



DALMIA CEMENT (B) LIMITED – DALMIAPURAM



PRODUCTION DEPARTMENT

Issue No. 02	Rev. No: 01	Effective Date: 22.05.2015	SOP/PROD/11
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Issued By: S & P	Approved By: Head – Production
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SOP FOR CLINKERISATION , CLINKER COOLING & TRANSPORT INCLUDING SHUTDOWN & START UP PROCEDURE- KHD KILN

SCOPE : CLINKERISATION , CLINKER COOLING & TRANSPORT INCLUDING SHUTDOWN & START UP PROCEDURE- KHD KILN

RESPONSIBILITY : CCR executive.

Accountability : Section Head – Pyro.

PPE:

1. Safety goggles,
2. Safety helmet,
3. Safety shoe,
4. Mask,
5. Cotton Gloves.

TOOLS:

1. Poking bar,
2. Hammer.
3. Showel

Hazard:

Risks associated:

Mitigating Measures

Fall of tools;

Carry the tools in tool bags

Hit of Hammer in hand;

Trained to be engaged

Hit injury while poking

Hand gloves and no one near by while poking

Procedure:

- After an extended stand still.
- Check & ensure all the inspection doors / openings in the PH & ESP circuits are closed.
- Get clearance from Maintenance Department.
- Take trial run of ESP Fan.
- Take trial run of PH. Fan in SPRS , LRS and LRR Mode.



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- Ensure proper functioning of raw meal & coal ESP/BFs.
- Check & ensure functioning of all dampers & slide gates with their end position indications properly.
- Check & ensure ESP Hoppers & GCT Hoppers settling chamber hoppers are free of dust accumulation & slide gates if any are in open condition.
- Check & ensure proper sealing in fresh air flap of PH.
- Check & ensure adequate furnace oil in the tank.
- Take trial run of primary air fan & clinker crusher exclusively.
- Take trial run in group for
 1. Clinker transporting & dedusting
 2. Cooler group, including Cooler ESP.
 3. Kiln & auxiliary group.
 4. Rawmeal dust transport group.
 5. Kiln & PC firing groups.
 6. Kiln feed group except shut off gate.
 7. VRM II Plant groups.
- If any group is not ready for trial run in raw mill & coal mill plants; get the oral approval from concerned Section Head & get ready for start up leaving that group trial run. However, this shall be ensured before raw meal feeding.
- Check & ensure that gas analyser is working all right.
- Circulate the furnace oil & check the spray / automisation outside.
- Spread cold clinker or raw meal in the kiln where new brick lining was provided.
- Spread cold clinker to a height of 300-400 mm on IKN grate plates.
- Position the burner pipe at the correct position in the kiln.
- Tie all the pendulum flap with rope in open condition.



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- Check & ensure that there is no accumulation of dust or coating in the raw meal flow pipe in various stages or in inlet chamber slope portion.
- Check coal mill is charged with grinding media as per recommendation after unloading & sorting .
- Complete the preparatory checks for start up.
- If any group trial was not conducted before light up the same should be completed before raw meal feeding.

1. LIGHTING UP, STARTING & RUNNING THE KILN:

- Get the clearance from kiln M/A & cooler M/A.
- Check & ensure that fresh air flap is open.
- Check and ensure that the IKN grate plates are covered with Old Clinker.
- Start primary air fan & adjust dampers and jet air & twist air. Light up the kiln by igniting the burner with torch and arrange for furnace oil pumping to day tank from service tank when level goes low.
- Regulate oil flow and air flow to maintain the flame for ideal heat transfer.
- Start cooler fan 1R & 1L and keep minimum required air flow.
- Get the heating schedule and follow it up (0-4 hrs) , (8 – 12 hrs) , (12-16 hrs) , (16-20 hrs) (24-28 hrs) etc.
- If any group trial was not conducted before light up the same should be completed before raw meal feeding.
- Start T.A. Flap cooling Fan in deinterlock mode when inlet temp. is around 250°C.
- Start kiln coal dust feed group when kiln inlet temperature is around 500 oC if adequate coal dust is available in bin.
- Start clinker transport & dedusting group-420 & check all the drives are running.
- Start IBAU Silo infeed group for ESP dust transport and ensure all the drives are running.



