



RHI MAGNESITA

STEEL / CONVERTER

Basic Oxygen Furnace



There for you, wherever you need us



The more closely we work with our customers, the greater the impact we can make for them. So a global network of offices, research centers, and production sites is important to us, and to them. We are continuously extending our global reach to be closer to even more customers.

Being closer to customers doesn't just mean we can be more responsive to their needs. It also helps us to listen better — to understand their concerns, cultures and ways of working. It makes us alert to new ways of thinking and ideas that enable us to deliver even better advice, services, and solutions.

Our exceptional resources and expertise extend far beyond making and selling products. We provide solutions to customers worldwide for cover projects, material specifications, thermal studies, numerical simulations, follow-ups and technical support in application of minerals, and maintenance and electromechanical services for refractory equipment.

35
Main production and
raw material sites

70
Sales offices

180
Countries shipped
to worldwide

North
America

3 COUNTRIES
1 R&D CENTER

South
America

6 COUNTRIES
1 R&D HUB

Middle East/
Africa

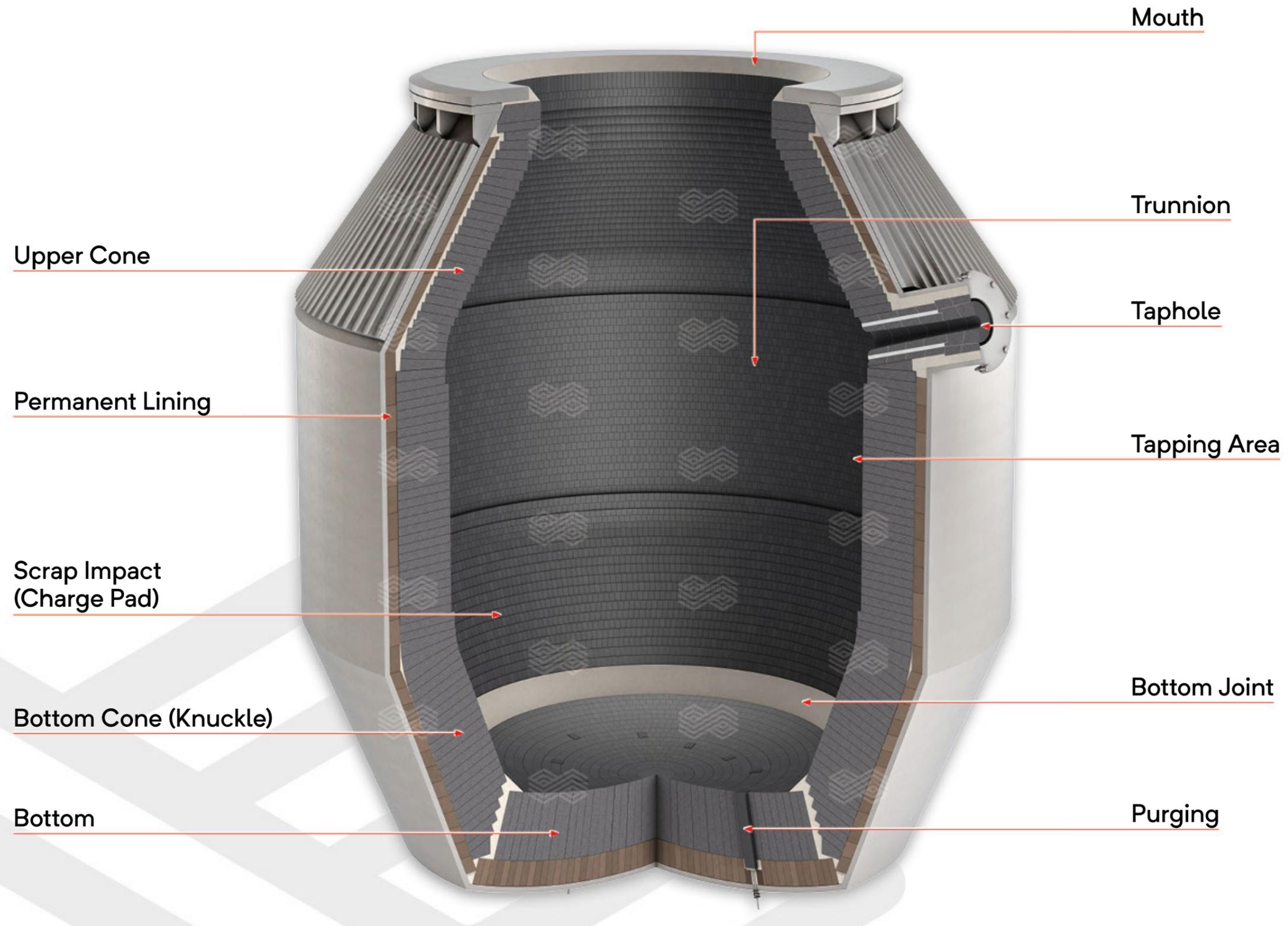
17 COUNTRIES
1 R&D HUB
1 R&D CENTER

Asia
Pacific

9 COUNTRIES
3 R&D CENTERS

2 COUNTRIES

The Basic Oxygen Furnace



Optimized Lining for BOF

RHI Magnesita provides lining concepts which are suited to the customer-specific converter operation and process conditions. Both carbon-bonded and synthetic resin-bonded bricks are offered as required. Highest campaign lifetime levels can be achieved in combination with the specifically adapted RHI Magnesita maintenance concepts.

