# A complete fire detection solution.

## Conveyor Systems in general have a fire risk due to external events and equipment failure. However the flammable nature of products including the ability of some types to self ignite introduces an exceptional hazard requiring special consideration.

There are two important areas to consider for Conveyor Systems:

- Fire prevention
- Automatic fire detection and suppression

**FIRE PREVENTION**

Some products have the ability to self combust under certain conditions. Some of the worst of these is Powder River Basin (PRB) coal which can self ignite even in very short time periods.

Even with less volatile products, measures that reduce the possibility of fire occurrence are by far the most economic.

Expenditure on both 'preventative design' and 'additional operational procedures' provides the most effective use of financial resource.

These actions can be considered to be **'Good housekeeping'**

**Housekeeping** means limiting the 'product dust' accumulation associated with Coal Dust or Biomass Dust explosions, preventing spills and effective regular clean up.

Fixed wash-down systems, designed for 100% coverage, are commercially available and when installed provide greatly reduced labour costs.

For optimum results these piped installations should be combined with Automatic Fire Suppression/Extinguishing Media.

Plants that have installed this form of integrated Fire and Cleansing hydraulic water-spray system, and operate it on a daily basis, report being satisfied with the performance.

**FIRE DETECTION**

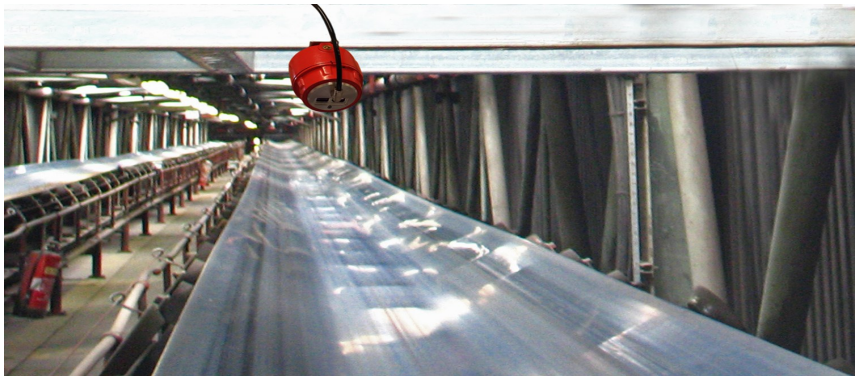
Despite the most stringent measures to prevent fires, even the best managed sites can experience fire events from time to time.

The faster that these are detected and addressed (extinguished) the lesser will be the cost due to plant damage and down time.

A fire condition within a conveyor system may be considered to be:-

- A **"static"** fire — On a stationary conveyor belt, or within the conveyor mechanism/ housing.
- A **"moving"** hazard — Hot or burning product imported onto a traveling conveyor belt.

It has been established that each of the above requires a different form of fire detection to provide a reliable fast responding and trouble free system.



It is the object of this guideline note to indicate general solutions. However it should be emphasized that any specific installation / site / plant must be addressed individually in order to obtain the correctly engineered system.

**Static Conveyor Fire**

In the conveyor structure any product which falls from the moving belt, or an accumulation of settled product dust, is a potential hazard.

A mechanical fault in the bearing of a roller, or the friction between a seized roller and the belt, will result in a build up of heat which can be sufficient to ignite the belt, when the belt stops.

The introduction of product can make a fire highly probable.

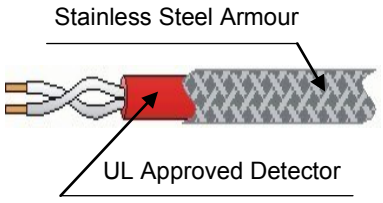
Many different types of fire detector have been tried for conveyors. These attempts, some going back many years, include:-

- Collective reflectors (thermocouple hoods)
- Ionization and optical point smoke detectors
- Point Heat Detectors
- Point Flame Detectors
- Obscuration detectors employing infra-red beams
- Pneumatic detectors with fusible bulbs

In every case, experience has shown that these devices are either unsuited to the environment producing unwanted alarms due to dust or fog, or are so insensitive that a fire can propagate and cover many metres of a length of the static conveyor before they are operated.

The true solution has been determined to be Linear Heat Detection (LHDC) for Static Fire protection and IR Heat Detectors for Moving Fire protection.

**LINEAR HEAT DETECTION**




Typical arrangement for *Electrical - Digital* LHDC

Patol Supply two types of LHD Cables:-

- Electrical — Analogue
- Electrical — Digital

In both cases the LHDC comprises of a 'robust Cable' that will 'Annunciate' an alarm if any portion of the LHDC experiences an abnormal temperature.

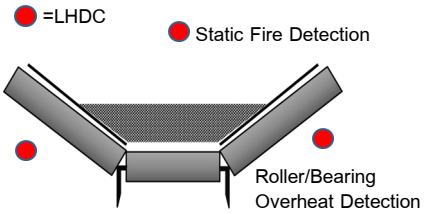
Being a sealed 'Cable/Wire' the LHDC is not prone to the water and dust problems that cause conventional smoke/heat/beam/ detectors to be ineffective in the rigorous environment of a conveyor housing/enclosure.

