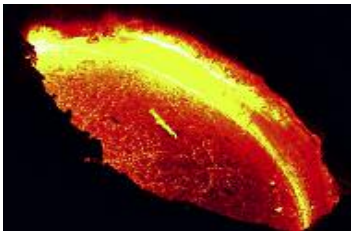
SMS group

EFFICIENT VACUUM CONVERTER FOR INDIVIDUAL NEEDS

Refined steels and ferroalloys



X-MELT® VACUUM CONVERTER

Producing special steels and ferroalloys

SMS group has specially developed the vacuum converter for the production of stainless, acid-resistant and heat-resistant steel grades as well as for high-alloy special steel grades.
It can also be used for medium- and low-carbon ferromanganese and ferrochrome. Lowest contents of carbon, nitrogen and hydrogen can be achieved.
By using CO_2 as reaction gas with a strong cooling effect and vacuum decarburization, steel producers save on metallic coolants when treating ferrochrome and ferromanganese and minimize the consumption of argon.
The entire process engineering aims to achieve the lowest operating costs.

PROCESSES AND PRODUCTS

Special & tool steel
- Hot-working steel
- Cold-working steel
- High-speed steel
- Special-purpose steel
- High-temperature steel

Stainless steel
- Austenitic grades
- Ferritic grades
- Martensitic grades
- Duplex steel

Ferroalloys
- MC + LC Ferrochrome
- Ferromanganese
- Ferronickel

Steel produced in the vacuum converter can be used for
- Power plants
- Shipbuilding
- Aircraft industry
- Offshore equipment
- Special applications defense

A gainful coalition
Thanks to the combination of two processes in one vessel, investment costs can be reduced. Moreover, this process offers metallurgical advantages at lower production costs.

CAPEX
Reduce investment costs

Metallurgical equipment

Vacuum Converter	- 35 %*

Civil construction

Vacuum Converter	- 30 %*

* Compared to AOD + VOD

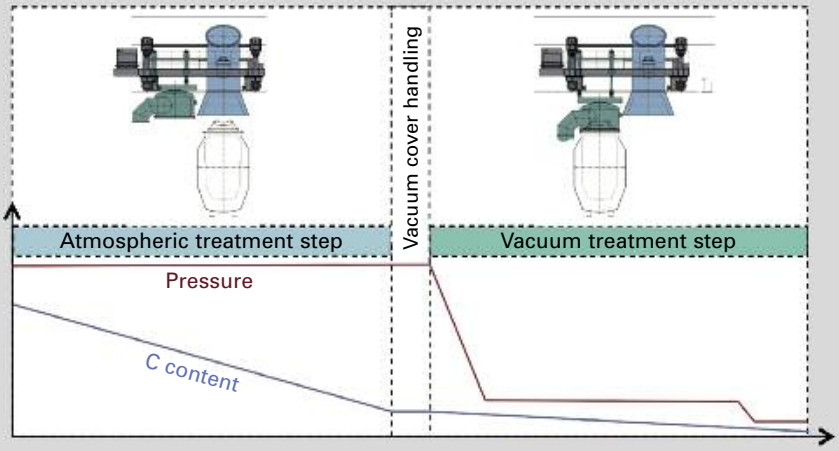
METALLURGICAL PROCESS

During the main decarburization phase, the exhaust elbow is positioned above the converter. The decarburization speed is determined by the amount of oxygen that is injected.
Unlike in the conventional AOD process, in the deep decarburization phase the reaction potential is not increased by the dilution with argon. Instead, with the vacuum converter, the pressure in the converter vessel is reduced by the vacuum hood that is positioned at the converter mouth.

METALLURGICAL CAPABILITIES OF THE VACUUM CONVERTER

- 98 percent chromium yield in stainless and special steel production.
- Ultra-low carbon, nitrogen and hydrogen contents
- 0.1 percent carbon in low-carbon ferrochrome production
- 0.5 percent carbon in low-carbon ferromanganese production

Example:
Decarburization process
The vacuum in the converter increases the reaction potential at such a rate that even small quantities of argon are sufficient for a deep decarburization of the melt.



