Technical

Advancements in synchronous drive belt design for industrial and consumer markets

By Taylor Jung
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Synchronous belts have been a mainstay in many industries for decades—so long, in fact, that many people hardly notice them as they operate, transferring power in industrial, recreational and transportation equipment.

The world is changing around us, however, and synchronous belt technology is changing with it. In both our business and personal lives, we are expecting more of the machines we operate.

TECHNICAL NOTEBOOK
Edited by John Dick

Faster, smaller, quieter, safer ... the list of expectations grows with every new design, release or modification, and belt performance requirements grow right along with them.

New designs, materials and production processes are enabling synchronous belt performance that previously was thought impossible. If you don't think a belt can meet—and even exceed—your needs, it's time to look again. Significant advancement has taken place, and today's belts can bring value in new and different ways.

Smaller footprint

A reduction in the size and weight of mechanical components, and machines in general, has been a universal desire throughout modern history, with the pressure to improve technology and the pace of change ever increasing.

Material science has delivered belts with improved cords, fabric and compounds, such the Gates Poly Chain ADV-brand product. First introduced in 2015, the Poly Chain ADV remains the strongest synchronous belt on the planet. These innovative, modern materials enable today's synchronous belts to carry significantly more power through the same width of belt.

Consequently, narrower belts and sprockets can be specified, saving valuable space and weight over legacy belt-drive systems. And the comparison to roller chain drive systems is even more stark. For example, Gates Poly Chain belts are a staggering 97 percent lighter in weight than a roller chain.

The benefits of these advancements are born out in real-world application. In manufacturing, increased production generated from the same overall footprint is always the goal; increased output means increased profit (all else being equal). Smaller and lighter belt drives, including belts, sprockets and guards, mean more compact machinery, which results in more efficient use of factory space while maximizing production output.

In the personal mobility industry, narrower belt drives allow more space for greater flexibility in the design of other vehicle components, such as wider drive wheel-and-tire packages and optimized suspension system designs, which help with traction and stability.

In addition, in certain types of vehicles such as motorcycles, scooters and off-road vehicles, a more compact transmission solution can allow for narrower overall frame width, limiting cross-sectional area and aerodynamic drag, which has benefits in both acceleration and fuel economy. And whether it's a performance-oriented motorcycle or a commuter-oriented scooter (gas or electric), the reduction of both sprung and un-sprung weight is critical for vehicle dynamics, affording better ride and handling characteristics.

Longer life

Alongside the continuous and accelerating push for miniaturization, machine durability is an equal imperative. With longer product life comes lower cost of ownership and more uptime with the machine doing whatever it was intended to do, whether that's an industrial conveyor carrying ingredients down a food production line, or an e-Bike zipping a rider to the office on their daily commute. Once again, materials science has delivered.

To meet the needs of the market, Gates has upgraded to premium materials such as carbon-fiber tensile cords and ethylene elastomer compounds in order to provide the required power capacity and long life. Other advances include new tooth reinforcement fabrics, with next generation weaving patterns and coatings for the fabrics.

Furthermore, when compared to typical roller chain systems, synchronous belts offer three times the usable life, and without metal-to-metal contact, sprockets can last up to 10 times as long. Meanwhile, legacy belt drive technologies that may have previously lasted a year in a particular application can today extend that duty cycle by multiples. Longer life means less time performing preventative maintenance—or worse, emergency repairs—and more time operating equipment.

Better technology: Belt vs. chain

In addition to greater durability and reduced size and weight, other benefits of belt-drive technology over roller chains are hard to deny. First, chains stretch and require re-tensioning; belts don't stretch and are virtually maintenance-free. Second, chains need constant lubrication and cleaning, a time-consuming, messy and sometimes

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Jung

The author

Taylor Jung is the senior director of global product line management at Gates Corp. and is responsible for industrial synchronous drives. He leads a team that identifies and prioritizes strategic opportunities and defines the products required to achieve and maintain share in those markets.

Jung's experience in sales, marketing, operations and engineering helps him create alignment across teams globally and deliver the most innovative and differentiated solutions in the marketplace. Prior to Gates, he was in technical sales at Trane Technologies.

He earned a bachelor's in chemical engineering from the University of Colorado.

Fig. 1: Poly Chain ADV represents the pinnacle of current belt technology.

