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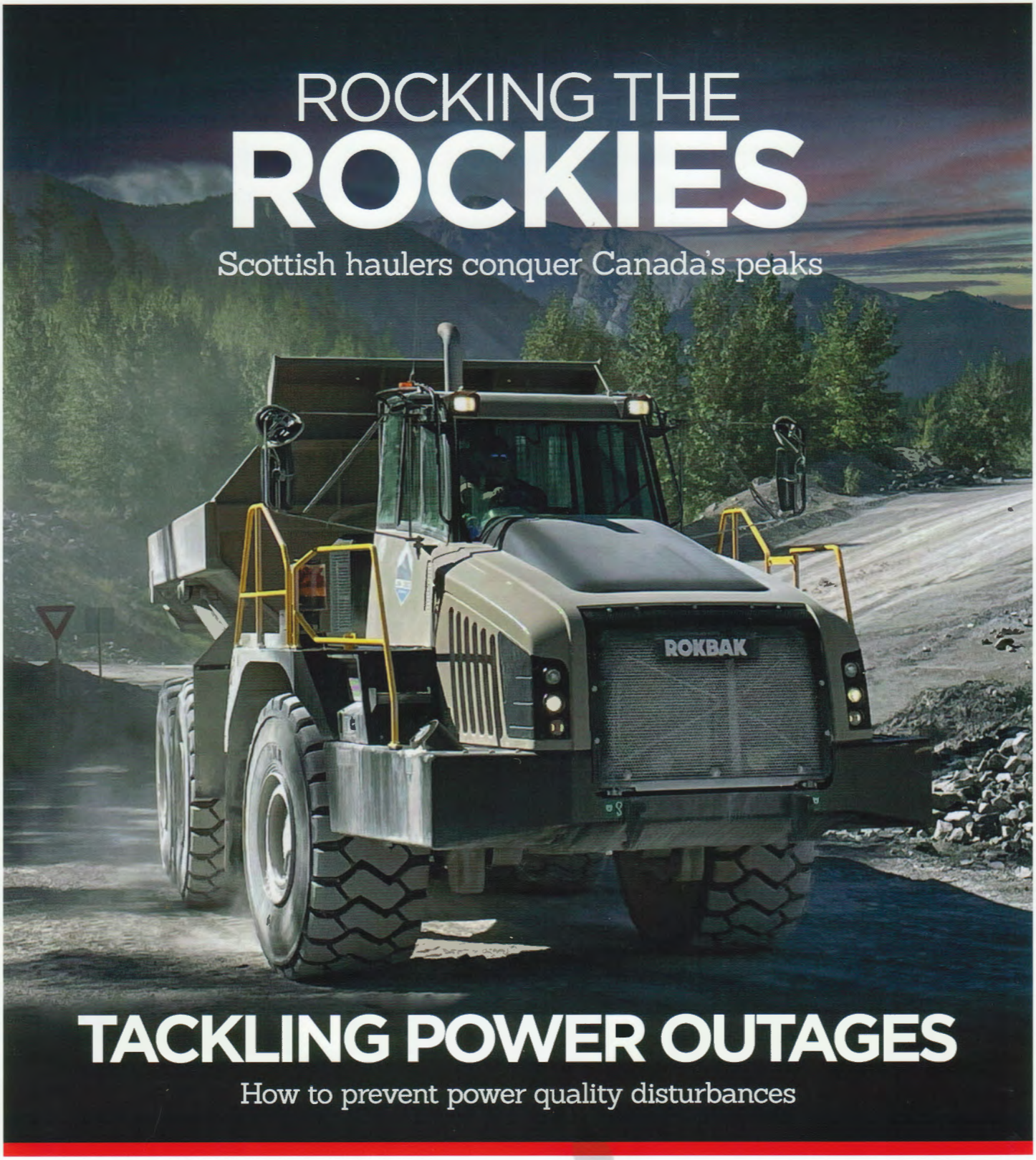

ROCKING THE ROCKIES

Scottish haulers conquer Canada's peaks

TACKLING POWER OUTAGES

How to prevent power quality disturbances

GOOD VIBRATIONS

Service expertise demonstrated with full diagnostics suite for vibrating screens

DYNAMITE DEFENCE

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LONG-LASTING LHDS

World's largest copper producer reports remarkable success with new bushings

Larger than minimum head pulley diameter for adequate belt cleaning with two primaries and one secondary cleaner

CLEAN SWEEP

Todd Swinderman presents a comprehensive approach to conveyor belt cleaner positioning

Knowing the location and number of belt cleaners required for a belt conveyor system is critical to improving safety, increasing component life, and reducing clean-up costs.