SMS group successfully tests a new metallurgical vacuum converter process for the production of ferroalloys with lowest possible carbon contents

Together with our customer Kazchrome, SMS group has successfully tested the refining of ferrochromium high-carbon into ferrochromium medium-carbon in a vacuum converter. With these tests, conducted in January 2013 in a plant belonging to Metso Tampere in Finland, it was proven that the carbon content can be lowered significantly from 8 percent to less than 1 percent. The objective was to reduce the treatment time and lower the production costs by using the vacuum process.
With this objective, the process was operated both with carbon dioxide (CO_2) and inert gas. During the test a significant reduction of the coolant consumption FeCr MC was achieved.


The successful team at Metso, Finland.

HIGHER STEEL QUALITY – REDUCED PRODUCTION COSTS

For stainless steel, production in the vacuum converter allows the lowest values of carbon, nitrogen, hydrogen and free oxygen.

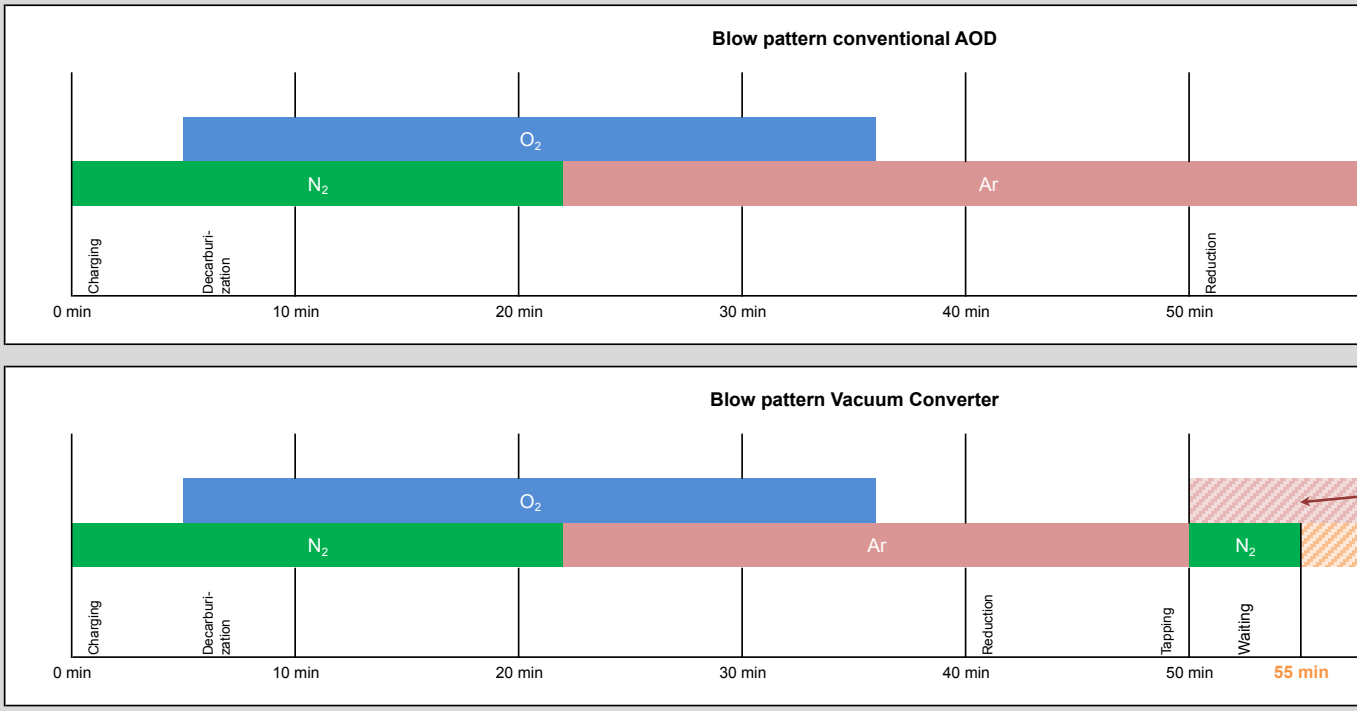
The lowest values of carbon can likewise be achieved for ferroalloys. Furthermore, significant cost savings can be achieved in comparison to other processes during the production process in the vacuum converter.

