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Fire Fighting System in Auto Mode for Tunnel Conveyors

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Abstract*—Fire is the major hazard in conveyors of any industries. Reasons of fire many which can produce ignition in conveyors like- coal material accumulate, rubbing the belt, friction in between conveyor. To eliminate the any fire incident in tunnel conveyors provide a fire fighting system which is running in auto mode. This auto mode system works when temperature rise above 65^0C sensed and then water spray in the conveyor and control or eliminate a big fire incident. This paper present modification in manual mode fire fighting ststem to auto mode fire fighting system in tunnel conveyors.*

Key Words: conveyor system, belt system, heat sensor cable, nozzles, emergency button, solenoid valve.

I. INTRODUCTION

Conveyors are power equipment‘s commonly used for to transferring the bulk or unit load continuously or intermittently, unidirectional from one location to another location over fixed path, where the main function is to transmit the material by the help of movement of some parts/machinery of the equipment. Whole setup does not move.

Conveying equipment is a group of machines which move loads in a continuous flow and sometimes may not lifting gear. Conveyors are efficient way of moving materials. Conveyors are most important mechanical material handling equipment‘s.

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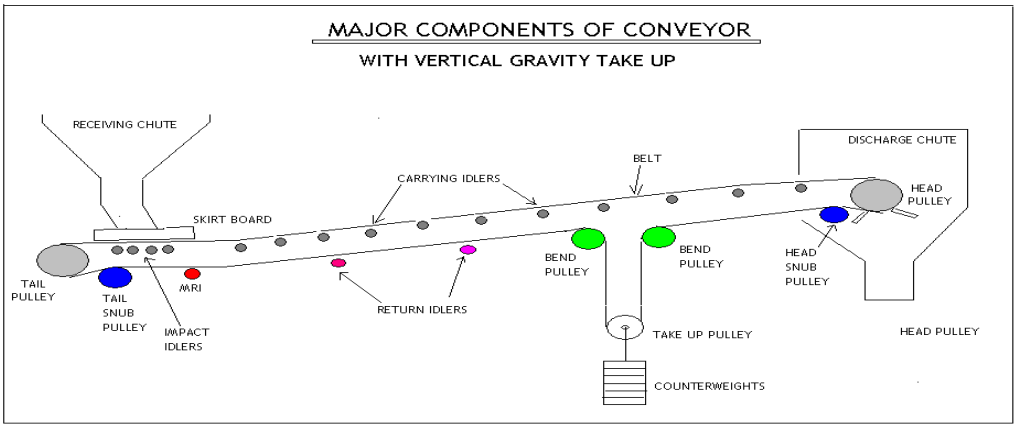

Fig.1 Configration of conveyor.

Study area

The JSW STEEL LTD. Bellay, Karnataka

Raw Material Handling System.

Conveyor belt

Conveyor belt is endless loop which move parts or materials from one location to another. Conveyor belts are driven by variable speed electric motors with two or more, the belt rotating around the pulleys. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the non-driven pulley is called tail pulley.

TYPES OF CONVEYOR BELT

1. Multi plies Conveyor belt- Nylon Polyester material (EP)
2. Fire and Flame resistant (FR)
3. Heat Resistant conveyor belts (HR)
4. Pipe conveyors
5. Steel cord re-in forced belts. (SC)

II. FIRE

Fire is most dangerous hazards in conveyors. A local caused of fire are transporting coal material through conveyor which spillage and accumulate near the conveyor belt. This accumulate coal material major cause of fire which high risk of fire and convert this fire in a big fire accident and damage more so early fire sensor is essential for eliminate a big fire accident.

Fire hazards

Conveyor enclosures and supporting structures are normally of non-combustible construction. However, any large fire in the

enclosure may damage, or in the case of included conveyors cause the collapse of, structural elements. The principal fire load includes the material being conveyed and the belt itself.