A common design problem is fitting belt cleaners in the optimum locations. There are structural, spatial, and safe access considerations that lead to limitations. Discharge chute configuration and installation of a dribble chute to capture extra discharge may also need to be factored into the design.

PLACEMENT AND POSITIONING

Unfortunately, space limitations often result in a very short section of belt surface between the head pulley and the snub pulley. [Fig. 1] This short distance allows little room for secondary belt cleaners and is further complicated by the space needed for a dribble chute.

Designers often locate work platforms based on major components, overlooking access for belt cleaner

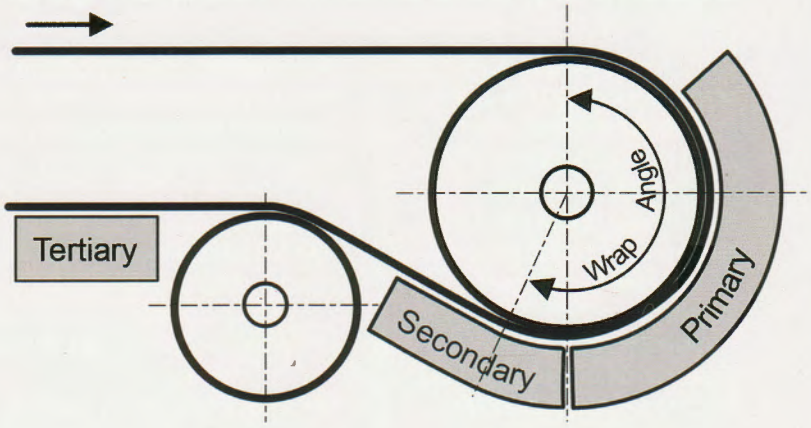


FIG. 1 Belt conveyor cleaner locations

inspection or maintenance and this can be an issue. Belt cleaners require more attention than major components to ensure system efficiency. There must be maintenance at optimal cleaning pressures because the blades are wearing components.

DESIGN AND INSTALLATION CONSIDERATIONS

Designers should abide by the following considerations if they want to provide users with belt cleaners that are fit for purpose.

First, they should ask whether the drive pulley wrap angle really needed. A common default wrap is 210 degrees, created by the position of the snub pulley. The gap between the head pulley and snub is an ideal location for a secondary cleaner, but the combination of pulley diameters and wrap angle may make mounting a secondary belt cleaner difficult and maintenance nearly impossible. We recommend utilising an updated engineering design programme that uses either the DIN conveyor belt standards or Conveyor Equipment Manufacturers Association (CEMA) methods for the calculation of accurate tension values and the required wrap angle, Θ.

Companies can also consider using a larger diameter head pulley. Although choosing a head pulley based on the minimum diameter may seem like it saves money, the Mine Safety and Health Administration (MSHA) reports that up to 85% of maintenance problems are because of fugitive materials, which increase costs for cleanup, labour, and equipment replacement. A larger head pulley allows for the installation of two cleaners in the primary position and enough snub pulley space for one or two cleaners in the secondary position, significantly reducing the amount of fugitive material.

Designers should also place a priority on easy access to the belt cleaners. Maintenance personnel can spend a considerable amount of time merely gaining access to the equipment but designing access to seldom-inspected or seldom-maintained components based on

The adequate belt tension

It is critical that designers determine the amount of wrap around the drive pulley is required to provide the adequate conversion of torque from the drive into belt tension sufficient to move the belt without slipping. The fundamental relationship describing this transfer does not depend upon the pulley diameter, only the coefficient of friction, μ, between the belt and pulley and the wrap angle, Θ and the belt tensions required to prevent slip.

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

Where:
T_1 = Belt tension entering the drive pulley
T_2 = Belt tension leaving the drive pulley
μ = Coefficient of friction between drive pulley and belt
θ = Angle of belt wrap around drive pulley (radians)

Drive pulley tension relationships

Secondary belt cleaner location geometry

Operators should mount some secondary cleaners at least 50mm from the point the belt leaves the head pulley. In addition, they should check the X dimension with the idler dimensions for adequate installation space. [Fig. 3]

A similar analysis of the location of a Martin Precleaner shows that with a 1,200mm diameter head pulley, users can install two primary cleaners and a secondary cleaner. Extra tertiary cleaners would be possible but may not be necessary if operators mount two precleaners and a secondary on the head pulley.

