

MTAG



SWITZERLAND

LUZERN • NEW YORK • SHANGHAI



Secondary Metallurgy Expertise

VENTUS

Vacuum Steel Degassing Using Dry, Mechanical Pumps



MTAG Switzerland is the market leader in the field of steel degassing plants equipped with dry mechanical pumps. Our plants' design benefits from integrating **experience, innovation** and **technology**, the 3 main pillars of our business.

Experience

Our company has supplied more than 63% of the steel degassing plants equipped with dry mechanical pumps worldwide. Our expertise covers all types of degassing processes like VD, VOD, RH, VT, VD-OB and VCD. The largest RH installation equipped with dry mechanical pumps (260 tons RH) in the world was supplied by us.

Innovation

Our technology was designed for large-scale production as a worldwide premiere in the year 2000, opening the way to progress for the entire steel industry. Driven by forward thinking and a vision centered on progress, our plant services lead the way to innovation ever since.

Technology

We are using the state of the art technology in dry mechanical vacuum pumps adapted to steel degassing processes.



Vacuum steel degassing process for high quality steel grades

Elements such as Nitrogen, Hydrogen and Oxygen largely determine the mechanical properties of steel in the final product.

The Vacuum Degassing Process leads to a reduction of these dissolved elements, providing high quality steel grades.

The strategic reason for starting a VD- project is the increasing challenge to enter additional steel supply markets, either with a horizontal market-approach, by the penetration of new end-user product fields or with a vertical market-approach, by offering significantly improved quality within an existing steel grade mix. During recent years, improved vacuum technology has become more and more accepted as a highly effective method to meet the demands of such market fields.

Vacuum degassing is performed for steels with limitations on the content of hydrogen, nitrogen, sulphur and oxygen. Additionally, the process is used for steel-grades alloyed with chromium, molybdenum and vanadium.

The beneficial effect of the vacuum degassing process is a significant improvement of the steel desulphurization and reduction of non-metallic inclusions.

The vacuum technology of special steels production gives also the possibility of reaching low carbon levels in the presence of a reactive slag.

The VOD process is the key step for the production of special stainless steel grades.





Dry mechanical pumps vs. steam ejectors

Steam Ejectors have been in the past the industry's choice for vacuum generation in the steel industry.

Steam ejectors have significant operational cost disadvantages (due to their high energy consumption during steam generation), are pollutant (containing liquid effluent a bi-product of the ejector operation), and have high maintenance costs (due to time consuming cleaning process).

Thus the development of Dry Mechanical Vacuum Pumping Systems has become a value added alternative.

Dry Mechanical Vacuum Pumps with their efficient and safe control, enable improved processing of heavy metallurgical reactions. By using tailor made pump-down programs, the process is optimized to the required quality level. In addition, a significant improvement in the recurrence of the degassing process is achieved and harmful discharges are avoided.



Vacuum solution

The master expertise of MTAG Switzerland

There are several processes available today for degassing, such as the voluminous vacuum circulation process – RH degassing – where the melt is exposed to vacuum in a separate vessel, versus the less voluminous and more flexible VD tank degassing, where the stirred melt remains in the ladle.



Dry mechanical pumps are highly recommended for all these different degassing processes, due to the significant process benefits and cost savings achieved.

MTAG Switzerland specializes in the following vacuum degassing processes:

- | | | | | | | | |
|---|------------|---|------------|---|------------|---|------------|
| 1 | VD | 2 | VCD | 3 | VOD | 4 | VOH |
| 5 | VMD | 6 | VAR | 7 | VAD | 8 | RH |



All of these processes demand precise **Process Control** for which the following requirements must be satisfied:

1. **Rapid Pump Down** - - A high pump performance is required in order to reach the partial pressure needed to start the desired reactions as soon as possible. This translates into temperature losses, which can be kept as low as possible.
2. **Maintaining the partial pressure** - In order to avoid the melt's over-foaming, the pressure must be kept under control and finely adjusted. These are requirements for achieving controlled reactions, which are only met by mechanical pumps with a variable suction capacity.
3. **Reaching a low vacuum pressure (medium vacuum)** - Certain elements can only be removed from the melt at low pressures, which requires that the medium vacuum phase is reached quickly.