Upper Cone
ANCARBON

Permanent Lining
ANKER

**Scrap Impact
(Charge Pad)**
ANCARBON

Bottom Cone (Knuckle)
ANCARBON

Bottom
ANCARBON

Mouth
ANKER
ANCARBON

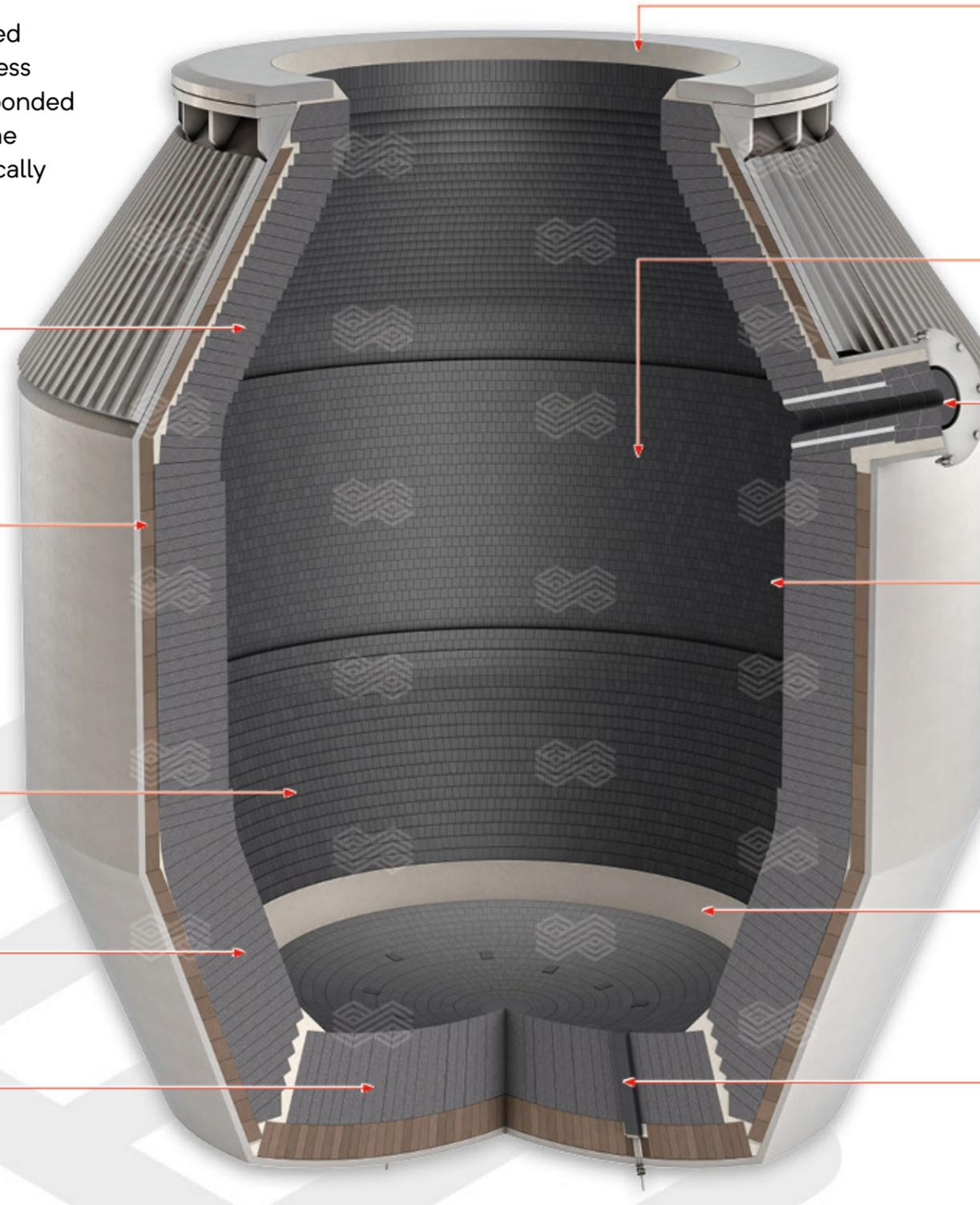
Trunnion
ANCARBON

Taphole
ANKERBLOCK
ANKERTAP

Tapping Area
ANCARBON

Bottom Joint
ANKERTAR

Purging
ANKERPERM



Product Variety of Bricks & Mixes for the BOF

ANKER

Fired Magnesia Bricks

- Compatible with basic slags
- Niche products restricted to special applications – commonly used in converter safety linings
- With carbon impregnation used in the mouth area of BOF

