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Analysis of Leakage in Weighed Material through Weighing Hopper Gate

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Abstract:- In Burden handling section material flows proceeds from screen to weighing hopper than to B_1 &D_1 conveyors. Hence weighing hopper is a hopper, which is balanced and floated on load cells. Leakage of weighed material at that time of screening through weighing hopper gate i.e. between discharge end of weighing hopper and weighing hopper gate. Then leakage of material observed on B_1 &D_1 conveyors and conveyor stopped, because of bin not ready, then identification of problem, and restart conveyor has been taken so much time (i.e. 30 minutes). It was occurred 9 times in a month.

I. INTRODUCTION OF BLAST FURNACE

Burden materials received in the stock house, one for each furnace through a junction house, Coke handled by two conveyors (one stand by) of 1400 mm width and 350 TPH capacity, sinter, lump ore by two conveyors (one stand by) of 1400 mm width and 800 TPH capacity. Sized ore and additives handled one reserve conveyor of 1400 mm width and 800 TPH. Junction house have cross over through, rolling reversible conveyor and stationary reciprocating conveyor. (For each furnace, there 6 bins for sinter (5700 M^3) 2 bins for lump ore (1900 M^3), 6 bins for coke (5700 M^3), 3 bins (400 M^3) each for limestone and quartzite and manganese ore. Coke, sinter and iron one screened in screens upto 400 M^3 /hr. capacity to remove the fines. The screened material is fed to the inclined conveyor for burden handling to top through a horizontal conveyor. Each material fed simultaneously by two hopper scale according to the predetermined furnace charging programme. Conveyors for burden handling to top 2000 mm width & 2160 M^3 hr. capacity and operate continuously. The materials positioned in conveyor in separate batches at certain intervals and in a certain sequence as per present programme. Automatic system provided for batching, weighting and feeding of the burden to the furnace top. The exhaust air is directed to electrostatic precipitators (2 nos.) for cleaning. The plant capacity 365 M^3/hr. The dust content of air is reduced from 2.85 gmjM^3 to 0.1 gm/M^3. 92 T of dust is collected every day. The dust collected is balled in granulation plant and is discharged into automatic transport for general purpose. The dust gas from the charging arrangement passes through the discharging gas pipeline to the spraying pipe with a sprayer for sprinkling, where gas is cleaned of dust and cooled. The gas is then discharged to the cyclone spray catcher of BF gas cleaning plant through 720 mm dia gas pipe line equipped with sprayer for sprinkling water. Water consumption is 200 M^3/hr/furnace. The burden handling system premises are hydraulically flushed (600 M^3/hr water). About 92 T of dust is taken out daily. Total effluents generation is 600 M^3/hr. After freeing from large suspended matters in primary setting tanks. It is pumped to dehydrating chamber to reduce moisture to 10 to 20%. The dehydrated sludge is transported to sinter plant by trucks.

1.2 Hot Blast Stoves

There four hot stoves for each furnace with a total heating surface of 2,24,000 M^2. The dome heated to a temperature of 1450^0C maximum while the waste flue temperature is 4000^o C. The stoves are capable of giving a blast temperature upto 100^0C. Stoves are heated by a mixture of blast furnace gas and coke oven gas having a calorific value of 1,100 Kcal/NM^3. Pressure of mixed gas before burners is 600 mm W.C additionally oxygen enrichment also provided. Gas mixing station is provided to mix BF Gas and CO Gas is required proportion and to get the necessary CV separate stations are provided for each furnace. Mode of operation of stoves is staggered - parallel and successive.High temperature zone lined with silica and mullite corundum refractories, medium temperature zone, with kaoline refractories and low temperature zone with fire clay refractories. The shell of dome and cylindrical part are heat insulated with a heat proof granite concrete in high temperature zone. Gaps between shell and walls are filled with mats from fibrous materials. Checker-work is lined with hexahedral refractories with round cells of 41 mm dia. Combustion chamber inbuilt construction of elliptical shape. The chimney 80 m high, 3.5 m diameter at the mouth. It is of reinforced concrete and fire clay lined. Bleeder for back draught is made of metal with refractory lining Air supply for burners I centralized. Three fans (one stand by) of 120, 000 M^3/hr., 1,080 mm we capacity each provided for the purpose. Evaporative cooling system is provided for cooling hot blast valves and burner cut off valves. By this system, heat extracted by 1 Kg. Of water increased by 60-80· times and less water required which makes it possible to accept this

system. Chemically treated water is acceptable and strength of parts to be cooled are more. The heat extracted is used as saturated steam. Steam output is 7 T /hr. upto 3 atm pressure and feed water consumption is 8 M3/hr. The main equipment in the system is parts of the stove valves and the cooling system proper, which consists of separating drum pipe lines and valves. Separating drum dimensions are 1500 x 6000 mm. Provision is made for natural circulation due to difference of specific water in pipes, which supply water to the valves and deliver the steam water mix from them.

