DIRECT IRON REDUCTION KILN

calderys

CALDERYS

150+ years of combined experience

6,500+ people and contractors in over 30 countries

50 plants in the 5 continents

One of the world's largest supplier in high temperature solutions

Enlarged portfolio of solutions from refractory bricks and monolithics to steel casting fluxes and green molding sand solutions

Calderys is a leading global provider for industries operating in high temperature conditions. We specialize in thermal protection for industrial equipment with a wide range of refractory products, and advanced solutions to enhance steel casting, metallurgical fluxes and molding processes.

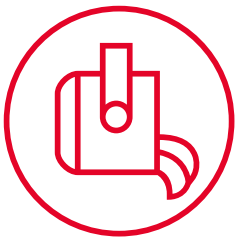
In 2023, Calderys joined forces with HarbisonWalker International, the largest supplier of refractory products and services in the United States.

Together, we form a high-growth, customer-centric provider with a comprehensive offering and a truly global reach. Drawing on over 150 years of combined experience, we support our customers in their energy transition needs. We count more than 6,500 people and contractors, in over 30 countries.

Our international network of experts ensures an end-to-end offer with tailored services. We are constantly developing innovative products and techniques in order to **optimize costs and performance**, combining world-class Research & Development and technical experts, as well as responsive supply chain and sales departments.

Our global structure allows us to design the customized solutions of today while **anticipating the industries' needs of tomorrow**. Calderys pays particular attention to the industry's impact on the environment and has a sustainability program articulated around three pillars: supporting our customers in their energy transition needs, improving our environmental footprint and being committed to people and local communities.

Health and safety is an integral part of how we do business. The same attention to detail that helps us provide personalized products and solutions is also applied to our rigorous health and safety criteria. Our activities require the highest level of professionalism to carry out our projects. To guarantee the strictest standards, Calderys employs a number of safety, occupational health and environmental protocols across all its entities worldwide — applicable to both our own employees as well as subcontractors and temporary workers.



OUR VALUE TO THE IRON & STEEL INDUSTRY

As a prominent ally to the Iron & Steel industry, Calderys has steadily enlarged its service solutions from ironmaking, liquid steel processing, continuous casting, reheat furnaces and other equipments. With innovation and sustainability as fundamental parts of our DNA, we have pioneered a tremendous number of new applications, such as pitch-free tap-hole clay for blast furnaces and our cutting-edge mold fluxes. Through the combination of HarbisonWalker International and Calderys' expertise, the company is offering complementary product portfolios and total care services, bringing a vast array of solutions to support customer needs in all refractory and casting fluxes applications.

What we bring to the Iron & Steel industry

- Close watch over ESG topics, such as product CO_2 footprint calculation, proposing a large range of refractory products resistant to H_2; as well as Environment, Health and Safety (EHS) concerns like the reduction of respirable crystaline silica (RCS) and Phenol (PaH).
- Complete portfolio of customized solutions from ironmaking, liquid steel processing, continuous casting, reheat furnaces and other equipment.
- Full set of refractory services: from engineering & design, installation, project management, dry-out & commissioning, to maintenance and refractory assessments.
- Process analysis including fluid flow and numerical simulations.
- Technical support from trial to after sales.

CALDERYS
AN EXPERT IN DRI TECHNOLOGY

Calderys, a leading refractory technology and solutions provider in the iron & steel and petrochemical industries, is fully committed to net zero. A world leader in providing refractory solutions for petrochemical processes such as natural gas reforming that requires high hydrogen and high temperature conditions.

Leveraging on rich hydrogen experience coupled with strong innovation focus Calderys has developed a full range of refractory solutions for direct reduction processes enabling the green transition of the iron and steel industries. In addition, Calderys has a complete range of refractory products for EAF and smelters that require melting DR pellets.

It has executed many DRI projects around the globe that includes engineering & design, refractory products, installation services and inspection.

