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(Comp. No: 19104)  
Ministry of Steel  
Technical Division

Udyog Bhawan, New Delhi  
Dated: 18<sup>th</sup> September, 2024

**Subject: Domestic Production of Refractory Ramming Mass / Gunning Mass / Fettling Mass**

Refractory Ramming Mass/ Gunning Mass/ Fettling Mass etc. is being used by the Indian Steel Industry, and is generally being imported Specifications of these material are enclosed for reference.

Domestic manufacturers are requested to intimate this Ministry about the capacity & production of these products in the country, within 45 days. The required information may be sent through email as mentioned below.

(Encls: as above)

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## Annexure 1

### 1. Name / Model No. / Technical Description of the Capital Goods / Accessories and Components for the Capital Goods to be imported: -

Sr. No.	Name/ Model No. / Technical Description of Capital Goods
1	Refractory Dry Ramming Mass
2	Refractory Furnace Gunning Mass
3	Refractory Fettling Mass
4	Refractory Tap Hole Clay Mass
5	Refractory Ladle Back Feeling Mass
6	Refractory MgO Base Ramming Material

### 2. Quantity required with Justification

Sr. No.	Name of the Product	Quantity
1	Refractory Dry Ramming Mass	39600 MT
2	Refractory Furnace Gunning Mass	13200 MT
3	Refractory Fettling Mass	15840 MT
4	Refractory Tap Hole Clay Mass	5280 MT
5	Refractory Ladle Back Feeling Mass	2640 MT
6	Refractory MgO Base Ramming Material	528 MT

Justification:

These are Refractories for Refractory Dry Ramming Mass, Refractory Furnace Gunning Mass, Refractory Fettling Mass, Refractory Tap Hole Clay Mass, Refractory Ladle Back Feeling Mass & Refractory MgO Base Ramming Material and are used to keep the Capital Goods in good working condition and preventing the break down.

Refractories are inorganic, nonmetallic & heat resistant materials that can withstand the action of abrasive or corrosive solids, liquids or gases at high temperature.

#### Properties in Refractory material are:

1. Ability to withstand high temperatures.
2. Ability to withstand sudden changes in temperature.
3. Ability to withstand load to service condition.
4. Ability to withstand action of molten metal, hot gases & slag erosion etc.
5. Ability to converse heat.
6. Abrasive resistance.

**Refractory Materials are generally classified as shaped, unshaped & fibrous refractory.**

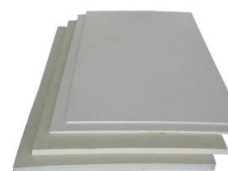
**Shaped Refractory** materials are the Refractory material which have different geometrical shapes according to the requirement of the user or design of the furnace/ equipment such as bricks, blocks, Pre fired Precast blocks.



**Unshaped Refractory** materials are the versatile material composed of aggregates, binders & additives offering refractory properties. These materials are in dry powder/ plastic forms and are applied by casting, spraying, vibrating etc. Unshaped Refractory comprises of Refractory mortar, castables, plastic masses, Gunning mass, patching mixes etc.



**Fibrous Refractory** is a composite insulation material composed of two different fibres such as silica or aluminosilicate. These materials are in the form of insulating fibre or boards.



**Note:** These different types of refractories are jointly applied/ installed in the furnaces & ladles & changed after achieving the desired service life.

### 1. Refractory for Dry Ramming Mass

Ramming mass is an unshaped refractory material that is used to line the bottom/bank of the Furnace to prevent corrosion, erosion & thermal shock. Basic ramming mass is mainly composed of Magnesia (MgO), which has high refractoriness, slag resistance & thermal stability. Basic ramming mass can be used for various types of furnaces such as induction, electric arc furnaces, converters, ladles & tundishes.

#### Properties of Dry Ramming Mass:

- Good chemical stability
- Good erosion resistance
- Good abrasion resistance
- Good anti-stripping property
- Good shock resistance.

#### Specification of Fettingling mass:

Chemical	MgO	Fe <sub>2</sub> O <sub>3</sub>	CaO
Values	75% Min	3.6% Max	20% Max

#### End usage of the product:

Basic ramming mass is usually applied by ramming or vibrating the dry or wet mixture into the bottom/ bank of the furnace. The ramming mass is then sintered at high temperatures to form a dense & strong layer that can withstand the harsh conditions inside the furnace. The sintering temperature depends on the composition & binder of the ramming mass, but generally in between 800 to 1300 C.

