ABSTRACT

In this paper compared with actual situation of the current thermal power plant, this paper studies installation of belt conveyor system in a thermal power plant. Analyze technical characteristics of belt conveyor system and installation and maintenance of the relevant machinery and equipment. Then, the installation of belt conveyor system and the proper method of the equipment installation, operations and maintenance are represented.

Keywords: Thermal Power Plant; Coal Handling System; Belt Conveyor system, installation and Maintenance.

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1. INTRODUCTION

Belt conveyor is a commonly used equipment of continuous transport, it has a high efficiency, and this system has large conveying capacity, simpler construction, and small amount of maintenance. Coal is the best fuel of thermal power plant. Continuing up the large unit, and large capacity, the demand of coal is very large. Coal need to process from loading and unloading to stockpile, this procedure can finish by coal conveying system. This system includes add up to tense mechanical, guarantee the important of these mechanical are normal operation, it is very important for this system stable operation. And it is a key problem of reduce costs, ensure safety in production, improve the efficiency of work.

2. INSTALLATION OF BELT CONVEYOR SYSTEM

The installation steps of belt conveyor are presented

1) The frame of the belt conveyor is installed, and the installing of the frame is start with the head frame, followed by all middle frames in order, last is the tail frame. Before the frame is set up, a center line is dragged along the whole conveyor, as keeping the conveyor’s center line Collinear is the vital condition of ensuring normal running of the belt. Hence, all sections of the frame must be aligned when they are installed, the allowable error is ±0.1mm for one meter of conveyor and for the whole conveyor, and the allowable error should be limited to 35mm. When each section is captured and installed, they are then joined.

2) The driving device is installed. When the driving device is installed, the conveyor’s transmission shaft must be perpendicular to the conveyor’s centre line. The centre of the driving pulley should coincide with the centre line of the conveyor, and the reducer axis should be parallel to the drive axle. Meanwhile, all the axles’ and pulleys should be made level. According to the width of the conveyor, the horizontal error of axle should be controlled in the range of 0.5-1.5mm.

A tension device can be installed while installing the driving device. Pulley axle of the tension apparatus should perpendicular to the conveyor’s centre line.

3) The installation of idlers. After frame, driving and tension device have been set up, the idler frame for upper and down idler can be installed due to which the belt has slowing turning curve, and the distance between the idler frame in the curved place should be 1/2-1/3 of that in a normal idler frame. The rotation of the idler should be flexible after be installation.
4) Last capture of belt conveyor. To make sure that the belt runs along the centre line of the idler and pulley from the beginning to the end, three requirements must be met when idlers, frame and pulleys are installed. First one is to ensure that all the idlers are in rows, parallel to each other and lateral level. Second, all the pulleys must be in rows and parallel to each other as well. The last, the supporting structure frame must be linear and keep lateral level. Therefore, last capture need be done to the conveyor’s centre line and horizontal place after driving pulley and idler frame have been set up. Frame is fixed on the foundation or floor. Feed and unload apparatus can be accommodated when the conveyor is fixed.

5) Placing conveyor belt. Belt should be first unfolded on the idlers of no-load section, and then be laid on the heavy-load section after the belt has surrounded the driving pulley. Hand winch of size 0.5-1.5t could help to place the belt. When the belt is tensioning and to be joined, the pulley of tension apparatus should be moved to the extreme position, for which screw-type and car like type, the tension device needs to be moved towards to the driving device, and pulley need to go to the top for the vertical one. Reducer and motor should be ready before the belt is tensioned. (1, p.4) After the belt is installed, idle commissioning is necessary. During idle commissioning, attention needs to be paid to whether there is off-tracking, running temperature of the driving parts, operating condition of idlers, contact level between the cleaning device and the belt surface. Adjustment can be done if necessary, loading commissioning can only be done after all the components work regularly. (2, p.4)
3. MAINTENANCE OF THE BELT CONVEYOR SYSTEM

There are many reasons for conveyor failure, but regular inspection and subsequent planned preventative maintenance is always far more efficient and less costly than breakdown downtime and repair. And it should be noted that conveyor belt maintenance not only includes proper care of the belt, but also includes care and maintenance of the hardware, which includes idlers, pulley, belt cleaners etc.

The maintenance of a belt conveyor is basically the same as any equipment with moving parts and no matter how well the conveyor is designed and constructed it will require scheduled maintenance and periodic service maintenance.