Conveyor belts are made of plies of rubber and fabric of natural or man-made fibers. Conventional belts are easily ignited, spread fire rapidly and liberate large quantities of smoke. Inclined conveyors may cause a flue effect thereby increasing the spread of the fire. An unusual occurrence is if the belt should part under tension: the burning ends will fly apart causing two remote fires. The fire hazard increases with the age of the belt; older belts may become coated or impregnated with oils or combustible residue.

Causes of fire

Ignition sources:- The investigations into possible ignition sources for conveyor belt fires showed various reasons for the occurrence of fires. The following non-exhaustive list summarizes causes for conveyor belt fires without any classification:

1. Friction of belts
2. Collapsed idler bearing
3. Fires of flammable liquids
4. Slide of a belt in a drive
5. Jammed rollers
6. Friction from brake
7. Coal spillage
8. Excessive temperature of the drive
9. Seizing of bearings
10. Seizing of gears
11. Collapsed pulley bearing
12. Sparks, electrical causes

III. EQUIPMENT AND METHODOLOGY

Equipment's

LHS CABLE (LINER HEAT SENSIBLE)

LHS Cable is a smart sensing product aimed at providing early detection of fire or overheating in adverse environmental conditions within areas of limited access and surveillance. These unique cables and associated systems can detect heat anywhere along the length of the cable by detecting changes in temperature.

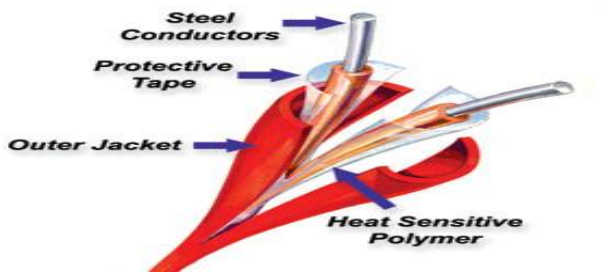

Fig. 2 Projection view of Lhs cable.

NOZZLE

A nozzle is a device designed to control the direction or characteristics of a fluid flow (especially to increase velocity) as it exits (or enters) an enclosed chamber or pipe A nozzle is often a pipe or tube of varying cross sectional area, and it can be used to direct or modify the flow of a fluid (liquid or gas). Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and/or the pressure of the stream that emerges from them. In a nozzle, the velocity of fluid increases at the expense of its pressure energy.

Fig.3 Full cone spray nozzle.

EMERGENCY BUTTON

When using emergency stop buttons and kill switches, are they designed in such a manner in which their role is more physical, such as interrupting a power supply (apparently in some of the models, like the one pictured, the button has to be turned before operation can resume), or are they just basic big red pushbuttons that are simply coded to wait until they're pressed and another work of emergency button is give signal about hazard.

Fig.4 Present condition of the Emergency button

SOLENOID VALVE

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold.Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas.

Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design.

Fig.5 Solenoid valve

METHODOLOGY

Laying of lhs cable for auto mode in firefighting system

Previously installed firefighting system was manual mode. After modification added the LHS cable along the length of the conveyor on both sides of the conveyor carrying side and return side which short-circuit above the temperature of 65^0C and send a signal to SMPS.