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- Check & close the cooler auxiliary chimney damper and cooler back end door, if already open.
- Start raw meal feed group as per Procedure No. DP10 in recirculation mode and check all the drives are running smoothly and raw meal flow is normal in recirculation mode.
- When the Kiln inlet gas temperature reaches 850 – 1100°C, start ^{ESP fan} _{20.08.2007} and maintain around –5 to –30 mmwg draught after PH fan by adjusting ESP Fan speed. Ensure ^{ir} _{fields of Raw Mill ESP} are 'ON', if not ask concerned to check.
3
- Start Pre-heater Fan group 400 & put T.A. Flap in auto mode. Check & ensure PH Fan is started and taken over to SPRS or LRR .
- Open PH fan inlet damper and adjust the speed of PH fan to maintain a draught of 150-200 mmwg at PH fan inlet and close fresh air flap. Keep TAD damper fully closed.
- Ask Kiln M/A to put the Kiln on Main drive and Kiln Auxiliaries in auto / CCR mode as per Work instruction.
- Inform the Kiln M/A to release the pendulum flaps below cyclones from open condition and ensure unhindered movement of flap as per Work Instruction.
- Start Kiln and auxiliaries group (401) and ensure all the drives are running.
- Start IKN fans 1 & 2 and keep the inlet dampers closed.
- Start CFG fans 2R, 2L & PR fans and ensure minimum air flow is maintained.
- Start Cooler grates with a speed of 3-5 rph in Ist grate and ration of grate speeds at 1:1.2.
- Regulate the kiln coal & oil quantity to maintain temp. at inlet.
- Maintain PH fan inlet draft around 150-200 mmwg by adjusting PH fan speed and damper.
- Once PH fan inlet temperature reaches 300-340°C, divert the raw meal from recirculation mode to kiln mode.
- Start kiln feed group 321 as per procedure after ensuring that the PH fan outlet temperature is about 300 – 340°C. & draught at PH fan inlet is about 400 to 500 mm wg.
- Check the temperature & pressures are varying as the feed enters the PH & ensure raw meal pipe-flaps are oscillating properly.



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- Start group 505 of coal feed to PC and ensures coal dust is fed to PC and all the drives are running.
- Regulate the PC Coal feed such that temperature at cyclone IV inlet is around 840 – 940°C.
- Put IKN air blaster in auto mode and ensure the blasting.
- Start cooler fans as required including the new fan and adjust cooler exhaust accordingly.
- Maintain CFG1L pressure between 600-750 mmwg by adjusting the grate speed and air flow in the cooler.
- Start coal mill plant as per procedure- DP13.
- Start VRM-II as per procedure-DP07.
- Stop furnace oil firing when adequate coal dust stock is ensured in coal dust bin I & II.
- Operate the plant i.e. Pre-heater, Kiln & Grate Cooler to achieve the quality of clinker as per quality control plan with optimum level production. i.e. around 120 TPH. By adjusting fuel feed rate, air flow rate, raw meal feed rate, kiln speed, grate speed etc. by maintaining the following important parameters.
- If any abnormality is observed in process parameter due to fault in process circuit or in the equipment as identified through the fault manager or in the advisor, concerned field personnel will be informed to check & give feed back for corrective action.
- In case of OPC- Grade 43, PPC if the kiln feed LSF/TC and the litre weight value is below the min. value as stipulated in quality control plan, then the clinker will be segregated and stored separately as given in DP24.
- In case of OPC- Grade 53/ GPHSSC Clinker, if the Kiln feed LSF/TC and the litre weight value is below the min. value as stipulated in quality control plan, it will be accepted as OPC- Grade 33/43 or PPC clinker, if the value is in the acceptable range or otherwise it will be segregated and stored separately as given in DP24.
- Such of these occasions, when clinker has been segregated will be reported to Head-Production as Non-conformities.
- For normal working the following operating parameters are suggested for optimized production.



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OPERATING PARAMETERS	TEMPERATURE °C	PRESSURE mmwg
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Before Pre-heater fan	300 – 405	- 300 to – 700
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After cyclone stage – IV	820 – 900	
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After Pyroclone	840 – 930	
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Kiln inlet temp.	850 – 1200	
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OPERATING PARAMETERS	TEMPERATURE °C	PRESSURE mmwg
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Pressure after PH Fan	-	-5 to -30 mm wg.
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Kiln Hood Pressure		-2 to –8 mm wg
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CFG1L Beam pressure		550-750mm wg
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- Operate the cooler in such a way that the following condition (refer Para 5.3) prevails so that maximum heat can be recuperated from hot clinker for clinker processing or pyro-processing.
- The above is achieved by regulating the air flow through clinker bed.
- When the operating parameter goes out of the suggested range take necessary corrective action to bring it back within the suggested range.