ANCARBON

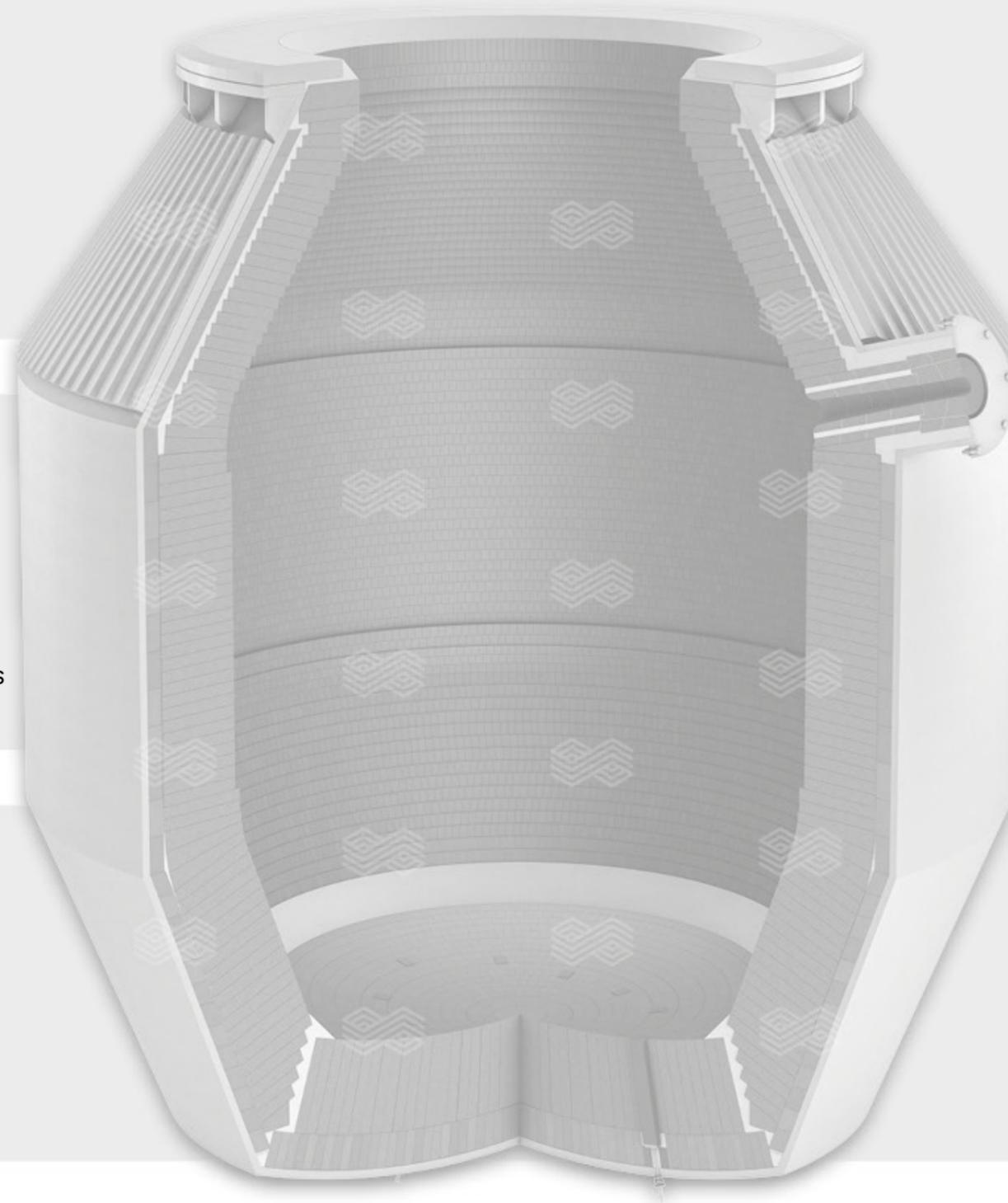
Magnesia Carbon Bricks

- Very high refractoriness
- Unparalleled versatility for various and even changing process conditions
- Commonly used in BOF
- Available in many different raw material combinations and special treatments (e.g. carbon impregnation)

RUBINIT, ANKERJET, ANKERREP, ANKERTAR, ANKERMIX, etc.

Basic Mixes

- Wide range of characteristics available for gunning, ramming and patching.



Content



Lining



Purging



Tapping



Solutions



Maintenance



BOF Lining Installation

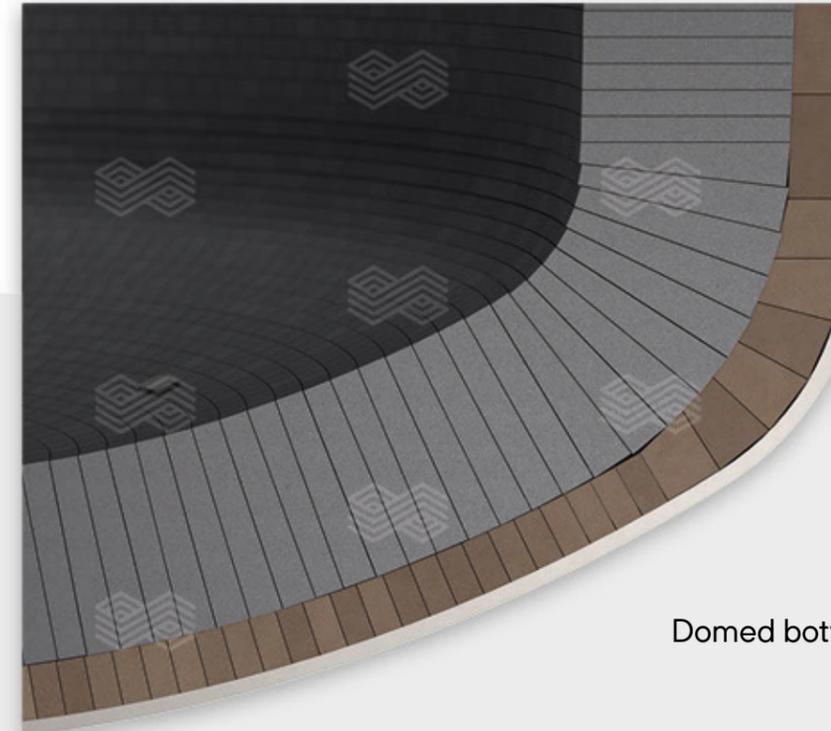
In order to minimize the time required for installation of the lining, RHI Magnesita offers individual concepts which reduce the duration of lining work significantly.

The following individual measures are combined optimally depending on customer requirements:

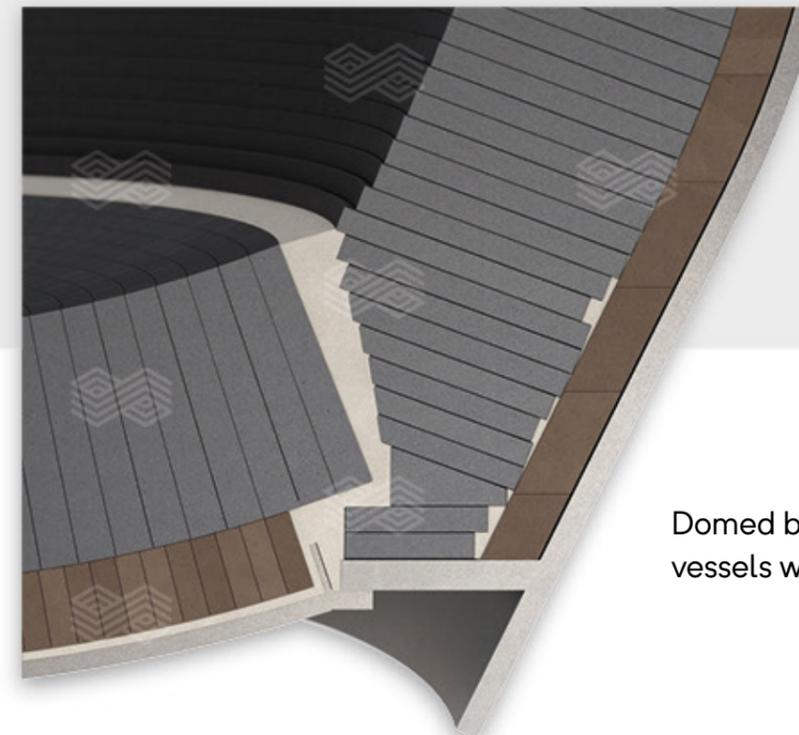
- Simplification of the lining concept — fewer shapes and grades
- Better use of space on the pallets
- Mixed pallets (several shapes on one pallet)
- Special shapes and solutions (domed bottom)
- Logistic measures (e.g. storage, shift model, etc.)

