Gear Drive Selection Process for the Parcel Handling Industry

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This paper is designed to help describe the selection process of a reducer to be used in the parcel handling industry. It will go over what different applications our gearboxes are used throughout parcel handling facilities such as UPS, FedEx, and DHL. This white paper will also discuss what factors are used to decide which gearbox is required to meet the demands of the industry, yet still be durable, long lasting, easy to maintain, and easy to replace when or if a failure does occur.

Introduction

When we receive a package in the mail, we never really stop to think about how it made it to our mailbox. We are just glad that it is here without any damage and the contents of the package are not harmed. But for a package to get from point 'A' to point 'B', there are many factors that make the process work. From making sure the mailing addresses are correct, to meeting the required delivery date, everything needs to operate seamlessly to keep the end user satisfied.

In most, if not all, sorting facilities, there are miles and miles of conveyor systems and all play an important role in making sure all orders are processes accurately. The conveyor systems are broken up into different sections based on their function. Some examples are mainline and box line conveyors, but there are also systems in which are used to sort the packages from one conveyor to the other depending on their destination. In all of the systems a reliable gearbox is required to keep the operation running smoothly.

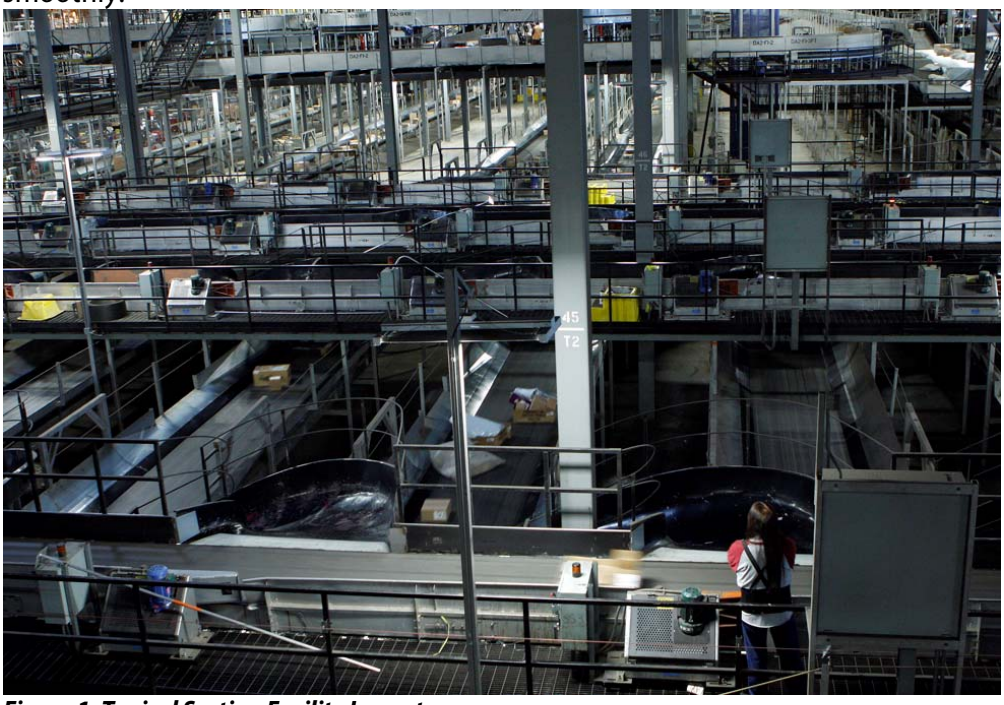

Figure 1: Typical Sorting Facility Layout

The gearboxes must also be able to withstand the demands of the facility. The most important requirement of the gearboxes is that they must be reliable. In the sorting areas, many of the gearboxes are used intermittently and need to be able to stand up to frequent starting and stopping. If one gearbox cannot take the abuse, and fails, the downtime required for the repair, could disrupt the entire flow of the distribution center. For when the inevitable happens, and a box does fail, the new replacement box

needs to available as soon as possible. The shipping companies cannot afford to be down for an extended period of time.

An example of a high demand for shipping facilities is during the holiday season. With the growth and popularity of on-line shopping, the amount of packages being shipped gets greater and greater every passing year. With this growth, the need for more and more gearboxes grows just as much. The Christmas holiday season starts right after Thanksgiving, and goes all the way to the end of December. Most online retailers offer many discounted prices, and consumers take advantage of them, and make the purchases as soon as they can. The retailers also may offer guaranteed delivery by Christmas day, and for the late shoppers, this is a must. The shipping companies bust me able to meet the demands of the extra packages that must be delivered.

"How do I select the correct gearbox for my application?"

