

IMPROVING EFFICIENCY OF APRON FEEDER BY INSTALLING SPEED SENSING SWITCH

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Article Received on 13/09/2019

Article Revised on 23/10/2019

Article Accepted on 03/11/2019

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ABSTRACT

Apron feeders are very important in the Coal Handling plant and it plays vital role in coal unloading from Wagon Tippler to conveyers. The control system used for these Apron feeders is important for operating safe. But in some Coal Handling Plant still use of simple on/off switches for controlling the apron feeders. And these switches are only play roll of protection up to some limit. These Apron feeders control system are one of the biggest problem for the plant operator

and maintenance engineers, being the cause of unsafe plant operation, which forced to plant breakdown and interrupt coal supply to boiler result loss of generation. Hence the efficiency of plant get reduces. This paper has been focused on required Apron feeders' control and indication and alarming by installing a Zero Speed Switch with a Proximity sensors, which will fulfill requirement of smooth and safe plant operation.

KEYWORD: ZSS, Apron Feeder, coal choke up, Wagon Tippler.

I. INTRODUCTION

The efficiency of Coal Handling is depending upon availability and reliability of Apron feeders and conveyor system. If both systems is working well then the reliability of CHP is almost 100 %. Apron feeder is installed next to Wagon tippler and it plays vital role in coal

unloading recruitment for power generation for Thermal Power Plant. The coal is unloaded to Wagon Tippler is transferred to Apron Feeders. The Apron Feeder is hydraulic driven and has electrical motor for the hydraulic power back. The coal transferred from Wagon Tippler to Hoper is approximately 65 to 75 tons. The speed of Apron feeders drive is variable which varies with hydraulic pressure from 40 to 280 kg/sq.cm If the coal is accumulated in the Coal Hooper and hence the fails to operate or run then Wagon Tippler does not get any indication or alarm of failure of Apron feeder drive and if the operator does not know this condition and allows makes Wagon Tippler to unload coal in Coal Hooper, then there is a heavy coal chock up in Coal Hooper, which requires to clean approximately 48 to 72 hours sometime. The Zero Speed Switch will be provide for checking speed and indication and alarm of speed of Apron feeder drive when Apron feeders fails to run or either in running condition. This ensures the reliability of coal handling plant.

II. EXISTING FAULT

Discontinued Coal Feeding Through Apron Feeder

Coal in the Coal Handling Plant comes through Three ways. They are 1. Road-ways. 2. Railways. 3. Ropeways. The most prior and important incoming supply of coal is through the Railways. The coal through the Railway is unloaded at the Coal Unloading Point with the help of Different feeders consisting of 1.Vibrating feeder. 2. Paddle feeder. 3. Apron feeder. Here the Unloading of coal coming through Railways is undertaken by the WAGON TIPPLER department (The most important and huge Quantity of coal Unloading point). Wagon Tippler section carries out this procedure of Unloading and Further feeding of coal with the help of conveyor belts. Our fault is located at the APRON FEEDER which use to feed the huge quantity of coal through its Biggest width "Tribal Conveyor". TRIBAL CONVEYOR at the Apron feeder has the biggest width of 2200mm belt. Its working is carried out by 5kw motor with rated current of 7.5 Amp. Discontinued Coal feeding through Apron Feeder leads to face a very huge loss in overall energy generation through the plant. This problem of discontinued coal feeding at the Apron feeder occurs due to the Trouble shooting of "Tribal Conveyor" of the Apron feeder .If the Tribal conveyor sometime fails to Carry the incoming quantity of coal from the Coal Hopper, In such cases the "Coal Chute" Of the Apron feeder gets Choke up with the Choke up of Tribal conveyor. In such cases the thing use to happen is that the Wagon Tippler Operator in the control room has no information about the coal chute choke up of Apron feeder. This choke up of coal chute occurs 80feet below the ground level where it is very difficult to clean or remove the excess

amount of coals at saturated at the coal chute which priory requires 3-4 working days to clean the Tribal conveyor and coal chute to obtain its proper operating condition. This leads to the discontinuity in the feeding of coal to the further Unloading point or boiler maintenance section, which directly effects on the generation of plant and has to suffer with very huge economical loss. Hence it was very necessary to provide the alarm or notification signal to the control room operator of wagon Tippler so that he must stop feeding the coal to the hopper in case of problem of coal chute choke up so that this choke up must be overcome . Due to which the continuous power generation would not be affected or suffer practically and economically too.

III. OVERCOME THE PROBLEM OF COAL CHOKE UP

The problem of coal chock up at Apron feeder is removed by installing a Zero Speed switch with proximity sensor.