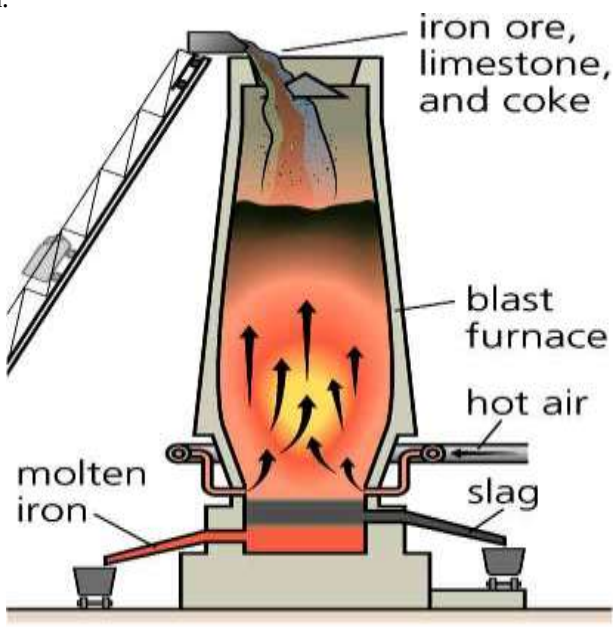

fig1.1 iron making in blast furnace

1.3 Blast Furnace-Masses And Compound Shop:

Refractory masses required in cast house viz. Runner Mass, Mud gun mass, tap hole frame mass are prepared in Masses Compound Shop. The raw materials required for preparing mass are received of various sizes from the different sources. These are crushed at various stages and stored in final storage bins. There are 12 final storage bins out of 6 are being used for coke, 2 for plastic fire clay, 2 for pitch and 2 for grog the capacity of final storage bins is 30 m^3. There are 6 operating groups for raw material handling and preparation of mass. From above bins raw material:

Group 1 - It is for primary handling of coke breeze and plastic fire clay. In case of coke there I no any crushing in this stage. In case of clay, the plastic clay of 250 mm size is crushed in two roll crusher to 40mmsize.

Group 2 - In this group final crushing and storage of plastic clay in final storage bins is carried out, where it is crushed to 0.5 mm by disintegrator.

Group 3 - In this group crushing of coke breeze from 25 to -1 mm by four roll crusher.

Group 4 - In this group pitch and grog are crushed in two stages. In case of pitch two roll crusher and in case of grog is crushed by hammer mill for secondary crushing.

Group 5 & 6 - Here pan-mixers used for mixing of water/ oil to prepare masses from above raw material storage.

There is a 5 tons capacity crane for handling the mass boxes.

II. BRIEF DETAILS OF BURDEN HANDLING SECTION

Burden Handling System consists total 36 conveyors including BHS charging conveyors called Bl, B2 and Dl, D2, BHS consists of auxiliary units like Inlet Ventilation Station, primary settling tanks and exhaust air cleaning plants and also fire fighting stations. BHS consists of three houses called main junction house, stock house 1, and Stock house 2. Junction housing 7 floors, in 7^{th} floor 5 incoming conveyors KA_l, KA_2 for handling of sinter 1400 width and 800 tones per hour capacity KK_l, KK_2 for handling coke same 1400 width 350 TPH additive's and iron ore handled by KP conveyor 1400 width 800 TPH below the above conveyors corresponding troughs are there for KK_l, KK_2, KA_l, KA_2 and KP having reversible shuttle conveyors to feed the material as fifth floor reversible conveyors KK_l KK_2, KA_3, KA_4. From this conveyors material take to stock house I & Stock house II B_3 & B_7, B_4 & B_5, B_8 & B_9, B_6 & B_{10}. In stock house B_3 & B_7, B_4 & B_8 coke conveyors pour in the coke bunkers and 5700 M^3 and lump ore 1900 M^3 capacity. Coke, Sinter and Iron ore are screened in vibrating screen up to 400 M^3/hr capacities to remove the fines. Fines sent to sinter plant by return conveyors.

All weighting hoppers as per batch matrix wise discharge the material on the B_1 conveyor. Both control rooms having instrumentation weight batch controllers working with the help of load cells, control room totally control by PLC (programmable logical control).

Same as Stock house I, Stock house 2 also consist of conveyers and screens. From 4th floor like B_3 B_7, B_4 & B_5, B_8 & B_9, and B_6 & B_{10} in Stock house I, in Stock house 2 also B_{2-3} & B_{2-7}, B_{2-4}, $B_{2-5,}$ B_{2-8} & B_{2-9} and B_{2-6} & B_{2-10}. Conveyers are used to fill the Bunkers. From Bunkers raw material is screened. For Coke 06 nos. of screens and weighting hoppers, for sinter 05 nos. of screens & weighting hoppers, for Iron ore 03 nos. of screens and weighting hoppers and for additives feeders with hoppers are installed'

2.1 Burden Handling System In Blast Furnace:

The Burden Handling System Consists Of The Following Units.

