Troubleshooting In Dry Fly Ash Conveying Systems

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ABSRTACT - *World wide for the production of power the coal fired boiler's are extensively used.In India 71 percentage of power production by the pulverized coal fired boiler's in National thermal power plant's.In the Thermal plants huge amount of the ash is produced,For coal combustion fly ash is the continuous by product.So,the fly ash is removal & transfer is a very important process of all coal fired plants.Pneumatic conveying systems are used to handle dry fly ash.During dry fly ash handling they were troubleshoots in conveying systems.Troubles as blockage in pipeline, moisture in line,cold air,erosion,system components problems,temperature variations etc..,.This paper issues some of these most common problems encountered in such systems and also address a potential solution to this problems.*

Key Words- *Fly ash handling,Dry fly ash Conveying troubles-potential solutions, Pipeline blockage, system related & ash drying problems.*

1.INTRODUCTION-In thermal power plants the ash handling practices-coal based solid waste are collected as i.bottom ash or wet ash under the furnace, ii.Fine particle size fly ash below the ESP.The fly ash system handles the Major(largest) fraction of total ash.so that the majority of problems are found in the ash handling systems.ESP used for the collection of fly ash from steam generators are mostly of dry horizontal flow.During the operation the fly ash deposited on the collecting surface of the ESP is periodically shaken loose by rapping electrodes and dropped into the collection hopper.Fly ash which is collected at hopper in rows closer to precipitator is nearly collects 40 to 100 times greater than that of rows towards the rear of the precipitator.Handlingindry fly ash at power station(thermal),the pneumatic conveying systems both the positive & negative pressure systems are widely used.

Pneumatic conveying systems are basically simple & are eminently suitable for the power and granular material.Requirements of system are a source of a feed device,conveyed materialdisengage receiver, compressed gas generally air,conveying pipe line & carrier gas.System enclosed totally,in an required condition then system can operate entirely without the moving parts coming into contact with the conveyed material.For the conveying of materials the negative, low and the high pressure systems are used.In the Materials of hygroscopic dry air is used in pneumatic conveying systems. For the materials of potentially explosive inert gases are used especially the gases like nitrogen.In suspension flow of ESP the ash is conveyed successfully,at inlet air velocity of very low conveying line.On other side collected ash in the economizer hopper is conveyed only in expansion flow of dilute phase.so,it is clear that the pneumatic conveying system design has consideration of many complex variables.Important design problems are present in the systems of pneumatic conveying, properties of conveying material has its influence on both of the components specification and system design.usually the designs are depends on use of testing data,for which the material has to be conveyed. In case of unavailability of the design data,generally it can be generated by the conveying of the sample materials of huge quantity in conveying systems test facility purpose. In the advertising literature of the company all of these material lists & these facilities that which they are experienced are often featured. so the data obtained is then tested from the test pipeline,to that pipe line of plant be designed.This complete process is empirical based,so that,in these systems the problem do arises.Often problems like this which are encountered in such systems, this paper will provides the solution.

2. ASH HANDLING PLANT

In thermal power plants the ash handling practices-coal based solid waste are collected as

i. Bottom ash or wet ash under the furnace,
ii.Fine particle size fly ash below the ESP(electrostatic precipitator)