When selecting the appropriate gearbox, there are a few points that must be taken into consideration. Firstly there are the environmental factors that must be taken into account, namely the ambient temperature. Temperature data should be collected to get an idea of what temperatures the unit will be encountering during its everyday usage. Next is to determine the operation that the gearbox will be performing. Sorters, Feed belts, and diverters are just a few of the operations required in the facility. Each different operation has it own set of requirements that each gearbox needs to meet in order to select the correct product.

For example, sorters and diverters (see *Figure 2*) will see a lot of start and stop operation. The sorters and diverters are mounted underneath the mainline of the conveyor, and when trigged, small rollers or plates are moved to change the direction of the packages that are moving so they go to the correct area. That constant on/off scenario, with many load variations can wreak havoc on a gearbox. On the opposite end of the spectrum, the feed belts are running for long amounts of time under varying loading conditions. The feed belts normally run constantly, with little or no downtime. They serve as the main drive belt that all the sorters and diverters run off of. Depending on the size of the packages, the belt can see a wide range of loads from very light, to moderately loaded all in a matter of minutes. So they need to be able to keep up the speed, and efficiency required allowing all systems to run smoothly.

Figure 2: Diverter

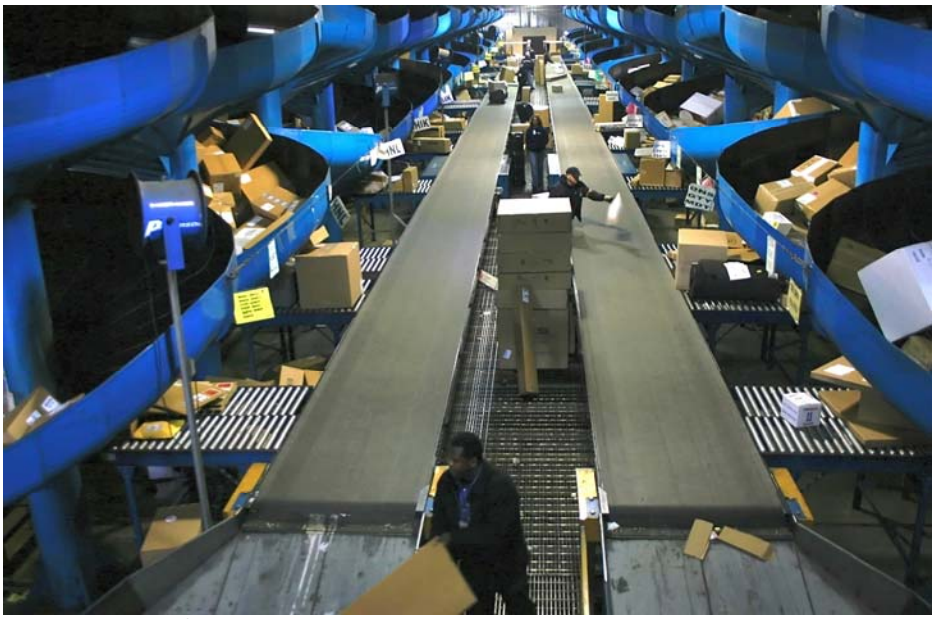

Figure 3: 2 Main feed Belts

Once the working environment is determined, the next step would be to determine what motor horsepower is required, and also what speed the conveyors will need to be running. This is determined based on what loads the conveyor belts will be carrying. If the packages being conveyed were heavier, a higher horsepower motor would be required, and in turn nets a higher torque output of the reducers. The higher torque output is what is needed for the heavier loads. With the higher torque units, the output speed of the reducer will be reduced. This must be kept in mind if a high speed is needed for the conveyor system.

After the speed and horsepower are determined, it is time to pick the correct gearbox. Sumitomo has a number of gearboxes available to cover most, if not all, ratios and speeds that would be needed for a parcel handling facility. Here are some of the products we offer:

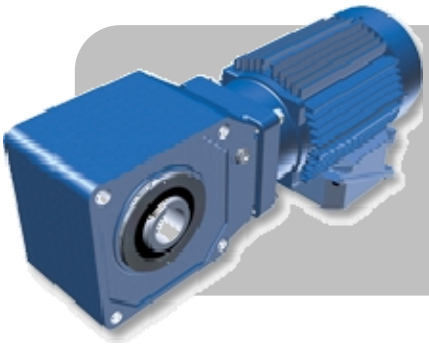

Figure 4: Hyponic
The Hyponic gearbox uses Hypoid gear technology along with grease lubrication. This allows the box to be mounted with any orientation without the risk of leaking. The grease lubrication is maintenance free and doesn't require frequent fluid changes. Hyponics are the perfect gear drive for conveyors that are not easily accessible for routine maintenance.