I.Burden materials handling conveyor system from the stock bin building of the sinter plant to B.F. junction house.

II. Stock house of B.F-1 with the gallery for burden handling to the top.

Burden materials handling conveyor system from the stock building of the sinter plant to the B.F. Junction house. It consists of 5 conveyors. These are KK_1, KK_2, KA_1, KA_2 and 'KP'. Coke will be handled by two (one stand by) conveyors KK_1 and KK_2 of 1600 mm width up to 350T /hour capacity. Sinter will be handled by two (one stand by) conveyors KA_1 & KA_2 of 1400mm width up to 800T/hour capacity sized ore and additives will be handed by one conveyor KP of width 1400 mm up to 800 T/hr. capacity. The conveyor KA_1 can also supply sized iron ore.

In the junction house, the burden materials will be supplied by Cross Over troughts and a rolling reversible conveyor to stationary reciprocating conveyors which supply lthem to the 4 main conveyors (b_3,b_4,b_5,b_6) KK_3, KK_4, KA_3 AND KA_4 are the 4 stationary reciprocating conveyors. Thus coke from conveyors KK_1 and KK_2 will be supplied by Cross over troughs to either of the stationary reciprocating conveyors KK_3 and KK_4. Similarly also additives will be handled from KP conveyor to either of the 4 stationary reciprocating conveyors KK_3, KK_4, KA_3 & KK_4 by means at a rolling reversible conveyor KKP.

The characteristics of this rolling reversible conveyor KKP are:-

1) Belt width -- 1400mm
2) Conveyor length between Centers of the drums -- 1.6 Meter /sec
3) Belt speed -- 1.6 Meter/sec.
4) Capacity -- 800/hr.

There are 17 bins in the stock house. There are 6 bins for coke, 6 bins for sinter, 3 bins for additives and 2 bins for iron are.

Table2.1The capacities are as follows.

Material	**Total Bins**	**Cap. Of each bin**	**Total capacity**	**Material stock**
Coke	6	950m(3x427.50t) each	5700 m^3	19 hrs.
Sinter	6	3 bins of cap 1165 m^3 (9097 tech) 3 bins of cap 735 m^3 (1323 tech)	5700 m^3	33 hrs.
Additives	3	400 m^3 (640 tech)	1200 m^3	100 hr each
Iron ore	2	950 m^3 92375 tech)	1900 m^3	73 hr each

Table2.2The characteristics of the 4 reversible shuttle conveyors b_7, b_8, b_9, b_{10}, are:

S.No.	**Characteristics**	**B7**	**b8**	**b9**	**b10**
1.	Belt width	1600 mm	1600mm	1600mm	1600mm
2.	Conveyor length between center of drums	48.1 m	52.1m	52.1m	48.1m
3.	Belt speed	1.6m/sec	1.6 m/sec	1.6m/sec	1.6m/sec
4.	Total consumption capacity	260T/hr (coke) 800T/hr	260T/hr 9coke) 800T/hr	800T/hr	800T/hr

		(additives)	(additives)		
5.	Conveyor speed (assembly Movement on track)	0.33 mtrs/sec	0.33 mtrs/sec	0.33 mtrs/sec	0.33 mtrs/sec

The specification of D_1 Conveyor is:

1) Belt width/length -- 2000mm/419mtm
2) Conventional capacity -- 2161m^3/hr
3) Max angle of elevation -- 10°30'
4) Belt travel speed -- 2mtrs/sec
5) Drive type -- double pulley intermedium
6) Main drive power -- 800+500 kws
7) Rated voltage of electric -- 6kv
   motor of the main drive
8) Power of helper working drive- 75kw
9) Reserve drive power -- 500+500kw

D_1 Conveyor:

The weighed material are fed on the horizontal conveyor b_1 then through an over loading unit on the conveyor D_1 and into the charging device of the furnace top. Time interval between portions on the conveyor depends from operation of the charging device run of furnace and top. Time interval between portions on the conveyor depends from operation of the charging device run of furnace and corresponds to the given programme of BF charge. When the charging system of BF works at high speed condition minimum time interval between portions of material in 40 see. Max size of coke portion 22-56, sinter portion 49.lt, additives portion 5t, lump ore portion - 13.lt. The service life of DI conveyor with minimum time interval between portions of material at high speed condition should be not more than 3 hrs/ day. Operating condition of the conveyor conditions 24hrs/day. The conveyor DI is heat resistant rubber rope belt, rigidly of its in 4000 kg F / cm of core width.

