International Journal of Mechanical Engineering and Robotics Research

ISSN 2278 – 0149 www.ijmerr.com
Vol. 2, No. 4, October 2013

Research Paper

OPERATION AND MAINTENANCE OF CRUSHER HOUSE FOR COAL HANDLING IN THERMAL POWER PLANT

Girja Lodhi[1]*

*Corresponding Author: Girja Lodhi, ✉ girja.lodhi@yahoo.com

Many utility systems in the world have power plants operating with fossil fuel. In the thermal power plants maximum requirements of fuel is a coal. The handling of this fuel is a great job. To handle the fuel, i.e., coal, each power station is equipped with a coal handling plant. Maintenance of Critical Equipments for Coal Handling Plants (CHP) of Thermal Power Stations is typical job. The failures of these equipments have led to high maintenance and operation costs. The reason for inspection depends on the component and its effect on plant operation. But one of the main systems of thermal power plant is coal-handling system. No such efforts are carried out to assess the life of coal handling plant component. To maintain an efficiently operating unit and avoid failure of critical equipment, it is necessary to maintain the critical parts of that equipment. There are varieties of critical equipments components in Coal Handling Plants. It is essential to identify the critical areas where failures are likely to occur and select suitable techniques for detection of such failures. Based on design criticality, past experience and previous failure information, suitable approach in inspection methodologies can be adopted. Maintenance of Coal crushing equipment of coal handling plant system in the thermal power plant is very important for Plant efficiency improvement.

Keywords: India coal grades, Crusher, Construction, Crushing stages, Defect identification

INTRODUCTION

The coal handling plant (CHP) in a thermal power station covers unloading of coal, its crushing, storage and filling of boiler bunkers.

Coal unloaded in the wagon tippler hoppers/ track hoppers is conveyed to crusher house by belt conveyors via pent house and transfer points depending on the CHP layout. Suspended magnets are provided on conveyors at pent house for removal of tramp Iron pieces. Metal detectors are also provided to detect non-ferrous materials present in the coal before crushers. In case the sized coal is

[1] Material Handling, Madhav Institute of Technology & Science, Gwalior.

received, then the coal is sent directly to stockyard and the crusher is by-passed.

In CHP crusher work on principle of combination of impact and attrition crushing. In this type of crushing first coal is break due to impact and further scrub between two hard surfaces to get desired coal size. Some crushers are work only on principle of impact crushing. Generally these crushers are used before final crushers.

The output size of coal affects the performance of CHP. Naturally these two hard surfaces of crusher are critical parts. One of these surfaces are known as grinding plates and other may known as rings, hammers, etc. The linkage between crusher rotor and drive assembly are also critical parts. As failure of these linkages will stop crushing. So its Operation and Maintenance at time to time is very important.

Different Type of Coal Grade Details

Mostly E and F Grade Coal used in India.

Table 1: India Coal Grades Details

Grade	C.V. (K Cal/Kg)	% Ash + Moisture
A	>6200	19.57
B	5601-6200	19.57-23.97
C	4941-5600	23.92-28.69
D	4201-5940	28.69-34.05
E	3361-4200	34.06-40.14
F	2401-3360	40.14-47.10

Crusher

A crusher is a machine designed to reduce large Coal into smaller Coals, gravel, or rock dust. crushers are machines which use a metal surface to break or compress materials. Mining operations use crushers, commonly

Figure 1: Coal Handling Plant

classified by the degree to which they fragment the starting material, with primary and secondary crushers handling course materials, and tertiary and quaternary crushers reducing ore particles to finer gradations. Each crusher is designed to work with a certain maximum size of raw material, and often delivers its output to a screening machine which sorts and directs the product for further processing.

Typically, crushing stages are followed by milling stages if the materials need to be further reduced. Additionally rock breakers are typically located next to a crusher to reduce oversize material too large for a crusher. Crushers are used to reduce particle size enough so that the material can be processed into finer particles in a grinder.

A typical processing line at a mine might consist of a crusher followed by a SAG mill followed by a ball mill. In this context, the SAG mill and ball mill are considered grinders rather than crushers.

Crushers may be used to reduce the size, or change the form, of waste materials so they can be more easily disposed of or recycled, or to reduce the size of a solid mix of raw

materials (as in rock ore), so that pieces of different composition can be differentiated.