Domed Bottom Design

- Problematic bottom joint area is eliminated
- Substantial stress reduction
- Suitable for removable bottoms, an exact and precise bottom joint is used, which greatly contributes to the stabilization of the bottom.



Domed bottom standard design



Domed bottom standard design for vessels with removable bottom

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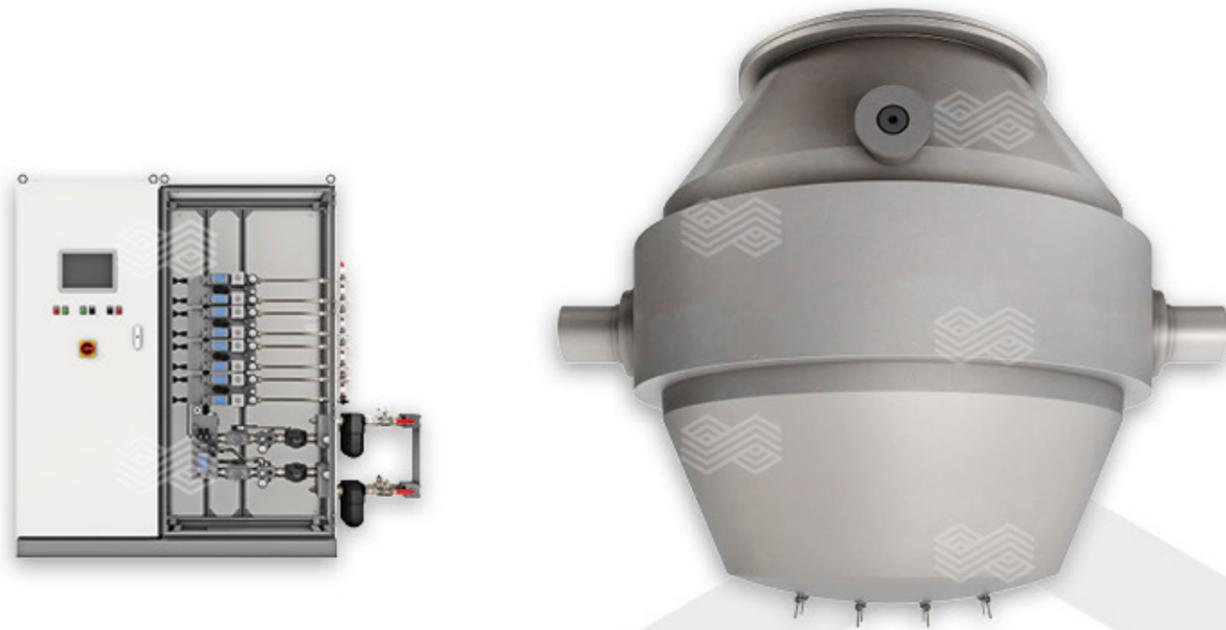
Maintenance



Purging

The BOF bottom purging system consists of:

- Purging plugs
- INTERSTOP Gas Control Box Type "CIP"
- Gas and control station
- Visualization, archival storage and supervision of process data



Purging Plugs

RHI Magnesita offers standard single hole plugs and state-of-the-art multi hole plugs.

Customers benefit from

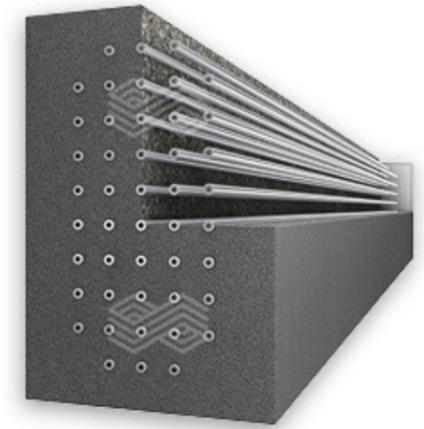
- Know-how and expertise
- Development of optimized purging plug arrangement
- Design based on metallurgical requirements
- Recommendations for purging programs
- Installation instructions
- Installation and commissioning

SHP (Single Hole Plug)

Common inner pipe diameter: 4 to 8 mm

MHP (Multi Hole Plug)

Common pipe quantity: 18, 24, 32, 46 or 100 with a pipe inner diameter of 2 mm



Taphole System Overview

HYFLO C

The HYFLO C taphole represents the latest evolutionary stage of BOF tapholes and was especially tailored to the demands of slag detection devices, e.g. IR cameras, and slag prevention systems, e.g. pneumatical slag stopper.