Improved **atmosphere control**:

1. **Humidity** resulting from the refractory lining, the slag and any condensed water of the cooled equipment parts can be a severe handicap for the process. This mainly affects the pump down speed, foaming of the slag and reduction of the hydrogen content. Working without steam, the dry mechanical pumps solution is more efficient compared to other systems.
2. **Oxygen Injection** may generate large amounts of carbon monoxide. Clear control of the composition of emissions is important so that specific post combustion can be initiated if necessary.
3. **Metal Vapors** from the melt and refractory lining should be oxidized in a controlled manner or, if chilled for metal recovery, be precipitated specifically. This requires the relevant ventilation devices using air or gas insert.

Advantages of MTAG Switzerland's vacuum degassing plants

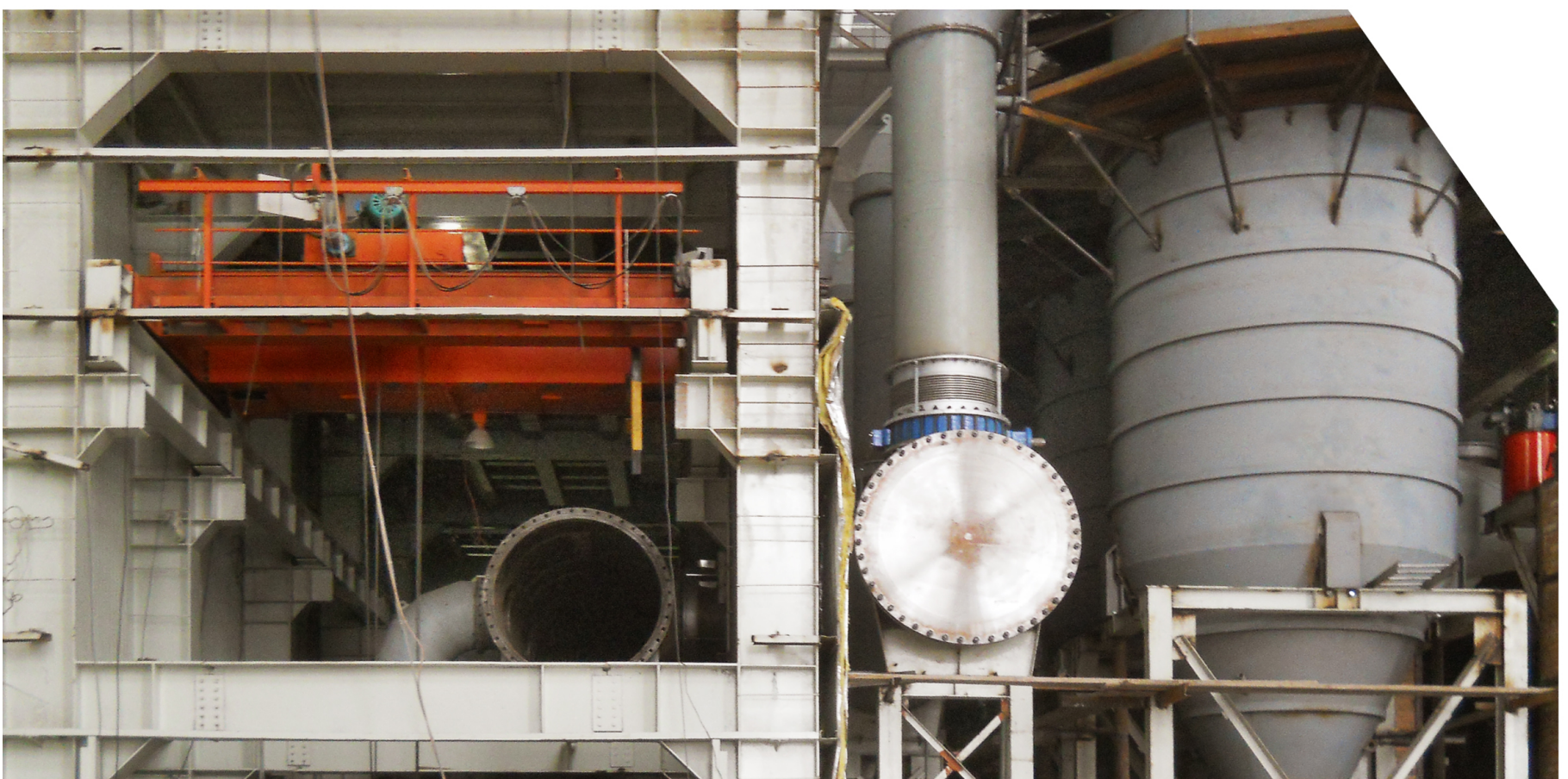
- **Significant Savings in Running Costs:** Low Energy Consumption
- **Improved control and automation** of the different degassing processes
- **Low Maintenance**
- **Better Environmental Impact:** No contaminated water effluent; clean exhaust gas
- **Designed to meet all EU environmental regulations**
- **Advanced Design Based on Process Simulation:** Computer modeling of the process combined with pumping process simulation allows the precise calculation of the required pumping capacity, the proper design of the pumping system structure, and the accurate prediction of the degassing process performance (example: Pump down time and vacuum level; expected value of H, N, C, O final concentration in the steel)
- **Tailored Pump Layouts:** A range of more than 25 different pumps that can be customized and configured, according to the clients' requirements. This enables us to assemble configurations that satisfy large suction capacities and pumping speeds. Tailor made pump down curves enable a better control of metallurgical reactions and are defined with the client according to specific process conditions (Steel grade, Freeboard, Degassing Times).



