

# Two-stage Helical Bevel Gearing

## Offers Alternative to Three-Stage Helical Bevel Gearboxes and Worm Gearing

Randy Summerville, Siemens Industry, Inc.

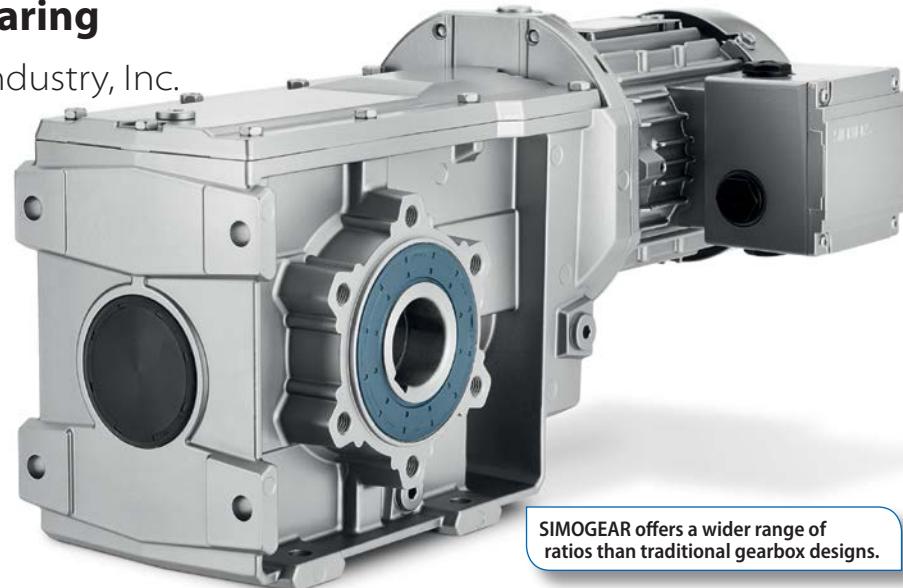
**Gearing is an essential component in conveyors.** The material handling industry appears divided between those who favor high-end three-stage helical bevel gearboxes and those who rely on less expensive worm gearing. But there's an often over-looked alternative, the two-stage helical bevel gearbox.

Two-stage helical bevel gearing offers significant benefits to both OEMs and end-users by lowering costs at both initial purchase and over the lifetime of equipment. With one less stage, and thus fewer components, compact two-stage helical bevel gearboxes are smaller, lighter and less expensive than three-stage helical bevel gearboxes with equal or greater output torque and speed.

An even lesser known fact is that two-stage helical gearmotors are often no more expensive than helical worm gearmotors. In addition to having a longer life, they also consume less energy in operation than either worm gears or three-stage helical bevel gearboxes. For any application beyond intermittent duty, this translates into substantial savings over the long term.

### Energy efficient gains

Whether you're using helical, bevel or hypoid gearing, each gearing stage experiences approximately a two percent energy loss due to friction in the gears, bearings and lubricant. With one less stage, two-stage helical bevel gears de-



SIMOGEAR offers a wider range of ratios than traditional gearbox designs.

liver an automatic two percent gain in energy efficiency over three-stage units.

A cost analysis of 200 gear units in a typical industrial setting over five years shows that using helical bevel gearing instead of helical worm gearing would save over \$52,000, with a return on investment of less than one year.

Of course, these efficiency levels assume that equipment will be properly maintained over its lifetime. Failure to maintain bearings and oil quality can increase friction and thereby decrease energy efficiency even in the best gearing designs.

### Designed for productivity

Although product ranges can vary by supplier, Siemens SIMOGEAR two-stage helical bevel gearboxes can handle input power of 10 hp. That makes them suitable for the majority of conveyor systems.

Since the motor pinion of a SIMOGEAR motor is in the form of a plug-in

**W**hile the automotive and baggage handling segments have mostly shifted to three-stage helical bevel gearing, much of the parcel handling, distribution warehousing and bottling industries often still use energy-hogging worm gearing.

or shank pinion, a wider range of ratios is possible than with traditional designs. SIMOGEAR units have ratios as low as nearly 3:1, allowing engineers the cost advantage of using standard four-pole motors, even in high-speed applications.

### Benefits for OEMs

Engineered to provide greater torque density in a smaller package, the SIMOGEAR B series two-stage helical bevel unit means fewer parts and smaller, lighter-weight aluminum housings. This makes them easier to hold and work with when assembling machines, translating into faster machine builds and less worker fatigue. The compact footprint not only contributes to their affordability, it makes them easier to incorporate into modern, streamlined machine designs.