2 NORMAL OPERATING PARAMETERS FOR COOLER.

- | | |
|---|------------------|
| - Under – grate pressure in I St chamber | 220 - 450 mm wg |
| - Under - grate pressure in 2 nd chamber | 150 - 300 mm wg. |
| - CFG1R pressure | 500 - 750 mm wg. |
| - CFG1L pressure | 550 - 750 mm wg. |
| - CFG2R pressure | 400 - 600 mm wg. |
| - CFG2L pressure | 250 - 500 mm wg. |

- Secondary air temperature 800 to 1200° C .

- Tertiary air temperature 600 to 1000° C .

- Cooler exhaust temperature 100 to 300° C

- Clinker temperature 70 – 200° C in Aumund Conveyor.



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- IKN-KIDS Cooler temperature below 80° C
- Grate plate temperature below 200° C .
- Kiln is operated by constantly monitoring raw meal feed to kiln, kiln & PC coal dust feed, Kiln speed, kiln load KW & AMPS, % O₂, % CO at PH outlet and brightness of burning zone.
- The actual coal dust to kiln or PC is checked with solid flow panel counter by comparing with loss on weight for a fixed period after stopping the coal dust feed to that bin. If the error is above +/- 10% the calibration of solid flow meter is to be carried out. The % error is recorded in fault register and informed to concerned, for carrying out calibration work.
- Put operation of cooler drive on pressure control system i.e., CFG1L beam pressure is under loop control with the speed of the first grate speed (Strokes per minute). The speed of the grate II is not less than 1.1 times of speed of 1st grate.
- Adjust the IKN fans reversing flaps, if needed, to maintain even bed thickness on KIDS and to eliminate red river problem.
- Put cyclone IV outlet temperature in loop control with PC- coal dust feed.
- To fire furnace oil sludge in pyroclone:
 - a) Make sure that sludge is available in the tank (min 500 mm).
 - b) Switch 'ON' the heaters at the oil pumping unit at kiln platform and tank heaters.
 - c) Run the pumps in recirculation for about 2 hours keeping the oil temperature between 75 and 90° C.
 - d) Check the oil spray from the lance for PC firing after directing the oil to PC firing system.
 - e) Put the spray nozzle into PC burner and run the firing system with a pressure between 8 and 15 bar in line.
 - f) Stop firing when the tank level is below 500 mm.



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- When the plant is running in steady state condition put the kiln control under OFLCS and give the set points to keep the stable condition and ensure quality clinkers as per the procedure below, when OFLCS is available for operation.
- When OFLCS is not in operation change over to manual mode in the Foxboro PC.
- **STARTING OPTIMA FUZZY LOGIC CONTROL SYSTEM. (OFLCS)**
 - 1) After restarting the system, open RSLinx and minimise it.
 - 2) From desk top double click clinker OFLCS.
 - 3) OFLCS will get started in simulation mode along with the driver. Minimise the driver.
 - 4) Open Control Action Report from fuzzy and see whether the values are getting transmitted. If the values are not getting transmitted, close Fuzzy Logic System (refer the instructions to close the OPTIMA Fuzzy Logic Control System) and restart the computer. Then continue from Step 1 of this instruction set.
 - 5) Then get logged into the system by giving the user name “OFLCS”. Now only you will be allowed to enter the limits.
 - 6) Clinker Quality Module from Start Menu. It opens up a window for enter the litre weights.
 - 7) Change the system status in OFLCS to online mode.
 - 8) Change OFLCS will go to online mode.



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9) Operators can now choose Ramco mode after giving the current set points in WRITE PARAMETERS for automatic control of kiln and cooler.

- CLOSING OPTIMA FUZZY LOGIC CONTROL SYSTEM

- 1) Change the system status in OFLCS to simulation mode.
 - 2) Now OFLCS will come to simulation mode.
 - 3) Click OK in the Quality Module window and close it.
 - 4) In the fizzy screen click the menu “System”. From here click the exit option.
 - 5) A message will be displayed “This will end your OFLCS session”. Click OK.
 - 6) Now OFLCS will get closed.
- During normal operation of the plant, follow the instructions (Refer Annexure- 1) for safe operation. Write log sheets once in a hour. In case of any problem in the plant or the when the plant is under stablisation , the logsheet readings will be recorded for the next hour after stablisation.
- When the kiln plant operation is to be stopped due to breakdown in maintenance system or production or known power interruption etc. the following documents to be referred and followed.

3 SHUTTING DOWN THE KILN PLANT FOR SHORTSTAND STILL:

- When the kiln plant is to be stopped for a longer period for planned shut down (More than 8 hrs.). The above documents to be referred and followed.