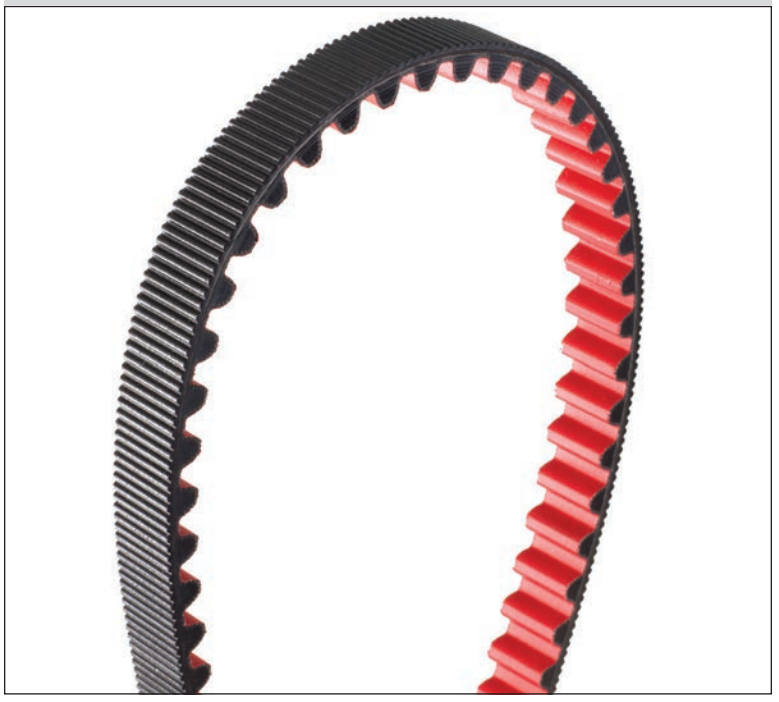


Fig. 2: Weight reduction makes handling and replacement easier and safer.

ROLLER CHAIN	19M POLY CHAIN®
200-2	19 MM PITCH, 125 MM WIDTH
LENGTH: 5600 MM	LENGTH: 5605 MM
WEIGHT: 21.7 LBS/FT	WEIGHT: 0.88 LBS/FT
RECOMMENDED MAINTENANCE: LUBRICATE. REPEATEDLY. RETENSION. REPEATEDLY.	RECOMMENDED MAINTENANCE: NONE. ZERO. ZILCH.

96% WEIGHT SAVINGS + 100% MAINTENANCE SAVINGS
WITH 19M POLY CHAIN® GT™ CARBON™ EXTENDED LENGTH

Fig. 3: Narrow, lightweight drives improve performance on an e-motorcycle.

Fig. 4: Material science development in belt components enables improved belt performance.

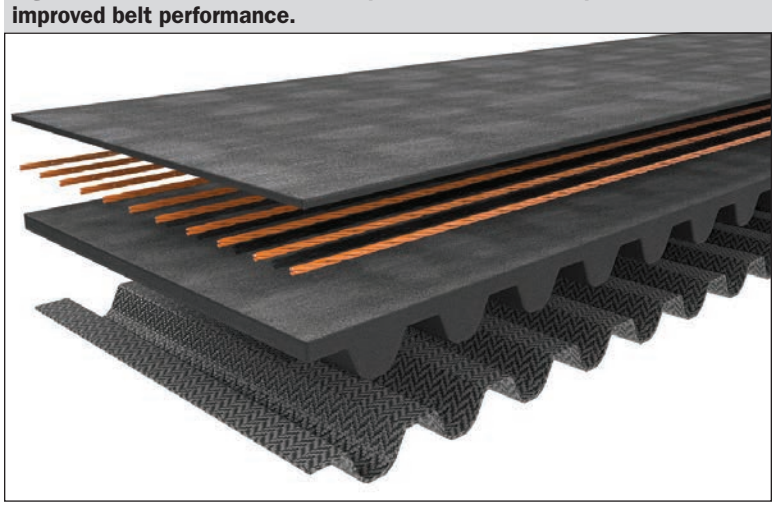
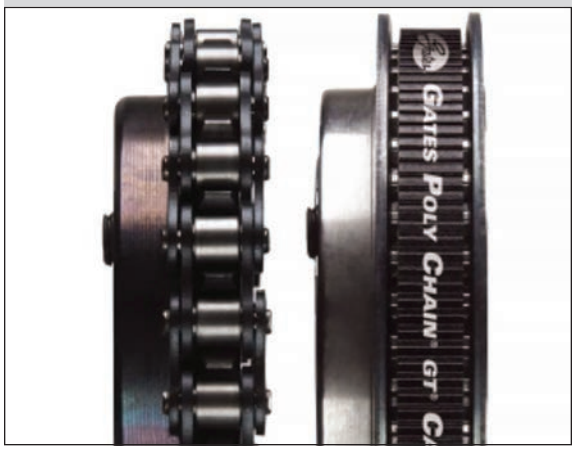


Fig. 5: Rust, grease and oil can cause maintenance problems with standard chains.