Ash volumes and properties

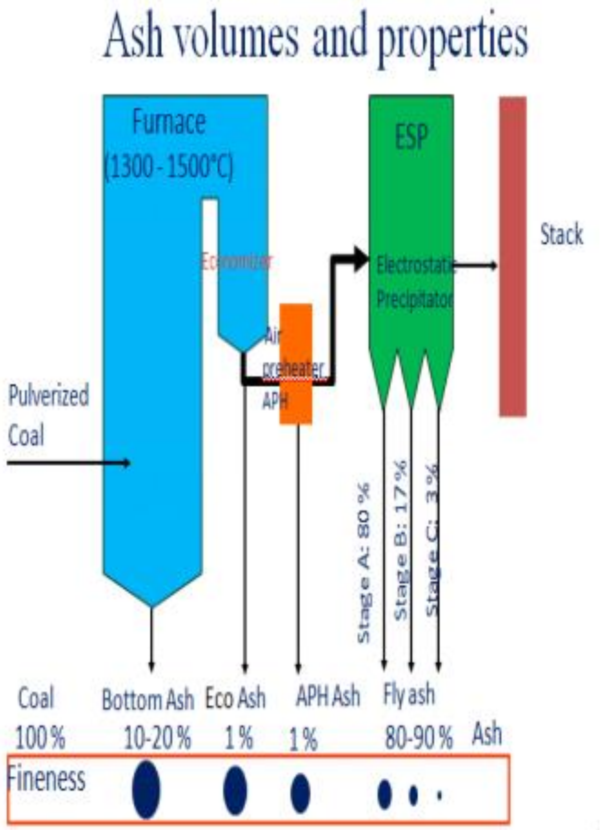


FIG 2.1 Ash handling plant

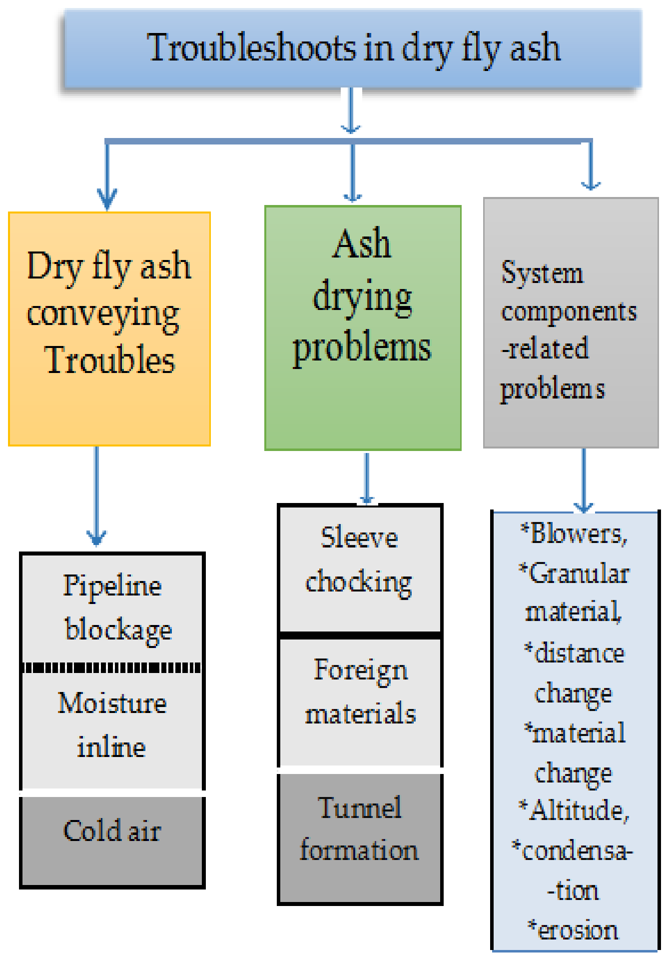
The fly ash system handles the Major(largest) fraction of total ash.so that the majority of problems are found in the ash handling systems.ESP used for the collection of fly ash from steam generator's are mostly of dry horizontal flow.During the operation the fly ash deposited on the collecting surface of the ESP is periodically shaken loose by rapping electrodes and dropped into the collection hopper.

ELECTROSTATIC PRECIPITATOR

FIG 2.2 Electrostatic Precipitator

For mechanical precipitators the electrostatic precipitators are preferred,this is due to particles precipitating capability from the range of sub micron to the big/large sized particles.The efficiency of the modern ESP's is of the order of 99.9%. The electrostatic precipitator consists of a large chamber, which comprises of parallel rows of sheet type collecting electrodes suspended from the precipitator casing with wire type discharge electrodes arranged mid-way between them. In the chamber at inlet,for gases uniform distribution distributor screens of gases are provided.

