The Misconceptions of Overbelt Magnets

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Overbelt magnets are magnetic separators suspended above conveyor belts to remove ferrous tramp metals from the stream below. They could contain either electro or permanent magnets to achieve the desired tramp metal removal.

There are a lot of misconceptions about how overbelt magnets work and what the requirements are to size an overbelt magnet. These misconceptions cause major delays in the sizing and quoting process of an overbelt magnet. This article will hopefully shed some light on the working principles and parameters that affect the sizing of an overbelt magnet.

Overbelt magnets are essential for applications where it is possible to have tramp metals present in the processing streams that could potentially damage downstream processing units. They prevent the ferrous tramp metals from causing severe damage to the downstream processing units like cyclones, crushers, conveyor belts etc. Therefore, removing these tramp metals with appropriate efficiency could prevent costly equipment damage, unplanned maintenance, below specification product, down time production losses and potentially hazardous repair work to damaged equipment.

Specifications required to size an overbelt magnet:

The figure below visually illustrates the parameters that need to be specified for the sizing of an overbelt magnet. A description of the parameters follow.

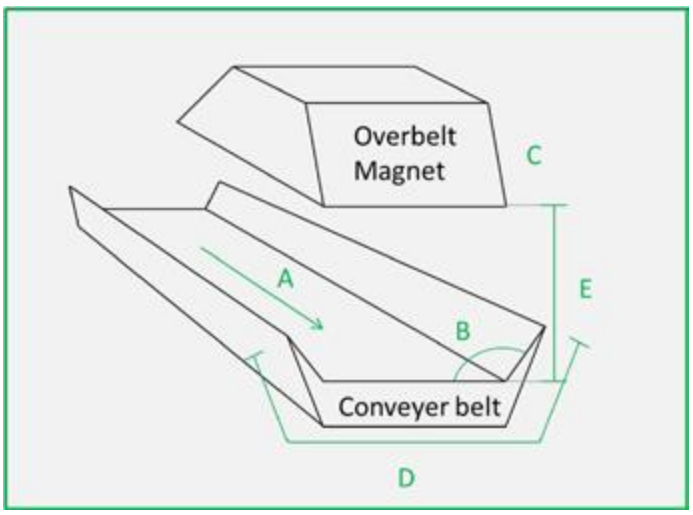

Figure 1: The dimensions and specifications needed for overbelt magnet sizing

The listed parameters below need to be specified to size an overbelt magnet:

A. Material specifications:
- A.1 - Short description of nature of burden materials
- A.2 - Feed mass flow rate (t/hr)
- A.3 - Belt speed (m/s)
- A.4 - Burden material bulk density (t/m3)
- A.5 - Tramp iron description (shape, size)
- A.6 - Feed moisture percentage (ton moisture/ton material)
- A.7 - Description of lumps

B. Idler angle

C. Overbelt magnet configuration (Inline/Crossbelt)

D. Belt width (m)

E. Clearance (m)

Description of the inputs required for sizing:

A.1 A description of the burden material is needed to determine the weight counteracting the magnetic force experienced by the ferro-magnetic materials.

A.2 The higher the burden mass flow rate, the more weight on top of the tramp metal counteracting the magnetic attraction force and then causing lower tramp metal recovery.

A.3 The faster the belt, the less residence time tramp metal will spend in the magnet's magnetic field to allow removal, the stronger the magnet must be.

A.4 Burden bulk density is used to determine the height of the burden material through which the magnetic materials must move. Higher bulk densities therefore cause lower tramp metal recoveries and require stronger magnets.

A.5 The smaller the tramp iron the less magnetic field lines it will be exposed to, the harder they are to remove, requiring a stronger magnet.

A.6 The feed moisture percentage contributes to the burden material weight counteracting the magnetic force.

A.7 Lumps in the feed create obstacles for the magnetic material removal and therefore need to be specified. Feeds with larger and more abundant lumps require stronger magnets to remove the tramp iron.

Figure 2: The in-line configuration

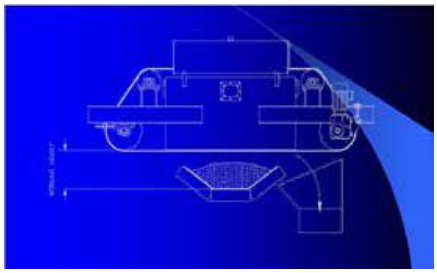

Figure 3: The cross-belt configuration

B. The idler angle determines the burden material profile. Lower idler angles decrease the burden height causing greater tramp metal recoveries.

C. The overbelt magnet configuration indicates how effective the magnet will be. In-line configurations generally have higher separation efficiencies than cross-belt configurations. This phenomenon is due to the lowered effective burden drag forces and closer proximity of the magnet to the belt in an in-line configuration.

D. Belt width indicates the area that needs to be covered by the magnetic field. The larger the belt means that a larger area needs to be covered by the magnet, requiring a larger magnet. The correct way to measure the belt width is:

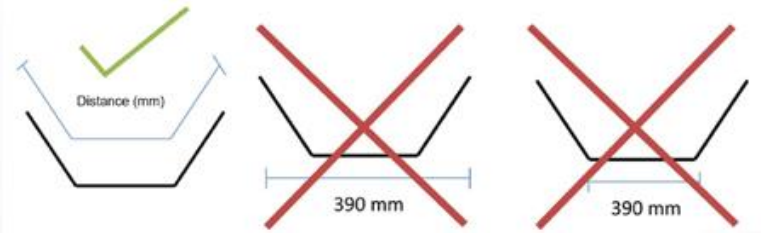

Figure 4: Measure with distance (mm)

E. The further away the magnet from the tramp metal iron, the lower the magnetic field intensity induced on the tramp metal therefore, the stronger the magnet must be to remove it. The clearance distance is determined by the size of tramp metal. For larger tramp metal, a larger clearance distance is required. Hence, larger tramp metals will improve extraction efficiency due to being exposed to a larger flux density, but they require a larger clearance distance, also lowering the extraction efficiency. Whereas for smaller tramp metals are exposed to a lower flux density, decreasing extraction efficiencies, but the magnet can be lowered if only small tramp metals are present. Therefore, it would be advantageous to only have either large or small tramp metals present on the conveyor.

Conclusion

It is vital that all the appropriate process parameters are specified with sufficient detail before an overbelt magnet is sized. If the magnet is improperly sized, it will fail to remove all the ferrous tramp iron metals and these metals could cause serious damage to downstream processing units. Therefore, it could potentially be much more costly to buy an inadequately sized overbelt magnet due to catastrophic downstream damage caused by tramp metals not extracted by the overbelt magnet. Overbelt magnets could pay themselves back in a single extraction event when one considers the effects of equipment damage, downtime and repair safety risks.

Multotec uses computerised mathematical modelling using the above critical inputs and years of experience on actual installations to size all overbelt magnets to ensure that each one is of adequate strength for its designated application. When tramp metal removal is critical and you need expert advice on magnet requirements, contact a Multotec magnetics sales person to assist.