

Detroit Hoist vs. Industry Standards

True Vertical Lift vs. Single Reeving

With two wire ropes evenly supported off the rope drum and the reeving assembly geometrically balanced within the hoist frame, the most important advantage of true vertical lift is even loading conditions through the entire lifting operation without any lateral movement of the load. This will allow for easy load positioning and it will minimize wheel loads and therefore extend the crane life cycle or reduce the structural crane girder size required to lift the load.

Gear Brake vs. Motor Brake

The Detroit Hoist gear brake functions on the oil-shear principle and is virtually maintenance free without adjustment. This is achieved by the careful selection of Kevlar-composite friction materials, a unique ball bearing engagement and precision grinding of extremely hard load bearing surfaces, making it our fastest acting and lowest pressure gear brake yet. It is located within the hoist gearbox and operates immersed in oil. The gear brake is engaged by the gravity of the load and serves as the primary hoist brake making the motor brake a redundant, secondary brake. This results in double safety, with mechanical brakes being mandatory for many lifting applications to provide extra protection against injury and damage to critical equipment. The Detroit Hoist gear brake has been designed for seamless operation in combination with variable frequency controls even at very low lifting speeds, which proves it to be unique in the industry. In addition, it reduces safety risks by eliminating the need for motor brake maintenance and replacements, which also eliminates a major cost factor of magnetic controlled “no mechanical brake” hoists that surprisingly are still the standard of the industry. Traditional design, slow acting load brakes, which have been the norm in the hoisting industry, will not protect the motor brake from wear efficiently and they will operate poorly or not at all in combination with VFD controls.

Premium Materials & Complex Heat Treatment vs. Untreated & Cheaper Materials

All Detroit Hoist gears are forged from 4140 alloy ingots and all pinions are cut from 4140 alloy bar stock, quenched & tempered. The gears and pinions are hobbled, induction hardened to 62+HRC, tempered to 52-54HRC, finish ground to exceed AGMA 10 quality and ionitrided to 62+HRC without distortion. The gear housings are milled from 356T6 heat treated aluminum alloy castings for maximum rigidity and accuracy to house shrink fit premium bearings. Detroit Hoist is using exclusively SKF or NSK bearings, no others.

All Detroit Hoist wheels and sheaves, regardless of size and capacity, are cast from the highest grade of graphite ductile iron, quenched for maximum core hardness to just below 36HRC, machined to final dimensions and ionitrided without distortion to 60+HRC hardness. The transition of the core hardness into the case hardness and the combination of the material and the heat treat processes result in the unmatched coefficient of friction of .10 between the wheels and the mating steel and an even lower

number between the sheaves and the wire rope. The final results are very long lasting wheels and sheaves, which can reach the 20+ year life cycle of a Detroit Hoist in addition to the extension of life cycle for the mating parts like rail, beams and wire rope. Wheels and sheaves made from lesser grades of ductile iron or even cast iron, forged or turned from carbon steel and heat treated by a simple flame hardening process (if heat treated at all), surprisingly, are still the industry standard.

Low RPM, High Duty Cycle Motors vs. High RPM, Low Duty Cycle Motors

The exclusive use of variable frequency drives for every motion of all Detroit Hoist equipment allows the use of low RPM, 4 pole squirrel cage motors. The advantage over industry standard 2 pole motors is that 4 pole motors will produce double the torque at half the speed for achieving the same work. This results in less mechanical wear and increased thermal capacity for Detroit Hoist motors, further boosted by the higher duty cycle applied in the motor selection process. All Detroit Hoist trolley and bridge motors are rated for Service Factor 1.15, Continuous Duty, and all hoist motors are selected for the same rating down to the minimum of SF1.0, 30min, S2 Short Time Duty. The industry standard for all trolley, bridge and hoist motors is SF1.0, 15%, S3 Intermittent Periodic Duty, which allows for the use of much smaller motors and frequently leads to thermal failures when the motors are operated at elevated ambient temperatures or beyond the intended Service Class of the equipment.

Direct Mount Motors and Gearboxes vs. Transfer Shafts and Motor Couplings

All motors used on Detroit Hoist equipment are directly flanged to their gearbox with the motor pinion mounted onto the motor shaft. This requires the most accurate motor alignment but it eliminates couplings and transfer shafts. All Detroit Hoist motors are directly mounted but surprisingly, couplings, transfer shafts, jack shafts with open gearing and open gear wheels are still the industry standard.

Interchangeable, Standard Industrial Components vs. Proprietary Equipment

Some hoist and end-truck components are product-specific and proprietary due to special design requirements, but it is Detroit Hoist philosophy to manufacture these components based on such high service factors that those parts will not require replacement during the entire life cycle of the equipment. Where that is not possible, for example in the case of wire ropes, which will require periodic replacements, Detroit Hoist will provide sufficient information in the equipment manual so that the crane manufacturer has the choice of sourcing the rope directly from a rope supplier. All motor brakes for Detroit Hoist equipment are protected from wear by dynamic braking through Variable Frequency Drives and that leaves only a few electrical components that would be potentially subject to replacement before the full life cycle of the hoist is reached. Such components are clearly labeled with their OEM specification within all Detroit Hoist equipment and they can be easily sourced through distribution or from Detroit Hoist at low prices. The option is available to all Detroit Hoist customers and can drastically reduce maintenance and component replacement cost. The Detroit Hoist approach stands

in contrast to the typical industry approach of making more and more replacement parts proprietary, only available from the manufacturer, priced at very high profit margins.