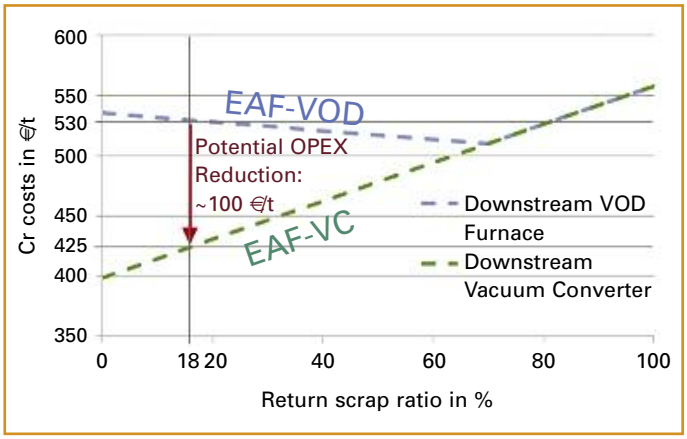
Stainless steel	
Carbon	~ 80 ppm
Nitrogen	~ 70 ppm
Hydrogen	< 2.5 ppm

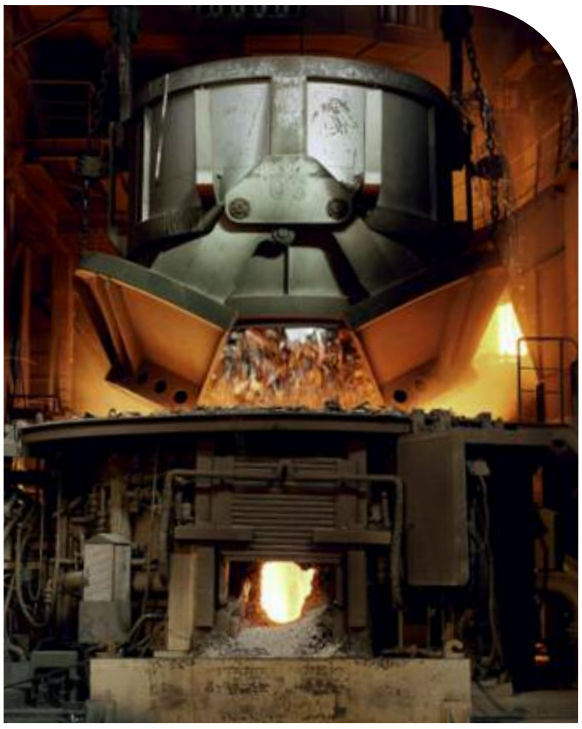
Ferroalloys	FeCr	FeMn
Carbon	0.1 %	< 0.5%
Savings	110 €/ t Cr	55 €/ t Mn

Savings during the process

Comparison between examples of AOD and VC blowing patterns for steel grade AISI 304L



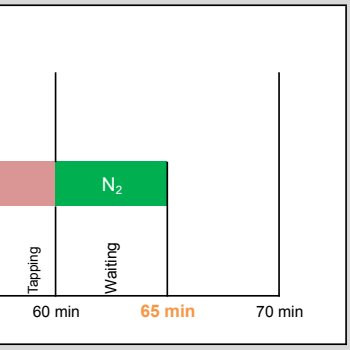


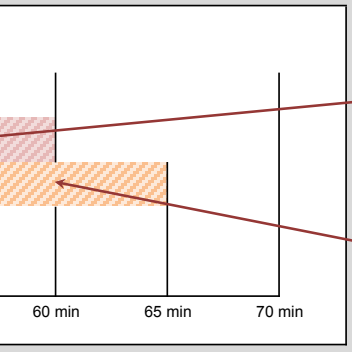


Further potential for savings can be generated in the upstream electric arc furnace. The decarburization speed in the vacuum converter is several times higher than that in a VOD facility. It is thus possible to use raw materials which have a significantly higher carbon content (e.g. FeCr HC).