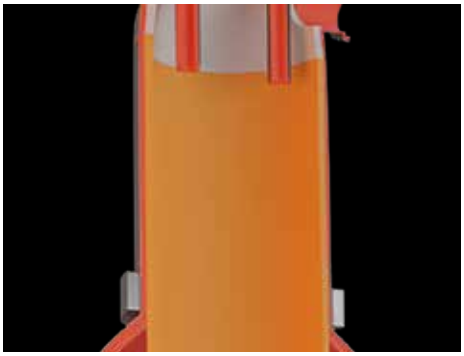
ZONING CONCEPT

DOME

Process requirement
- Heat insulation

Special focus for product design
- Low iron
- Monolithics except bricks for pipe exit

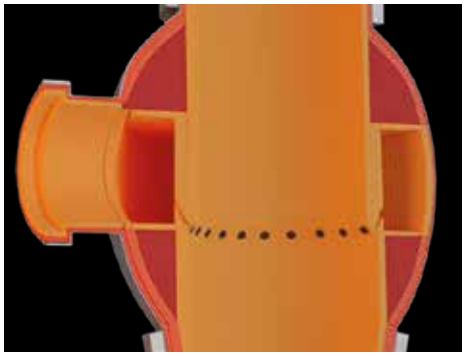
SHAFT



Process requirement
- High abrasion & CO resistance

Special focus for product design
- Low iron
- Possibility of phosphate bonded
- Bricks

PLENUM

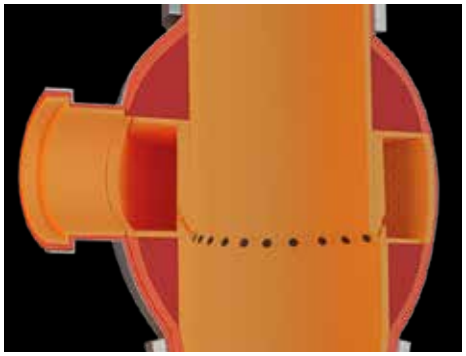


Process requirement
- Low abrasion resistance, high H_2 and heat load resistance

Special focus for product design
- Low iron
- Bricks

ZONING CONCEPT

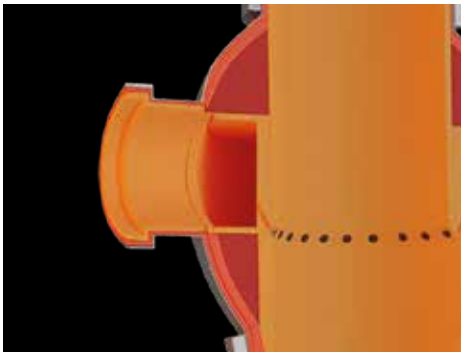
INJECTION NOZZLE



Process requirement
- High abrasion and high H_2 and heat load resistance

Special focus for product design
- Low silica
- Bricks

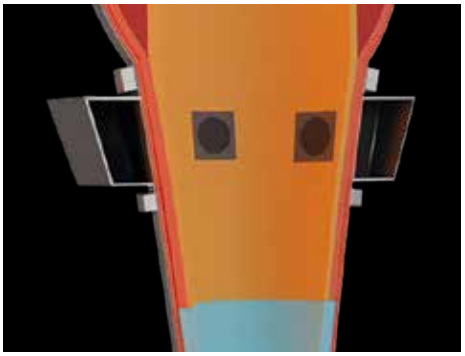
TRANSFER LINE



Process requirement
- Medium abrasion and high heat load resistance

Special focus for product design
- Low silica
- Bricks

LOWER SHAFT



Process requirement
- Low abrasion and low CO and H_2 resistance

Special focus for product design
- Low iron fire clay, andalusite bricks, insulating monolithics
- Low iron
- Bricks
- Insulating monolithics

OUR SERVICES

ENGINEERING AND DESIGN

- Thermal
- Mechanical
- Thermomechanical
- Corrosion
- Abrasion
- Shape and design

REFRACTORY PRODUCTS

- Total inhouse product solutions - bricks, monolithics, jointing products
- External procurement - anchors, support, etc. approved through stringent quality control

INSTALLATION, PROJECT MANAGEMENT AND SERVICES

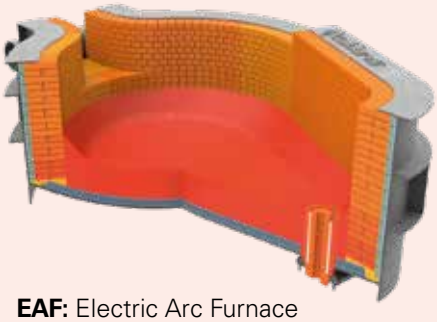
- Direct / supervised installation
- Project management
- Maintenance services

DIRECT IRON REDUCTION KILN

OUR REFRACTORY SOLUTIONS FOR EAF & SMELTER/SAF/OSBF

As DRI technology is being introduced into the integrated steelmaking process, the subsequent downstream process is bound to change. Calderys is well in advance in working on existing solutions such as EAF, and future technologies like Smelter/SAF/OSBF.

