HASLE quality management

1 Quality Management at HASLE

Raw materials	Products	Installation	After installation	R&D
Check on incoming raw materials	Quality control on unshaped castables	Technical guidance and supervision	Customer feedback	Test of materials in line with operation conditions
Control on processed raw materials	Quality control on precasted, prefired elements	Test of installed material	Post mortem analysis	Adjustment of products and raw materials

2 Quality Assurance at HASLE

- Bulk store — Test of incoming raw material
- Crushing area — Test of crushed and milled fractions
- Mixing area — Test of unshaped castables
- Casting area — Test of PCPF elements

3 Test of raw materials

Incoming raw materials	Crushed and milled fractions
Grain size distribution	Grain size distribution
Moisture content	Moisture content
Bulk density	Dry litre weight
Open porosity	
Dry litre weight	
Chemical analysis	

4 Test of unshaped castables in bags

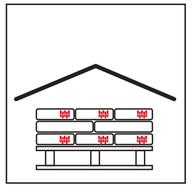
General properties	Physical properties after drying at 110°C	Physical properties after firing at 500-1000-1500°C
Particle size distribution	Density	Density
Water demand for proper casting	Cold Modulus of Rupture	Permanent linear change
Workability (consistency)	Cold Crushing Strength	Cold Modulus of Rupture
Setting time		Cold Crushing Strength

5 Test of pre-cast and pre-fired elements

Every batch after drying at 110°C	After pre-firing at 500-1050-1350°C
Water addition	Density
Density	Permanent Linear Change (PLC)
Modulus of Rupture	Modulus of Rupture
Cold Crushing Strength	Cold Crushing Strength
Inspection of casted elements	Inspection of pre-fired elements

6 Complementary test on refractory properties

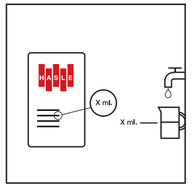
Generel properties	Thermo-mechanical properties	Corrosion behaviour
Refractoriness	Thermal shock resistance	Resistance to alkalis (cuptest)
Thermal conductivity	Hot modulus of rupture	Resistance to melt or slag (cup test)
Open porosity after firing	Abrasion resistance	Resistance to melt (dynamic test)
Microstructure	Thermal expansion	CO resistance



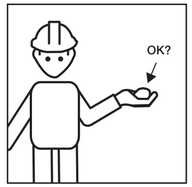
Store bags in dry conditions, sheltered against rain, wind and direct sunshine.

Use clean pan mixer.

Mix dry material for 3 minutes.



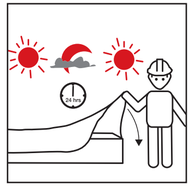
Add water according to prescriptions on bag. Use clean tap water only.



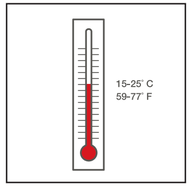
Mix for 4 minutes with water. Add more water if too dry and mix for 4 minutes.

The material should be installed immediately after mixing.

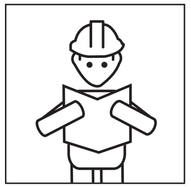
Vibrate thoroughly until castable flows together.



Allow curing for a minimum of 24 hours. Protect surface from drying out.



Ideal casting temperature is 15-25°C / 59-77° Fahrenheit. Under very cold or warm weather, hardening of the castable can be significantly prolonged or accelerated respectively.



Follow HASLEs instructions for drying out and firing.

HASLE REFRACTORIES

www.hasle-refractories.com
info@hasle-refractories.com

HASLE 01-2015

We Protect Your Process

At HASLE Refractories we take great pride in developing, manufacturing and supplying refractory materials to protect your hot metal process. As a refractory company with a history of more than 150 years, having our roots in Scandinavia, it has always been our mission to supply the highest quality to the industries we serve.

Our range of alumina-silica based monolithics and pre-cast elements ranks among the best materials in the world. Our R&D, engineering, management and manufacturing facilities are all based in the same location. This ensures a tightly knitted HASLE team continuously working to provide the best material solution for our customers. Our main focus is to supply a high and uniform quality combined with technical support which will secure our customers a safe installation and long refractory lifetimes.