4 SHUTDOWN THE PLANT FOR EXTENDED STANDSTILL:

5 FOR STARTING THE PLANT AFTER A SHORT STAND STILL:

- During power failure the immediate measures to be taken are explained in the Annexure-5.



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- Monitor the operating parameters in Pre-heater & give instruction to PH, M/A & Kiln to clear the coating if any in inlet chamber, pyroclone, cyclone etc.
- Record any small or major maintenance or production or process problem in fault register.
- Monitor all the important operating parameters and indicated values in the advisor and ensure that the operating parameters are recorded automatically in the Logsheet. In case of any problem on automatic generation of the Logsheet, record manually and inform the concerned engineer to solve the problem.
- Record stop, start timing of kiln feed raw meal interruption occurred with the probable reasons.
- Record Laboratory information like Kiln feed raw meal analysis result, % residue, Litre weight of clinker etc.
- Take remedial action like changing of setting of sweetner or additive feeding to raw mill in order to maintain the kiln feed raw meal values in line with Quality Control Plan.
- Take remedial action in altering the operation parameters in order to maintain litre weight.

6 ROTARY KILN OPERATION UNDER NORMAL CONDITION:

6.1 Instruction for safe operation:

Location and eliminating mechanical electrical and process engineering failures in the plant are pre-conditions for ensuring as trouble free operation as possible.

For preventing costly disturbances and standstills the instructions and rules specified below definitely have to be observed.

6.1.1 Kiln Waste Gases:

To ensure proper burning of the kiln fuel maintain O₂ not less than 1.5% and CO not more than 0.5% at the PH fan inlet.

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As a CO-content of more than 0.5 - 0.8%, high voltage supply and rapping gear of the electrostatic precipitators for coal and VRM-II respectively have to be disconnected immediately – unless these operations are done automatically.

In the event that actions taken, such as reducing fuel feed rate and / or increasing the pre-heater fan speed and increasing the required negative pressure in front of the pre-heater fan which has to be observed – have to be stopped. This applies, in particular, upon first start up of the rotary kiln.

In the event that monitoring combustion as a function of the O₂ –reading and of applicable temperatures, pressures and gas volumes within kiln and pre-heater is impossible, the high voltage supply to the electrostatic precipitator or even the complete system has to be stopped.

6.1.1 Temperatures:

The waste gas temperature measured at the pre-heater fan must not exceed 405° C during continuous operation.

Granulating material inside the sintering zone will have the gas temperature behind cyclone IV reach values of about 800 oC. With temperatures reaching values above 950 oC the draught through kiln and pre-heater and the fuel rate have to be reduced. Prior to reducing the fuel rate, efforts should be made to lower the gas temperature by increasing the raw meal feed rate. Upon over-heating of cyclone IV – which may happen at an interruption of raw meal supply of no more than 1 – 2 minutes raw meal coating will readily occur at the refractory cyclone lining. During Production operation coatings that have come off may be the reason for clogging phenomena because they have got stuck in the raw meal flaps and raw meal lines.

If the temperature within the sintering zone falls to a level that even upon low kiln speed clinker formation will no longer be ensured, the plant has to be heated up over the fresh air socket long enough until standard granulation of the material has been restored.

6.1.3 Raw meal feeding:

Raw meal feeding should not fall below 40% of the rated capacity of the plant during start up in order not to induce coating and clogging, especially of cyclones III and IV after system overheating.

The plant should be fed with material after termination of the heating up period only if satisfactory granulation and clinker formation within the sintering zone are ensured.

Otherwise, heating up of the plant with open fresh air socket has to be continued until operating temperatures have been reached.

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6.1.4 Important rules for Pre-heater / Kiln/ Cooler Operation:

The intervals of upward and downward motion of the kiln shall not exceed 1 day shift so as to prevent scoring of the supporting rollers. If the period mentioned is either much shorter or longer this draw back, has to be overcome by the well-known mechanical and electrical manipulations for shortening or extending the upward and downward motion.

As soon as rough patches or scores become noticeable on the contact surface of the thrust roller the lateral contact surface of the tyre and of the thrust roller have to be lubricated continuously.

For maintaining stable kiln operation during Production the sintering zone has to be watched continuously and the power consumption of the main kiln drive (KW-reading) definitely has to be controlled.

It will be of advantage to have the sintering zone temperature, i.e. the clinker outlet temperature measured during first start up. To do so the free lime content of the clinker should be determined at intervals of no more than 8 hours because a constant relation between weight per unit volume and content of free CaO will be upset varying raw meal composition and depending on the coating of the kiln.