3. TROUBLESHOOTING IN DRY FLYASH CONVEYING SYSTEMS



4.Dry fly ash conveying Troubles

4.1 PIPELINE BLOCKAGE

During the operation of the pneumatic systems the blockage of the pipeline is recognized as the major issue.this issue may raised because of two reasons

i.Issue related to components of system that is like feeding device.

ii.It might be material related issue that is like size of particle,may be moisture.

ANALYSIS DRAFT OF ROOT OF PIPELINE BLOCKAGE

ATTAINABLE CAUSES	ACTION TO BE TAKEN FOR BLOCKAGE
1.Inaccurate specification In air mover	check conveying line air velocity at inlet &delivery pressure rating.
2. Relief valve Air mover	check whether it set very low
3.flow regulation in air mover	check valves operating in air lines.
4.inlet filter (air mover)	check the inlet has to free/clear
5.low air temperature (air mover)	check conveying line of air velocity at inlet
6.Dust injection wear (air mover)	check against original specification rating
7.Over sized wet material In pipeline	Check material taken from blocked areas
8.Condensation in pipeline	Lag pipes trace heat pipes , dry air, or purge with warm air until dry
9.Air leakage too great in feeder	check clearance
10.over-feeding in feeder	rotary valves and screws: Reduce speed blows tanks,suction nozzle:change proportion of air flows
11.non-steady feeding	reduce operating pressure or increase power
12.Wear in feeder	check clearances,valve seating,etc..,

TABLE 1 Causes & action to be taken for pipeline blockage

4.2 MOISTURE IN LINE

In the pneumatic conveying in line moisture is the annoying trouble. Due to the condensation in pipeline there is a wet surface inside the cold pipeline, when the material is blown. The pipe lines of large temperature various this pm will be occur.

Overcome: In order to overcome this trouble, pipeline section should be heated/dried/ for a period of time they must blow the conveying air to dry.

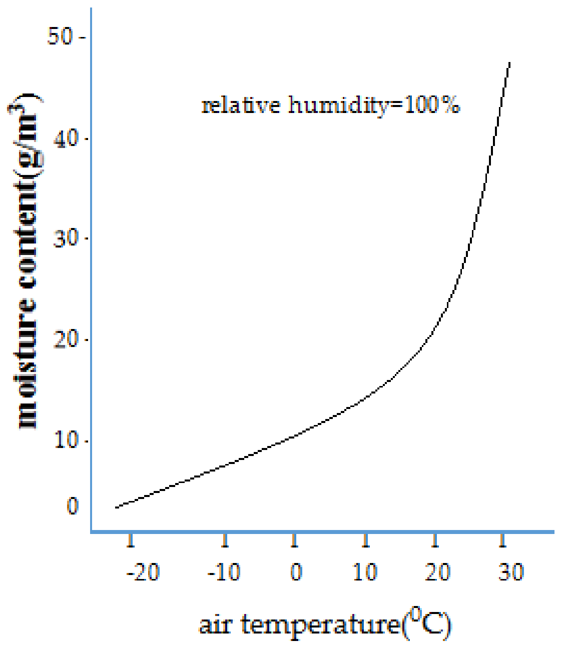


FIG 4.2 Influence of temperature on water vapour in air.

From the figure we can see clearly that, moisture content varies with the air temperature in Celsius. For the drying of air the temperature should be increased, so that the humidity is decreased thus results in the air which is free from a wet content.Humidity stays in 100 percent when the condensation came into existence. The figure illiterate that, for basically saturated air, the figure used to find out the water vapour mass, that which condensate to the presented variations in temperature. In usual high pressure plant of the air supplies the moisture is often a trouble.

The air in the plants was used as a moisture absorbent, in the case of the wet, the material will be stick to the surface of wall. It was due to the previous bends in the system pipeline. Vertical pipe line may leads to the drain down to bend in bottom and collect as pool of water. Based on the nature of conveying and that's interaction with water.