A. *What is ZSS?*

The zero speed switch i.e. ZSS is used to detect the absence or presence of motion of rotating, reciprocating or conveying equipment. Means simply it gives the indication where the equipment is rotate or not, if the equipment is not rotating "absence of speed" it gives the signal to the PLC panel and operator takes the necessary action. It also gives the signal if the equipment is rotate properly means "presence of speed" to the PLC panel and operator is considered our working operation is in safe zone. The ZSS consists of a circuit card and magnet assembly potted in the probe body. The ZSS is powered from the line voltage and provides a set of dry relay contacts for indication of motion. The probe must be aimed at a ferromagnetic material or target on the equipment in order to sense motion. The system comprises of a suitable motion detector probe and electronic circuitry for detecting zero speed.

The circuit consists of a step down transformer, a rectifier, a filter and a DC regulated power supply. It consists of a delay circuit that provides starting time delay and a re-triggerable timing circuit, which compares the time between two pulses with a fixed time duration. The sensor circuit senses the moving target and outputs pulses, whose frequency is proportional to the speed of moving target. Adequate cable entries are provided for wiring. The speed switches can work in a broad range of temperature with -20°C as the lowest and +60°C being the highest temperature point. The zero speed can be set from 3 ppm (pulses per min.) to 20 ppm. A small timing delay may be required for avoiding nuisance tripping during running as

well as during starting of the machine. This is taken care of in the electronics of the ZSS. There are two types of ZSS, based on supply provision. One is interrupted power supply type, in which the power supply is given to ZSS only for the duration for which the power is going to the motor of that machine. In the second type, the power supply is continuously given to ZSS.

B. Principle

When power is initially applied to the zero speed switch, the alarm relay is energized and held by the timing circuit for desired (settable) time duration. Whenever the motion detector sensor detects a target, a signal in the form of pulse re-triggers an internal timing circuit. This action keeps the alarm relay energized providing a fail-safe operation of the contacts. If no target is sensed for desired time duration (that is settable), the timing circuit will not be re-triggered. This will cause the alarm relay to de-energize and the contacts to change state. Thus the relay output contact can be used for signaling / controlling.

C. Specification

Power : 115V/50-60Hz, 10VA
: 230V/50-60Hz, 10VA
: +10% -10% of rated voltage.

Temperature : -40 to 60 degree Celsius.

Range : 7.8 to 36 mm.

Shifting Weight: 2kg.

Output : 1 from C dry relay contact, rated at 5 amp at 250v ac

D. Installation

The Zero Speed Switch must be mounted in an area that is non-hazardous, within the ambient temperature range and non-corrosive to the material connection. The Zero Speed Switch is sensitive to lateral disturbances to its magnetic field. If the Zero Speed Switch is responding to motion from an interfering target, move the Zero Speed Switch or install a ferrous plate (steel) as a shield between the Zero Speed Switch and the interfering target. Do not mount the Zero Speed Switch in direct sunlight without the use of a sun shield.

Zero Speed Switch has four setting keys that are Key 1 - Program (menu)

Key 2 - Shift (>) Key 3 - Up (^) Key 4 - Enter

Zero Speed Switch has 14 input/output terminals for different connections as shown fig. 1.

Hardware required for installation and operation of Zero Speed Switch

1. Zero Speed Switch Unit
2. Proximity Metal sensor
3. Indicating Lamp
4. Alarm
5. Electric Terminal Board
6. Welding machine
7. Cables

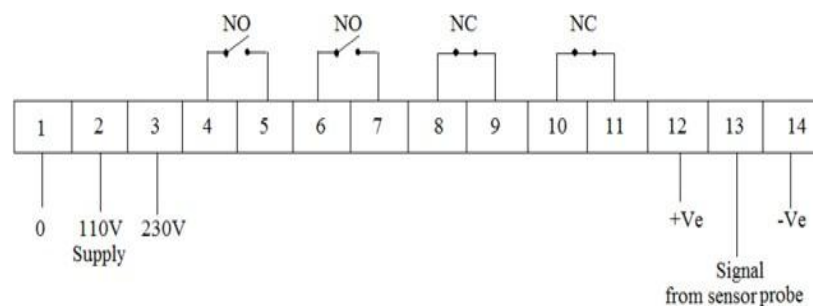


Fig. 1. Input/output terminals of zero speed switch.

As shown in fig. 3. we are giving supply to 1, 2 and 3 terminals of Zero Speed switch as per requirement i.e. 1 and 2 for 110 Volts and 1 and 3 terminal is for 230 Volts. Terminal 4, 5, 6 and 7 are taken as normally open (NO) contacts and terminal 8, 9, 10 and 11 are taken as normally closed (NC) contacts. Terminal 12 and 14 are connected to PLC where Alarm and Indicator are connected. Separate supply of 24 Volts is given to Alarm and Indicator mounted on PLC. At terminal 13 signals from proximity metal sensor are taken. Proximity Metal Sensor is mounted in front of nuts and bolts connected on coupling of Apron Feeder and Gear Box of Hydraulic machine, and Nuts and Bolts are used as sensing element. This Proximity sensor Welded properly on the Gear Box at particular position where it exactly face the Nut and Bolts so that it can sense the speed of Apron feeder. The gap between the metal sensing probe and the Nuts and bolts should be sufficient such that there is no danger of the Bolts damaging the sensing probe. The maximum allowable gap is 38 mm, and effective gap between Sensor and Bolts is 7.8 mm. Where possible, the sensing probe should be mounted such that the conduit entry is pointing downward to avoid accumulation of condensate in the casing. Connection of the sensing probe should be made via flexible conduit for easier removal or adjustment of the sensing probe.