TBD Taphole Changing Unit

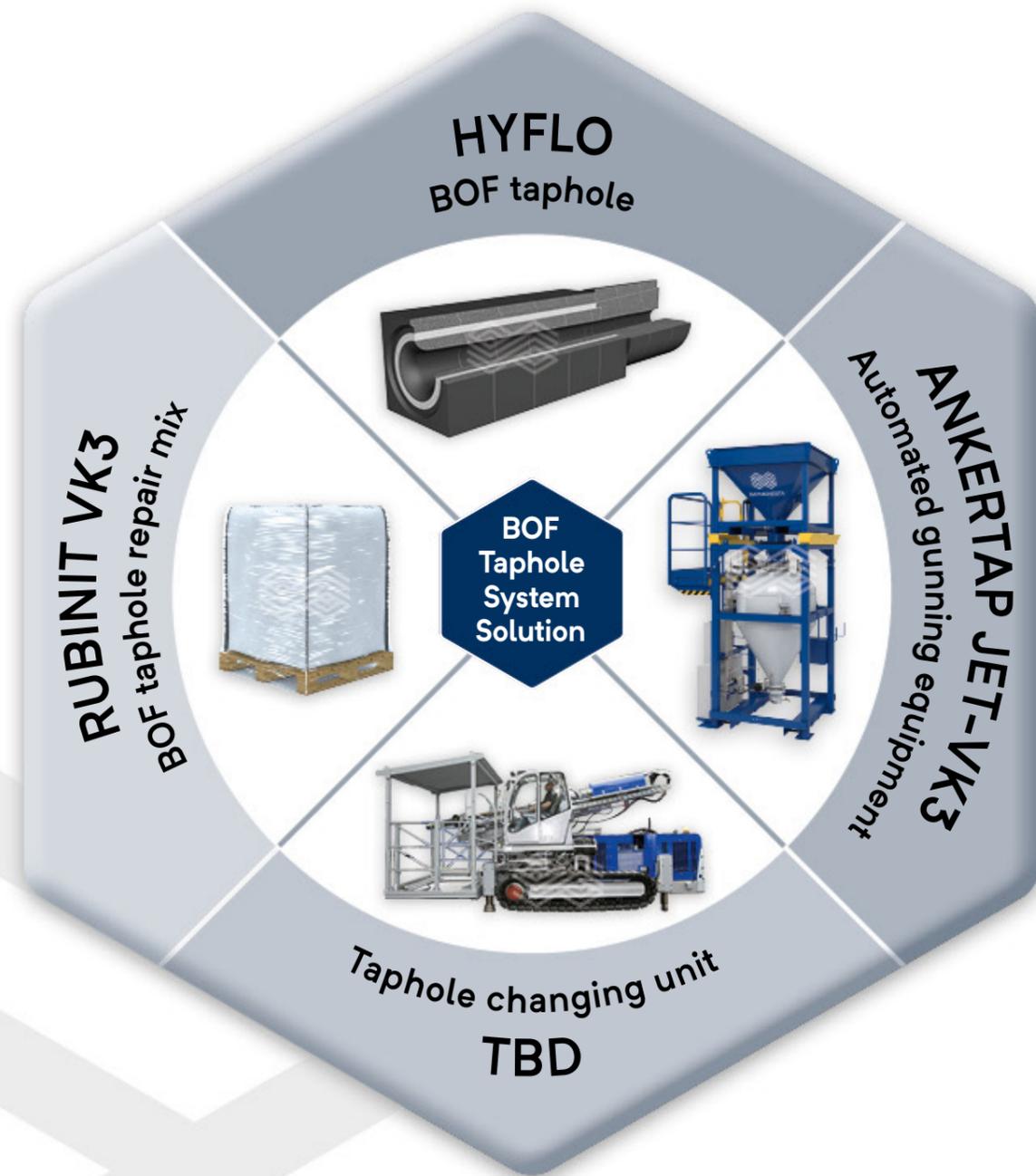
The TBD has been developed for a rapid and efficient change of worn taphole repairsets.

RUBINIT VK3

RUBINIT VK3 represents the BOF taphole premium repair mix with highest performance.

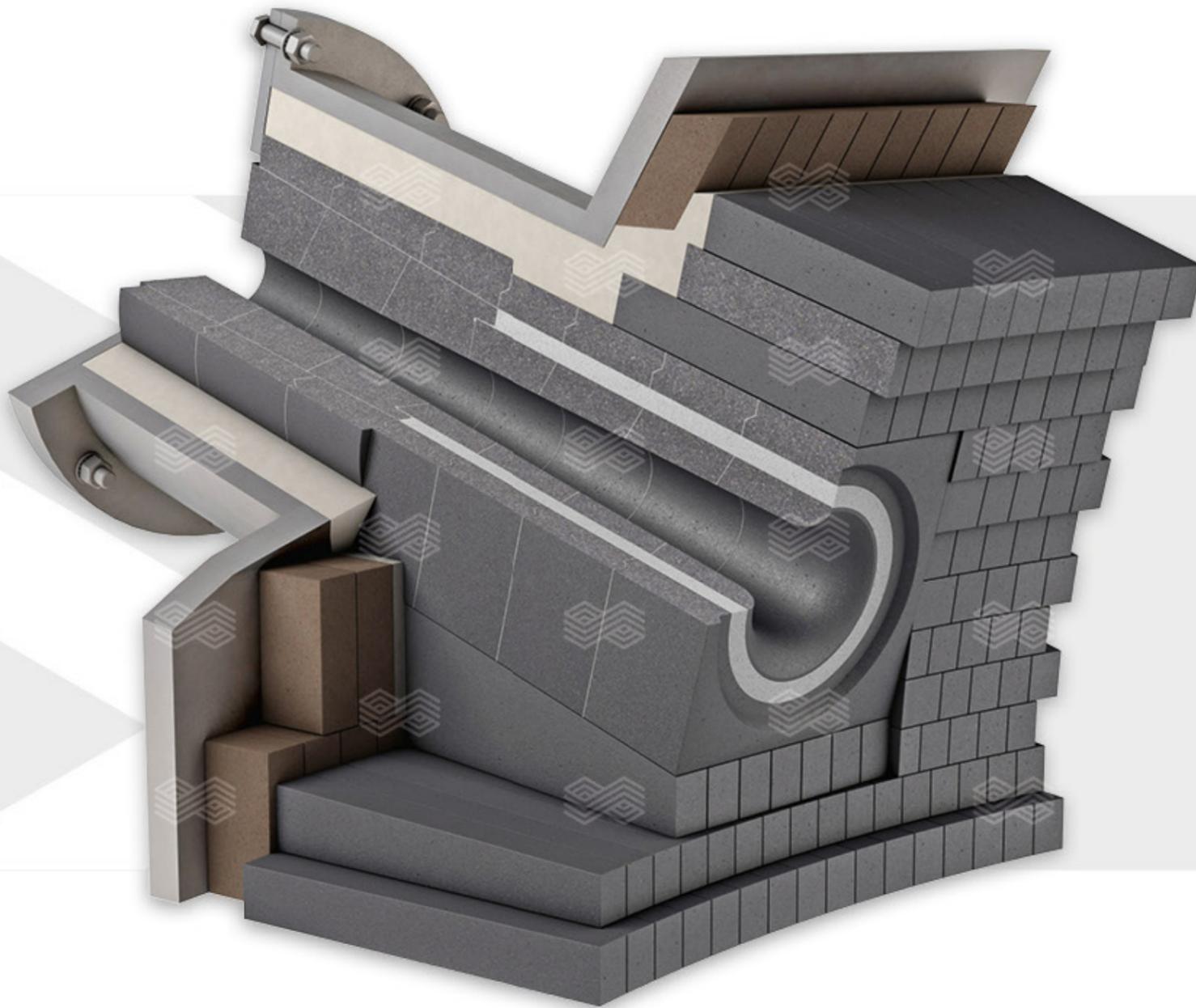
ANKERTAP JET-VK3 Automated Gunning Equipment