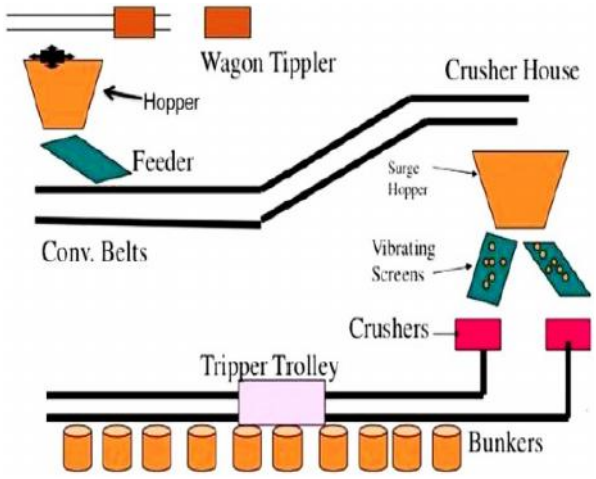
Crushing is the process of transferring a force amplified by mechanical advantage through a material made of molecules that bond together more strongly, and resist deformation more, than those in the material being crushed do. Crushing devices hold material between two parallel or tangent solid surfaces, and apply sufficient force to bring the surfaces together to generate enough energy within the material being crushed so that its molecules separate from (fracturing), or change alignment in relation to (deformation), each other. The earliest crushers were hand-held stones, where the weight of the stone provided a boost to muscle power, used against a stone anvil. Querns and mortars are types of these crushing devices.

Coal Crushing Operation

In the thermal power plant coal handling system, Conveyors leading to crusher house have facility for manual stone picking, at a suitable location after penthouse. In line magnetic separators are also provided at discharge end of conveyors for removal of remaining metallic ferrous tramp from the coal before it reaches the crushers. Coal sampling unit is provided to sample the uncrushed coal. The size of the coal received is normally (-) 300 mm which may, however, depend on coal tie up. The received coal is sized in crushers (ring granulators) from (-) 300 mm to (-) 20 mm. Screens (vibrating grizzly type or roller screens) provided upstream of the crushers screen out (-) 20 mm coal from the feed and ( ) 20 mm coal is fed to the crushers. A set of rod gates and rack and pinion gates is provided before screens to permit maintenance of equipment downstream without affecting the operation of other stream.

The crushed coal is either fed to coal bunkers of the boilers or discharged on to conveyors for storage in coal stockyard through conveyors and transfer points. Crushed coal is sent to stockyard when coal bunkers are full. Stacking/reclaiming of coal is done by bucket wheel type stacker-cumreclaimer moving on rails. The stacker-cum-reclaimer can stack coal on either sides of the yard conveyor. During stacking mode coal is fed from conveyors on boom conveyor and while in reclaim mode, boom conveyor discharges coal on the yard conveyor for feeding coal to bunkers through conveyors and transfer points. The yard conveyor can be reversible type depending on layout requirement.

Figure 2: Coal Crushing System



Coal Crushing Mechanism

Three stage crushing system is used in plant.