2.3 Junction House Details:

1) At elevation 59.7m TEOT cranes are there each capacity 20T space16 m and 54 m Lifting height.
2)One freight passenger lifts at capacity 38.6 m lifting 350 T / hr.
3)KK-1 belt conveyor, type-200, belt width 1400 mm and length 450 m of capacity 350 T / hr.
4)KK-2 belt conveyor, type 200, width of the belt is 1400 mm and length 450mtrs of cap-350 T / hr.
5)KP belt conveyor type-200, belt width 1400 mm and 256 m of capacity 800 T/ hr.
6)KA-1, belt conveyor type-200, belt width 1400 mm 301m of capacity 800 T / hr.
7)KA-2, belt conveyor type-200, belt width 1400 mm and 301m of capacity 800 T / hr.
These above all are at elevation 51.7 m level.
8) KK-3, belt conveyor type-120, belt width 1400 mm and 33mof capacity 800 T / hr.
9)KK-4, belt conveyor type-120, belt width 1400 mm and 33mof capacity 900 T / hr.
10)KA-3, belt conveyor type-120, belt width 1400 mm and 36.5m of capacity 800 T / hr.
11)KA-4, belt conveyor type-120, belt width 1400 mm and 36.5mof capacity 800 T / hr.
12)Retractable reversible conveyor of belt width 1400 mm capacity 800 T/ hr and length -11500mm.

2.4 Air Cleaning Plant Of Burden Handling System:

The Burden Handling System handles the various raw materials required for charging into the furnace. The various raw materials are Coke, Sinter, sized Iron Ore and additives. In fact lot of dust is generated while handling there materials. In order to remove the dust generated in the stock house, the following is provided in the Burden Handling System.

I} Covering for the dust generation equipment.

2} Local suction devices from coverings.
3} Cleaning of dust in exhaust air in the electro - static precipitators.

The air exhausted from the screen coverings, weighing hoppers, feeders, stock loose reloading places in directed through the collector for cleaning in 3-3-230 type electrostatic precipitators. These are two ESPs. 3-3-230 electro-static precipitators is a horizontal three fold apparition with .discharge needle type electrodes and collecting 5 shape electrodes. The electrodes height is 12 m. There is a provision for the pre chamber with gas distributing grids in order to ensure proportionate distribution of gas before the electrostatic precipitator. Shaking of discharge collecting electrodes and gas distribution gids will be performed by means of a hammer. The intervals between shakings are determined during start up adjustment work. The dust caught from the electro static precipitators bins are delivered by slice feeders to the conveying pipe line which there transfers it by air to the dust granulation plant after balling the dust in discharged into automatic transport of general purpose.

table 2.3 basic parameters of exhaust air cleaning plant:

S.No.	Description	Unit	Qty.
1.	Plant cap. (two 3-3-230 type ESP's)	m^3/hr	2,000,000
2.	Temp. of air at the plant inlet	0^0C	10 to 45
4.	Dust content of Co. gas at the inlet bulk wt. of the dust	Gm/m^3	2.85
5.	Bulk wt. of the dust	Gm/Cm^3	2.0
6.	Qty. of dust caught by 2 precipitators	T/day	1
7.	Dust content of the cleaned air	G/m^3	0.1
8.	Hydraulic resistance of the ESP	Kg/Cm^2	30
9.	Average velocity of the air in the action pectin of the ESP	Mt/sec	1.2
10.	Power consumption	Kw	833

2.5 Safety And Protection Devices In Operation:

Conveyor system incorporated electrical safety devices to facilitate protection of operating personal as well as to prevent damage to the mechanical portions of the conveyors. The common devices normally used are the following. Some transfer points and certain materials dictate the use of chute level switches. These are intended to operate when the chute becomes nearly plugged and are arranged to shut down the conveyor discharging to the chute. Similar switches are used in hoppers, bins and below the discharge points of stackers.
These switches require normal reset to make motor control circuit operable. Conveying equipment moving during normal operation requires and travel and over travel limit switches to maintain such movement within safe limits. Example of this type of equipment include tipplers, shuttle conveyor and stackers. Audible devices are normally conveyor system in being placed in operation or that equipment in the travel mode. A better form of interlock in the use of a centrifugal switch driven by an idler pulley at the last point on the belt to start moving. These switches can be used to prevent starting of the next belt, until such time in belt speed has closed the switch contacts. Conversely, they can be used to stop the next belt if speed has decreased below a given value. Mary of those switches can be obtained with variable spitting for speed increase and decrease. A modern and efficient control center employing television to monitor or complex and extended belt conveyor system. A well developed mater control center and console which provide for efficient operation of the belt conveyor system.

2.6 Periodics Repairs Required:

Periodic repairs required on belt conveyors and their drives are follows:
1)Daily oil should be checked in all KD type gearboxes and once for every two weeks should check-up all other PKD type conveyor gear boxes.
2)Periodically idlers, return rollers, skirt plates scrappers, snub pulleys, head end drums, side rollers and tail end drums will be replaced by
3) Periodically belt conveyors will be replaced by new conveyors and sometimes rubber patches will be provided when ever belt damaged.
4) Sometimes the conveyor comes one side due to half center loading in to be centered and tail and head end drums will be aligned properly.
5)During daily inspection if you found any leakage of oil in any gear box that should be opened and cleaned the two mating surfaces of gear box casing apply new gasket cement on those surfaces and mantled in its rival position.