4.3 COLD AIR

The degree of compactness of a substance (density) of air rises with growth in temperature. General performance of discharge temperature of air from the air moves like (root type blower) is some 60 degree Celsius more than the section temperature .Thus results in the ambient temperature value is less about 20 to 30 percentage than the velocity of air at conveying.

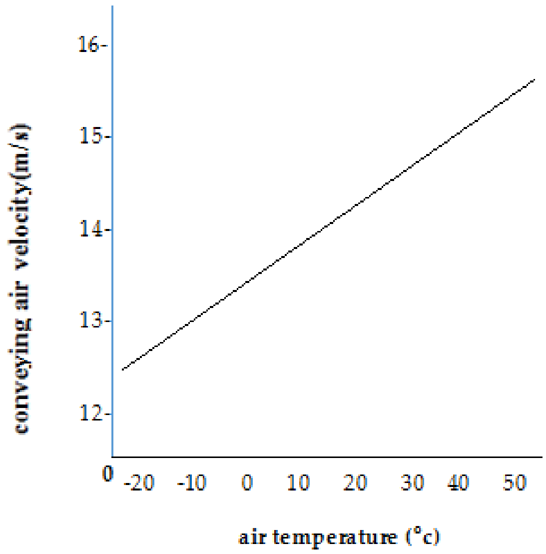


FIG 4.3 Influence of temperature on conveying air velocity

For conveying material the air at the starting up was initially be cold. The graph illustration the point, that the air conveying velocity is under the material that pipe line would block. Narrow band of temperature of air is plotted against the convey air velocity.

Due to the rise of air density the temperature will reduce, so it was important the requirement depend on the least temperature which is accomplished. In winter the cold start up is in lowest possible air and material temperature must be catered for. The conveying air velocity is more completely tactful to temperature, additionally to pressure. The grid which it plotted is between the conveying air velocity and air temperature.

It can be applied for which the Free air flow rate is 0.5m²/sec.,Pressure=1.0bar.,Bore=150mm(pipeline).In plants this was essentially needed where was the material is below usual position that is perhaps at temperature is more. In case of assemble of the air flow necessities for the least temperature out-turn in surplus high conveying velocities of air throughout usual performances.The methods of predicting the flow rate of air to the line of conveying should be included. In consistent speed control of air mover and chocked flow nozzles in the diversion supply air line and through the control valve the air is dis charged to the atmosphere. For the usual performances the air flow rate would be controlled to enter into the pipeline they were some methods. Increase in the air density will decreases the temperature in the discharge air temperature of the air from the air mover in the general performances.

5. ASH DRYING PROBLEMS

PROBLEMS	REMEDIES
1.Sleeve chocking	➢ Sieve inclination more than the material angle of response. ➢ Shape of sieve opening straight bars without any horizontal obstruction to flow
2.Foreign materials	➢ Pre-sieving of fly ash for plant roots and large stones ➢ Controlled discharge of wet material on the sieve to avoiding overloading.
3.Point feeding	➢ Distributing the all material along the sleeve Width. ➢ Optimum vibration level for effective sieving.
4.Air channelization i. Non uniform distribution of material and air. ii.Dryer capacity gets drastically reduced iii.Wet material fall down increases	➢ Patented feed distribution system. ➢ Material get distributed throughout the conveying duet cross-section area. ➢ 100% material dried from dryer.
5. HAG temperature -	➢ Keeping the fuel control point close as possible to HAG. ➢ Proper fuel modulation system with fast response.
6.Clincher cooling exhaust temperature variation	➢ Modulating control system. ➢ Instrumentation.
7.Tunnel formation	➢ Air blasters are provided to blast the scaffolding. ➢ More number of screw to ensure the uniform spreading of material before entering the dryer.