Fig. 6: Chain vs. Gates Poly Chain: Technology allows belt replacement in similar package sizes.



Nokian Tyres eyes 2021 recovery in N.A. business

Tire Business

NASHVILLE, Tenn.—Nokian Tyres Inc. management is expressing optimism about 2021 following favorable third-quarter financial results and the resumption of production at its year-old factory in Dayton, Tenn.

"I am a strong believer that people will be driving even more in the future, so they can stay safe in their nice, clean cars instead of going to airports," Tommi Heinonen, North American director of sales, said during a recent company podcast. "I expect that tire demand will be there—when people have been locked down, there's a need to travel again. Cars are the safest way to do it."

Heinonen

Heinonen, who's been involved in sales for North America since 2010, stressed that there have been "positive things going on" throughout 2020, including "a lot of creative ideas and new ways of doing business. When times are challenging, people will always find a way to do business."

After the industry—Nokian included—experienced a significant downturn in travel last spring, the company saw a recovery in certain markets. In North America, for example, Nokian reported 25 percent sales growth in the third quarter versus 2019, to $63.4 million, and the fourth quarter typically is one of the company's strongest due to its strong position in winter tires.

Revenue generated in North America for the nine months, however, was down 16.2 percent, reflecting the 51 percent drop in sales in the second quarter, when the company was forced to shut its recently opened U.S. plant for several weeks.

Nokian, like many other tire makers, was forced to get creative with customer relationships in 2020 in response to the pandemic and the business restrictions that came with it, Heinonen said.

Among other things, the company redesigned its training seminars for virtual delivery, and sales representatives took their show on the road where appropriate, driving recreational vehicles to customers' shops and hosting socially distanced seminars around the campfire and at drive-in movie theaters.

"We tried to help our customers and they stayed loyal to us, even during tough times," Heinonen said. "Our dealers trusted us and gave a fair share of their business to us. Our partnerships stayed strong and carried us through difficult times."

Nokian modified sales programs to provide increased flexibility when necessary and reworked its dealer co-op program to allow dollars to be dedicated for philanthropic purposes, not just marketing uses, as a way to help customers serve their communities amidst the adversity.

On the product front, Nokian launched the One HT light truck/SUV tire in January 2019, and Heinonen said sales have "exceeded benchmarks."

"We have been doing very well when it comes to new products," he added, "and look forward to future products in North America."

Since restarting production at the Dayton factory in early May, Nokian has continued to ramp up production and has nearly doubled its work force there over the course of the year.

"Starting production in Dayton makes us really proud and is the cornerstone of our growth in North America," Heinonen said. "We can help our dealers by producing locally in the United States and shortening the lead time for products. That's the most important thing that happened for us in 2020."

The factory also earned ISO 9001 quality certification less than a year after opening, and it became the first tire production facility in the world to earn LEED v4 Silver certification, recognizing it as a low emissions, energy-efficient facility.

Heinonen, the vice president of sales for North America since May 2018, has been with Nokian since 2000. He was named general manager/managing director for North America in 2010.

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even dangerous maintenance requirement.

Belts do not need lubrication, eliminating downtime for maintenance, environmental and safety concerns with lubricants—and in the case of the food and health science industries, eliminating concerns about contamination during production. And it bears repeating: despite the lack of required maintenance, belts simply last longer.

In industrial settings, belt drives offer very real safety benefits. Drives can be in difficult-to-access locations. Heavy chains and slippery lubricants increase the risk of strains, falls and other injuries, both during installation and regular maintenance.

Belts, meanwhile, offer ergonomic benefits, with their lighter weight making installation much easier and safer. And with no lubrication required, risks decrease dramatically. Obviously, the safest drive is the one you don't have to maintain at all. Finally, belt drives run much more quietly, reducing noise concerns on the factory floor. This quieter operation also benefits the personal mobility space, allowing e-Bike and electric motorcycle users a more enjoyable ride. At the same time, the longer life and reduced maintenance schedule of belt-drive systems make a bicycle, scooter or motorcycle platform far easier and more appealing to own.

Conclusion

Faster, smaller, quieter, safer—and more cost-efficient to own and operate—synchronous belts have enormous value to offer across many applications and industries, including manufacturing, transportation and personal mobility.

Whether the comparison is between today's belt-drive systems and their predecessors of even just a few years ago, or between synchronous belt and a roller chain drive, the benefits run the gamut and warrant consideration when designing or replacing a power transmission system.