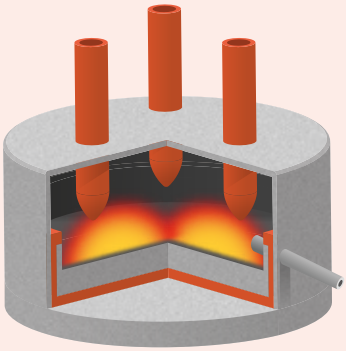
- **DRI:** Direct Reduced Iron
- **HBI:** Hot Bricketed Iron
- **Scrap**



EAF: Electric Arc Furnace

Secondary steelmaking Ladle Furnace, RH Degasser, etc.

- **DRI:** Direct Reduced Iron
- **HBI:** Hot Bricketed Iron
- **Scrap**



Smelter/SAF/OSB: Electric Arc Furnace

BOF: Basic Oxygen Furnace

Secondary steelmaking Ladle Furnace, RH Degasser, etc.

OUR H_2-COMPATIBILITY BACK-GROUND EXPERIENCE

Calderys refractory product development and selection is based on rich experience and extensive R&D work. Our bricks, monolithics and mortars are designed to resist the direct reduction iron process:

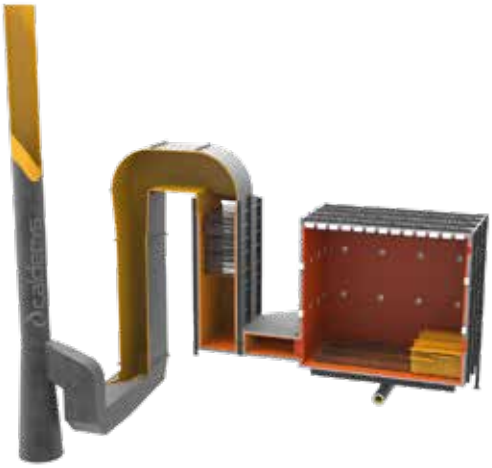
- corrosion resistance by reducing gases, including 100% hydrogen.
- abrasion resistance to burden material
- thermomechanical stability

Our solution is optimized for 100% hydrogen environment

FROM THE BACK-GROUND EXPERIENCE IN PETRO-CHEM INDUSTRY

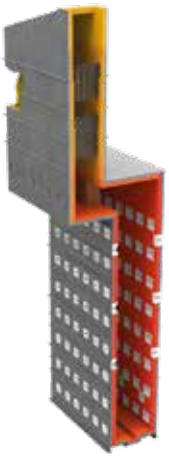
Calderys has a rich experience in the petrochem industry supplying refractory material, consultation, project engineering, installation, supervision, dry out and maintenance. Refractory requirements are very stringent as most of the operations take place at high temperature and high partial pressure of hydrogen. These experiences are very valuable in the context of DRI.

H_2 reformer with convection section duct and stack



Secondary reformer

Ethylene cracker



Cold collector line and NH_3 cracker

A SOLUTION WHENEVER YOU NEED US

Category	Product name	Composition %			Other characteristics
		Al_2O_3	SiO_2	Fe_2O_3	
Bricks	CALDE® BRICK F45 CO	47.5	49	1.1	Fireclay high fired low iron oxide
	CALDE® BRICK A65 CO	65	33	0.9	Andalousite enriched with corundum
	CALDE® BRICK M75 CO	74.5	24	0.7	High proportion of corundum
	CALDE® BRICK C92FM	93	6.5	0.2	High corundum mullite bonded, silica not free providing high thermal shock and chemical inertia
	CALDE® BRICK C90P	90.8	7	0.3	1.6 % of P_2O_5 is added to ensure phosphate bonding
	CALDE® BRICK M75P	75	23	0.6	1.08 % of P_2O_5 is added to ensure phosphate bonding
Monolithics	CALDE® FLOW MM 68 CO	68	26	0.8	Self flowing - Abrasion and carbon monoxide resistant
	CALDE® GUN F 55 CO	55	35	2.2	Gunning - Abrasion and carbon monoxide resistant
	CALDE® GUN MW148 CO HR	51	38	0.7	Gunning - High Strength and resistant to carbon monoxide
	CALDE® CAST 40 TR	95	4.4	0.1	Tabular alumina based free from silica and iron and widely used in petrochem
Jointing Products	CALDE® TROWEL HA 55	48	46	0.7	Sodium silicate bonded
	CALDE® TROWEL HC 85	86	9	0.5	Sodium silicate bonded
	CALDE® TROWEL PC90U	88.2	6.2	0.2	Phosphate bonded

calderys

www.calderys.com