- Double Roll Crusher
- Rotary Breaker Crusher
- Impact Crusher

Figure 3: Coal Crushing System Stages

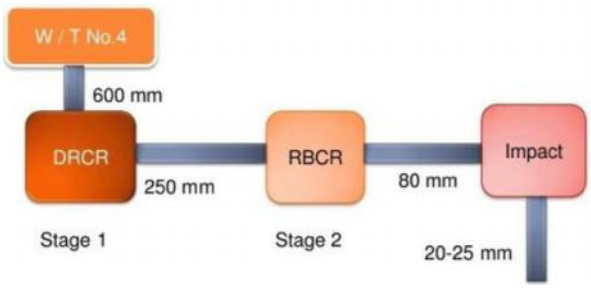


Figure 4: Double Roll Crusher

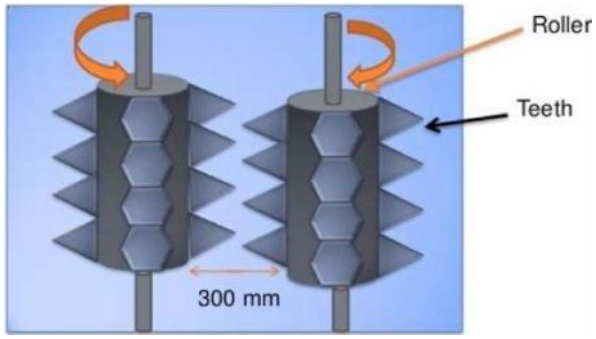


Figure 5: Rotary Breaker Crusher

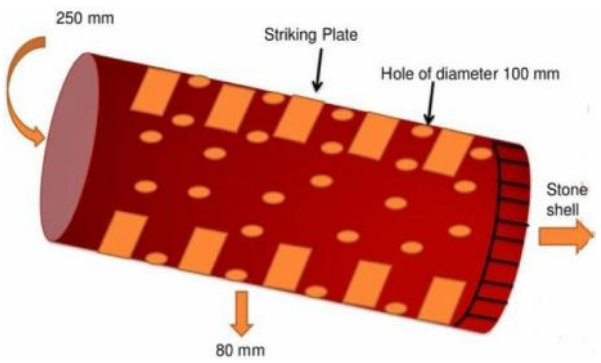
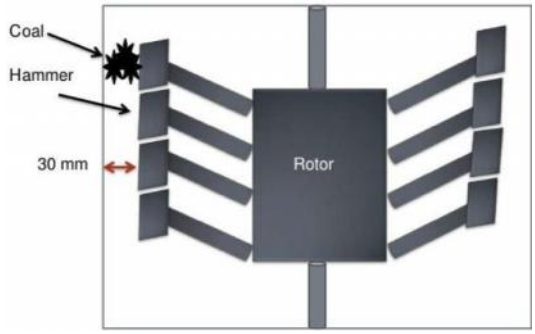


Figure 6: Impact Crusher



DEFECT IDENTIFICATION

Depending upon the actual Operating and environment condition, material properties of CHP Equipments degrade as a function of service life due to one or more of the time dependent material damage mechanism such as fatigue, corrosion, erosion, etc.

Table 2: Crusher Defect Identification

Component	Type of Defect	Affecting Factor	Reasons
Grinding jib of crushers	Reduction in thickness due to wearing of surface	Continuous coal flow	Friction between coal and component
Grinding jib of crushers	Development of cracks, holes	Impact of coal	Crack generated from the holes for fixing of bolts
Grinding jib of crushers	Pitting	Corrosive component of coal	The wet coal when flows through then chances are more
Motor Shaft of Crusher	Unbalancing, Misalignment	Coal Improper Impact	Vibration
Crusher structures	Fracture failure	Improper Loading	A result of manufacturing fabrication defects or localized damage in service,
Crusher Rotors, Suspension Bars, Arms	Development of cracks	Impact of coal	Due to internal flaw
Bearings	Development of cracks in the races	Improper loading,	Due to internal flaw

Parichha Thermal Power Station

I have visited and done the 30 days training in the Parichha Thermal Power Station is located at Parichha in Jhansi district in the Indian state of Uttar Pradesh, about 25 km from Jhansi.

I have studied the Coal Handling Plant (CHP) and focused on the "Operation & Maintenance of the Crusher House". The detailed specifications, operation, working principle and construction details of the Crusher unit is as follows:

General Details of Crusher

Type: Ring Granulator

Make: TRF

Capacity: 1350 TPH

Feeding Coal Size (max): 800 mm

Ring Granulators are rugged, dependable units specially designed for continuous high capacity crushing of ROM coal and other medium hard friable materials.

These are ideal machines for crushing coal to a size suitable for pulverisation, in power station.

Figure 6: Ring Granulator

Principle of Crusher

In this Crusher, the crushing action by combining impact and rolling compression in a Ring Granulator results in higher output with lower power consumption. they offer better overall economy in terms of power consumption and maintenance.

Positive adjustment of clearance between the cage and the path of the rings is provided to compensate for wear and to adjust or maintain product gradation.

CONSTRUCTION FEATURES AND WORKING DETAILS

Frame: Fabricated from heavy steel plates with large inspection front and rear doors, fitted with dust tight seals. Access for further maintenance is provided on the top. Doors on the sides above the rotor shaft facilitate removal of the rotor without completely dismantling of the machine. this is made of abrasion-resistance steel.

