

RECOMMENDED GUIDELINE FOR IRON & STEEL SECTOR		
MINISTRY OF STEEL, GOVT. OF INDIA	SINTER PLANT	Doc. No: RG / 05
		Rev no.: 00 Effective Date: --

1. **OBJECTIVE**

Sintering is an agglomeration process of fine mineral particles into a porous mass by incipient fusion caused by heat produced by combustion within the mass itself. Iron ore fines, coke breeze, limestone and dolomite along with recycled metallurgical wastes are converted into agglomerated mass at the Sinter Plant, which forms 70-80% of iron bearing charge in the Blast Furnace.

This entire process of sinter making is associated with various safety hazards like hit / entanglement with mobile equipment, burns, fire, slip & fall, exposure to dust, smoke, noise, heat & gas etc.

2. **SCOPE**

This code of safety is applicable to Sinter manufacturing plant as well as Sinter Plant Dept. of an Integrated Steel Plant.

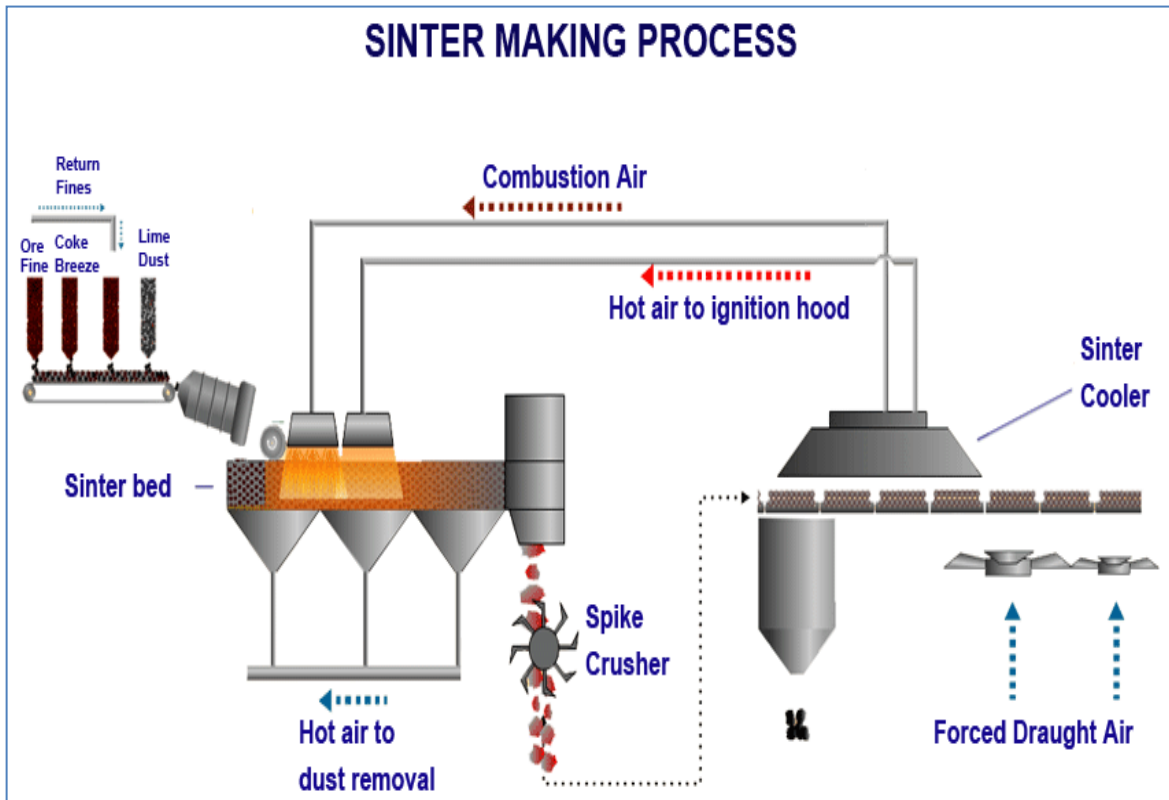
3. **PROCESS BRIEF**

Sintering process is developed mainly to utilize under size of lump ore called iron ore fines; which otherwise, could not be charged directly in blast furnace. In order to conserve these, otherwise waste material, they are compacted together and made into lumps by a process known as sintering. Sintering is defined as the agglomeration of the Iron ore fines (generally <8 mm) by incipient fusion of fine mineral particles with heat produced by burning of coke breeze, uniformly distributed in raw mix bed. During the sintering process, iron ore fine particles agglomerate into a porous compact heterogeneous lumpy mass called SINTER by incipient fusion caused by the heat produced during the combustion of the solid fuel within the moving bed of loosely particles.

The coke at the top of the blend is ignited by gas burners, that can be fueled by coke oven gas, blast furnace gas, or natural gas. As the sinter bed moves, air is sucked from the top through the mixture, enabling combustion through the entire layer and complete sintering – where the temperatures may reach 1300 – 1480°C. At the end of the strand, the material is cooled by air and finished sinter is size-screened.