6)If you found and misalignment in' the gear box input or output shafts and their couplings will be replaced or set sighted if possible.
7)Sometimes the shuttle conveyor realignment will occur, the shaft wheels will be lifted and placed in proper position.
8)Periodically the shaft wheels of the shuttle conveyor will be changed.
9)According to the requirement, tension will provided fro belt
conveyors.
10) Daily lubrication will be done in required places as per the requirement.
11) As per the preventive maintenance schedule some jobs will be maintained to prevent problem not to accruing future.
12) Some time timer gear boxes input or output shafts will be changed it found any fault in that gear box and gearbox casing also changed accordingly.
13) As per the requirement deck plates of shuttle conveyor should be charged and replaced by new one.

2.7 Types Of Rollers Installed And Their Maintenance:

There are two basic types of belt conveyor idlers or roller, carrying idlers. Which support the loaded run of the conveyor belt and return idlers which support the empty return run of the conveyor belt.

Carrying Idlers:

Carrying idlers are of two general configurations one is used for troughed belt and usually consists of three rolls. The two outer rolls are inclined upward ; the center roll is horizontal. The other configuration in used for supporting flat belts. These idlers generally consist of a single horizontal roll positioned between brackets which attach directly to the conveyor frame.

Return Idlers:

Return idlers usually are horizontal rolls positioned between brackets which normally positioned between brackets which normally are attached to the under side of the support structure on which the carrying idlers are mounted. Two roll 'V' return idlers are also used for better training and higher load rating.

2.8 Rollers Are Lubricated And System Of Lubrication To The Rollers:

Lubrication in one of the most important items of maintenance most troubles and breakdowns of machines or machinery can be traced to non observance of the specified lubrication schedule and the use of improper lubricants. Particularly the rollers are lubricated as per the manual supplied by the manufacture of that particular rollers. Lubricants are selected depending on the pressure per unit of frication surface, area, speed, finish of the rubbing surfaces, temperature, shape and nature of the junction. Hence, when selecting or lubricant the operating duty of the mated parts, the degree of their wear and specific feature of operation should be taken in to account.

Generally for lubricating every roller of conveyor, more man power in required. That's why the rollers are lubricated thrice in a year. Monthly lubrication will given better performance and increase life of rollers. But it is not possible because even one conveyor having some hundreds of rollers. If there is any possibility to provide centralized lubrication system in conveyor rollers. After lubrication over the grease nipples must be refitted. The rollers are lubricating before fitting them in their position over lubrication also avoided in rollers because this system will cause some troubles. So rollers are properly lubricated as per the requirement.

III. VIBRATORY SCREENS

Below the bunkers, the vibratory screens are fixed. For additives there are no vibrating screens but only additive feeders are there for screening, 'Coke, Sinter and Iron ore, there are double screening arrangement are provided. For coke screening, punched plate sieves are provided. The upper sieve is of Φ40mm while the lower sieve is of Φ25mm. The screening of sinter, ore in done by the grate type of sieves with the upper one of ~20mm, while the upper ore of Φ20mm while the lower sieve is of Φ5mm . The vibrating screen in an ore mass vibrating system with mechanical in extra exciters secured in the vibrating mass, the system being coupled with the (base with flexible links) i.e., springs.

The vibrating system vibrates in resonance under action of the forces generated upon synchronous rotation of the shafts of the vibrations in the opposite senses, The screen is placed into a line of continuous operation equipment to sieve the material on sieves. The sieve secured rigidly to the box to vibrate linearly at 450 inclination to be the horizon. This enables to sieves the material, and transfer it along the sieve in the discharge direction.

The screen operator in a mode directed by the rotational speed of the vibrator exciter and by the amplitude of vibration of the box. The amplitude in adjusted by varying equally the external unbalanced masses. The vibration frequency of the screen is not adjustable. The screens are intended for intermittent operation' start' &stop mode, as in sieving a blast furnace burden material should be equipped with crane motors type MTKH

having considerably starting torque on the shaft.
The characteristics of the screens are as follows:
1)Screening S / c dimensions in mm
Width -- 2000 mm
Length -- 4960 mm
2. No. of screens -- 2
3.Vibrator rotational speed, 'BAO rpm
RPM 735 at 50 HZ RPM 880 at 66 HZ MTKH 600 - 840
4. Amplitude (half swing) mm: 6 at 50 Hz
5 at 60 Hz
5. Installed power of motors: 2 x 22=44kw
6. Overall dimensions of oscillating
Portion of the screen length : 5760mm
Width : 2690mm
Height : 2000mm
7. Inclination angle of screening s/c 0^0

Periodical checks of the screen include 'these of its overall dimensions vibration amplitude and rotational speed of the vibrator shafts. To check the our all dimensions, use can be made of a measuring reel accurate with in 5mm to check the vibration amplitude, use can be made of an indicator triangle. The check for the vibration amplitude should be accurate with in 0.2 mm. The recommended instrument to check the rotational speed of the vibrator shafts (No. of box vibrators/min) in STROBOSCOPE a tachometer is also allowable in which cash the rotational speed of the shafts is determined based on the measured' rpm' of the drive motors.