Automated BOF taphole gunning process for RUBINIT VK3 with programmed water adjustment according to mix feed rate.



A perfect setup between all components is necessary

Taphole System HYFLO C



HYFLO C

The HYFLO C taphole represents the latest evolutionary stage of BOF tapholes and was especially tailored to the demands of slag detection devices, e.g. IR-cameras, and slag prevention systems, e.g. pneumatical slag stopper.

RHI Magnesita is able to provide optimal solutions tailored to customers' requirements, ranging from the smallest to largest converter vessel up to 400 mto tapping weight.

Advantages

- Maximized taphole lifetime
- Self-centering repair sets
- Massive outlet sleeve
- Compact and bundled tapping stream
- Later appearance of the vortex effect
- Patented channel design
- Shorter annular gap (less mix needed and shorter drying time)

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Taphole System Automated Repair Equipment

Premium mix RUBINIT VK3 is a key factor to avoid steel penetrations in the annular gap especially for long life time converter campaigns.

RUBINIT VK3



Advantages

- Customized gunning equipment
- Programmed water adjustment according to feed rate
- Perfect mix consistency
- No steel penetration in the annular gap
- Low drying time
- Reduced taphole repair time
- Higher converter availability
- Automatic filling system
- Load cells & water management
- Update of existing gunning machine possible
- Gunning time 5-7 minutes
- Drying time 5-10 minutes

Programmed and efficient gunning process with perfect water consistency with RUBINIT VK3.

ANKERTAP JET-VK3



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Taphole System TBD (Taphole Changing Unit)

The TBD has been developed for a rapid and efficient change of worn taphole repairsets.

Due to the steady increase in converter life time during the past years, a taphole repair method that is gentle to the taphole surrounding elements is of great importance for converter availability.

BOF Taphole Repair Procedure

- Quick and precise positioning of the TBD unit in front of the BOF taphole
- Efficient removal of worn taphole sleeves by counter-percussion technique
- Precise insertion and fixation of new taphole repair set
- Gunning of the remaining annular gap

Advantages

- Individual adaptation of the machine to customer's requirements
- Quick and precise removal of worn taphole sleeves
- Gentle to the taphole surrounding elements
- Highest safety standards
- One-man operation
- Increased converter availability



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Augmented Reality and Virtual Reality Device for TBD Maintenance

What?

- Virtual reality (VR) training about TBD and BOF taphole
- Step-by-step guidance and (remote) assistance during removal of old and installation of new taphole sleeves with augmented reality (AR) device
- Remote assistance during maintenance work of machine with AR device

Why?

- The close interaction between refractory material and machine is visible
- Immediate (remote) assistance during removal/installation/maintenance is possible
- Regular training and practicing independent of availability of real machine and converter
- Time for installation/maintenance as well as time for training can be reduced due to immediate remote assistance
- Videos are available at any time for refreshing the knowledge
- Practicing correct handling in a secure environment and addressing safety aspects

How?

- Virtual reality device for training before working at customer site
- Augmented reality device for remote assistance at customer site



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APO Automated Process Optimization

Fostering a greater understanding of the correlation between steel production parameters, maintenance and refractory by analyzing data on a central master computer, using artificial intelligence methods.



Easily accessible via mobile devices



Example of APO lifetime prediction

Customer Challenges

- Unforeseen downtimes / excessive maintenance — casting interruption and delayed delivery
- Inefficient processes — increased energy costs
- Unsafe operations

APO Value Proposition

- Digital refractory wear model
- Identification of wear influencing parameters
- Refractory benchmarking
- Automated maintenance