As per given burden, raw materials are collected on a common conveyor from the respective bunkers through weigh feeders and then mixed homogeneously in mixing drums (primary & secondary mixing drums) by adding required water (7 to 8 %) and then feed on sinter machine. Generally, raw mix bed height is 550 mm and is adjusted based on quality of the raw material. The bed in running (motion) condition is taken to ignition front. The raw mix undergoes through the ignition furnace and there is a negative suction from bottom. As soon as suction

takes place, hot products of combustion are sucked through the bed and transfer its heat to the next layer of the bed keeping it ready for the combustion. These flue gases are let out from chimney through ESP. After completion of the sintering process, sinter cake will be crushed and screened after discharge from the machine. Sinter having size > 5 mm will go to the cooler and then it will go to BF. Sinter with size < 5 mm size fines will be re-cycled in the process.



4. Some of critical Equipments/ facilities in Sinter Plant are asunder:

Sl. No.	Major equipments
1.	Conveyors, charging bins for Iron Ore Fines/ Coke Breeze/ Lime Dust/ Return Fines, Mixing Drums, Sinter Machine, Sinter Breaker/ crusher, Screens (Hot & Cold), ESPs (Electrostatic Precipitator), Exhausters, Storage Bunkers etc.

5. HAZARD ANALYSIS & NECESSARY RISK CONTROL MEASURES

Sl. No.	Equipment	Hazards	Risk Control Measures
1)	Conveyors	Rotating parts of conveyor system, like head pulley, tail pulley, snubpulley, coupling guards etc.	a) Guarding of All rotating parts of conveyor system. b) Pull chord in conveyors c) Emergency switch (Refer: SC-09: Safety Code for Equipment and Machine Guarding, SC-19: Safety code on Operation and Maintenance of Conveyor Belts)
2)	Charging Bins/ Hoppers	a. Fine Dust deposition b. Electrical Drives c. Noise	a) Use of PPEs b) Dust Extraction (DE) System c) Guarding of all rotating parts of conveyor system d) Pull chord in conveyors e) Emergency switch f) Use of Ear Plug g) Display of Noise level at site h) Adherence to electrical safety precautions (Refer: SC-18: Safety code for Personal Protective Equipment (PPE) management, SC-19: Safety code on Operation and Maintenance of Conveyor Belts, SC-15: Safety Code for Electrical safety)
3)	Mixing Drums	a. Rotating Machineries b. Burden Spillage c. Noise	a) Guarding of all rotating parts. b) Use of Ear Plug (Refer: SC-09: Safety Code for Equipment and Machine Guarding)
4)	Sinter Machine	a. Moving Sinter Bed b. Gas Leakages c. Rotating Machineries d. Handling Hot Burden e. Spill over of hot burden f. Hot burden splinter	a) Barricading. b) Online gas detector on both sides of ignition furnace, portable gas detector c) Guarding of all rotating parts. d) Use of Fire retardant jacket in hot zones

Sl. No.	Equipment	Hazards	Risk Control Measures
		during sintering g. Fire in Electrical panel/cable nearby h. Electrical Drives i. Hot Flue Dust j. Contact with hot surface k. Fine Dust deposition l. Structural Corrosion m. Heat & Burn	e) Smoke detectors in electrical rooms. f) SAP based periodical inspection. g) Display of Hot Area at site h) Adherence to electrical safety precautions i) Use of PPEs (Refer: SC-11:Safety Code for Barricading, SC-16: Safety Code for Fire Safety, SC-15: Safety Code for Electrical safety, SC-21: Safety code for Handling Fuel Gas)
5)	Sinter Breaker	a. Rotating Machinery b. Handling Hot Sinter c. Electrical Drives d. Fine Hot Dust e. Noise	a) Guarding of all rotating parts b) Fire retardant jacket, in hot zones c) Use of PPE d) Adherence to electrical safety precautions (Refer: SC-09: Safety Code for Equipment and Machine Guarding, SC-15: Safety Code for Electrical safety)
6)	Screen (Hot & Cold)	a. Handling Hot Sinter b. Hot Dust c. Noise	a) Guarding of all rotating parts b) Access Control c) Use of PPE d) DE System e) Use of Ear Plug f) Display of Noise level at site. (Refer: SC-09: Safety Code for Equipment and Machine Guarding)
7)	ESP	a. Hot Flue Gas b. Fine Hot Dust c. Electrical Transformers d. High Electrical Voltages	a) Access control b) Use of dust mask
8)	Exhauster	a. Rotating Machinery b. Electrical Drives c. Noise	a) Guarding of all rotating parts b) Access control e) Adherence to electrical safety

Sl. No.	Equipment	Hazards	Risk Control Measures
			precautions c) Use of Ear Plug d) Display of Noise level at site (Refer: SC-09: Safety Code for Equipment and Machine Guarding, SC-15: Safety Code for Electrical safety)
9)	Raw Material receiving bins top trolley, Trolley over Surge bin, Trolley over Sinter Storage bin top	Moving Shuttle	a) Auto hooter blowing whenever shuttle shifting command given b) Guards / Barricading (Refer: SC-11:Safety Code for Barricading)
10)	Lime lifting facilities	a. High Pressure Lime dust b. Tanker movement	a) Use of helmet with wiser b) Separate glass cabin for tanker staff c) Access control

References:

1. SAIL Plants Safety Manual
2. Tata Steel Safety procedure