A strict maintenance schedule and well-trained maintenance crew can save companies a large amount of money over the course of equipment life. The maintenance function in any operation is in charge of keeping the equipment operating at maximum productivity or capacity. Scheduled maintenance reduces downtime and ensures the efficient and safe operation of the system. A quality maintenance program begins with management and their insistence on strict routine maintenance schedule and periodic outages specifically for the overall review of the equipment.
Equally as important to the main tenance schedule of belt conveyors is that service is performed by well-trained, competent personnel provided with proper test equipment and tools. The maintenance crew should be skilled employees empowered to shut down the conveyor to make the necessary repairs.

3.1. Belt Conveyor

Belt conveyor is constantly operating transporting equipment which is mainly used to convey mass bulk material like mineral, coal, sand, etc in powder or block as well as packed freight in metallurgy, mining, building heavy industries and transportation industry. Belt conveyor is the most perfect conveying equipment for coal-mining, because it can work efficiently and continuously. Compared with other transporting equipments, belt conveyor not only has the merits of long conveying distance, big capacity, constant working operation, but also with the features of operational reliability, easy to have automated and concentrated control. Belt conveyor has become the key equipment especially for high-output and high-efficiency coal mine.

![Figure 2 Typical profile of belt conveyor]

3.1.1. The startup and stop of belt conveyor

Belt conveyor has varied work conditions, such as normally, loading start-up, operation, stop, accident stop. Under normally, it should no-load start-up. Under stop, belt conveyor must no-load, until next startup. When any part of this system broke down, we must emergency stop, to avoid accident broaden. After accident stop, the start-up is loading start-up. Need big moment of force. Sometimes, belt conveyor cannot normally because of loading, or start motor overload smoke even burn out. Although driver unit high speed side of belt conveyor erection limit fluid
coupling, it can protection start motor, but when belt conveyor start-up not allowed belt speed long time not reach rated value, because it can make oil temperature high of fluid coupling, when a given temperature is reached, low-fusing alloy will melt, As a general rule do not allowed to loading start-up.

3.1.2. The interlock and protection of belt conveyor

At coal handling system in thermal power plant have interlock the equipment which can avoid equipment bad sequence start-up interlock, every equipment work according to sequence rule start-up. So as to ensure the safe operation of this system. Belt conveyor is the main equipment of this interlock system. When it start-up, every part start-up comply counter-direction of coal movement one by one, when it stop, it stop comply opposite direction one by one. Under operation, any part of this system have a malfunction, all equipment will stop comply counter-direction of coal movement. Other equipment wills normal. Meanwhile, a coal grinder does not stop except it own accident. So as to avoid or mitigate accident. Lastly, on main control rooms have emergency stop button, set this button, every part of this system will stop. Meanwhile, coal grinder delay stop. Belt conveyor also have protection equipment such as burden detection switch, under speed switch, avoid deviation switch. Motor overload protection and so on.

3.1.3. Operation and maintenance of belt First point

To extend belt service, must do routine maintenance, periodically and duly scavenged the belt, avoid belt injuries. When the machine working, because the water and viscosity of coal. The working surface of belt will sticky coal and coal drop to no-working surface. If do not routine maintenance, the on the belt will bulge, and the belt long time work will be break down, reduce belt life. Cleaning equipment at head and tail will clean the coal at working face and no-working surface.

The belt do not at work track, the flank of belt will abrasive, the belt will be break down because of abrasive surface expands. Erection polarization transfer can modify work orbital, make the equipment works salty.

In operation, litter in coal got stuck between rollers and belt, the belt long time work will be breakdown. So erection separator can clean these litter, avoid blocked failure happened. The belt will be impact at working, so erection more buffer rollers will reduce Impact for belt. Lastly, for Plod unloaded of belt, the belt should choose thick material and low belt speed.
Adopt the above mentioned measures, can extend belt life, reduced the maintenance work, save material, ensure the equipment running safely.

### 3.2. Screen broken machinery

![Figure 3 Roller](image)

Figure 3 Roller

The coal into boiler, requirements have fixed grain size. Always at 30~50mm, so before coal into boiler should sieving and tattered. At large and medium-sized coal handling system in thermal power plant, screening machinery for roller screen, so thick roller sieve, sieve volatility, higher the probability of screening applications. There are many types of coal crusher; work is the use of an external mechanical force to overcome the binding force within the material.