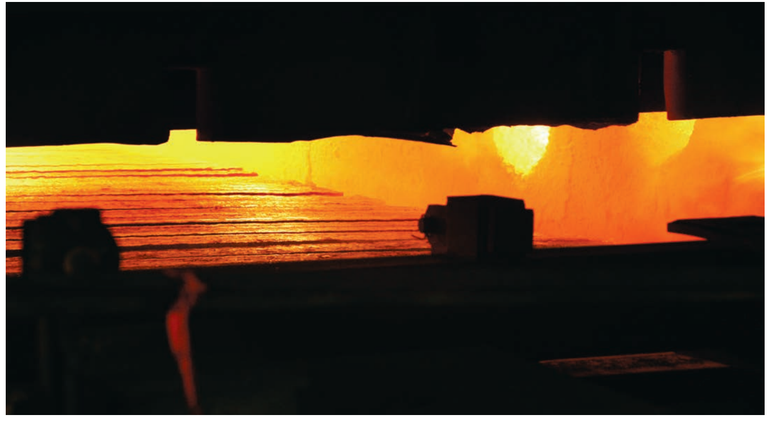
HASLE Low Cement Castables are characterized by having a very dense and strong matrix with high thermal stability and high wear resistance. The ultralow porosity and permeability will also restrict the penetration of liquids, slags and gasses into the refractory lining whereby the corrosion process is slowed down. HASLE LCCs show very high mechanical strength despite their rather low density, thanks to selected aggregates and an optimized grain size distribution.

Foundries
Ladles of various sizes are essential process tools of all foundries and call for reliable refractory linings.

HASLE Ferrum Cast A has a long proven history as lining for foundry ladles, including ladles used for the inoculation of cast iron melts by magnesium. Our raw materials are carefully selected due to their low content of iron and fluxes to stabilize our castables during operation.

Cover linings
The dense particle packing and high thermal stability of HASLE LCCs qualifies their use in covers for ladles, induction furnaces and as electric arc furnace roofs.

Andalusite as raw material in Ferrum Cast A and Ferrum Cast M/EU provides high thermal shock resistance and slow crack formation which is essential to withstand the high temperature radiation from liquid steel and electrodes.



Direct reduction process
The increasing production of electric steel across the world has also increased the demand for direct reduced iron – or sponge iron – which can be melted alone or along with recycled scrap in various induction furnaces.

Producing sponge iron has several routes, one of which is the rotary kiln, where refractories are stressed by abrasion, thermal shock, and chemical corrosion at reducing atmosphere. Utilizing high-ash coal for the reduction process increase the build-up problems inside the kiln, but the chemical composition and low porosity of HASLE Ferrum Cast M reduces the build-up and ease the removal of accretion.

Reheating furnaces
The transport of heavy slabs, billets or forgings into and through reheating furnaces requires refractory with high impact resistance and exceptional compressive strength irrespective of furnace type.

HASLE LCCs like Ferrum Cast M/EU meet these challenges thanks to its combination of Mullite, Andalusite and Bauxite. Precast elements easily withstand the heavy thermal and mechanical stress and show a high resistance to scale slag.

Thanks to the strong matrix, the abrasion resistance of most HASLE LCCs is high, and especially Ferrum Cast MB shows exceptional wear resistance at all temperatures which makes it well qualified for floor areas.

Precast and prefired elements

The life-time of precast elements is most often superior to casting on-site thanks to the controlled mixing, vibration and curing conditions that can be set-up. At HASLE we have a long-time tradition for production of precast elements that undergoes a strict quality control. We offer both standard and customized precast solutions. Innovative mould building techniques and in-house furnaces that can be fired up to 1350°C have opened new possibilities when it comes to precast design and performance under operation.

		Density (kg/m3)	Chemistry		CCS (MPa)	PLC (%)	AP (%)
			Al_2O_3	SiO_2	Fired at 1500°C		
LOW CEMENT CASTABLES							
FERRUM CAST A	Andalusite	2550	56	37	160	+0.30	10-11
FERRUM CAST M/EU	Mullite, Andalusite	2500	60	35	160	+0.30	11-12
FERRUM FLOW M	Mullite	2450	60	35	100	-0.20	12-13
FERRUM CAST MB	Mullite, Bauxite	2550	65	30	170	+0.50	12-13
FERRUM CAST F	Fireclay	2250	40	55	130	+1.00	12-13
FERRUM CAST S	SiC (20%), Andalusite	2550	50	25	100	+0.30	11-12
LOW CEMENT DRY GUNNING MIXES							
GUN39A	Fireclay	2050	39	56	60	-1.00	22-24
GUN59A	Mullite, Andalusite	2250	57	38	95	+0.25	20-22
LOW CEMENT SHOTCRETE MIX, PUMPABLE							
PU55A	Fireclay, Corundum	2450	55	40	140	+0.80	14-15
INSULATING DRY GUNNING MIXES							
CSI 1050	Perlite	1050	17	47	-	-	-
CSI 1300	Light-weight fireclay	1300	35	43	-	-	-
TRADITIONAL MOULDABLE CASTABLE FOR REPAIRS							
B1500	Fireclay	2100	49	41	50	-1.50	24-25

Anchors, insulating bricks, ceramic fibre products and mortars can be supplied along with our products.