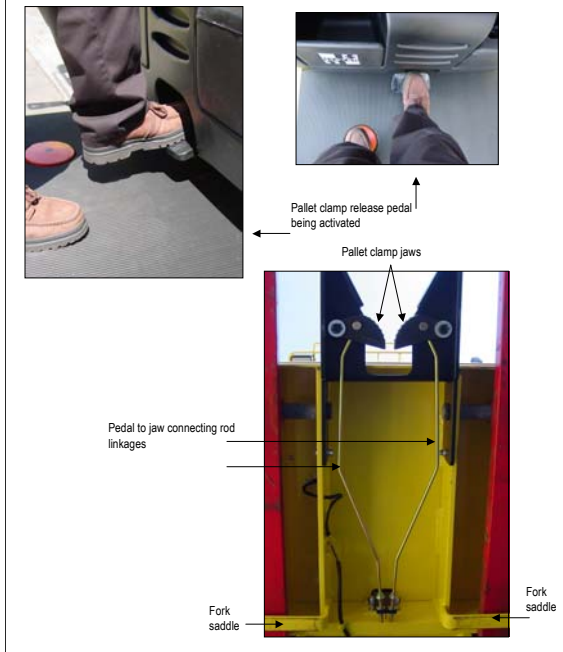


Hyster Pallet Clamp and Fork Adjustment



The Hyster pallet clamp is automatically activated and manually released. The pallet clamp jaws automatically grip the pallet runner when the pallet clamp is engaged to the pallet. To release the pallet clamp, simply step on the release pedal.

The pallet clamp jaws are connected to the release pedal with connecting linkage rods. These connecting rods are tucked up under the operator platform for protection. Connecting rods are used in lieu of the typical cable and pulley design for the pallet clamp because the connecting rods do not stretch like the cables will; minimizing adjustment requirements while maximizing reliability.

Fork adjustment on the Hyster R30XM₂ requires no tools. Simply push up on the fork tip. This will cause the fork to pivot on the mounting shaft-pin. The fork can be slid within the fork saddle easily to the left or to the right. When the desired fork position is obtained, lower the fork tip back down.

Crown Pallet Clamp

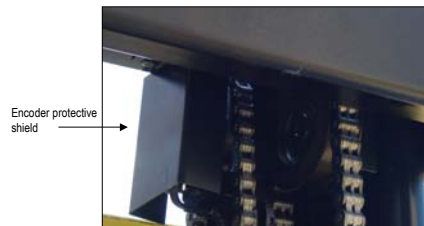
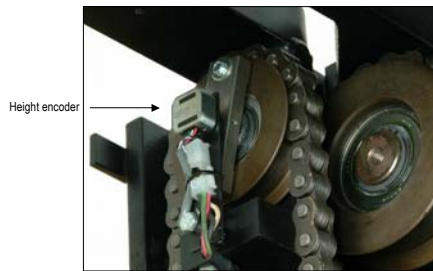


The Crown pallet clamp assembly is manually activated and manually released. Once the pallet is grasped by the pallet clamp, the pedal is applied. Pushing the foot pedal locks the pallet clamp jaws to the pallet runner. When the pallet has reached its destination, the release mechanism must be activated (top right photo from top) to unlock the pallet clamp jaws. The pallet release pedal is 7.5 inches off the platform floor mat. For applications requiring frequent pallet drop offs (which is frequent for order pickers) this activity contributes to operator fatigue and reduced productivity levels.

The pallet clamp is controlled by a series of cables and pulleys. Cables stretch and require frequent adjustments to maintain proper gripping of the pallet clamp. There are a lot of moving parts and pulley alignment is critical.

The locking mechanism pedal is not ergonomically positioned and proves to be uncomfortable to apply. The pedal has no flat plate or pedal pad for foot comfort.

Hyster Height Sensing



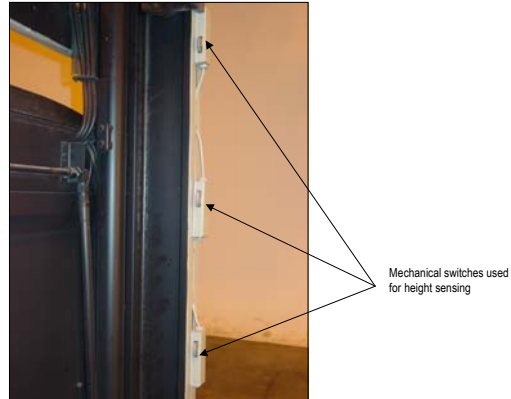
The R30XM₂ features a continuous height sensing system, referred to as HySense™. An optical encoder is used in conjunction with the software logic contained in the Curtis 1310 master control unit (MCU) to regulate travel speeds.

