Top-Running End Trucks and Common Misconceptions

Contrary to common belief, it is not possible to achieve higher wheel loads by just increasing wheel diameters. Only a larger tread width, combined with a wider rail, can reduce the pressure or increase wheel capacity. Beside the cost, another problem with larger wheels is that they require larger end truck structures, which prohibit flexibility and prevent even contact between wheels and uneven rails. Larger wheels also require higher gear reductions, increasing not only reducer sizes, but also overhang loading for torque arm mounted gearmotors. Torque arms are a problem by themselves because they are only used to compensate for inaccuracy and misalignment. They should be replaced by more accurate designs whenever possible.

Quenching in the heat treatment process of wheels will lead to tread distortion, requiring finish grinding. This grinding step is typically not performed for cost reasons but steel wheels still require heat treatment because of low core hardness. In contrast, graphite nodular iron wheels already offer a high core hardness of 300 BHN as cast and are perfectly suited for low temperature ionitriding.

Ionitriding is not a coating, but diffusion based. The process achieves hardness above 615 BHN with a case depth exceeding 0.02 inches. The case will not chip and provides excellent antiscoring and antigalling properties. The heat treat is distortion free, improves resistance to wear, fatigue, corrosion and erosion. Most important, it lowers the friction coefficient to 0.09 against steel, in contrast to 0.12 between steel and steel. Graphite nodular iron wheels offer high yield and tensile strength and are self-lubricating.

The proper manufacturing process for end trucks is essential for parallel wheel alignment, which in turn is crucial for minimum wheel flange contact and a long-term, maintenance-free operation. It is very difficult to line-bore all bearing seats in one set-up. This would require a bore head travel in excess of the end truck wheelbase in addition to distortion-free work piece clamping. The better manufacturing solution is a positive fixture alignment of all bearing seats at once, but located off the wheel axles only. This will eliminate the chance for misalignment caused by locating off the end truck structure.

Design Philosophies

- Limit wheel diameter and physical end truck size to a minimum
- Use flexible hollow structural material for end truck structures
- Maintain end truck flexibility in the girder connections
- Use only graphite nodular iron castings as wheel materials
- Locate the bearing alignment of the wheel axles only
- Use variable frequency drives with dynamic braking only
- Oversize gearmotors and maintain high service factors
- Eliminate torque arms and use crown axle designs instead
- Use taper connections instead of splines and keyways
- Eliminate the need for special tooling in assembly processes
- Provide alignment tooling for crane set-up procedures
- Provide end trucks including connections ready for crane assembly