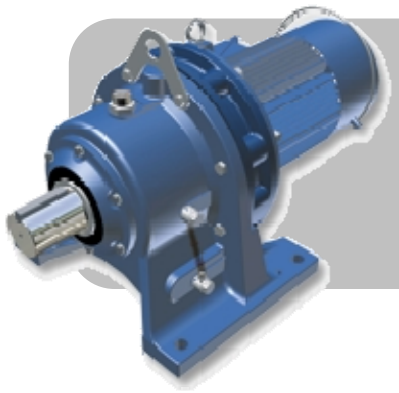

Figure 4: Cyclo 6000
The Cyclo unit is very efficient unit, and is best suited for conveyors that will see any sort of shock loading. The Cyclo units are also very quiet during operation without sacrificing any reliability or quality.

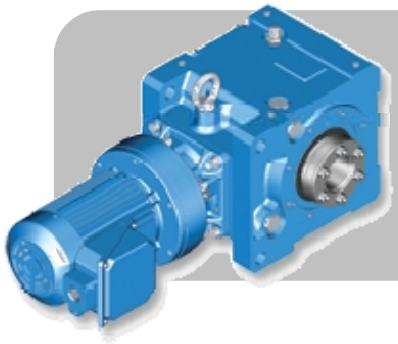

Figure 6: Cyclo Bevel Buddybox (BBB)
The Cyclo Bevel Buddy Box (BBB) is one of the smaller, more compact units, but it maintains the advantages of the Cyclo unit. With the patented Taper-Grip Bushing, the Cyclo BBB is perfect for retrofit applications onto existing conveyors with shaft-mounted reducers.

Figure 7: Cyclo Helical Buddybox (HBB)
The Cyclo Helical Buddy Box (HBB) is another alternative for a shaft-mounted reducer. It also replaces the need for belt drives, sheaves, or keys by using the Taper-Grip Bushing to mount on the conveyors driven shaft.

Maintenance

No matter what gearbox manufacturer is selected for a project, there is one item that cannot be avoided and that is maintenance. All the boxes must be regularly monitored. Any increase in the temperature of the box, can lead to premature failure due to the lubrication fluid inside the box breaking down, and becoming unable to lubricate the gearbox properly. In some cases, there is no visible or audible sign of a pending failure. The box will fail without warning, and cause unwanted down time. If the box were properly maintained, the inspector would be able to spot an issue, and resolve it before incurring a timely delay in productivity.

A simple way to check on a gearbox, is via the "Hand Test". A touch of the gearbox can determine if it is operating at the optimal temperature. This isn't the proper way to test the box temperature, but it can be a quick way to determine if further investigation of the gearbox is needed. *Figure 8* is an example of how hot a gearbox can be in operation. The shown temperature is an extreme case and it shows a temperature rise that is more than the AGMA Standard of 100°F above ambient temperature This is not an acceptable temperature rise, and this unit would be due for and inspection and/or maintenance.