The encoder shaft is attached directly to the left hand side mast chain pulley. The encoder counts the number of pulley rotations, which is directly proportional to the platform motion (up and down).

The encoder has a sealed shaft and ball bearings to assure durability and requires no adjustments.

The continuous height sensing system eliminates stepped travel speeds and provides linear travel speeds in relation to platform height. Specifically, as the platform is raised above sixty inches the traction speeds are gradually reduced at various platform heights instead of certain designated (pre-determined) heights. This allows maximum speeds at various platform heights.

Crown Height Sensing and Speed Reduction



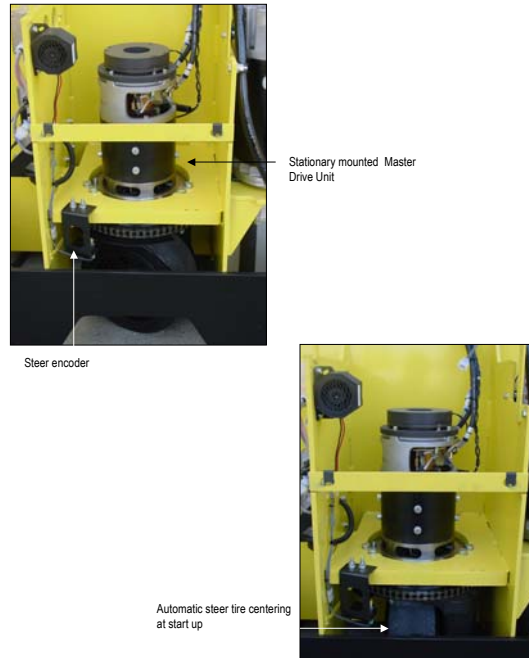
Crown height sensing on the SP3020-30 order picker is done through the use of mechanical switches. Mechanical switches have several issues that can be identified as disadvantages - compared to the Height Encoder used on the Hyster R30XM₂.

- Mechanical switches are less reliable
- Mechanical switches are more vibration sensitive
- Mechanical switches require more adjustments
- Mechanical switches are also more susceptible to physical damage

The main topic of discussion with this design is that when the mechanical switches are used the speed reduction is done in steps or stages. When the switch is activated, at the point of activation the speed is reduced or increased, depending on if the platform is being raised or being lowered. The truck maintains that speed until the next switch is activated.

The advantage of the height encoder speed reduction system (Hyster design) is that the speed is reduced or increased in a linear (gradual) fashion as the platform is being raised or lowered. This system optimizes travel speeds. This permits more picks at higher heights, increasing productivity levels.

Hyster Drive Unit Assembly



The R30XM₂ features Separately Excited Motor (SEM) technology, which improves reliability and performance. SEM traction control systems provide control of the traction motor field current independent from the armature current, providing superb traction control.

Regenerative plugging (braking) is also a part of the SEM traction system. Regen braking occurs when directional input changes from one direction to the other while the truck is in motion. The energy (heat) generated through the motor is transferred to the battery, which acts like a large heat-sink, minimizing motor heating.

Furthermore, SEM requires less current through the motor brushes, thus increasing motor brush life.

The SEM drive motors, in conjunction with the MOSFET traction controller, eliminates the forward and reverse contactors which increase reliability, durability and simplify servicing. SEM technology provides better battery shift life, smooth acceleration, adjustable plugging and regenerative braking as compared to non-SEM traction systems.

The R30XM₂ drive motor is fixed-mounted. The drive motor is stationary, resulting in fewer loose connections and less cable and wire harness fatigue and failure as compared to rotating drive motor designs.

Crown Drive Unit Assembly

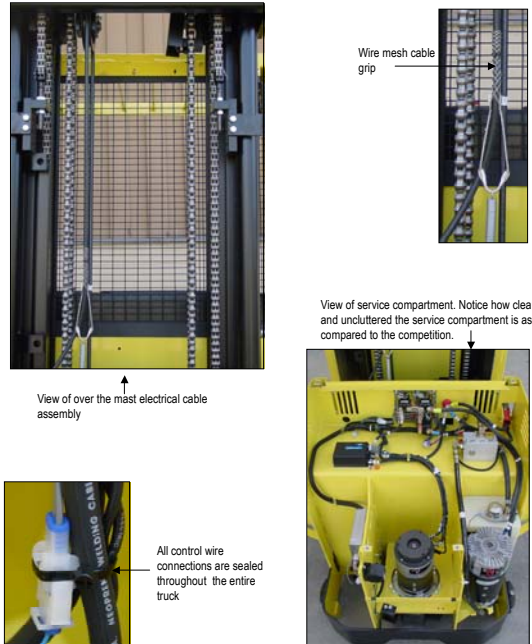


Master Drive unit (MDU) assembly

The Crown SP3020-30 drive unit assembly is an older generation of electronics featuring a series wound drive motor. Crown **DOES NOT** feature SEM technology. Without SEM technology, there are several issues that can be discussed:

- The series wound drive motor does not provide the same level of speed control as shunt wound motors nor the acceleration.
- The series wound drive motor does not provide regenerative plugging. Therefore, the kinetic energy generated when plugging (directional changes with truck in motion) is transferred to the motor as heat build up which contributes to reduced motor performance and decreases motor brush life.
- Directional contactors (forward and reverse) are used in the Crown traction system increasing maintenance and component costs as well as being much noisier.
- Not CANbus compatible.
- More wires and cables required, increasing potential loose wire connections and potentially higher maintenance costs.
- There is more wear and tear on the electric parking brake.

Hyster Wire Harness and Cables



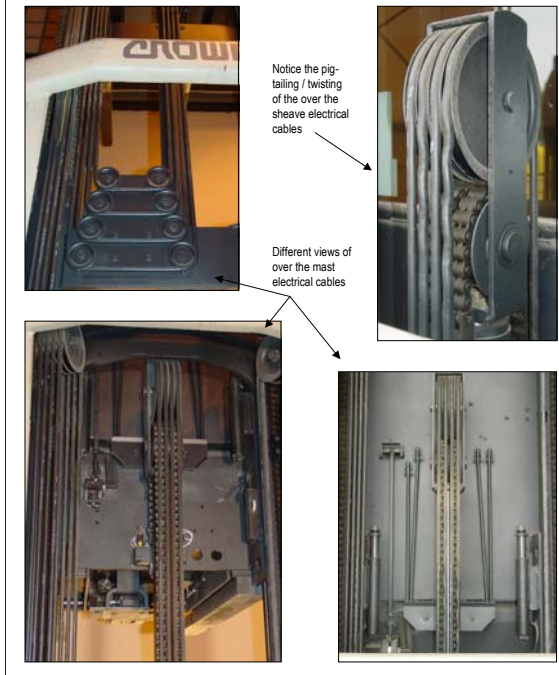
With the innovative electrical system, the over the mast cable assembly has been reduced to a single 8 conductor (8'strands') cable, no matter what combination of options are configured on the truck. The smaller conductor cables do not pigtail (twist) like the larger cables typically do. This alone reduces truck downtime and maintenance cost.

The over the mast cable is properly tensioned by a wire mesh cable grip. Having the proper tension on the cable assures the cable will track properly on the cable sheave preventing pig tailing (twisting) which will eventually cause the wires to pull apart resulting in truck down time, and diagnostic and repair time.

Wires are color coded and numbered for ease of identification and reduced trouble shooting time in the event of a fault.

All wire connectors are sealed for a positive connection and for moisture protection.

Crown Wire Harnesses and Cables



The Crown truck **DOES NOT** utilize a CANbus communications system as the Hyster truck. This is evident by the number of cables required to interface the platform to the chassis (4 eight conductor cables = 32 individual strands of wire).

Notice the pig tailing (twisting) of the over the mast cables. This causes the wires to eventually pull apart. Typically, this will start as an intermittent electrical problem. The wires will separate and short together, usually only at a certain point going over the cable sheaves. The rest of the way up or down the electrical system will function fine. Typically, this situation takes a technician several attempts to find and resolve the problem. With the large number of cable assemblies and pulleys on the Crown SP 3000 series, this can be a very expensive machine to maintain.

As with a lot of Crown products, at first glance the truck looks good with a lot of covers and cosmetics. However, removing the covers and taking a closer look reveals a lot of expensive maintenance issues.

Hyster Load Wheels and Base Arms



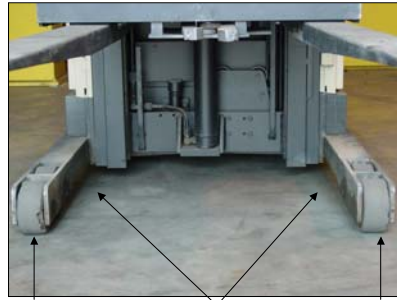
The Hyster Load wheel and base arm assembly provide several distinct advantages over the competition:

- The Hyster load wheels are designed to articulate. The articulation provides a smoother ride for the operator, especially on uneven floor surfaces.
- Articulated load wheels tend to wear more evenly than non-articulated load wheels.
- Typically with non-articulated load wheel designs, when a single load wheel needs replacing, both are replaced due to uneven floor surface contact. Uneven floor surface contact can result in truck wobble and cause uneven weight / load distribution on the load wheels. Additionally, uneven floor contact can result in tracking problems, especially in rail guided and wire guidance applications. Because the Hyster load wheel design provides articulation, the load wheels will find their position independently, minimizing load wheel replacement.