Patol recommend using Digital LHDC and tests have been carried out to determine the optimum location.

To protect the upper side of the conveyor itself a detector “run” should be installed above the centre of the belt at a height of 1 to 1.5m. Normally this is achieved by the use of a steel catenary support wire to which the LHDC is affixed.


**LHDC and Catenary Wire Support**

To protect the underside of the conveyor, LHDC “runs” should be installed at the conveyor side to detect heat generated around the belt edges from events occurring on the underside. The LHDC is mounted above the return roller (belt) on each side.

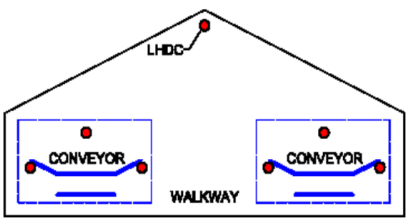



**Digital LHDC Routing Example—Conveyor**

Each specific conveyor arrangement must be considered in order to determine the optimum mounting method. The mechanical arrangement of some conveyor truss work can provide a suitable mounting without further protection such as slotted steel trunking or LHDC Armour.

The LHDC must always be mounted by clips or thermal spacers, such as to be in the air flow. It must not be mounted directly to steelwork which would act as a heat sink and retard response.

Enclosed conveyors should have extra detection at ceiling height to detect dust ignition on cable trays, pipes etc. located above the conveyors. With a pitched roof enclosure LHDC should be located near the apex.




**Cross section of dual conveyor housing**

Patol’s DDL controller with distance locator display activates on fire condition and displays the distance into the zone the alarm has occurred.


**5610 ATEX IR Detector with Compressed Air Inlet for Lens Cleaning System**

**Detecting Black Body Emissions on Moving Belts**

One of the most reliable ways to detect fires on a moving conveyor is to monitor for infra-red “black body” emissions.

Infra-red emissions occur for all materials. The wave length spectrum and intensity of this IR depends on the materials temperature, and for solid bodies is determined by the Laws of Physics formulated by Planck, Stefan, Boltzman and Wien.

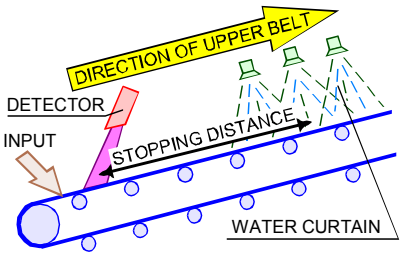
Planck’s Law defines the spectrum and level of IR emissions for a ‘black body’ at any given temperature.

Patol’s IR Black Body Emission Detector employs IR filters that select longer wavelengths and are “blind” to the visible spectrum. They can detect both high energy emissions from very hot/glowing embers, and those from abnormal but relatively low temperature product transiting the monitored belt area.

Whist some detectors may be able to respond to *burning* product (550°C to 1000°C) the correct type of IR Black Body Emission detector will also respond to an abnormal but non-ignited conveyor load (100°C to 200°C).

Spark, Ember and Flame detectors will not respond to the latter condition. Patol’s IR Heat Detectors have a target range of 80-1000°C.

The detector when mounted above the conveyor at a height of between 1.0 and 1.5 metres, should be able to cover the full width of the belt with its optical system. The system must also detect glowing product of up to 30mm diameter and less.




- The infra-red detector should be mounted at the start of each conveyor including transfer towers and loading points, such that on detecting a fire the belt could be stopped:-
- Where the fire would be within a water spray deluge curtain.
- Before it can discharge the fire to another belt or silo, etc.

The Infra-red Detector is configured to automatically stop the conveyor and raise an alarm.

At this stage the water spray can be initiated:-

- Automatically by the IR Detector.
- Manually, after an operator has observed the belt.
- Automatically after a time delay, if not overridden by the operator.
- Automatically by LHDC detection.

**Typical Control Equipment Series 5000 Monitors and PSU**

As these “stop zones” will be remote from the plant control room, they could be monitored by CCTV cameras*

*If it is opted to always automatically initiate water spray from the IR Detection equipment then CCTV is un-necessary.

In addition to the arrangements described above for belt “loading” points, an IR Detector should be installed just prior to the conveyor system discharge to silos and hoppers.

The detector must be located sufficient distance back from conveyor end in order to be able to stop the detected “hazard” within a water spray zone and before discharge of the belt.

In the case of long conveyors due consideration should be taken of the fact that abnormal heat can be aided to develop into ignition by the movement of the product in air and therefore it may be prudent to install additional intermediate IR detection units typically every 50m.

**Special Considerations**

Conveyor tunnels and housings are an extremely dusty environment. IR Detectors employed must accommodate “air cleansing” for optical lenses. For Zone 21 classified areas, the ATEX certified 5610 IR Heat Detector should be used.

Patol’s IR Detectors are supplied with either Compressed Air Inlet or separate Blower for ‘Air Cleansing’

All equipment must be able to withstand the rigors of “housekeeping hose down” arrangements.

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