- The waste gas temperature has to exceed the dew point of the electrostatic precipitator. This is the only way of avoiding steam condensation.
- High excess air means low gas temperature in the kiln and poor heat transfer. The heat consumption will increase.
- In contrast to the statement just made little excess air means high gas temperatures in the plant and satisfactory heat transfer.
- Upon heating the plant with coal of high ash content, ash deposits may occur especially in elbows, cyclone tips and raw meal lines.
- Such deposits, if any, definitely have to be removed prior to raw meal feeding.
The coal ash accumulated in the rotary kiln may entail abnormal burning conditions which duly have to be considered. There may then be pronounced “Snowman” formation in the cooler.
- A jam in Preheater cyclones can be detected by one or more of the following,
 - a. Draught above cyclone increases
 - b. Draught at Cone of the cyclone decreases
 - c. Temperature at Cyclone outlet increases
 - d. No movement of cyclone flap
 - e. No suction at poke holes
 - f. Jam detected by Gamma ray detector

In any of the above condition kiln feed should be directed to re-circulation side immediately and jam to be released as per procedure DCB: SFT:W:PRD:06.



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6.1.5 Information on Pre-heater Fan operation:

The bearing temperatures have to be controlled every hour upon commissioning the fan.

If the plant is stopped, the inspection cover of the pre-heater fan housing shall be open only after the fan temperature has dropped to about 150°C. If the cover is opened at higher temperatures there is danger that the impeller cools down unilaterally by the inflow of cold air thereby damaging the impeller.

The pre-heater fan temperature shall not exceed 405° C during continuous operation and at temperatures of 425° C at the latest the fan shall be automatically stopped.

6.1.5 Excess temperature in front of the Pre-heater fan:

Excess temperatures in front of the fan caused by interruption of the raw meal flow or by other occurrences which have been noticed too late required the following checks to be taken immediately.

- Stopping the Pre-heater fan.
- For avoiding thermal deformation the Pre-heater fan should be operated at minimum speed.
- The fuel feed rate has to be lowered to a minimum or interrupted completely.
- The flap in front of the Pre-heater fan has to be closed.
- The fresh air socket has to be opened.
- The kiln speed has to be reduced to a minimum.
- The grate cooler has to be stopped.
- Injection of water into the spray tower has to be stopped, the flap in front of the precipitator fan has to be closed. The fan should then be operated at minimum speed. The high voltage supply to the electrostatic precipitator has to be stopped.



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7. SHUTTING DOWN THE KILN PLANT:

Details on the procedure for shutting down the instrumentation have to be taken from the documentation for electrical engineering.

7.1 Shutting down the kiln plant for short stand stills:

Shut down kiln and secondary mill upon “Compound operation”.

Disconnect kiln and secondary firing fuel feed or lower their capacity to a minimum.

Direct the raw meal to recirculation mode and continue turning the kiln at minimum speed.

Open fresh air socket. Have socket closed again in case of excess temperature drop within the system.

Lower the pre-heater fan speed to a minimum value while adjust a pressure of just a negative pressure behind the pre-heater fan, or have the fan stopped completely. Have flap in front of or behind fan closed (3.1.5 refer).

Reduce the ESP fan speed to minimum and then stop the fan.

Reduce kiln speed to a minimum or disconnect main drive and continue turning the kiln with the aid of the auxilliary drive. Disconnect cooling air blower at the kiln outlet.

Shut down all cooler blowers except the blower of the first cooler compartment. Reduce air volume of the first cooler blower.

Disconnect cooler grate drive.

Adjust the kiln hood to just a negative pressure by the cooler waste air fan.

Run cooler grates at regular intervals for distributing the clinker falling into the cooler inlet from the kiln which is turned with the aid of the auxiliary drive.

Close tertiary air flap.

If the temperature inside the pre-heater increases to 900°C behind cyclone IV during the standstill it will be necessary to have the ESP fan changed to minimum speed as well and to close the flap behind the fan so as to preclude the formation of coatings in cyclone IV upon restarting the plant

If the standstill exceeds 30 minutes continuous kiln turning should be changed over to turning by ¼ revolution (at intervals of 15 minutes)

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6.5.2 SHUTTING DOWN THE PLANT FOR EXTENDED STANDSTILL:

The capacity of the plant should be reduced to the feed rate suitable for restarting; such reduction should be carried out 3 – 4 hours prior to the planned time of shutting down. This will avoid that the meal volume accumulated at the kiln inlet during production operation will reach the sintering zone because the kiln is turning continuously during the cooling period; if the meal would be displaced to the sintering zone this would affect heating up and starting operation.

