (see Fig. 1).

The process water is routed at an elevated position on a pipe bridge to the degasser(s). Water is then distributed to several nozzles inside the degasser vessel. Air is introduced in countercurrent flow for efficient degassing of the process water, whereby mostly CO₂ but also from other dissolved gases such as CO are removed.

The offgas from each degasser vessel is routed via a stack to a safe location for discharge of the gas mixture (mainly air and water steam with some traces of other gases).

A bypass line across the degasser can also be installed.





Fig. 1: Typical location of degassers for top gas scrubber weir and top gas scrubber cone return at the inlet to the clarifier(s)



Fig. 2: Degassers for Midrex top gas scrubber weir return and top gas scrubber cone return (to the right of the clarifier)

REFERENCES

Degassers for process water were already implemented by Primetals Technologies at the Midrex plant of voestalpine Texas (see Fig. 2) as well as at several COREX®/FINEX® plants (see Fig. 3). These plants have been in operation for many years. Based on the excellent operational results, the described degasser systems are being considered for installation in additional Midrex plants such as for the Cleveland-Cliffs HBI project.

Primetals Technologies has developed degasser designs for the process water systems of its COREX and FINEX technology starting in the late 1990s. Due to the similarity of the process water technology, this proprietary degasser technology was also implemented in Midrex direct reduction plants.



Fig. 3: Degassers at a COREX® plant for forced degassing of process water return

MAIN BENEFITS

The following advantages can be achieved with the installation of process water degassers:

- Removal of CO₂ from the process water return from the top gas scrubber with a degasser in front of the clarifier can increase the pH value by approx. 1.0 upstream of the clarifier.
- Better precipitation of solids in the clarifier is thus achieved.
- Fewer additions of caustic soda and acid (or none at all) are required.
- Suspended solids, are reduced by >50%, which means less required cleaning of water systems (water ponds, scrubbers, heat exchanger). This results in higher plant availability and lower maintenance costs.
- The quality of blow-down water (waste water) is improved.
- Less silt accumulates in the cooling tower sump, the cooling tower structure as in the well as process-water supply lines.
- Scaling in piping systems is significantly reduced.
- Soluble iron levels are decreased by >50%.
- Less diffuse CO emissions at the clarifier feed box, clarifier and process classifier
- Slight decrease of process cooling water temperature (effect of small cooling tower).

Thanks to chemical savings and reduced downtime required for cleaning, the payback period for process-water degassers from Primetals Technologies can be expected to be less than one year. The degasser systems can be also retrofitted in existing Midrex plants.

Primetals Technologies Austria GmbH
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Turmstrasse 44 | 4031 Linz | Austria
primetals.com

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