The Hyster basearm assembly has two distinct advantages over the competition.

- The Hyster designed basearm assemblies consist of a basearm with wheel hanger weldments welded to the end of the basearms. This design allows the replacement of the wheel hanger and not the entire base arm in the event the truck is run into a rack or damaged. With the R30XM₂ design, the wheel hanger can be cut off the base arm and a new wheel hanger assembly welded back to the basearm.
- The wheel hanger weldment assembly features end caps to protect the load wheels from becoming damaged.

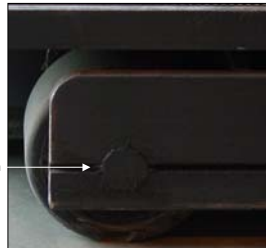
Crown Load Wheels and Base Arms



Notice the exposed load wheels and the chunk of load wheel missing

Base arms

Notice the exposed load wheels and the chunk of load wheel missing



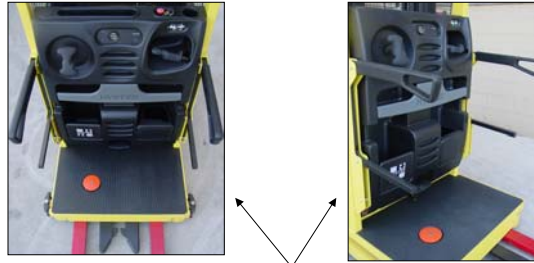
Fixed load wheel design

The Crown load wheels are exposed and unprotected. As can be seen from the top photo, wheel damage is inevitable.

The Load wheels are fixed-mounted to the base arms and do not articulate like the R30XM₂. Several issues can be discussed:

- Load wheels tend to wear unevenly
- A rougher ride is experienced, especially on rough or uneven floor surfaces.
- Typically, when a single load wheel on a tandem load wheel design needs replacing, both are replaced due to uneven floor surface contact. Uneven floor surface contact can result in truck wobble and cause excessive wheel loading due to uneven weight / load distribution. Additionally, uneven floor surface contact can contribute to truck tracking problems, especially in rail guided applications.

Hyster Retractable Side Gates



View of retractable side gates and operator compartment. Double arm design.



Soft touch-sure grip retractable side gates



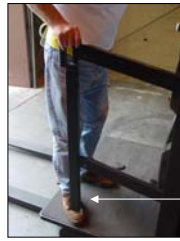
View of side gates in fully retracted position

The retractable side gates are standard on the R30XM₂. Fixed side gates are also available on the R30XM₂.

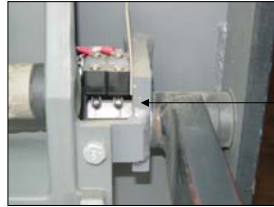
The R30XM₂ retractable side gate design features a soft touch sure grip rubber coating, with a gas cylinder assist. Order picking requires the side gates to be raised and lowered many times throughout the work shift. The rubber coating provides increased operator comfort and reduced hand fatigue, while the gas assist cylinder reduces shoulder and arm fatigue.

When the side gates are raised, interlock switches are activated causing the traction circuit and lift/lower circuit are interrupted. Only with the side gates fully lowered will traction, hoisting and lowering functions be enabled.

Crown Retractable Side Gates



Retractable sidegate design allows a foot pinch point when lowering to fully lowered position



Micro-switches are cam activated by the side gates when raised or lowered

Retractable side gates are standard on the SP 3000 series. The Crown side gate design lacks ergonomic consideration.

- No soft touch – sure grip rubber coating on hand grip
- The side gates present a pinch point when fully lowered
- There are no gas assist cylinders, rather the side gates are spring assist.

With no soft touch–sure grip rubber coating on the side gate hand grip, the side gates can easily slip out of an operator's hand, especially in freezer or intermittent freezer applications. Also, no rubber coating, contributes to operator hand fatigue.

The side gates are designed to stay in the raised position by the angle of the side gates once in the raised position. However, with no gas assist cylinder, there is nothing to prevent the side gates from falling if bumped by an operator while picking from the rack. There is a pinch-point presented when the side gates are being lowered. Furthermore, with no gas assist cylinder to control the side gates while lowering, the operator must manually lower the side gate all the way to the lowered position for a controlled function. Over time, the side gate assist springs stretch and loose tension. The side gates are heavy, and as the assist springs loose tension they will fall to the lowered position very quickly. With the operator having to manually control the lowering of the side gates, increased operator arm and shoulder fatigue is the end result.

Micro switches are used to relay electrical signals to indicate when the side gates are raised and lowered. The traction system and hydraulic system are interrupted when either of the side gates are in the raised position. Traction functions and hydraulic functions will resume when the side gates are lowered.