The process of from big to small. Currently medium-sized power plant coal handling system used in coal crusher, structural characteristics can be divided Hammer, Impact, and other types of hammer ring, hammer coal crusher due to its large strengths, high-efficiency features, used more often.

#### 3.2. (A) Operation and maintenance of roller screen

(i) Roller screen installed in the system, Interlock with the system running. Starting, first start roller Screen, second Start belt conveyor. Stop, in reverse order, cannot start with a load. Shutdown, the screen Surface material must be unloaded and then shut down the net.

(ii) Regular observation of the operation, replacement of oil, grease, and replacement cycle can be determined Based on the actual operating conditions.

(iii) Between the reducer and screen machines equipped with overload protection device. When the screen Axis due to iron, wood and other debris stuck, exceeds the allowable security torque, the safety coupling of the shear pin cut off incurs, screen axis to stop rotation.

(iv) Motor and reducer direct connection, motor using overheating relay.
3.2. (B) Application and maintenance of Ring hammer coal crusher hammer

(i) Feeding should be uniformly distributed rotor in the effective length

(ii) Coal allowed mixture large (> 150mm), more metal, wood and other debris, surface water should be <15%.

(iii) When the hammer ring worn around the corner wear limit, should be replaced, requiring hammer ring weighing, with a set of installation.

(iv) Size sieve, broken board should maintain a certain thickness, wear thicker than 20mm, the new Board must be replaced.

(v) The amount wear of body wear plate cannot exceed the original thickness of 2/3.

(vi) Daily operation, we should always pay attention to whether the metal machine, which do not impact the normal sound, check whether there is loosening of the fasteners, and timely maintenance.

(vii) Not allowed to start with a load, be sure to the device after reach normal operating speed, the Imposition of the load, put into operation.

(viii) Run-time, not allowed opening the access door, not attached to the machine or climbing machines, to avoid danger.

(ix) Lubrication of coal crusher.

Bearing lubrication is an important part of coal crusher, the oil should be 1 / 2 to 2 / 3 Is appropriate of the oil chamber, always check the location of oil and oil cleanliness, once every three months Should add oil, cleaning twice a year at least.

(x) Regular cleaning thereon Room.

Ring hammer crushed coral can remove iron mixed in coal, wood and other debris in order to protect them not injury. Debris has been appropriated for iron interior, but also of coal into the iron room, If not clean, not only receive in addition to the effect of debris, and take the objects (e.g., cotton, straw, rags, etc.) throw into the sieve gate holes, cause congestion. Even when faced with iron, issue impact with the body, resulting the machine vibration and noise, so that damage to the hammer or the trash rack of sieve, which is very dangerous. Therefore, every day should be cleaned once addition iron room should be checked once a week in various parts of the machine working conditions.

(xi) Sieve gap adjustment.
Ring hammer coal crusher should periodically adjust the gap between hammer loop and sieve. The size of the gap determines nesting size. The gap is too big, coal crusher cannot play the normal output and Efficiency, On the contrary, will greatly reduce the ability of exclude debris. Gap cannot be too small, the gap is too small, equipment will reduce contribute and the power consumption increases. So the gap of Sieve should be appropriate adjustment.

3.3. Dust, iron and removal equipment

Coal from mining to shipped to plant, inevitably mixed with iron and other debris. Debris into the coal handling system can make the belt vertical cut through, coal drop pipe, coal bunker and other clogging phenomenon. The coal crusher and other equipment early wear and tear, and even cause serious accidents. Therefore, usually coal handling system to conduct multi-level dust iron. Lastly, at process of crushing, screening, processing ,dust debris and transport, coal due to vibration, shock, throwing and so on, will generate a lot of dust, to prevent dust pollution to the environment, must do dust handled. Ventilation and dust removal in industrial production is application of effective; in the thermal power plant coal handling system is widely used. Ventilation and dust removal is sent the gas from fans pipeline into dust collector, to remove the dust, commonly referred to as dust removal system refers to the casing, duct, fan and dust that "four pieces" composed of ventilation and dust removal system, operation and maintenance of dust iron and removal equipment in coal handling system is an important content of work, good or bad of work quality has a direct impact on the stable operation of coal handling system, affect plant safety. Therefore, it must be carried out strictly in accordance with relevant procedures.
4. **THE RECOMMENDED COMPONENTS OF A BELT CONVEYOR REQUIRING ROUTINE MAINTENANCE AND SERVICE:**

**Electrical Motors:** lubricate internal bearings as recommended by the manufacturer. Safety switches check electrical connections and any signs of broken parts. Reducers: Lubricate internal bearings and fill oil level as recommended by the manufacturer.