E. Operation

When power is initially applied to the Zero Speed Switch, the alarm relay is energized and held artificially by the timing circuit. This will simulate the normal operation of the ZSS for a start-up delay of 3 ± 1 seconds (or 5 seconds if a jumper is wired across terminal block 1 TB - 7/8). As a ferromagnetic object passes through the probes permanent magnet field, the distortion of the flux is sensed by the magneto resistive sensor. The sensor modulates the current through it to produce a pulse which resets an internal timing circuit. This action keeps the alarm relay energized providing fail-safe operation of the contacts. If no target or change in flux is sensed for a period of 10 seconds (or 5 seconds if a jumper is wired across terminal block 1TB-7/8), the timing circuit will not be reset. This will cause the alarm relay to de-energize and the contacts to change state. Thus the ZSS will not detect the motion of uniform ferromagnetic masses that do not produce pulses within the period of the time delay on zero speed.

In this System following Setting are available-

1. ITD
2. CUR
3. NTD
4. RPM
5. PPR

In Run mode we can set the values for different modes-

1. ITD- 10s

This is the initial time delay to start the process. Maximum value can be set as 99 second. To see this value, press PRG Key in run Mode. Display will show last set value. To set new value, say 20. Press Up key 2 times, now display will show value as "0002". Now press shift key, this will shift the digit toward, now display will shows as "0002". Now press Enter key to set this value.

2. CUR

Press Enter keys. It will show zero message on display press enter key. It will show previously set value. This setting for the 4mA current.(allowed count are 530 to 550). Press enter will display "Span" message on display press enter again. It is use for the fine tune the 20mA o/p(allowed count are 2700 to 2800).Press enter on display "Set Z"(e.g.60 RPM) lower limit for the setting point for the 4mA. Press enter "Set P" enter the value for 20mA

reading value.(e.g. 4800 RPM).

3. NTD

This is Nuisance delay; this is activated when the current RPM goes below the set RPM level. e.g. If the set RPM value is 10, and suddenly RPM goes below 10. If we set Nuisance delay as 5 sec. relay will be gets off after 5 sec. To set the value when user press enter key after setting value for initial delay. Display will show NTD message. Here set desire value by using Up and shift key combination.

4. RPM

This is reference minimum RPM value to value to keep output relay ON. When RPM goes below this value, then nuisance delay will get in action. Maximum settable value is 9999.

5. PPR

Pulse per Revolution. In this user can set No. of pulses in single rotation. Maximum value can set 99.

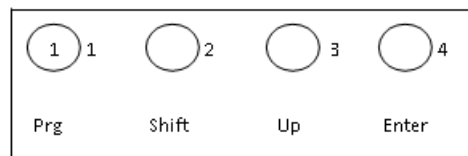


Fig. 2. Setting keys of Zero Speed Switch.

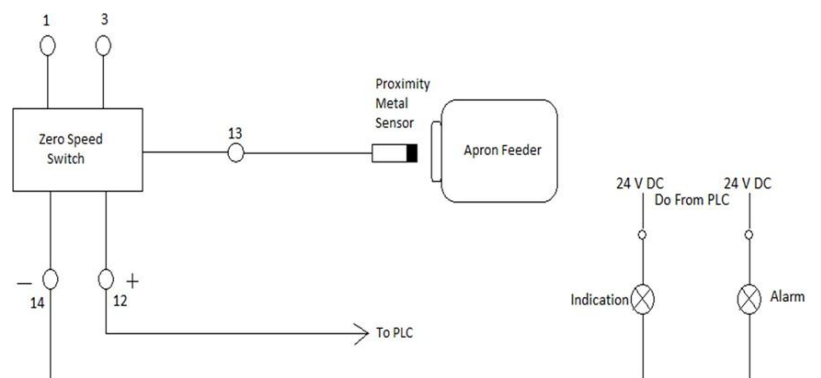


Fig. 3. Single Line Diagram of Installation of Zero Speed Switch.

CONCLUSION

By installing Zero Speed Switch the speed of apron feeder is controlled and hence the problem of chock up of coal at Apron Feeder is overcome. And hence we improve the efficiency of CHP and availability of auxiliary.

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