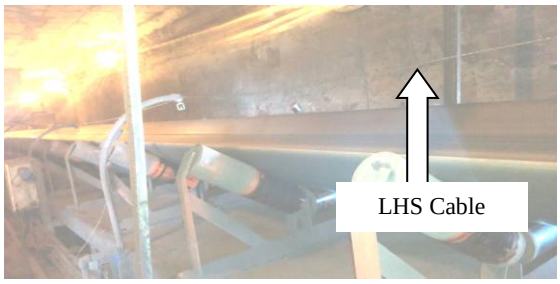

Fig.6 After laying LHS Cable

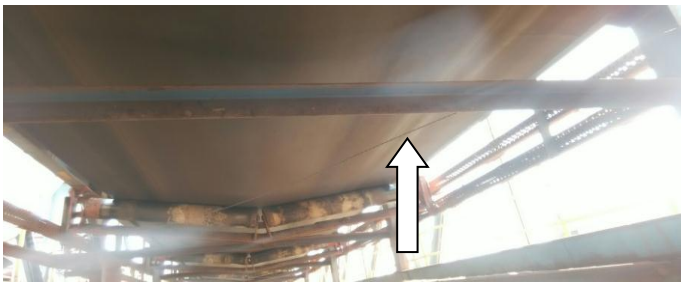

Fig.7 After laying LHS Cable

Fixing of nozzles for better water spray in firefighting system

Previously before implementation of the project the nozzles are not installed with the conveyor, but the water also discharged at a single point of the conveyor.

After the implementation and installation of the full cone nozzle for every meter of the conveyor installed with the conveyor, the water will be discharged with full spray over the conveyor covering one meter. In this way all over the conveyor water will be sprayed.

Fig.8 Before fixing of nozzle

Fig.9 After fixing of the nozzle

Replacing emergency button against manual press button in every deluge valve house

Previously manual mode firefighting system have a manual press button in every DVH which is not easy to operate for every one due to no knowledge about this button because less uses. But new emergency button is installed in DVH for emergency situation which is easy to operate by everyone because this uses every location for emergency purpose.

Fig.10 Previous manual press button

Fig.11 Present condition of the Emergency button

IV. RESULTS AND DISCUSION

Firefighting system was taken in auto mode

Firefighting system was taken in auto mode reducing the chances of firefighting system.

Surface area of water spray has been increased.

1. Previously before implementation of the project the nozzles are not installed with the conveyor, but the water also discharged at a single point of the conveyor.
2. After the implementation and installation of the full cone nozzle for every meter of the conveyor installed with the conveyor, the water will be discharged with full spray over the conveyor covering one

meter. In this way all over the conveyor water will be sprayed.

Chances of happening fire incidents were reduced by increasing the conveyor safety.

1. Previously if the fire catches at the conveyor it takes some time to ON the water spray and it increases the fire on the conveyor.
2. After installing the LHS cables and changing the Emergency Switch even if there is no communication the fire can be attended immediately.
3. When LHS cable senses small amount of heat it gets Short-circuit and immediately the solenoid valve gets open and the water spray will sprayed over the conveyor.

Reduced the cost of demerge caused by fire incident.

1. If a fire incident happens the conveyor will be burnt and causes the production breakage. With this tippling also will be stopped so that effecting with heavy demerges.
2. With this project the conveyor will be saved from the fire and the demerge was controlled because of the fire incident.

Saving the time and increasing the availability of conveyors.

1. If the conveyor catches fire then it takes more time to replace the conveyor and the restart the production and tippling.
2. With this project the conveyor can be saved from the fire and the conveyor availability can be increased.

Reduced the water pressure and eliminate the water pump damage

In relevance to initial condition, the happening of fire hazard leads to start-up water spray to the entire length of conveyor. This may causes pressure drop to the extreme end of conveyor. Despite of all this, fire hazards at ends of conveyors results insufficient water spray and also high load on pump. So, prior to the above consequence we distinguished entire conveyor into three zone (fire zone, previous zone, next zone), with respect to fire hazard in respective conveyor zone water spray will light up. Therefore there will be a saving in water and also enhance of water pressure to compress fire.

CONCLUSION

After project has been done to test the process. The heat and fire sensor continuously monitors the temperature present in the conveyor region and gives

signal to the LHS Cable where a particular temperature has been presented. Once the preset temperature has been reached the LHS Cable got disconnect and gives signal to the relay which gives supply to solenoid and solenoid energized and water gets sprayed.

Thus a fire risk prevention and control measure in belt conveyor has been practically done with the installation of auto fire fighting system. Which is verified and risk has been reduced. This setup can be implemented in a large scale for the whole plant. The methodology is simple and cost effective and easy to implement the methodology helps to reduce the fire risk and also electrical risk caused by fire hazards. This methodology definitely reduces the chances of fire and electrical accidents in the conveyor and minimizes the fatality.

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