With a parallel groove drum, outer layers of rope sit smoothly in the grooves formed by the layer underneath

Winch drum selection can have a significant impact on the behaviour and lifespan of wire rope, says CRIS SEIDENATHER, managing director of Lebus International in Germany

The choice of drum

Parallel grooving on a winch drum…

…ensures smooth spooling for multi-layer applications

Most crane manufacturers have moved over from using smooth winch drums to ones with some kind of grooving. The benefit of the grooves is that they help the rope to wind smoothly and sit on the previous wrap rather than neatly alongside it. Untidy spooling is not merely a matter of aesthetics – the rope can get caught, crushed and otherwise damaged – and rope renewal is a costly business.

A helical (spiral) groove on the winch drum, similar to the thread of a screw, can be used to guide the rope to sit neatly and avoid the risk of damage. A problem with the geometry of this grooving, however, is that when the rope reaches the end of the drum – neatly covering the whole drum in a single layer – the subsequent layers of rope are not guided to travel back along the drum so neatly and will naturally sit across the layer beneath. An end-filler bar can solve this problem but, in general, helical grooving is not really appropriate for applications where there are more than two layers of rope on the drum.

A solution to this age-old problem was designed in the 1950s by Frank LeBus, an American supplier of oilfield equipment. In 1937 LeBus patented the use of a groove bar to guide the spooling of rope on hoist drums and later refined this to become what he called the LeBus Counterbalanced Spooling System. What makes the geometry of this system distinctive is that the grooves are parallel to the flanges (edges) of the drum, except for two crossover sections.

This means that instead of having the second layer of rope lying across the first layer, it mostly nestles into the groove pattern created by the layer beneath. Cross winding is reduced to approximately 20% of the circumference of the drum, and 80% remains parallel to the flanges in the inner layer rope groove.

Parallel grooving evenly distributes the load between the individual layers and has been show to increase substantially – test have shown by more than 500% – the life of the wire rope. Reduction of rope damage also has the benefits of improved safety and reduced downtime.

In the name

Parallel groove drums are often incorrectly generically called Lebus drums and the grooving geometry called Lebus grooving. This is incorrect, since Lebus International, now owned by Frank's

Welding or bolting a grooved sleeve onto a smooth drum can be a cost-effective alternative to total drum replacement

grandson Charles, still exists today, producing winch drums and related spooling equipment. Headquarters are in Longview, Texas and it has sister companies in Germany, the UK and Japan. It still produces the equipment with which its name has become synonymous, but other companies also manufacture their own parallel grooved drums. To call these Lebus (or even lebus) drums is like calling all crawler tracks "caterpillar" tracks.

The downside of parallel grooving is that, since it is more sophisticated, it is more expensive than helical grooving, although the cost can easily be repaid in wire rope savings. It also requires certain operating conditions. One of the most important of these is that the fleet angle – the angle between the rope coming off the drum and the point it meets the first fixed sheave – should generally never be any more than 1.5 degrees and no less than 0.5 degrees, as a rule of thumb, although opinions do vary slightly (by a quarter of a degree here and there) and it can depend on the load, the wire rope construction and the hoist speed. Using these fleet angle guidelines means that for every 10 m that the drum is distanced from the sheave, the rope's distance from the midpoint of the drum should never be more than 260 mm (520 mm between the flanges).

With helical grooved drums, the fleet angle can be up to 3 degrees, since the grooving is already at an angle to the flange, but only if the rope is wrapped in a single layer. If there is a second layer with such a large fleet angle, the rope would cut across too much and leave gaps. This damages the rope.

However, fleet angle compensator devices are available for applications that do not meet the necessary parameters but do require smooth multi-layer spooling.

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In any multi-layer spooling application it is important that when the rope is first installed on the drum, it is done so under tension to avoid any slack on inner layers that can be crushed or nicked against the groove walls by outer layers.

Generally, the tighter the line, the better the spooling. Lebus, for example, recommends that the rope should be tensioned with at least 2% of the breaking load or 10% of the working load, although provision must also be made for the safety coefficient and the design of the cable. It is never a bad idea to seek specialist advice.

Parallel grooved drums are designed and produced specifically to meet the application for which they are to be used, with the groove pattern designed to meet the rope length, diameter and construction type. In special applications a cost-effective solution is often to start with a smooth drum and have a sleeve made with parallel grooves machined into it. The sleeve is then cut laterally into two pieces and bolted or welded onto the smooth drum. If in the future a different type or size of rope is used, the sleeve can be taken off and replaced with a new one designed for the new application. ■