



環球物源有限公司

Sino-Global Sourcing & Supply Limited

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BF Cast House Refractory - Tap Hole Clay

SPECIFICATIONS					
Properties	Index	Category			
		GUTKO 1000	GUTKO 2000	GUTKO 3000	GUTKO PLUS
Chemical compositions (%) \geq	Al ₂ O ₃	20	30	30	30
	SiC	25	25	30	35
	Si ₃ N ₄	-	-	5	10
Bulk density (g/cm ³) \geq		2.10	2.20	2.30	2.30
Permanent linear change (%)	1300 ^o C x 3h	\pm 1.0	\pm 1.0	\pm 1.0	\pm 1.0
Cold modulus of rupture (MPa)	1300 ^o C x 3h	2 - 5	2 - 5	2 - 5	3 - 6
Cold crushing strength (MPa)	1300 ^o C x 3h	6 - 12	6 - 12	6 - 15	6 - 15
Working volume of BF		< 1000m ³	1000 - 2000m ³	2000 - 2500m ³	> 2500m ³

The new generation blast furnaces with large volumes operate at high top pressure, increased blast temperature, injection at tuyeres e.g. coal and oxygen. This has resulted in an increase in tapping rate, tapping temperature and duration of tapping. Such changes have prompted radical changes in the materials and applications of refractories in the BF cast house areas, particularly tap hole clay.

The tap hole is prone to early erosion and therefore for obtaining a trouble free cast, a good and strong tap hole of requisite strength is required, for which a good quality tap hole clay is essential. Earlier in most of the blast furnaces hydrous mass was used, which doesn't provide strong tap hole. This hydrous mass, water bonded was found to be responsible for oxidizing the carbon lining around the tap hole, leading to breakouts.

To achieve a trouble free tapping a constant tap hole length need to be ascertained. The expansion of the tap hole need to be controlled with hot metal and slag volume. The delivery speed of the hot metal stream should have minimum possible variation. Any turbulence in the stream at the tap hole exit should be avoided. The operation and closing of the tap hole need to be smooth, to the extent possible. High temperature and Si content of the hot metal affects the performance of the tap hole clay adversely.

Material design for tap hole clay has undergone a radical change. Superior grade **Al₂O₃-SiC-C** based anhydrous tap hole clays are put in regular use in medium to large size blast furnaces. Both silicious and aluminous aggregates are used along with various additives and binders. Phenolic resins, tar and various oils are used as binders along with Carbides (**SiC**) or nitrides (**Si₃N₄**) as additives. Carbides and Nitrides impart corrosion and abrasion resistance properties where it also improves sinterability of the mix.

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These anhydrous tap hole masses maintain good tap hole length, offer smooth & controlled drainage of metal & slag and protect the hearth in tap hole region, the zet impulse of the tap hole is lowered, which reduces wearing of trough lining. Slight expansion has been recognised as a desirable property as negative **PLC** (permanent linear change) leads to gap formation.

The hearth should be empty as long as possible; otherwise the permeability of the blast furnace will be influenced negatively. This is influenced by '**Gun - up**' to '**Knock - out**' (**GUTKO**) time practiced in any individual plant. To achieve the best results the **GUTKO** time should optimum for any plant depending on the charging rate of the furnace, number of tap holes available and tap hole diameter.

Installation Techniques - Tap Hole Clay

In the classification, based on appearance, the tap hole clay is always in 'mud state'; the reason why, it is also called **tap hole mud**. It is applied by a electro-mechanically /hydraulically operated mud gun, the reason why, it is also called **mud gun mass**. The capacity of the mud gun largely depends on the pressure inside the blast furnace.

The mud gun mass is extruded from mud gun into the tap hole through electro-mechanic/hydraulic pressure. Pressure gauge installed on the mud gun monitors the pressure being applied for the extrusion. A higher pressure reading reflects the excessive hardness of the material, where as, a lower pressure reading reflects the softness of the material. A good flowability helps in formation of desired mushroom inside the blast furnace. Mud gun is removed after 5-10 minutes of the extrusion, once the tap hole clay is sintered on the hot face and seals the hole.

For opening the tap hole for metal cast, drilling machine is used. An optimum drilling time is the reflection of a good quality tap hole clay. At the manufacturing end, this property is ascertained by evaluating the cold crushing strength of the coked material.

Depending on the mud gun capacity, pressure being applied on mud gun, capacity of the drilling machine and **GUTKO** time, the tap hole clay is tailor made to cater to the need of an individual plant.

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