- Upon reducing the capacity for the planned shut down of the plant, the graphite blocks have to be withdrawn from the supporting rollers thus making sure that the kiln will have reached its top most position until it is shut down.
- Disconnect raw meal feeding.
- Stop operation of the raw material mill.
- Have the coal feed bins emptied. If required or keep minimum stock.
- Open the fresh air socket.
- Shut off rotary kiln firing and PYROCLON system; close tertiary air flap.
- Have primary air blower continue operation at reduced capacity for cooling the burner lance.
- Have blower of the secondary firing system continue operation.
- Shut off pre-heater fan or continue its operation at minimum speed; shut off cooler blowers IV and V (unless they are disconnected by the interlocking system). Reduce air volume of IKN and CFG fans to match the volume to the capacity of the cooler dust collecting system.
- Shut off kiln main drive and have the kiln turned continuously with the auxiliary drive.
- Reduce cooler grate stroke number to a minimum.
- Change kiln hood pressure control system to the prevailing operating conditions by adjusting the flap behind the fan of the cooler dust collecting system.
- Close throttle flap in front of the pre-heater fan.
- Close throttle flap in front of the spray tower.
- Disconnect cooling air fan at the kiln outlet.



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- Shut down filter fan: Closed flap in front of fan.
- Withdraw ignition burner for light fuel oil.
- Disconnect dust transport system of the precipitator after ensuring the empty hopper.
- Withdraw gas sampling probe from the inlet chamber.
- Have burner lance withdrawn for the first time from the kiln hood by 1 meter after about 3 hours. Subsequently, have it withdrawn further by 0.5 M at intervals of 1 hour. Burner will be withdrawn after 30 mts. After shutdown if plant is stopped for changing burner lance pipe.
- After shut down of the plant turning of the kiln has to be continued for atleast 1 hour with the aid of the auxiliary drive. Such continuous turning with the auxiliary drive has to be extended if red-hot patches exist on the kiln shell until such patches have disappeared.
- Shut down cooler grate operation.
- Continue running IKN fans at closed damper position.
- After termination of continuous kiln revolution with the aid of the auxiliary drive, the kiln shall be turned by auxiliary drive as from the time of shutting down the auxiliary drive.
- These intervals are changed as follows:

1/3 turn every 15 minutes for 2 hours	}	To be suitably altered
	}	
1 / 4 turn every 30 minutes for 4 hours	}	If reqd. to be stopped brick lining. ESP Fan
	}	to be started at min. speed & min. damper
1/8 every after 60 minutes for 4 hours	}	opening after 8 hours. Of kiln stoppage.
	}	Continue the cooling for 8 hrs. & stop the
1/8 turn every 2 hours for 6 hours	}	fan.
	}	
1/8 turn every 4 hours for 6 hours	}	
- Shut down primary air blower.

The kiln hood may be opened after 8 – 24 hours. Withdraw burner carriage.

The door of the cyclones, inlet chamber and the flaps on the elbows of the gas line may be opened after the plant has been allowed to cool down sufficiently.



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Commencing inspection and maintenance work at the various plant sections.

In case of heavy rainfall it may be necessary to change over to continuous turning with the auxiliary drive depending on the kiln shell temperature.

It has to be made absolutely sure that the kiln has reached its topmost position in cold state.

6.5.3 Shut down of the IKN-KIDS grate cooler:

When the kiln stops for a scheduled standstill, the IKN fan dampers are closed and the grate stroke is reduced so as to keep a clinker layer of adequate thickness on the IKN-KIDS grate plates. The discharge of material from the kiln, during kiln barring, has to be watched and the grate drives are switched on from time to time to maintain the adequate clinker bed thickness on the KILN-KIDS grate plates. The back end cooler fans are stopped after 2hrs of the kiln stoppage. Once the kiln barring is stopped, IKN-KIDS, CFG grates and second grate can be emptied. The IKN and CFG fans, grate drives and clinker crusher are stopped.

We recommend to have the grate system inspected and maintenance jobs carried out, if necessary.

6.5.4 Starting the plant after short standstills without heating flame and providing for immediate raw feeding over the pre-heater.

Whether the plant may be started after a short standstill by immediate raw meal feeding over the pre-heater has to be decided from case to case. However, the temperature behind cyclone IV shall not be less than 650 °C if production operation is started immediately. If there is any doubt it should be general rule to have the kiln heated up via the fresh air socket (see 4.1.9) until the sintering zone temperature have reached a level that permits clinker formation and consequently starting operation.