Our rapid pump-down allows for smaller temperature losses and an overall longer low vacuum phase, thus lowering the cost for overheating the melt in the LF and increasing the quality by longer fine vacuum treatment times.

- **Optimal Compression for Energy Efficiency:** The design of our multiple stage mechanical pump sets, which provides optimal compression due to their distribution across 3 to 4 stages, leads to a substantial reduction in energy consumption. The efficiency of the pumps can be fully utilized at a minimum increase in temperature, which means that the pumps do not have to be operated permanently at maximum speed. As a result, the operating life of the mechanical elements such as bearings and seals is considerably extended.
- **Simple and Safe Dust Management:** Our Innovative filtration equipment successfully handles fine dust safely and with an almost perfect dust separation. Coupled with a very small drop in pressure, our filtration system is designed to withstand the harsh condition of the process without being damaged by the temperature and ignition of said dust.
- **Fully Automated:** Two levels of automation are used in our process: Level 1 and Level 2 Automation Layer. Our Level 1, either fully automatic or fully manual, provides full control of the installation. Level 1 Automation logs and reports functional and process values and also generates, logs and reports different messages - alarms, faults, warnings, statuses etc. The first level of Automation has 2 components: HMI component – human-machine interface, and PLC component, programmable logic controller. On the other hand, our Level 2 Automation Layer for Steel Vacuum Treatment Plants provides comprehensive monitoring of the metallurgical parameters such as: steel temperature, hydrogen, nitrogen, sulphur concentrations.
- **Expansion Options:** The layout of the valves, filter unit and the vacuum pumps is designed to allow the future expansion of the plant for an increased capacity at any time.





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MTAG Technology aims to meet and exceed today's growing global demand for more efficient, eco-friendly and sustainable solutions based on integrating experience, innovation and technology. We proudly offer complete plant services, from Engineering, Implementation in the layout, Feasibility Studies, Functional Analysis, Process Technology, Automation, Documentation, Manufacturing, Supply, Erection and Commissioning, to Training and After Sales Service for steelworks internationally.

Together We Define the Future



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