Synchronous-Belt Drives Drive Users To Reduce Electrical Costs

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Driven by a need to reduce energy costs, more and more plant engineers are using synchronous belts to replace conventional V-belts on power-transmission equipment.

While initial prices for synchronous belts are generally higher, reduced electrical requirements allow these units to pay for themselves in short order.

For example, a manufacturer of bottles uses a conveyor system that feeds waste glass into a grinding mill for reuse. Frequent peak loads caused the original set of two four-stranded joined belts to slip, resulting in lost energy and premature belt failure.

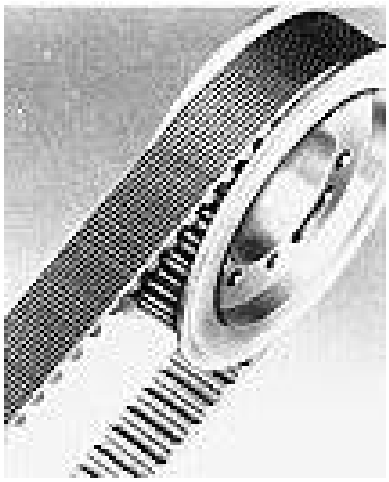
Plant officials installed polyurethane synchronous belts on the conveyor system. Since that time, the belts haven't required retensioning or any other maintenance.

And the new drive draws only 9.2 amps--38% less than the joined belts. Not only did the manufacturer receive an $84 rebate from the power company for the changeover, but the new belts have cut the firm's energy bill by $60/month. Based on energy savings alone, the investment in synchronous belts was recovered in four months.

For any plant engineer, the elimination of KWH losses in power-transmission systems is a high priority today. At one time, a KWH of power was available for only two cents to three cents. The substantially higher energy costs of today--250% more than 10 years ago--provide an incentive to carefully evaluate drive systems to cut efficiency losses. Otherwise, 35% premiums paid for energy-efficient motors could be wasted due to inefficient drives.

With energy efficiency as an important consideration, synchronous-belt drives are suited to a wide range of applications. These belts require no lubrication, resist corrosion, are unaffected by abrasive particles, and can operate in wet conditions.

Advanced tooth configurations provide these belts with greatly enhanced power ratings. Improved stress distribution allows belt teeth to withstand the shearing action of high-torque loads without separating from the belt. Helically would tensile cord members impart strength and provide exceptional flex and elongation characteristics. Extra protection is afforded by a wear-resistant, nylon fabric covering. And neoprene backing ensures that tensile cords are protected from oil, grime, and moisture.



Detailed tests have supported the conclusion that synchronous belts use less electricity than V-belts. At one laboratory, a 3V belt drive was tested against an 8mm synchronous belt drive. Efficiencies were measured at shaft speeds ranging from 1,160 rpm to 3,500 rpm. Various pulley diameters and variable loads from 2 hp to 25 hp were used.

The tests measured the relationships among efficiency, torque, speed, pulley size, and single vs. multiple V-belts. The most significant findings were:

- Power-transmission efficiencies greatly increase with torque. For synchronous belts, efficiency improves under increasing torque. For V-belts, efficiency declines as slippage increases when torque over comes the preset static tension.
- Pulley diameter affects efficiency. Larger pulleys produce greater efficiency.
- Narrower or fewer belts tend to produce higher efficiency at low torque. Wider or more numerous belts offer higher efficiencies at high torque.
- Underbelted or overbelted V-belt drives become inefficient, while synchronous belts remain relatively constant.
- Relatively large variations exist among V-belt efficiencies, yet synchronous belt drive efficiencies can be accurately predicted.

The maintainability of belt drives also affects their energy efficiency. At the time of installation, V-belts can run as high as 95% to 98% efficient. In operation, this efficiency could deteriorate as much as 5% due to slippage.

Synchronous belts begin operation at 0 slip and stay that way. Because low bending stresses result in minimal heat buildup, synchronous belt drive can operate as much as 98% efficient.