TABLE 2 Ash drying problems and remedies

6. SYSTEM COMPONENTS RELATED PROBLEMS

6.1 Blowers

TROUBLE

- Rotary lobes in blowers are machined to close tolerances as are moving parts in many other air compressors.
- Any ingress of dust or material into the machine will have a serious effect on the performance of the blower.
- Down-stream of the blower or any other air mover, non-return values should be fitted into the air supply lines to prevent the possibility of back-flushing of materials. This is a possibility of the pipe line blockage.

SOLUTION

- Some materials that have very poor permeability are capable of holding back air pressure of 6bar gauge with just a short plug of material in pipe line.
- If the pipe line blocks and the air movers is switched off, while the pipe line is being cleared.
- The material in the pipeline could easily be black-flushed to the compressor if it was not protected with non-return valves.

6.2 Granular materials

TROUBLE

- Difficulty may be experienced in discharging granular material from a top discharge blow tank as air permeates very easily through these materials so insufficient resistance will be built up to discharge the material.

SOLUTION

- Bottom discharge blow tanks were generally recommended for granular materials.They will require a little air for there discharge from a blow tank and so if the discharge line is unnecessarily long or long horizontal section the discharge line is likely to blocked.

6.3 Change of distance

TROUBLE

- If the blow tank is to be used to convey a material over a range of distances it will be necessary to change the proportion of the air according to the distance conveyed. If this is not done in a pipeline will be under-utilized for shorter distances , and may block on longer distances.

SOLUTION

- Feeder control with respect to the change of distance , is an issue that must be considered with regard to any type of feeder. This is where a pressure gauge in the air supply line is particularly useful, for it can be used to ensure that the material flow rate through the pipeline is always the maximum that can be conveyed to with the given air supply, regardless of the distance.

6.4 Change of material

TROUBLE

- Material type also has a significant influence on discharge capability of a blow tank, and for a given material the performance will differ between top and bottom discharge.

SOLUTION

- In general, top discharge blow tanks are capable of achieving the highest feed rates and are to be recommended for materials conveyed in dense phase . bottom discharge blow tanks are best for materials conveyed in dilute phase as they provide better controls for this made of conveying. Because of the different conveying capabilities of different materials , a pressure gauge in air supply line will also help with regard to ensuring optimum feeder control to achieve maximum utilization of pipe line with different materials.

6.5 ALTITUDE

- The operation of a pneumatic conveying system at altitude should present no problems at all, provided that due account has been taken of the local air pressure, and hence density of the air. This will influence the specification of the air mover, since the volumetric flow rate is generally quoted in terms of free air.

- It will also influence the size of the filter required as discussed earlier in the section on component related problems.
- For a plant located at an elevation of 1000m above sea level, for example there is reduction in ambient pressure of about 11.4 KN/m2 or 85 mm of hg.Which is more than10% of the standard atmospheric pressure at sea level. The normal atmospheric pressure at sea level can fluctuate quite naturally by 25mm Hg on a day to day basis, which equates to a change in elevation of about 300m

6.6 CONDENSATION

- Condensation is liable to occur in pipe lines which are subject to large temperature variations, particularly where there are pipe runs outside buildings, and air drying is not employed.

6.7 EROSION

- Abrasive wear is caused by the sliding of particles against surfaces. conveying air velocity is a major variable in the problem and any reduction that can be made in the velocity at which the material is conveyed will help to reduce the problem.
- conveying air velocity increases along the length of the pipeline.The bends along the pipeline are likely to fail first.
- Erosion here could be reduced by increasing the pipeline bore over the last part of the pipeline. Use of the stepped pipelines to achieve a lower velocity profile is an accepted practice.

7. CONCLUSION

- As dry fly-ash conveying systems has been extensively chosen at the thermal power plants, there perhaps trouble shooting in the conveying systems such as – pipeline blockage - moisture in line – cold air- erosion – chocking were hinder difficulties experienced in these systems.
- This papers will contribute the promising explanation/ resolution to conquered these difficulties in dry fly-ash conveying systems.

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