Table 3.1The specifications of the screens are given below:

S1.No.	Description	Coke screen	Sinter/iron ore screen	Additions feeder
1.	Capacity m^3/hr	360	360	150
2.	Sieve size			
	Upper	40mm	20mm	--
	Lower	25mm	5mm	--
3.	Type of drive	Electro	--	Electro
		Mechanical	--	Vibrating

The furnace charge (sinter, are and coke) in fed to the weighing hoppers by means of screens and the fines from under the screens will be discharged on the four longitudinal fines conveyors KM-1, KM-2, KM-3, KM4 by way or chutes and gates which change over the flow of fines. Where by they are carried to the transverse conveyors out of the four longitudinal conveyors, two conveyors KM-1-3 &KM-1-4 are arranged under the sinter and ore hopper and the other two conveyors KM-l-1 &KM-l-2 all placed under the coke hoppers. Each pair of the conveyors in engaged in the transportation of only is kind of charge fines.

Table 3.2 The specification of the fines conveyors are given below:

S1.No.	Description	Coke fines conveyors	Ore and sinter fines conveyors
1.	Type	Belt	--
2.	Width of belt mm	1000mm	1000mm
3.	Length	100000mm	124350mm
4.	Belt speed m/ sec	1.14	1.14
5.	Capacity M^3/hr	350	350
6.	Bulk density of conveyor material	0.45	2.5-1.5
7	Conveyor drive	Non-reversible	Non-adjustable

IV. WEIGHING HOPPERS

The Sinter, Coke, iron are and additives weighing hopper are intended for the making up of weighing of these materials, their short time storage and for charging them on command into the furnace charging

Conveyor. The making up of a weighing in accomplished by mean of a strain gauge system, where in the strain gauges bear the weight of the weighing hoppers and feeding of materials to the weighing hopper in affected through screens (for sinter, iron are and coke) and feeder for addition.

After the weighing of charge to dumped into the conveyor, the weight hopper gate in fully closed and a signal is sent from the batching control complex on the absence of material in the weighing hopper a command in sent from the automatic control circuit to the control circuit of the screens or feeders for the making up my a new preset weighing of material. A Screen or feeder in engaged and material in fed to the respective weighing hopper. The charging mechanism are disengaged on reaching the weighing or slightly earlier.The weight of the materials in the weight hoppers in indicated on the digital displays of the indicators installed on the boards of the pneumatic.

On receiving the command for dumping a weighing of charge into the conveyor, the weighing hopper gate drive motor is started to run in the direction of opening the gate. The rotation of the motors is transmitted through a reduction gear to the crank, which through a tie rod, opens the gate. These must be no mistake in the direction of rotation of the motor. The complete opening of the gate in effected with the crank having turned around 180°. The flow rate of the material in to be adjusted before hand by means of manually operated shutter plate which partially class the hopper discharge hole as to height at the initial discharge of material from the hopper it is adjustable to set the shutter plate in such a way that the hole flow area be,

For Siner and 0.35Sy

For Coke 0.45Sy

After weighing hopper in completely empty, a command in sent (with a time delay) for the closure of the gate, where open the gate drive motor starts running in the direction of the gate closure. In the end positions of the gate (complete opening or closure) the drive motor is disconnected from the power supply line on the command from a mater controller a limit switches and then if I dynamically braked with the simultaneous application of an electromechanical brake. At the same time a signal is sent from the drive Circuit on the position of the hopper gate with the weighing hopper gate closed a permission signal in sent from the weighing hoper gate drive circuit for the transmission to the top charging program. The weighing hopper consists of

a)Hopper

b)Swinging gate with an electro-mechanical drive

c)Shutter plate with manual drive

d)Stands with strain gauges

The hopper in a welded made up of sheet steel. The hopper wall are finned outside and lined inside with a liner plates made up of wearresistance alloy steel,' the coke hopper I lined with dia base or tore plates. The armour plates and detachable and fastened to he hopper wall by meaner at bolts the dia base plates are also bolted to the hopper walls but on their placement the join to between them should be filled with mortar.

fig4.1: Weighing Hopper

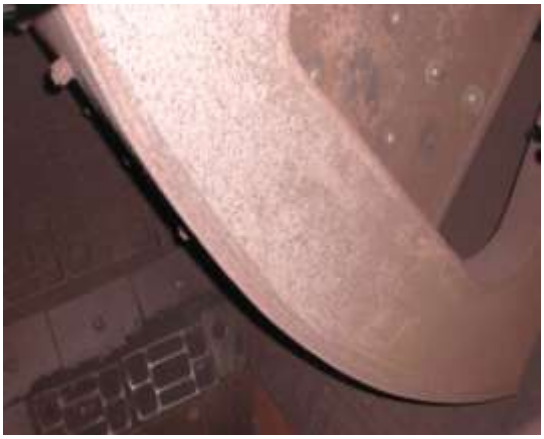

fig4.2 Weighing Hopper Gate

Table 4.1 The Characteristics Of The Weighing Hopper Are As Follows:

SI. No.	**Description**	**MATERIAL**		
		Coke	**Sinter**	**Additions**
1.	Method of weighing	Electro mechanical		
2.	Weighing limits	1 - 0 - 20	5 -100	0.25 - 5.0
3.	Useful volume of weighing hopper	$47M^3$	$47M^3$	$3.5\ M^3$
4.	Indicating instrument	Converting instrument	And batch 1<11	58.01
5.	Steps of indicator recordings, Kg	10	100	10
6.	Allowable limit or error	±100	±500	±20
7.	Bulk density of weighed Material T/M^3	0.45	1.8 - 2.5	1.6 - 2.5
8.	Granulometric composition of weighed Material mm	25 -70'	10 - 50	5 -10
.9	Temp of weighed Material CD	Up to 130^DC	Up to 100^DC	-
10.	Weighing hopper gate	Swinging	- do-	Value
11.	Weighing hopper gate drive for complete opening and closure of hoper discharge hole	Electromechanical cal		
12.	Time of gate opening		4 - 6 Sec	
13.	W /H gate Control	Automatic with possibility manual set up remote Control		
14.	Periodical adjustment of height of layer of charge dumped from weight hopper	Shutter Plate	Sliding shutter	Gate value
15.	Drive of sliding	- Manual-		
16.	Material for weight hopper lining	Wearing plates of 30 MM steel & Dia base plate	Wearing Plats of 30-250MM steel	Weighing plats of 10 mm steel

4.2 Scale Verification Devices:

The scale verification devices all used for systematic verifying the weighing hoppers by means of loading them with check up weights. The verification devices for sinter, coke and ore weighing hoppers are essentially two tracks with some weights, arranged on them. The weights are planed inside a special framing fitted with grips for the weights the grip are swiveled on rods and have two positions. In the position when the grips are along the track path they do not come the engagement with the weights when the framing in moving upward and when arranged square with axis of the weights and lift them up. At the top of the farming there in a cross piece engaged with the grip secured to weighing hopper. The weighing hopper grip is arranged along the axis of the truck travel at some distance from it as to height.

The grip in equipped at the top with a hydraulic cylinder. When the rod of the hydraulic cylinder in retracted, the grip lifts off the track framing with weights and a load is applied to the weighing hopper equal to the mass of the training with weights. The framings of both the trucks are to lifted off at the same time, where by the no. of weights in each training in to be the same. It will be necessary before lifting the weights, to lift off both the framings without weights, for which purpose the grips of both the framings one to be set in a position parallel with traveling direction of the truck. After the framing are lifted off, the weights indicators are set to zero. Then the framings are lowered and the verification procedure can be initiated. The verification of the weighing hoppers and the replacement of strain gauges in the weighing hoppers is possible only with the weighing hopper is empty.

The verification of weighing hoppers is supposed to be carried out as follows:

For coke weighing hoppers -- Once a week
For sinter weighing hoppers -- Once in every 10 days.
For additives weighing hoppers -- Once a month

4.3problem In Weighing Hopper Gate

In Burden handling section material flows proceeds from screen to weighing hopper than to B_1 &D_1 conveyors. Hence weighing hopper is a hopper, which is balanced and floated on load cells. Leakage of weighed material at that time of screening through weighing hopper gate i.e. between discharge end of weighing hopper and weighing hopper gate. Then leakage of material observed on B_1 &D_1 conveyors and conveyor stopped. Because of **BIN NOT READY**, then identification of problem, and restart conveyor has been taken so much time (i.e. 30 minutes). It was occurred 9 TIMES IN A MONTH.