Drum Speed Sensor vs. No Speed Feedback

All Detroit Hoist hoists from 1Ton to 110Ton capacity are equipped with a rope drum speed sensor. The sensor has operational and safety functions. It provides:

- pulse counts to set the high and low hoist limit switch simply through a push of a button*
- slow down zones before the hook reaches the high and low limit switch positions*
- speed input data to trigger the 90 Hz over-speed option, engaging at loads below 50%*
- safety logic between the PLC controller, the VFD and the motor brake circuit*
- speed measurement for over-speed protection and brake slip detection*

To operate an overhead hoist without drum speed feedback greatly limits the extent of safety features and operational features. Surprisingly, drum speed sensors are not required by HMI or CMAA, but they are standard with all Detroit Hoist equipment.

Variable Frequency Drives vs. Magnetic Controls and Dual Wound Motors

Detroit Hoist is using Vector VFD Controls for every trolley, bridge and hoist motor from 1Ton to 110Ton capacity. The superior speed and torque control in addition to intelligent input and feedback controls is finally starting to push magnetic motor controls and special wound motors out of most industries including the hoist and crane industry.

VFD Controls with Dynamic Braking vs. VFD Controls without Dynamic Braking

The most significant advantage of VFD controls over magnetic controls in hoist applications is Dynamic Braking, where the energy generated by the load via the AC squirrel cage motor is converted through the VFD to a DC output connected to a braking resistor or returned into the power supply through a Line Voltage Regenerator. VFD hoist controls without Dynamic Braking (or programmed for coast to stop) will not protect the hoist motor brake efficiently and present a poor investment when used in combination with traditional, slow acting load brakes.

Open Loop Vector VFD Controls vs. Closed Loop Vector VFD Controls

Closed Loop VFD Controls are perceived to be the choice of controls for heavy duty lifting applications. This is not the case with Detroit Hoist equipment. The extra cost for Closed Loop VFD Controls in addition to fragile encoder feedback systems, combined with very complex programming and fault coding, makes Closed Loop VFD Controls a poor choice for hoists. Open Loop VFD Controls are the far better choice, as long as the system is equipped with a positive speed feedback like the Detroit Hoist sensor bearing, controlled by a PLC. The sensor is mounted directly to the rope drum. This allows the monitoring of the entire hoist system in contrast to motor mounted encoders with Closed Loop Controls that only monitor the motor.

The following control features, formerly only available with Closed Loop VFD Controls can now be achieved with Open Loop VFD Controls, standard with all Detroit Hoists:

- *Maximum Speed Control Ratio of 60:1, 2-step, multi-step or infinite variable*
- *Automatic Lifting speed increase of 50% up to 50% of rated load*
- *Full Dynamic Braking down to 3 Hz & Load Float during reverse direction*
- *Continuous Overload Protection within 5% accuracy*
- *Over-Speed Protection through PLC sensor bearing input, no encoder required*
- *Torque Proving, Brake Proving and Automatic Motor Tuning*
- *Interactive Safety Checks between VFD, Sensor Input and Motor Brake Circuit*

Line Voltage Regeneration vs. Braking Resistors

Line Voltage Regeneration is standard for all Detroit Hoist equipment without Load Brakes. Instead of turning the energy, generated by the load, into heat through braking resistors, the energy is returned into the hoist power supply, improving energy efficiency by 40-50%. The energy savings can be estimated by:

Savings/Year = KW x η x Duty Cycle x Days/Year x Hours/Day x \$/KWh

Example:

20 KW Motor, 45% efficiency, 25% Duty Cycle, 260 Days, 8 Hours/Day, \$ 0.09/KWh

20 x 0.45 x 0.25 x 260 x 8 x 0.09 = \$ 421,- (annual savings)

In addition to energy savings, Line Voltage Regenerators (LVRs) have many more advantages over resistor banks:

- *LVRs save space, which is very important for hoist applications*
- *LVRs do not limit duty cycle, they are sized for KW, not duty cycle, like resistors*
- *LVRs do not generate heat in contrast to resistors, which allow temps of 400°F*
- *LVRs do not cause safety hazards by faulting VFDs due to overheating*
- *LVRs allow the use of Dynamic Braking in explosion proof applications*
- *LVRs are rated for KW not Ω and can be used with multiple VFDs at once*
- *LVRs monitor the power supply for harmonics, voltage and phase imbalance*

True Explosion-proof Labeled Equipment vs. Unlabeled “Explosion-proof” Equipment

It seems to be possible to navigate through different chapters of the NEC and qualify the use of standard IEC and NEMA motors, even brake motors, for light duty explosion-proof applications, without having the motors or brakes labeled as explosion-proof. Detroit Hoist is not willing to take that risk and therefore all Detroit Hoist motors and brakes for explosion-proof applications are certified and labeled for the proper explosion-proof classification. The Detroit Hoist approach is very simple, “if it doesn’t say explosion-proof, then it isn’t”. Surprisingly, that approach is not shared by the industry.

Detroit Hoist Design Philosophy

Detroit Hoist equipment is the result of design conviction, from true vertical lift to mechanical load brakes, from premium materials and modern heat treatments to high service class motors, from highly sophisticated VFD and PLC controls to sensor bearings and energy saving voltage regeneration. These technical features are not options but Detroit Hoist standards. They are incorporated into every Detroit Hoist product to achieve the safest lifting conditions and the longest possible life cycle with the least amount of maintenance, resulting in a very low cost of ownership for Detroit Hoist equipment, supported by the lowest pricing for replacement parts in our industry.