ADVANCED DETECTION SYSTEMS

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Metal Detection 101: When Magnets Aren't Enough

It's a common sight at any mineral processing facility; over-the-belt fixed magnets removing tramp metal from the product stream and protecting downstream crushers. With growing production demands placed on staff and equipment, and with a growing trend of utilizing recycled materials, the magnet-only operation is at risk.

Magnets are still the most-effective means of removing tramp metal and other contaminants from a product stream, but they're not always successful in protecting the crushers from damage. A large contaminant resting on the belt, with burden on top, or a bucket tooth with a high manganese content, might get past the magnet, and the resulting damage to the crusher, subsequent downtime, and maintenance and labor costs, can be staggering.

Although metal detection is not a new technology in the rock processing industry, it does seem to be overlooked at the plant level. Metal detectors have always been looked upon as a voodoo science, perceptions of the technology misunderstood, and the proper application of the detector and its operation often ignored in lieu of more pressing matters at the plant.

If the metal detector performs flawlessly, everyone is happy and the potential for damage to equipment is greatly reduced, but an improperly installed detector, or a unit that's improperly adjusted, is simply an accident waiting to happen.

So how does a metal detector actually work? Is it as complicated as we've believed it to be? The answers will surprise you.

Understanding the Machine

Metal detection is based on a very simple technology, the creation of a magnetic field and the induction of metal introduced into that field. Most metal detectors use a “balanced field” design utilizing two coils, a transmit and a receive coil.

The transmit coil creates a magnetic field broadcast at a specific frequency, and the receive coil is ‘tuned’ to that frequency, much in the same way your car stereo is tuned into a radio station. The conveyor belt passes through this magnetic field. The metal detector is balanced.

When metal is introduced into the magnetic field, it is electrically stimulated by the transmit coil, and creates an imbalance in the magnetic field. It is this imbalance in the magnetic field that triggers the metal detector.

The detector can be set up to react to specific degrees of change, thereby ensuring that small items such as aluminum cans, nails, or other non-damaging metal can simply pass through, eliminating false trips and improving productivity. It is here that the proper adjustment of a metal detector is critical.

Product Effect

A metal detector is never truly perfectly and constantly balanced. Although the transmit coil is producing a stable field, external factors are always upsetting the balance of that field in small, minute ways. These factors include electrical equipment operating in close proximity to the detector, physical vibrations, and of course, the product on the conveyor belt. This is referred to as the ***Product Effect***. Product effect will range from very small magnetic footprints, like limestone, to very large, like iron ore. Understanding the magnetic and conductive nature of your product can assist you in establishing tramp metal detection standards.

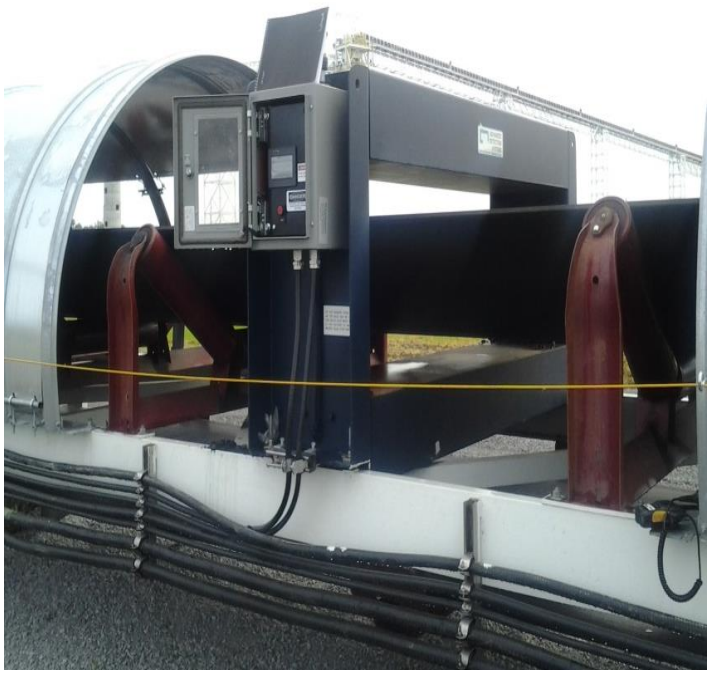
A metal detector must always be adjusted to allow the product to pass without false-trip detection. The amount of product effect also predicates the size of the contaminant that can be detected. It is physically impossible to detect a contaminant whose value is less than the product effect of the material on the conveyor. What this means to the quarry manager is that a 2-inch mill ball can be detected in crushed limestone, but the same mill ball might not be detectable in comparable amounts of iron ore.

Metal Detector Installation

Polymer rollers installed at the edge of the 48" metal-free zone on an inclined conveyor, Mexico.

Because metal detectors are susceptible to outside interference, there are several factors to consider when installing a detector onto a conveyor. The most-critical factor is location. Detectors must be far enough away from sources of external interference, such as magnets, variable-frequency devices, power transformers, and any device that creates a magnetic field.

Metal detectors require a metal-free zone, an area that typically extends outward from the centerline of the detector to 24" in either direction of the conveyor, or 48" overall with the detector in the middle. This includes the removal of steel idlers on either side of the detector. If idlers cannot be removed, then replacement with non-magnetic polymer idlers is recommended. Safety rails or other overburden devices must be replaced with non-magnetic materials such as wood, PVC or fiberglass. Any metal within the metal-free zone will upset the balance of the field and compromise the detection levels of the unit.



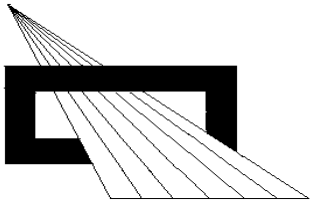
Sheet metal hoods can affect detector performance and must be removed within the metal-free zone.

Metal detectors, when installed properly, are best used as a last-line of defense, getting anything that magnets failed to remove. Unlike magnets, metal detectors cannot remove a contaminant from a belt, it can only inform the operator that a contaminant is present and even mark the location of the contaminant if required. They can, however, be tied into existing PLCs (Programmable Logic Controllers) to shut down equipment and conveyors, or can be given master control of a piece of equipment and facilitate shutdown locally. In addition, a reject device can be tied into the detector to physically eliminate the contaminant from the product stream. The most-common is the waste gate, although hydraulic belt plows and shovel systems do exist to physically remove product from the conveyor without interruption.

A Matter of Trust

Metal detection has changed dramatically in the last 10 years, with the industry adopting digital technology and touch-screen interfaces, effectively eliminating the need for annual calibrations and perpetual baby-sitting of metal detection units. A digital Protector HD unit, properly installed and configured, can be as trouble-free as the magnets further upstream, protecting your crushers and screens from tramp metal contamination. In an ideal situation, a fixed electro-magnet, followed by a metal detector connected to a reject device or PLC, can provide superior protection for your equipment and increase productivity, efficiency, and profitability.

For a more in-depth discussion of state-of-the-art metal detection technology and applications, please contact Advanced Detection Systems at 414-672-0553 or visit www.adsdetection.com



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