Rotor Assembly: Statically/dynamically balanced to operate with minimum of the vibration and noise. Weight concentrated within rotor eliminates the external fly-wheels.

Rotor Shaft: This is made of forged and heat treated alloy steel.

Suspension Bar: EN-24 duplex suspension bars are provided in all models.

Crushing Rings: Made of heavy cast Mn-steel toothed and/or plain Crushing Rings depending upon applications.

Cage Adjustment: Cage assembly can be easily moved by a ratchet wrench and worm gear assembly either towards or away from the path of crushing rings. Adjustment which

can be made while the granulator is in operation, provides control over the product size within permissible limits. The cage hinge bearing is so located that in any adjusted position all parts of cage face are practically equidistant from the rotor assembly. This ensures even wear.

Cage Bar or Screen Plate: Trapezoidal cage bars are of replaceable cast Mn-steel, ensuring free discharge. Screen plates are made from abrasion resistant steel. Selection of cage bars or screen plates depends on application.

Breaker Plate: Replaceable abrasion resistant steel.

Tramp Iron Pocket: Tramp Iron and uncrushables are prevented from continuing around and back into the crushing zone by a heavy deflector plate. The debris is collected in a pocket and removed from access door.

Bearing: Heavy duty double row spherical roller bearings with cast steel split type bearing housings with labyrinth type seals.

Lubrication: Grease lubrication for small and medium size granulators. Oil splash lubrication system for bigger models.

Drive: Direct coupled drives are recommended. For smaller models V-Bels drive may be used.

CONCLUSION

Most efficient applications and the work environment is generally more difficult, to keep equipment running in good working condition, extend equipment life, improve the quality of operation, reduce operating costs has been the goal of engineering and technical personnel. Analyze and resolve the impact normal operation of the main problems, to ensure the good functioning of the device, it is an important work of the equipment maintenance. This analyzes the proposed method. Helpful to improve site maintenance staff levels to solve practical problems, for practical project has important significance.

REFERENCES

1. Catalog of NDT Systems, Inc. 17811 Georgetown Lane, Huntington Beach, CA, available at www.ndtsystems.com/Products/products.html
2. Catalog of Zawada NDT, ul.Tatarkiewicza 8, PL 41-819, Zabrze, available at www.webmedia.pl/zndt
3. Deepak Bansal and Murthy C R L (1996), "Nde Of Helicopter Composite Rotor Blades Using Acoustic Impact Technique", Indian Institute of Science, India Presented at 14th World Conference on Non-Destructive Testing, New Delhi, available at www.ndt.net/article/wcndt96/papers/idn232
4. Ed Ginzel (1999), "New ASTM Standard for Pipeline Inspection", Published in NDTnet, Vol. 4, April, www.ndt.net/v04n04.htm
5. "Flaw Detection & Thickness Measuring Using Ultrasonic Systems", Magnetic Analysis Corporation, 535 South 4th Avenue, Mount Vernon, NY, USA, available at www.mac-ndt.com/moreaboutndt.html
6. Gronau O, Belitsky S and Sukhorukov V (2000), "NDT of Steel Ropes with Magnetic Flaw Detectors: Documentation

and Interpretation of Test Results", Presented at 15th World Conference on NDT, October 15-21, Rome, www.ndt.net/article/wcndt00/papers/idn281

7. Sundaram Baskaran (2000), "Role of NDE in Residual Life Assessment of Power Plant Components", Vol. 5, No. 7, Industrial Quality Concepts Chennai, India Published in NDT.net, available at www.ndt.net/v05n07.htm
8. Tor Harry Fauske, Peer Dalberg and Arnfinn Hansen (2000), "Ultrasonic Crack Detection Trials", Presented at 15th World Conference on NDT (15-21Oct 2000) in Rome, available at www.ndt.net/article/wcndt00/papers/idn437
9. Wawrzinek T, Zscherpel U and Bellon C (1997), "Wall Thickness Determination In Digital Radiography", Presented at the NDT Conference and Exhibition of the French NDT Society (COFREND), SEP 22-26 '97, Nantes, available at www.ndt.net/ut1097.htm