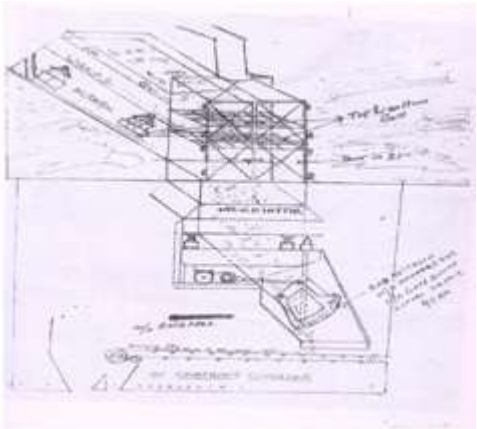

fig 4.3Material Leakage From Weighing Hopper Gate

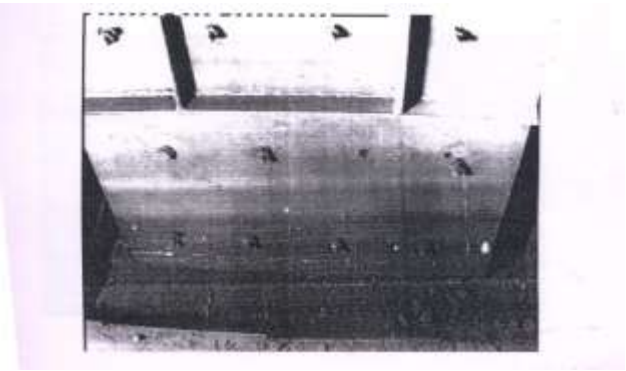

fig 4.4 Material Leakage Between Weighing Hopper Discharge End And Weighing Hopper Gate

4.4 DEFINING THE PROBLEMS:

- Unwarranted B_1, B_2 stoppages
- B_1, B_2 belt rupture / damages
- B_1, B_2 drive gear box problems
- Hole formation in B_1- D_1 chute
- B_1, B_2 idler/ pulley problems
- B_1, B_2 belt off center, tensioning problems
- Breakdown of all feeding conveyors at a time
- Weighing hopper gate leakage of material on B_1 or B_2 at the time of screening --- B_1, B_2 and D_l, D_2

CONVEYORS STOPPAGE OCCURS.

4.5 IDENTIFICATION OF THE PROBLEM:

Leakage occurred while screening between weighing hopper discharge end and weighing hopper gate. This is due to **WEAR OUT** of weighing hopper discharge end. Hence at the time of weighing hopper gate closing gap was found40mm.

4.6 solution:

To avoid such a stoppage of B1 and D1 conveyor. Remedy has taken to arrest leakage of material through discharge end of weighing hopper gate.As shown in figure provided a curved plate on both sides and front hanging rubber at weighing hopper discharge area. So only 5mm gap is maintained between weighing hopper discharge end and weighing hopper gate.

fig 4.5 Modification At Weighing Hopper Dischsrge End For Material Leakage Arrest

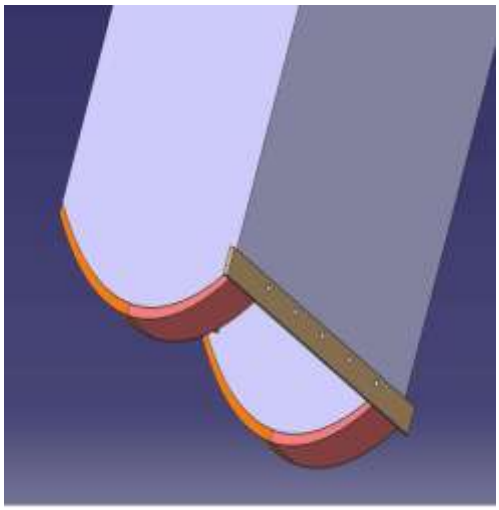

fig4.5aModification At Weighing Hopper Dischsrge End For Material Leakage Arrest

V. CONCLUSION

5.1CONVEYOR STOPPAGE BEFORE MODIFICATION:-

B_1 & D_1 Conveyor stoppage per month = 9 times
B_2 & D_2 Conveyor stoppage per month = 8 times
Now of after modification stoppages has been come down drastically
B_1 & D_1 Conveyor stoppage/month = 4 times
B_2 & D_2 Conveyor stoppage/month = 3 times
So leakage problem has been solved. But due to others problem such a stoppage still occurring.
1.b_1 & b_2 belt rupture of damages.
2.b_1& b_2 belt off center & tensioning problem.
3.D_1 ***&*** D_2 stoppages.
4.Hole formation in b_1 to D_l chute.
5.b_1 or b_2 drive gear box problem.

5.2cost – Benefit Analysis

Av. No. of stoppages of before modification
For B_l, D_l conveyor stoppages per month = 9 times
For B_2,D_2 conveyor stoppages per month = 8 times
Av. No. of stoppages after modification
For B_1 ,D_l conveyor stoppages per month = 4 times
For B_2,D_2 conveyor stoppages per month = 3 times
(Av.=3)
No. of stoppages reduced/month/furnace = 8 - 3 = 5
i.e. Out of 5 no. of stoppages at least $^1/_4$ of 5 stoppages will be delayed more than 15 min. and at least one batch (charge) will be missing
Missing charge per month per furnace = ¼ (5) = 1
Saving of production per year for both furnaces
= production cost/ thm x hot metal tonnage / batch
1 x 12 x 2 =Rs. (1342 x 40 x 1 x 12 x 2) = Rs. 1288320/-
Cost of implementation (Labour +material)
=2x(200x3x5) +1500 = Rs. 9,000/-

NET SAVINGS PER YEAR

= Rs . 11,79,320

5.3 Intangible Benefits

- Healthy furnace movement
- Effective utilization of manpower
- Minimization of cost
- Improved equipment availability and reliability
- Improved working condition

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