Customer Benefits

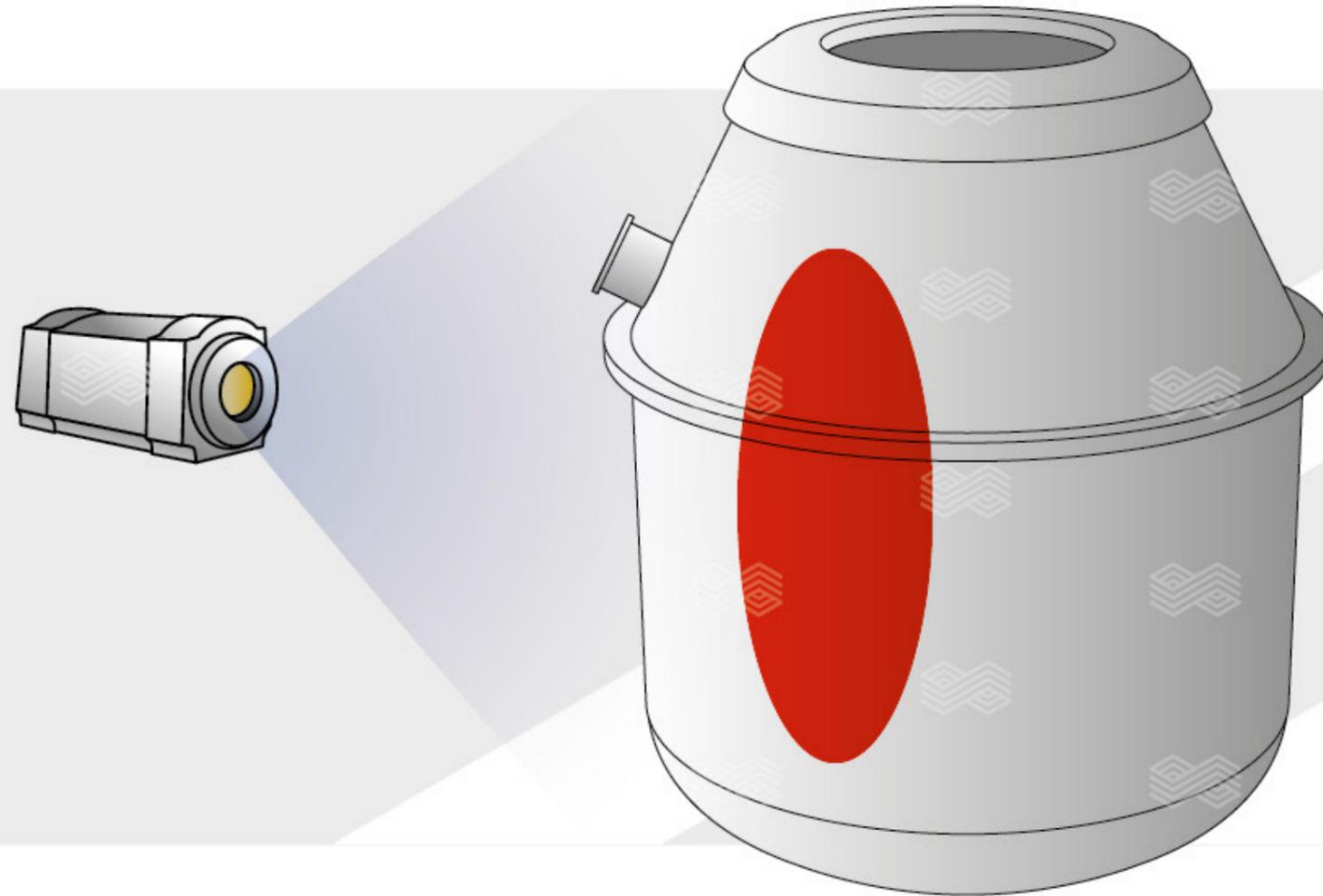
- Matching refractory cycles with plant cycles enables better use of refractory and reduces refractory waste
- Optimized plant scheduling and saves energy costs
- Increased operational safety

VISIR-FurnaceSafe

Furnace breakout prevention

User Benefits & Advantages

- Early "hot spot" detection and warning
- Used with LF, RH, EAF, AOD, LD/BOF
- Historical database open to process metallurgist



More Information



Content	Lining	Purging	Tapping	Solutions	Maintenance
					

Modern Converter Maintenance

As a supplier of high-grade refractory products, RHI Magnesita develops innovative solutions for products and machinery to ensure best converter maintenance. These developments are best implemented in close cooperation with our customers in order to guarantee optimal solutions.

Converter Maintenance has Several Objectives

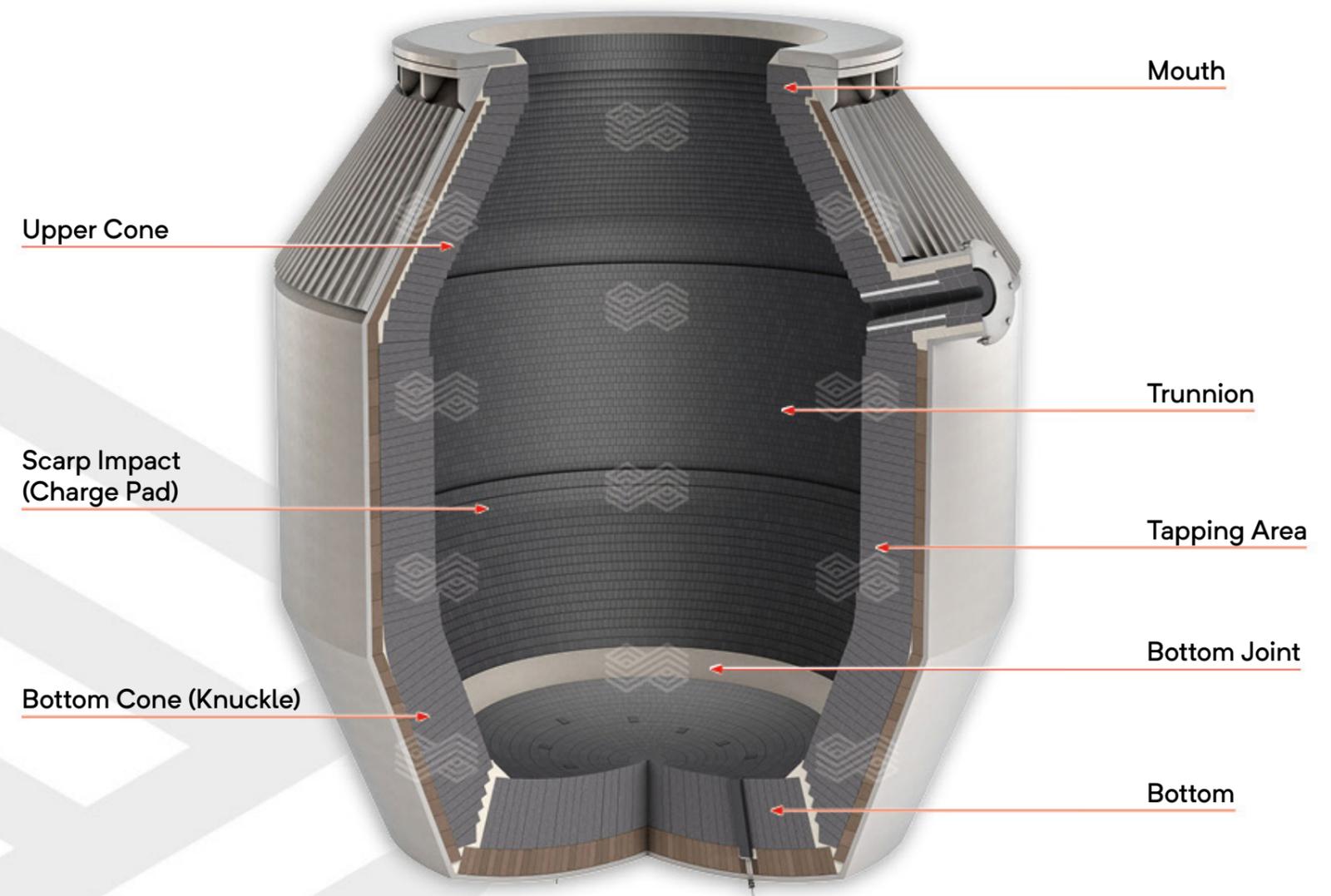
- Reduced specific refractory consumption
- Repair of areas with premature wear
- Increase in operational safety
- Longer life time
- Observance of scheduled lining cycles