Operating state of the plant during short standstills.

- The Pre-heater fan has been stopped and ESP fan is kept running at minimum speed.
- Kiln raw meal dust transporting system operating.
- The firing system have been stopped, the primary air fans continue to operate for cooling the burner lance and the burners of the second firing system.



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- The kiln is turned by 1 / 4 revolution at intervals of 15 minutes with the aid of the auxiliary drive or it continues to revolve at minimum speed of the auxiliary drive.
- The Cooler IKN fans are kept running at closed damper position.
- The CFG cooler fans are operated at reduced air volume.
- The remaining cooler blowers and the cooler waste air blower have been disconnected.
- Clinker crusher and clinker transport system are operating.
- The temperature behind cyclone IV equals 650 / 750° C.
- The tertiary air flap has been closed.

UPON IMMEDIATE RAW MEAL FEEDING THE PLANT IS STARTED AS SPECIFIED BELOW:

- Ensure fresh air flap is open & ignite the kiln firing system and adjust the fuel feed rate to the volume normal for production operation with due regard to the maximum permissible waste gas temperature of 300 – 405° C behind pre-heater stage I; adjust the corresponding primary air volume.
- Adjust the O₂ content min. 1 % in the inlet chamber; as a function of the pre-heater fan speed.
- Switch on cooler grate drive at minimum speed.
- Start operation of the electrostatic precipitator fan; damper has to be opened.
- Start operation of the pre-heater fan; open flap in front of pre-heater fan. The pressure behind the pre-heater fan is adjusted with the aid of the flap installed behind the precipitator fan. Set the minimum speed at the pre-heater fan required for igniting the kiln firing system. The fresh air socket has been closed.
- Connect high voltage supply to the electrostatic precipitator. The Co volume has to be below 0.5% - 0.6% for Coal ESP & 0.8% for VRM-II ESP.
- Switch on dust transport, if stopped.
- Switch off auxiliary drive.

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- Have Rotary kiln continue to revolve with the aid of the main drive.
- Open CFG fan dampers and maintain minimum air flow.
- Start raw meal feeding.
- Check the raw meal flow in the pre-heater, at the flap boxes.
- Have cooler blowers IV and V switched on as required.
- Open the IKN fan dampers gradually and maintain the clinker bed thickness on KIDS
- Have fuel feed rates, raw meal feed rate and pre-heater fan speed, kiln speed and stroke number of the grate cooler increased to the necessary production volumes as a function of the kiln state.
- Start operation of the pressure-control system for the kiln hood.
Start operation of the cooler control system.
- Start operation of the cooler air blower at the kiln outlet.
- Open tertiary air flap.
- Switch on fuel feeding to the secondary firing system. Correspondingly adjust fan speed and fuel rates with due regard to the O₂ reading behind the pre-heater.

6.5.5 Starting the plant after short standstills without heating flame and providing for heating up via the fresh air socket.

The fact that the temperatures in the pre-heater system have dropped during standstill of the plant (temperature behind cyclone IV less than 600° C) do not permit restarting the plant with immediate raw meal feeding over the pre-heater. Instead, the kiln has to be heated up over the fresh air socket, i.e. without pre-heater fan until the temperatures inside the pre-heater and in the kiln have reached production values. In view of the prevailing draught about 1,000 – 2,400 kg. of coal/h can be burned via the fresh air socket. While doing so the O₂- content in the inlet-chamber has to be watched so that complete burning of the coal is guaranteed.

Operation state of the plant during standstills:

- The pre-heater fan has been switched off.
- The throttle flap in front of the precipitator fan has been closed (3.1.5 refers) or ESP Fan is stopped.



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- Kiln raw meal dust transporting system operating.
- The firing systems have been shut down; the primary air fans continue operation for cooling the burner lance and the burners of the secondary firing system.
- IKN- fan dampers are closed completely.
- The kiln is turned by 1/ 4 revolution at intervals of 15 minutes with the aid of the auxiliary drive.
- The CFG fans operate at reduced air volume; the cooler waste air blower continues operation.
- The cooler grate is operating (as long as clinker is falling out of kiln) and the IKN-KIDS bed thickness is maintained.
- Clinker crusher and clinker transport systems are operating.

The temperature behind cyclone IV is less than 650 °C.

- The tertiary air flap has been closed.