Assumption: Top and bottom runs of the conveyor belt (X) are parallel entering head pulley and leaving snub pulley [Fig. 2]

Variables:

Θ = Wrap angle of belt around head pulley

ω = Wrap Angle, Θ, - 180 degrees

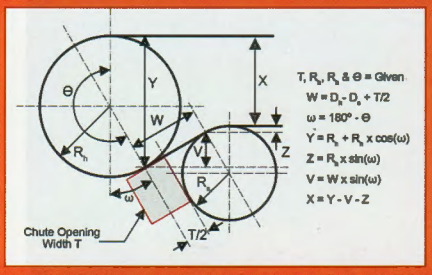
H = The height of the opening for the Secondary belt cleaner blades and frame installation

R_h = Radius of Head pulley plus lagging, plus belt thickness

R_s = Radius of Snub pulley plus lagging, plus belt thickness. (Snub Pulley Diameter default value: 0.64 × head pulley diameter per DIN 22101)

T = The width off the opening for the Secondary belt cleaner blades and frame installation

W = Length of belt segment tangent to both the Head and Snub pulleys



Secondary mounting location basic layout [Fig. 2]

$T/2 = 150$ mm
$D_h = 1200$ mm $R_h = 600$ mm
$D_s = 600$ mm $R_s = 400$ mm
$\Theta = 210°$
$\omega = \Theta - 180° = 30°$

$W = D_h - D_s + T/2$	= 550 mm
$Y = R_h + R_h \times \cos(\omega)$	= 1119.6 mm
$V = R_s - R_s \times \cos(\omega)$	= 53.6 mm
$Z = W \times \sin(\omega)$	= 275 mm
$X = Y - V - Z$	= 791 mm

Secondary mounting space example [Fig. 3]

X = Distance between top and bottom runs of the conveyor belt

Y = The vertical distance between the top run of the conveyor belt on the Head pulley and the tangent point where the belt leaves the Head pulley and starts the return run

costs. Consider structure and work platforms that allow belt cleaner inspection and maintenance.

There's also the option of motorised pulleys that offer energy advantages and weight saving. This also opens up space for belt cleaner installation and maintenance. Since all rotating components (including the main bearings) are located inside the pulley, the external stub shafts need minimal space to be mounted to the structure.

Finally, mounting belt cleaners properly that are accurate to within a few millimeters will help them perform optimally and limit the possibility of belt damage during cleaning or repair.

Contracting with the belt cleaner supplier ensures proper installation with minimal change and the new chute is well maintained.

CONCLUSION

To gain the direct and indirect long-term cost benefits of reduced fugitive material, operators should properly specify, design, and install a belt cleaner system. However, compliance is also an issue. OSHA, 1926.1412(d) and MSHA 75.362 states: "A competent person must begin a visual inspection prior to each shift the equipment will be used, which must be completed before or during that shift." Safe access with adequate space for installation, maintenance and inspection is critical to supporting longer system life and a lower cost of operation. ●

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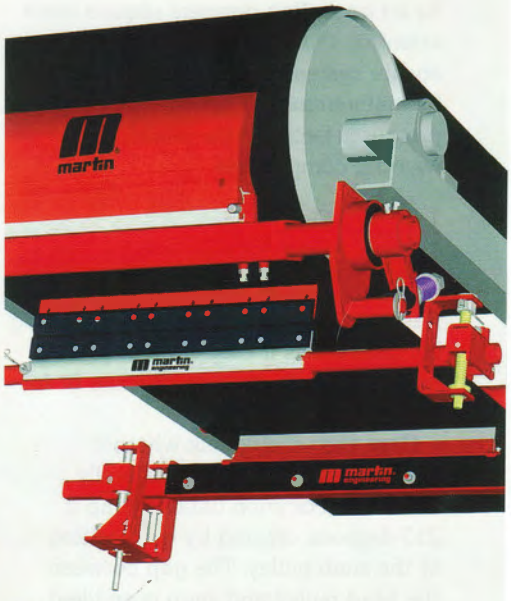

Primary, secondary and tertiary cleaners are all specially engineered for purpose and placement