V-belts, on the other hand, typically run 40°F to 80°F above ambient temperatures. And V-belts tend to stretch during their lives. causing initial tension to drop. If maintenance and proper tensioning of V-belts are neglected, slippage can dramatically increase, resulting in energy losses as high as 10% in poorly maintained drives.

In a facility where belt drive systems carry 5,000 hp to 10,000 hp or higher every year, money wasted in slippage can amount to tens of thousands of dollars.

Converting from a V-belt system to a synchronous belt one can usually generate payback in a short time. For example, look at a situation in which a 75hp fan drive is converted to synchronous belts for continuous operation. The approximate cost of the system of V-belts is $340. The same system's cost with synchronous units would be about $1,018. The difference is $678.

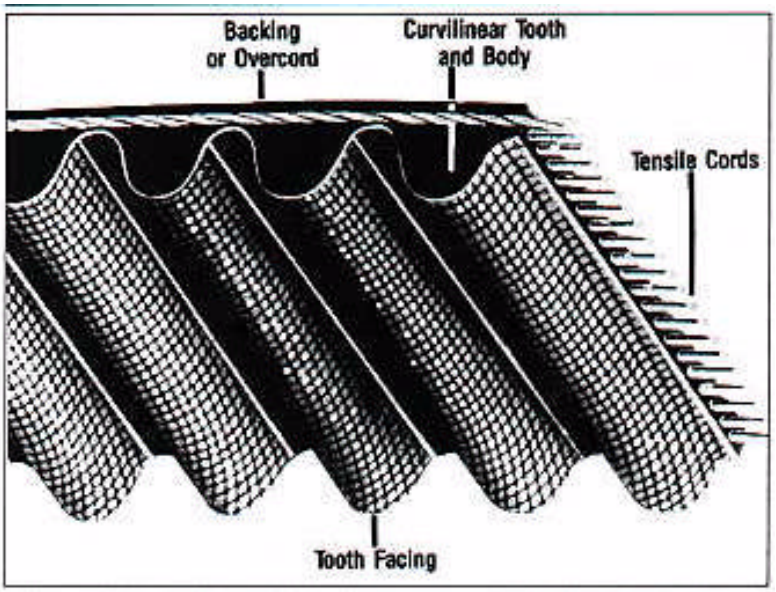
However, assuming a 5% slip and electric costs of $0.08/KWH, the synchronous belt yields a predicted energy saving of $2,149 a year.

By dividing the synchronous drive cost by the annual energy cost savings, the payback time in this situation is determined to be less than four months.

In addition, recommended installation tension for a synchronous belt is often less than that of a V-belt. Thus, shaft bearings will operate under lower average loads to provide significantly longer service life.

In today's economic and energy climate, plant engineers need to use drive systems that can get the job done economically and efficiently. Switching to synchronous belts generally provides favorable financial benefits.

Synchronous Belt Drive Savings			
# of Motors	**40 Hour Week**	**80 Hour Week**	**168 Hour Week**
10	$75	$149	$314
15	$109	$219	$461
20	$144	$288	$606
25	$176	$352	$741
30	$209	$419	$879
40	$279	$558	$1,171
50	$345	$690	$1,448
60	$414	$827	$1,738
75	$512	$1,023	$2,149
100	$682	$1,365	$2,864
125	$843	$1,686	$3,542
150	$1,011	$2,024	$4,250



While synchronous-belt drive systems generally cost more than conventional V-belts for power-transmission equipment, electrical-use reductions make the synchronous units more cost effective. Chart (top) shows the estimated annual energy-dollar savings per motor using a synchronous belt system rather than a V-belt one. Figures assume a 5% slip and are based on a cost of $0.08/KWH. Suitable for a range of applications, today's synchronous belts feature tooth configurations that provide greatly increased power ratings. Helically wound tensile cord members (above) impart belt strength and provide exceptional flex and elongation characteristics.