#### Stage where the product is used:

Ramming mass is used in the lining of the furnaces to prevent from damage caused by high temperature & molten metal or slag & during the maintenance of the furnace by hot repair.

**How the product is used:**

The material is spread over the bottom & banks of the furnace in hot conditions around 70-80 heats depending on the condition of the banks as well.



**Hot repair with Dry ramming mass**

**2. Gunning Mass/ Gunning Material.**

Gunning Mass is an unshaped refractory, It is a mixture of graded refractory aggregates with chemical binders & plasticizers. These mixes are optimized for application using air spraying tools, ensuring easy installation, reduce downtime & excellent performance.

**Properties of Gunning Mass:**

- High bonding strength, less shrinkage
- High adhesion rate & less rebound loss
- Good erosion resistance, good slag resistance
- Easy for application.

**General specification of Gunning mass:**

<b>Chemical</b>	<b>MgO</b>	<b>SiO<sub>2</sub></b>	<b>CaO</b>
<b>Values</b>	<b>80-85%</b>	<b>6-10%</b>	<b>3.0 Max</b>

**End usage of the product:**

AMNS is equipped with the process & facility which produces various quality of steel depending on the end usage. The route followed in AMNS is Conarc/EAF-Steel ladle-RH/VD-Caster where liquid steel is tapped from Conarc to steel ladle at 1580 to 1620 C & sent to ladle furnace for fine tuning of the chemistry as per the requirement & sent to caster for converting into slab which is rolled after passing through reheating furnace at Hot strip mill.

During this batch process, the refractory installed in Conarc, Steel ladle operating at such high temperature gets eroded gradually & cracks are observed. To compensate for the above erosion, gunning mass is sprayed through the gunning machine to achieve the target campaign life.

**Stage where the product is used:**

Based on the conditions & erosion on the walls of the furnace & steel ladle Gunning material is applied on the walls as a maintenance of the Conarc / EAF & Steel ladle which helps in extending the performance of furnace & Steel ladle refractory, reducing the overall refractory consumption.

**How the product is used:**

Application of gunning mass in Conarc or Steel ladle is done with the help of Gunning machine which lasts upto 3-4 heats depending on the condition.



**Gunning Mass**



**Gunning Machine**



**Applied on the walls of Ladle & Furnace**

### 3. Refractory Fettling mass.

Fettling Mass is an unshaped refractory, It is a refractory material especially made for repairing the worn out areas of bank of bottom of Conarc / EAF.

#### Properties of Fettling Mass:

- High bonding strength, less shrinkage
- High sintering rate
- Good erosion resistance, good slag resistance
- Easy for application.

#### Specification of Fettling mass:

Chemical	MgO	CaO	SiO <sub>2</sub>
Values (MgO based)	75-80 %	16-18%	<=2.5%
Values (Dolomite based)	35-40 %	50-55 %	<=1.5%

#### End usage of the product:

As explained in point no. 2 above, AMNS is equipped with the process & facility which produces various quality of steel depending on the end usage. The route followed in AMNS is Conarc/EAF-Steel ladle-RH/VD-Caster where liquid steel is tapped from Conarc to steel ladle at 1580 to 1620 C & sent to ladle furnace for fine tuning of the chemistry as per the requirement & sent to caster for converting into slab which is rolled after passing through reheating furnace at Hot strip mill.

During this batch process the refractory installed in bottoms & banks of the Conarc operating at such high temperature gets eroded & maintenance of the same is being done by fettling material through fettling machine.

#### Stage where the product is used:

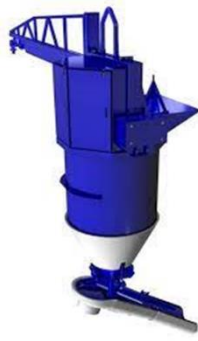
Based on the condition of the banks & bottom of the furnace fettling material is applied on the bottom as a maintenance of the Conarc / EAF which helps in extending the performance of furnace refractory, reducing the furnace refractory consumption.

#### How the product is used:

Application of fettling material in furnace is done with the help of fettling machine which lasts upto 10-14 heats depending on the condition of the furnace.



