

High Wires in Dragline Hoist Ropes

This bulletin covers a common operating occurrence typically associated with dragline hoist ropes. Individual wires raised above the hoist rope are referred to as high wires (see photo). This bulletin describes the occurrence and its causes, recommended maintenance practices, service life expectancy, and safety concerns.

High wires are single individual wires that are raised above the geometric contour of the rope. The mining and wire rope industries use many synonymous words and phrases to describe high wires, the most common being proud wires, looped and arched wires, and suitcase handles. The term proud wires is typically used to describe wires that are raised slightly higher than the adjoining wires in the strand. If a wire is raised high enough to get a pencil or finger underneath, then it is commonly called a looped and arched wire. Suitcase handles would be wires raised high enough to grab with the hand.

High wires on hoist ropes usually appear during the first 10% of service life expectancy. There could be one or many; in a single strand or randomly distributed throughout all the strands; and be raised to differing levels (e.g. proud, looped and arched). High wires usually manifest themselves between the drum and the mast sheave or the drum and the first boom deflection sheave. During hoisting, the affected area may wind onto the drum for several wraps or traverse over the first sheave. The length of the affected area in these locations may be 20 to 40 feet long while the rest of the rope is normal and shows no high wires. In the affected section(s), the high wires are on the "top" of the rope,



Figure 1:
Mismatched
Wedge



Figure 2: Severely Deteriorated Wedge

the "bottom" or underside of the rope that contacts the sheaves and drums is typically not affected.

High wires can be caused by equipment problems, installation techniques, and manufacturing difficulties. Equipment and installation related causes include improperly sized or worn sockets and wedges, unbalanced seating of the wedges, and tight sheave or drum grooves. Improper wire tensioning during the manufacturing process could also induce high wires. In all cases a slight imbalance or looseness in the rope is the result. As the rope is worked over the sheaves and drums, the underside of the rope is under extreme pressures as it is forced to conform to the groove profile. Any looseness or crowded wires will be worked (milked) to the areas between contact points (as described previously) and high wires is the result. The crowded wires on the underside of the bending rope are forced out of place to the top portion of the rope that is not in contact with the groove. Tight grooves will worsen the condition and in some cases the crowded wires on the underside of the rope will break and loop out due to the higher than normal pressures caused by the tight grooves.



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High Wires in Dragline Hoist

A rope exhibiting high wires is cause for concern, but is typically not cause for removal. The high wires show up early in life and remain throughout the service life of the rope. Each outer wire represents less than one-half of one percent of the rope's strength, so there can be many high wires in each lay length before strength is compromised. More often than not, high wires can be considered nothing more than a cosmetic problem that requires some monitoring. The high wires should not be cut out unless there is the possibility that the wires could damage adjacent wires or get mashed on the drum or sheaves. In these instances the looped section of the wires should be cut out at each end of the loop where the wire disappears underneath the strand in the rope valleys.

In extreme cases, usually due to tight sheaves, the wires can break in the rope valleys and loop up; and the wire end(s) may or may not pull out of the strand. So when looped wires develop, pull on the wire loop with pliers to determine if there is a broken wire end in the valleys. If broken ends are found, rope integrity may have been compromised and the rope manufacturer should be contacted to determine if the rope is safe to continue in service.

Past history has repeatedly shown that in the majority of instances where high wires developed in a rope, the rope continued in operation and provided full service life. Maintenance records should include notations on high wires as a recurring or worsening problem may indicate problems with related equipment. In addition, record keeping should also include service dates, end-for-end information, hours and/or yards rendered, digging conditions, and any operational problems encountered while the ropes were in service.

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