Advantage: cost-effective ferroalloys with high carbon contents can also be used in the EAF. This can bring about savings of up to 100 Euros per ton in comparison to a VOD facility.

The overall duration of decarburization can be reduced and productivity correspondingly increased by up to 15%. Argon consumption is significantly reduced during deep decarburization under vacuum. In stainless-steel production, savings of up to 50% in Ar consumption are achieved compared to the AOD process.
Further savings are achievable in the production of MC ferroalloys since, in this case, argon can be completely replaced by CO_2.





VC Benefit 1: Argon savings up to 50%

VC Benefit 2: Production increase up to 15%

OPEX
Reduce operational costs

- Reduce tap to tap time

Vacuum Converter **- 5 %***

* Compared to AOD

- Reduce shell lining consumption

Vacuum Converter **- 75 %***

* Compared to AOD + VOD

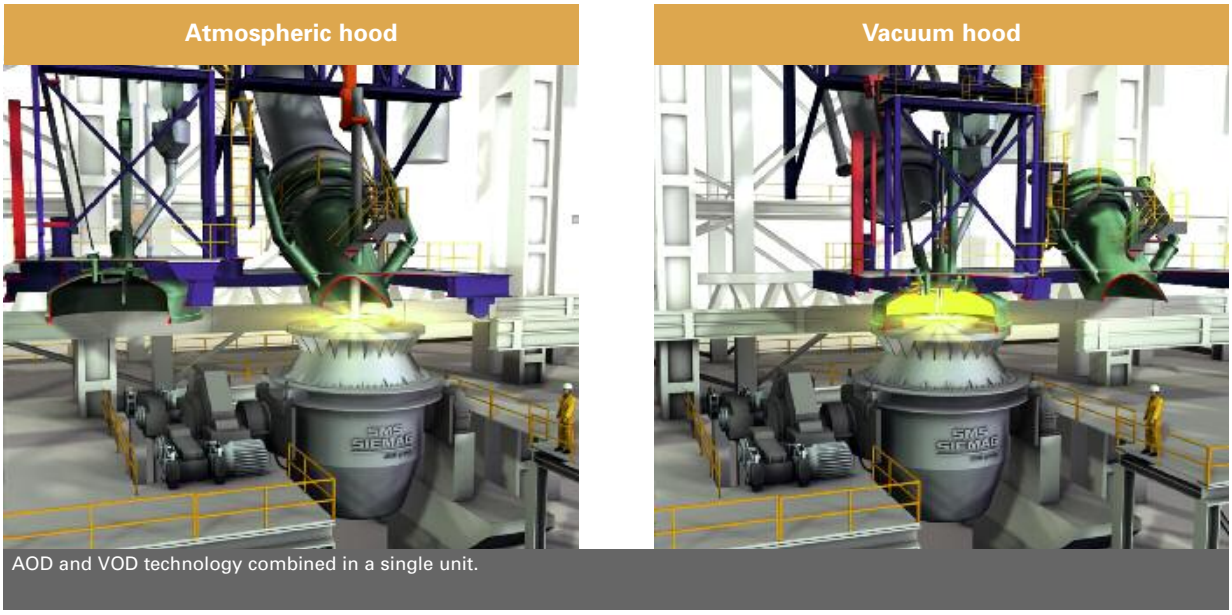
- Minimize heat loss

Vacuum Converter **- 5 %***

* Compared to VOD

- Reduce Argon consumption
- Reduce FeSi consumption

MODULAR STRUCTURE FOR OPTIMUM PROCESS CONTROL



AOD and VOD technology combined in a single unit.

