Nash Vacuum Pumps & Jet Ejectors for Steel Degassing

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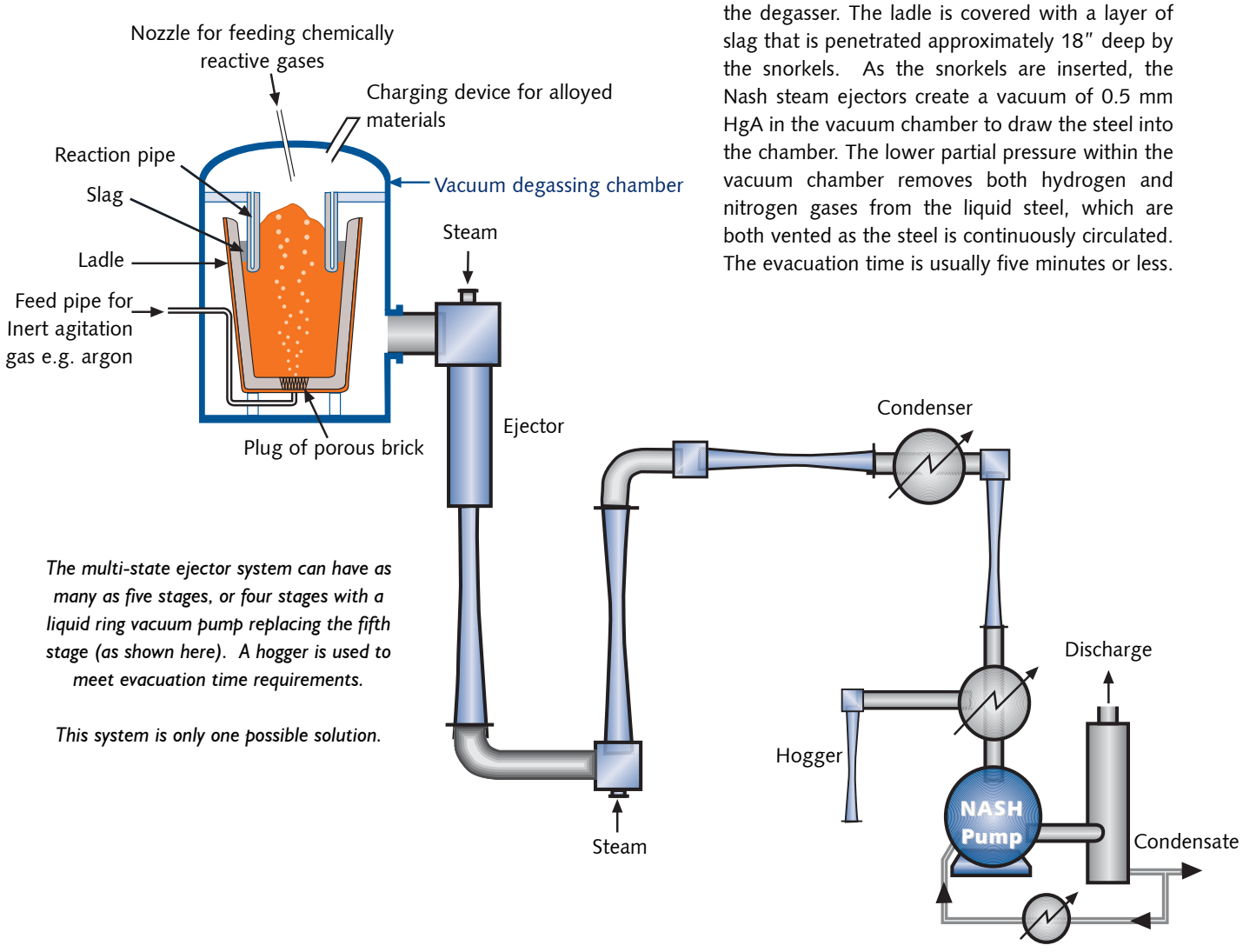
Stronger, higher quality steel results when the molten steel is treated under vacuum

Steel Degassing

Vacuum degassing of steel takes place after the molten steel has left the furnace and before the steel is poured into ingots or processed through a caster. The main objectives of steel degassing are:

- Reduction/elimination of dissolved gases, especially hydrogen and nitrogen
- Reduction of dissolved carbon for more ductile steel
- Preferential oxidation of dissolved carbon over chromium when refining stainless steel grades

After leaving the furnace, molten steel is moved in a ladle to the degassing area and positioned inside the degasser. The ladle is covered with a layer of slag that is penetrated approximately 18" deep by the snorkels. As the snorkels are inserted, the Nash steam ejectors create a vacuum of 0.5 mm HgA in the vacuum chamber to draw the steel into the chamber. The lower partial pressure within the vacuum chamber removes both hydrogen and nitrogen gases from the liquid steel, which are both vented as the steel is continuously circulated. The evacuation time is usually five minutes or less.



The multi-state ejector system can have as many as five stages, or four stages with a liquid ring vacuum pump replacing the fifth stage (as shown here). A hogger is used to meet evacuation time requirements.

This system is only one possible solution.

Types of Steel Degassing

There are three basic types of vacuum degassers: stream, recirculation and ladle. The system choice is determined by many factors, including the primary objective of the degassing, capital investment costs, operating costs, temperature losses, tonnage throughput, space availability and turnaround time. All types of systems take place in a vacuum chamber, and the vacuum is created by multi-stage Nash steam jet ejectors, often in combination with a Nash liquid ring vacuum pump.

The steel degassing process requires:

- rapid evacuation of the vacuum tank
- maintenance of vacuum while at the same time sucking out a heavy flow of inert gas
- immediate availability
- dust resistance
- safe operation under harsh conditions

Designing the vacuum pumping system

In order to design your degassing system, you will need the following information:

- The quantity of dissolved gases to be removed. Absolute pressure, steel chemistry and argon flow rate will all affect the rates at which the gases will be removed
- The load at system design pressure in Dry Air Equivalent
- The load the system needs to meet at different pressures (if required by out gassing system)
- The system volume
- The process time requirement to go from atmosphere to deep vacuum
- The final absolute pressure of the system. This will determine how many stages are needed
- The quantity of argon required. This will determine the agitation energy and the rate of dissolved gas removal
- The in-leakage rate of air into the system
- The steam pressure and temperature
- The cooling water temperature
- The cost of steam and electricity

Each degassing system is designed to meet the steel mill's specific requirements. 100 years of design experience with liquid ring pumps and steam jet ejectors makes Nash the top choice for your system. Steam jets work on a constant mass flow basis, while liquid ring vacuum pumps work on a constant volume basis. Used together, an economic break-even point may be reached to take advantage of the best characteristics of each. Your Nash engineer can help you determine the optimal solution.

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