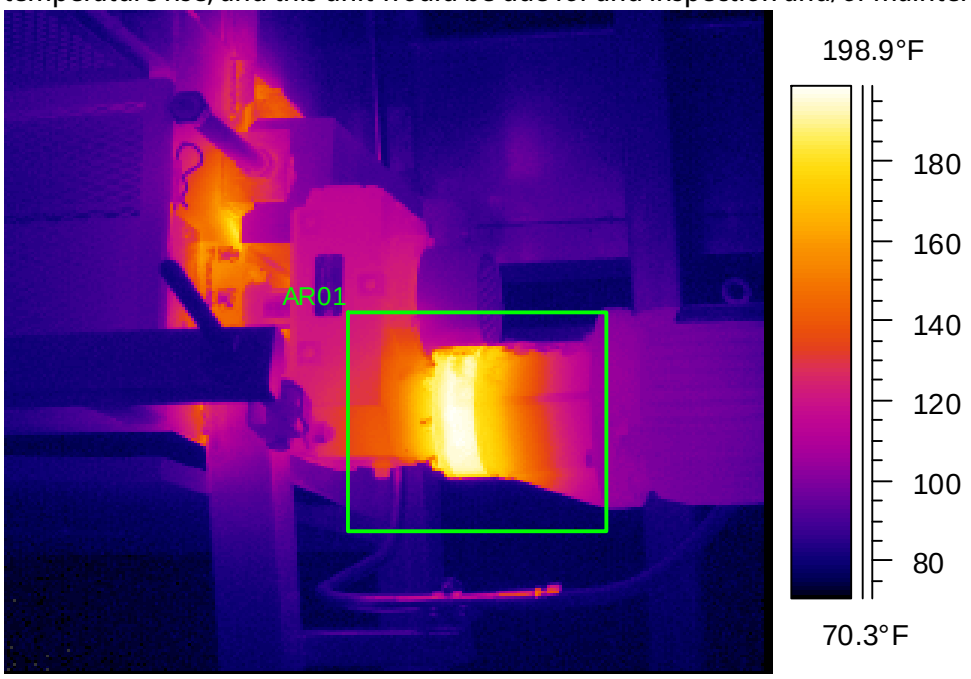

Figure 5: Thermal Image of Gearbox in Operation

Another way to prevent premature failure is to ensure the box is installed correctly. Each gearbox is designed based on proper installation. Everything inside the box including the bearings, shafts, gears, and seals all are sized to be able to withstand certain load amounts and temperature ranges. If these parameters are exceeded, failure of the box is unavoidable.

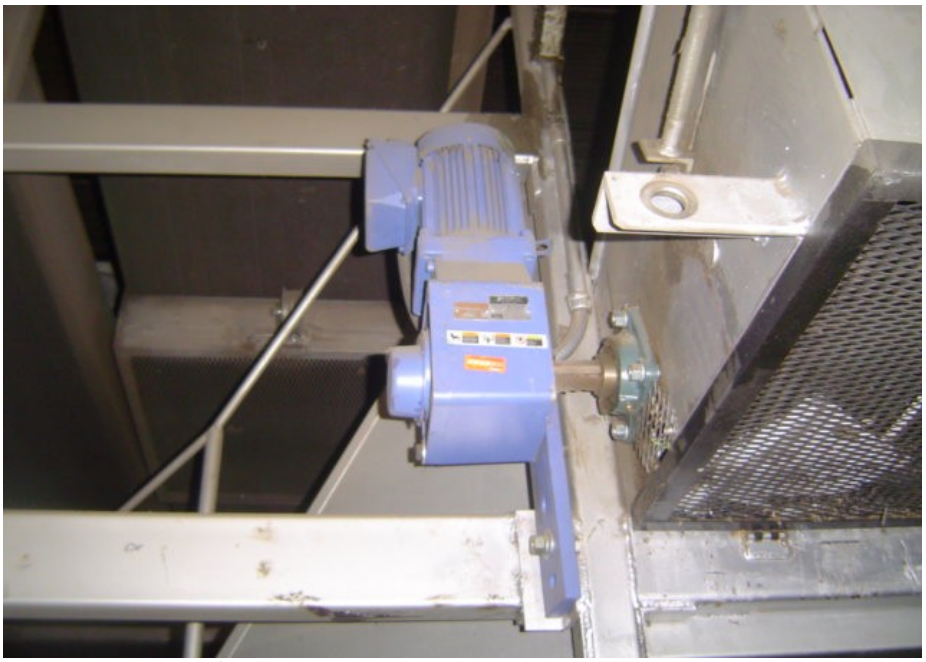

Figure 6: Example of Improper Installation

In *Figure 10*, you can see that the unit is mounted a long distance away from the bearing of the conveyor. That gap causes the bearing on the low speed shaft to support the more of the weight that it was designed for, which can cause a bearing failure. Another issue with the installation shown in *Figure 9*, is that it is completely rigid mounted. The bolt through the mounting plate on the bottom does not allow for any run-out of the driven shaft. With this installation, all the run-out of the shaft will be transferred into the unit causing seal failure and/or bearing failure.

Figure 7: Example of Seal Failure

Figure 8: Example of seal failure

Conclusion

For the employees in the parcel handling industry, there will always be pressure to make sure the job is done smoothly and efficiently. From the phone operators that answer the calls of the angry customer whose package arrived three days late, to the driver of the delivery trucks who still have to make their deliveries on time no matter how bad the weather gets - the pressure to perform will always be there. The pressure from the consumer is something that comes with the territory, but keeping the distribution facilities running smoothly is one of the easiest ways to keep the demands of the industry at a manageable level. By using the correct reducer for the job, the possibility of downtime due to a gearbox failure is much less. With less downtime of the facility, comes better efficiency and in the long run, happy customers.

The efficiency doesn't come without some work, though. The maintenance of the gearboxes is key to keep them up and running optimally. Regular visual checks of the gearboxes, and temperature monitoring will be required on a regular basis. Also, when the gearboxes are installed, they must be installed correctly to perform their desired functions. If all these factors are taken into consideration, the end user can expect a long life for the gearboxes being used, which means a much more successful package handling facility in the long run.

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