![Figure 5 Electric Motor](image)

**V-Belts:** Check for proper tension and worn or cracked areas.

![Figure 6 V-Belt](image)

**Chain drives:** Check for proper tension and worn rollers and sidebars.

**Screw Take-ups:** Check for proper belt tension and remove any built up material.

**Idlers:** Check for free rotation and excessive worn areas, if any types lubricate as recommended by the manufacture. Remove any built up material.

![Figure 7 Idler](image)

**Training Idlers:** Check for proper alignment to belt and free rotation or excessive worn areas, if any type lubricate as recommended by the manufacture. Remove any built up material.

**Pulleys:** Check pulley alignment and surface of lagging if lagged. Pulley assemblies should rotate freely. Remove any built up material.

![Figure 8 Pulley](image)
Bearings: Check for proper alignment to frame and lubricate as recommended by the
Manufacture remove any built up material.

Belting: Check for proper tension of excessive wear areas, torn, or ripped areas, if a mechanical
splice check fasteners

Belt Cleaners: Check for proper tension and wear on the cleaner blade and replace if needed to
keep cleaner from rolling under. (9, p.9)

5. SAFETY OF USING A BELT CONVEYOR

The increase in production quality, work productivity, the capacity of the devices and efficiency
in various regions of human activity must not conflict with safety. Good common sense is the
key when working on any equipment and must be used while observing or servicing equipment.
Some general safety guidelines of using a belt conveyor should be observed.
Lockout/tag out all energy sources to the belt conveyor, conveyor accessories and associated
process equipment before beginning any work – whether it is construction, installation,
maintenance, or inspection that is directly associated with the equipment you are involved in.
The use of lockout device with one key for each piece of equipment should be used. The person
actually doing the work should be the only person with the key to the lockout device. Operating
and maintenance personnel should become familiar with the material being handled in the
system along with the location and purpose of the safety devices before being allowed to operate
or work on the equipment. A belt conveyor safety training session should be a portion of a
comprehensive safety program provided by the company to all employees that will be required to
operate or maintain the equipment. (3, p.11-12)

All safety devices should be in a good working condition, properly maintained and easily
accessible. An emergency stop switch with safety pull cords should be mounted at a proper
height. The equipment should be operated at its design capacity and speed. Overloading belt
conveyors result in spilled material and hazardous working conditions and premature failure of
components. During and after maintenance of the equipment a safety “walk around” is
recommended as a precaution for leaving tools or work material prior to starting the equipment.
A formal maintenance and inspection schedule should be developed and followed for the equipment and associated safety devices. Required personnel safety equipment such as hard hats, safety glasses, and steel toe shoes should be worn when in the area of the equipment to provide any type service or work. (3, p.12)

Manual inspection, maintenance or repairs must be done at a time that can be taken out of service, properly lockout and tagged. In no case should belt conveyors or any operating equipment be serviced while in operation. Only visual inspection can be done during operation and care must be taken to be at a safe distance and not be wearing loose clothing. Inching drives provide an excellent method of visually inspecting the belting. (3, p.12)

Working conditions must be constantly observed by the company, and if doubt exists, as to whether you deem your equipment safe enough for your employees welfare, call a qualified safety engineer to advise you as to whether or not your equipment satisfies current safety regulations and requirements of any federal, state, municipal or other duly constituted regulatory agency to whom you might be responsible.

It is also the responsibility of the company to properly train your personnel in the correct use of this equipment. Keep in mind that what might be considered an open and obvious danger to the most experienced plant operator could be completely ignored and overlooked by an inexperienced or less perceptive employee.

6. CONCLUSION

This paper focus on installation, maintenance, effect and working principle of coal handling system in thermal power plant. Analysis the installation, maintenance, operation and work of major equipment in this system, describes the main malfunctions format key equipment. Emphasized some main problems of these mechanical devices which should pay attention on use and maintenance. For the actual production safety of thermal power plant has a certain reference and guidance and improve the operation efficiency.

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