A movable platform is installed above the converter vessel for a fast changeover between atmospheric and vacuum process. Both the exhaust elbow and the vacuum hood are installed on this platform. Instead of transporting the melt between the main decarburization under ambient pressure and the deep decarburization under vacuum, the exhaust elbow is moved and the vacuum hood placed on the converter vessel.
Both process steps are thus carried out by a single unit. Result: Reduced production time, minimized temperature losses and enhanced yield

STRUCTURE OF VACUUM CONVERTER

The vacuum converter is modular in design and enables targeted arrangement of the components for the production of the steel grades / ferro alloys in quantities desired by the customer. The following packages, each suitable for a particular application, can be selected:

Basic package – Vacuum converter

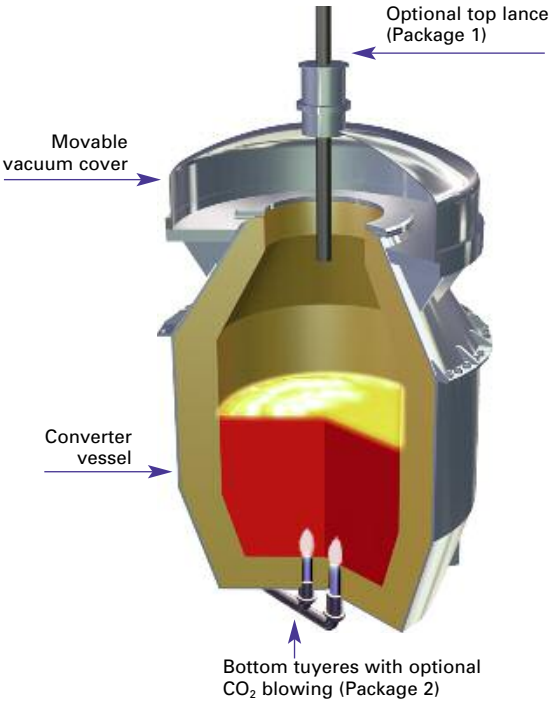
The basic package comprises the converter vessel including bottom tuyeres with two sliding hoods: one for atmospheric operation and one for vacuum operation.

Package 1
Vacuum converter + top lance

This package extends the basic version described above by a top lance for oxygen blowing, including valve station, hoisting equipment for the lance, lance changing equipment and cooling water system for lance cooling.
To be chosen if shortest tap-to-tap times are desired.

Package 2
Vacuum converter + CO_2 injection

In this version, the equipment is equal to the basic package above. The only modification is that the valve stand will be equipped with one additional line for CO_2 which will be used to substitute argon as process and/or shroud gas.
To be chosen if reduction of argon costs is desired.



	Configuration for meltshops (stainless and special steels)	Configuration for ferroalloy refining facilities
Basic package Vacuum converter	• Low carbon, nitrogen and hydrogen contents • Low free-oxygen level • Extended product range: austenitic, ferritic, martensitic and duplex steel grades; Ni-basic alloys	• Production of medium, low and ultra-low carbon grades • Added value by processing products with higher margins
	• Less trimming and repair work on castings • Reduced annealing time thanks to low hydrogen content	
	• Use of low-cost alloys in the EAF, leading to a reduction in raw-material costs for the entire process chain	
Package 1 VC + lance	• Higher productivity thanks to shorter tap-to-tap time*	• Higher productivity thanks to shorter tap-to-tap time
Package 2 VC + CO_2 blowing	• Lower operating costs as CO_2 is cheaper than argon*	• Lower operating costs as CO_2 is cheaper than argon
		• Reduced cooling material consumption thanks to high cooling effect of CO_2
		• Reduced operating costs and enhanced yield thanks to lower evaporation losses and better temperature control (continuous cooling vs. batch cooling)

* Economic efficiency has to be evaluated case-by-case.

SMS group GmbH
Metallurgical Plants and
Environmental Technology

Eduard-Schloemann-Strasse 4
40237 Düsseldorf, Germany

Phone: +49 211 881-6638
Telefax: +49 211 881-6143

E-mail: Steelmaking@sms-group.com
Internet: www.sms-group.com

H2-309E