**Fettling material**



**Fettling machine**



**Fettling the banks  
of the furnace**

#### **4. Refractory Tap hole clay**

Tap hole clay is an unshaped plastic material used to seal the tap holes of blast furnaces, Corex & other smelting operations. It is composed of various raw materials such as alumina zirconia, Silicon carbide, mica etc that provides high resistance to corrosion, erosion & thermal shock. Tap hole clay also has good adhesion & plasticity to ensure stable & long tapping time.

##### **Properties of Tap hole clay:**

- High refractoriness can withstand the effect of high temperature iron slag smelt.
- Strong ability to resist the erosion of iron slag smelt.
- Moderate plasticity, easy to operate the mud gun & from the tap hole mud bag.
- Good volume stability, no leakage of molten iron due to shrinkage.
- Easy to drill, no clogging or sticking of the drill bit.

##### **End usage of the product:**

A taphole is a hole that is drilled through the refractory wall of a blast furnace & sealed with a clay material after each tapping. Tapping is the process of draining the molten metal & slag from the hearth of the furnace. Taphole is fixed in blast furnace by using a special device called a mud gun, which pushes the clay material into the hole under high pressure. The clay material expands & plugs the hole, preventing the leakage of metal & slag.

##### **Stage where the product is used:**

The process of drilling & sealing the tap hole with clay material is done in every tapping ensuring the tap hole length.

##### **How the product is used:**

The main physical need of this material is to achieve trouble free tapping of hot metal & to be a constant tap hole length during the tap hole opening operation, which usually takes an hour. Additionally, there should be smooth flow of the hot metal & slag. The performance of mud gun mass is crucial for optimizing the operation & profitability of the furnace.



## 5. Refractory Backfill Mass.

Backfill mass is an unshaped refractory, which is a specially designed product & mainly available in 60% to 85% MgO Content. It is a magnesia based moldable water free mix & is applied between the safety & working lining of steel ladle.

It is an excellent protective shield by preventing from any slag & steel penetration.

### Properties of Backfill Mass:

- Good thermal insulation.
- Low shrinkage & high strength
- Good compatibility with the working lining.

### Specification of Fettingling mass:

Chemical	MgO	Fe <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>
Values	68% Min	4.8% Max	23% Max

### End usage of the product:

The purpose of the backfill mass is to accommodate the expansion of the working lining & to prevent the deformation of the safety lining. The refractory properties of the backfill mass depend on its composition, particle size distribution, density & porosity. The Refractory backfill mass is an important component of the steel ladle lining system, as it can affect the performance & service life of the ladle.

### Stage where the product is used:

This material is filled between the safety & working lining of the steel ladle. It is applied during the initial lining of the steel ladle refractory & after achieving the desire service life of steel ladle refractory the slag zone refractory is removed & relined with new refractory bricks & backfill mass.

### How the product is used:

This material is manually filled between the safety & working lining during the ladle relining activity in every campaign of 70-75 heats.



→ Safety lining  
→ Backfill Mass  
→ Working lining

## 6. Refractory MgO based ramming mass

Ramming mass is an unshaped refractory material that is used in repiping the Eccentric Bottom Tapping sleeve for maintaining the tapping duration of the of Conarc & electric arc furnaces.

### Properties of MgO based ramming mass:

- Good chemical stability
- Good erosion resistance
- Good abrasion resistance
- Good anti-stripping property
- Good shock resistance.

### Specification of MgO based ramming mass:

Chemical	MgO	Fe <sub>2</sub> O <sub>3</sub>	CaO
Values	94.3% Max	2.9% Max	1.6% Max

### End usage of the product:

EBT repair castable is a type of refractory material that is used to repair the tap hole of an Conarc, Electric Arc Furnace (EAF) with eccentric bottom tapping (EBT). EBT repair castable helps to restore the integrity of the tap hole, prevent leakage of molten steel & extend the service life of the EBT.

### Stage where the product is used:

EBT repair casting is a process of filling the gap between the EBT sleeve & EBT brick with a refractory material that has self levelling properties & high resistance to thermal shock & chemical attack. EBT repair is usually done when the furnace is hot after tapping the liquid steel & before charging the next heat. EBT repair helps to restore the integrity of the tap hole, preventing leakage of molten steel.

### How the product is used:

After the molten steel is tapped, the steel tube is inserted into the tap hole & refractory material that has self levelling properties & high resistance to thermal shock is pored into the gap between the tube & the bricks. The refractory material sets & harden under high temperature. The material forms the strong bond with the EBT bricks & restores the integrity of the tap hole.