The Plant is heated up over the Fresh air socket and operation is started as detailed below:

- Open the fresh air socket. Ignite the firing system with the light fuel oil burner. Start heating up of kiln and pre-heater at a fuel feed rate of about 2 TPH to 4 TPH Of coal.
- Have the kiln turned continuously with the auxiliary drive.
- The plant can be fed with material only after clinker formation has been ensured in the sintering zone. The gas temperature in the inlet chamber will then range between 900 and 1100° C approx. and the temperature behind cyclone IV is adjusted between 800 and 880 °C
- Start ESP Fan and open the inlet damper.
- Switch on pre-heater fan and adjust it to the required speed. Open the flap in front of the fan, adjust the flap in front of the filter fan to automatic operation
- Adjust the pre-heater fan speed relative to the fuel feed rate with due regard to the O₂- content in the inlet chamber.
- Switch on dust transport system. If stopped to avoid dust emitting through fresh air flap.



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- Switch on high voltage supply to the electrostatic precipitator on the condition that perfect combustion has been reached.
- Start cooler grate drive and open the flaps of CFG fans in accordance with the amount of cooling air required.
- Keep IKN cooler fans dampers closed.
- Continue kiln turning with the main drive.
- Close fresh air socket, direct raw meal from recirculation mode to kiln mode.
- Increase kiln speed. With due regard to prevailing temperatures and clinker formation within the sintering zone, the kiln speed shall be gradually increased to the production value. Switch on cooling air blower at the kiln outlet.
- The temperature measured behind stage I shall not exceed 300-405° C during stabilized operation.
- Start operation of cooler air blowers IV and V as required. Adjust the cooling air volumes to the required values.
- Gradually open the IKN fan dampers and maintain the KIDS bed thickness.
- Open the CFG fan dampers and maintain the air volume required.
- Start operation of the kiln hood pressure control system.
- Start operation of the cooler control system.
- Check raw meal flow inside the pre-heater.
- Gradually increase fuel feed rate, raw meal feed rate, kiln draught, kiln speed and cooler stroke number relative to the kiln operating state.
- Open tertiary air flap.
- Switch on fuel feeding to the secondary firing system. Adjust fan speeds and fuel feeding rates with due regard to the O₂ and CO readings behind the pre-heater.

6.6 IMMEDIATE MEASURES TO BE TAKEN PRIOR UPON POWER FAILURE:



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Switch on primary air fan (scavenging air fan) provided it has been connected to the emergency network.

If the primary air fan has not been connected to the emergency power supply, the nozzle assembly has to be withdrawn after termination of the blowout period.

The kiln should be turned with the auxiliary drive for about 30 minutes; subsequently the kiln should be turned by 1 / 4 revolution at intervals of 15 minutes (continue turning).

The gas sampling probe has to be removed immediately after failure of the cooling water supply; the problem has to be checked for tightness before being reassembled.

If a television monitor has been installed at the kiln hood that device has to be withdrawn manually unless such operation is done automatically.

This is also true in case of compressed air failures.

IKN fans & CFG fans should be started by emergency power network.

Job Safety Analysis	Job: Clinkerisation process	Date: 01 – 09 - 2013	Analysis by: Section Incharge	Reviewed by: Section Head
Title of employee doing job:	Supervisor: Sec.Incharge	Department : Production	Section: Pyro	Approved by: Department Head
Req'd/recommended PPE:				
Sequence of Basic Job Steps	Potential Hazards	Recommended Safe Job Procedure	What Could Go Wrong	Corrective Action



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Cleaning of the Coating at kiln riser duct	pipe hit to the person	Hold the Pipe properly, if there any possible tie it one end.	Pipe may hit the person while cleaning the chute.	Hazards to be explain to the people who are working in that area by safety PP talk, tool box talk.
Inspecting the clinker crusher chute	Hit of hot clinker to the person	Safety Goggles to be wear before opening the side door of the clinker discharge chute	Asbestos hand gloves to be wear while opening the door	Use PPE while inspecting chute
Cleaning spillage in around conveyor bottom	Showel may entrapped into conveyor	Ensure showel should not touch the conveyor while cleaning	Person may entrapped into conveyor if he hold strongly	Stop the conveyor and start the conveyor after clean the spillage material Spray water over the fine coal dust and then clean that with showel

Emergency Shut- off:

1. If body injury is there due to hot material, First aid will be given and inform to the Safety department or Call Emergency number 233/555/9865125176/9865177444.

Records/Annexure:

1. Refer Line clearance certificates.
2. JSA as enclosed below.

HOD PRODUCTION

HOD TECHNICAL