RHI Magnesita Offers

- Competent analysis and consultation
- High-end refractory mixes
- Specially designed machinery
- Experienced service technicians
- Complete systems consisting of material + machine + man

Application	Mouth	Upper cone	Scrap impact	Trunnion	Tapping area	Bottom cone	Bottom joint	Bottom
Manipulator gunning	••	••	••	••	••	••	••	••
Manual gunning	••	••	•	•	•	•	•	•
Slag coating			•••		•••		•	••
Slag splashing		•	•	•	•	••	••	••
Patching / Hot repair			•••		•••		•	••

• Suitability



ANKERJET A

Application:

Multi-purpose pressure vessel machine for basic and non-basic mixes

Advantages:

- Useable in a variety of aggregates
- Consumption data recording
- Different equipment variants available (e.g. load cells, detachable silo, ...)
- Charging by crane or forklift
- Low maintenance and wear costs
- Easy-to-use automatic and manual operation
- Transportable by crane and forklift



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SHOOTER

Application:

For rapid gunning repairs in the BOF

Advantages:

- High flow rate ensures short repair times
- Highly accurate gunning repair
- Semi- and fully automatic gunning operation
- Increased BOF availability
- Less physical strain on operating personnel
- Small turning radius due to crawler chassis
- Gunning lance endlessly rotatable
- Shooter can be operated by cable and radio remote control



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GEKKO BOF

Application:

For rapid gunning repairs in the BOF

Advantages:

- Precise gunning repair
- Less physical strain on operating personnel
- Increased BOF availability
- Battery powered undercarriage
- Four-wheel drive
- GEKKO can be operated by cable and radio remote control



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Application:

For fast BOF taphole exchange

Advantages:

- Exact positioning in front of the BOF taphole
- Part of the RHI Magnesita BOF taphole system
- Quick and precise removal of worn taphole sleeves
- Precise insertion and fixation of new taphole repair set
- Breakout and setting unit on one machine
- Counter percussion technique
- Safe working conditions
- Increased BOF availability



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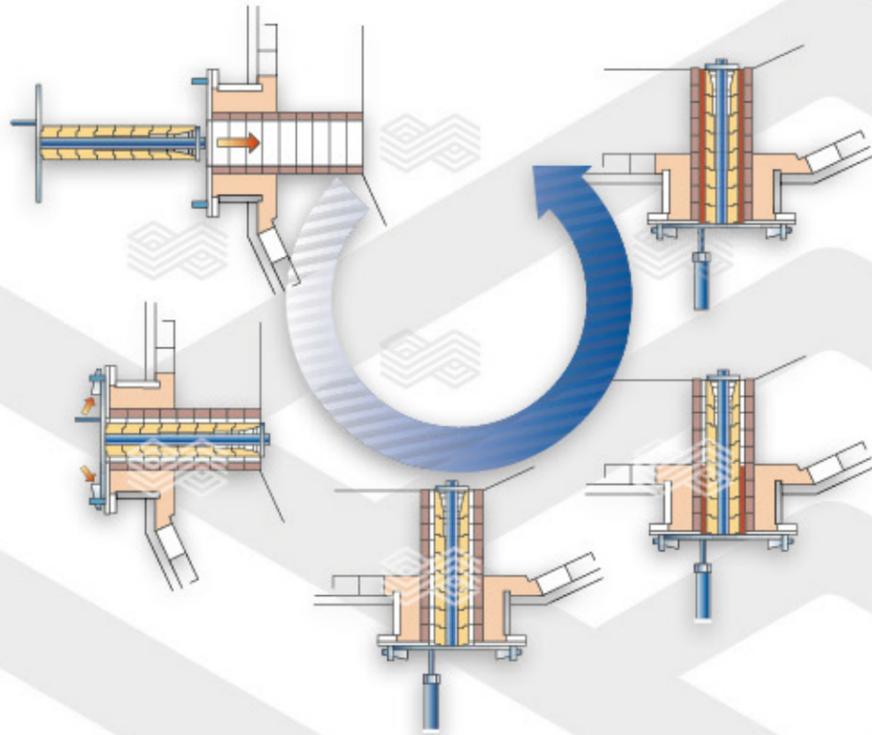


Application:

For filling the annular gap between taphole surrounding elements and taphole sleeves

Advantages:

- Optimal filling of the annular gap
- Less steel infiltration
- Longer life time of the taphole
- Time savings due to shorter drying time
- Easy handling
- Increased BOF availability



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ANKERTAP JET-VK3

Application:

For gunning the annular gap between taphole surrounding elements and taphole sleeves with RUBINIT VK3

Advantages:

- Part of the RHI Magnesita BOF taphole system
- Optimum amount of water is set automatically
- Two water settings for wet and creamy mix consistency
- Consumption data recording
- Detachable silo
- Charging by crane or forklift
- Low maintenance and wear costs
- Easy-to-use automatic operation



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