#### 2-stage vs. 3 stage helical bevel gear motors.

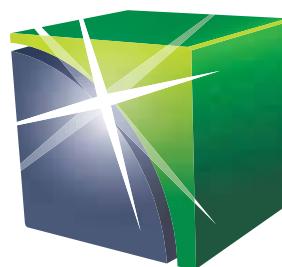
	Helical bevel gear motors 2-stage (B Series)	Helical bevel gear motors 3-stage (K Series)
Efficiency	Up to 96%	Up to 94%
Output torque (lb-in)	442 to 3,982	1,947 to 14,160
Ratio	3.47 to 59.28	5.17 to 244.25
Motor power (HP)	1/3 to 10	1/3 to 20

A close-up, slightly blurred portrait of a man's face, showing his eyes, nose, and a wide, joyful smile revealing his teeth. The background is a soft, out-of-focus teal and green.

WE ARE  
UNDER PRESSURE TO  
BE FIRST IN AUTOMOTIVE  
INNOVATION—PRESSURE  
WE WELCOME! IMTS  
FUELS GENERAL MOTORS  
WITH INSPIRATION & IDEAS,  
DRIVING OUR CURIOSITY  
TO NEW DESTINATIONS.

# WE ARE

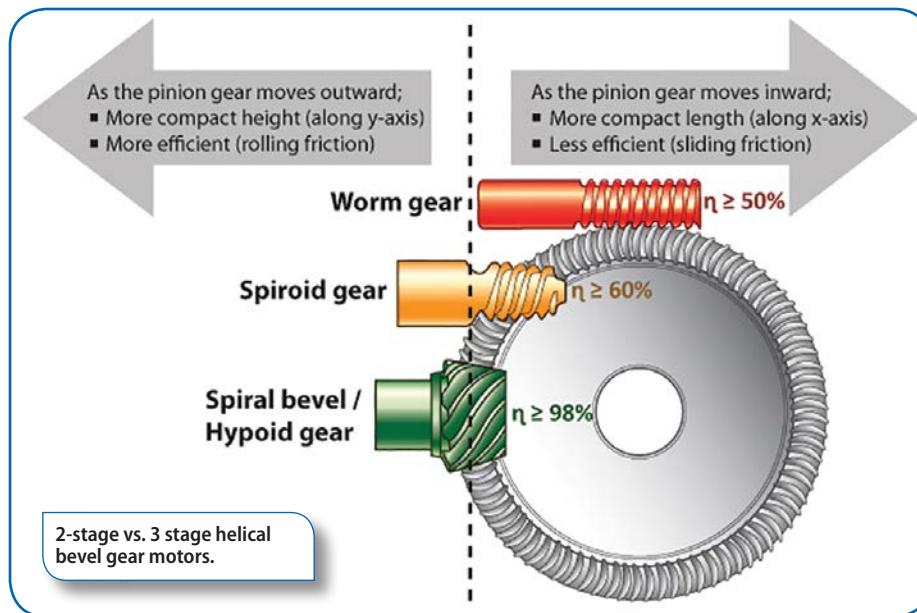
PREPARED.



## IMTS2016

International Manufacturing Technology Show  
September 12 - 17, 2016 · McCormick Place · Chicago

register now at [imts.com](http://imts.com)



Just as important is their initial affordability, which is often at or near the same price point as the inefficient worm or spiroid gearing long favored by cost-conscious OEMs. The significant energy efficiency gains when moving from worm to helical bevel gearing also mean you may be able to use a smaller motor in the same application. Given the high cost of motors, this provides another benefit to OEMs.

- Efficiency
- Output torque (lb-in)
- Ratio
- Motor power (hp)

**A**n even lesser known fact is that two-stage helical gearmotors are often no more expensive than helical worm gearmotors. In addition to having a longer life, they also consume less energy in operation than either worm gears or three-stage helical bevel gearboxes.

The ability to achieve the same performance with lower energy costs is a particularly important advantage for OEMs involved in export markets where electricity costs are higher than in the United States. Even in this country, consuming less energy in a process can help end-user customers avoid high utility demand charges.

### The key to energy efficiency

The material handling industry relies on shaft-mounted right angle gear motors to deliver the torque and power needed to move conveyors. While the automotive and baggage handling segments have mostly shifted to three-stage helical bevel gearing, much of the parcel handling, distribution warehousing and bottling industries often still use energy-hogging worm gearing.

Since the actual efficiency of any drive train can be no higher than its least energy-efficient part, it is defeating the purpose to use any component that doesn't match the efficiency of its most efficient part. Selecting variable frequency drives, motors, gearing,

couplings, controls and other drive train components with similar energy efficiency ratings assures that the end goal of reducing energy consumption and operating costs can be met.

One of the most common examples of this kind of mismatch is combining worm gears with Premium efficiency motors. In this case, the extra money spent for the efficient motor has been mostly wasted and operating cost reductions will not be as high as they could have been if the entire drive train had been evaluated.

### Why worm gears may not be your best choice

It's important to understand that the energy efficiency of worm gears decreases as the ratio increases. Worm gear units with efficiencies of less than 70 percent are not uncommon. This means that up to 30 percent of the energy consumed by a process is wasted.

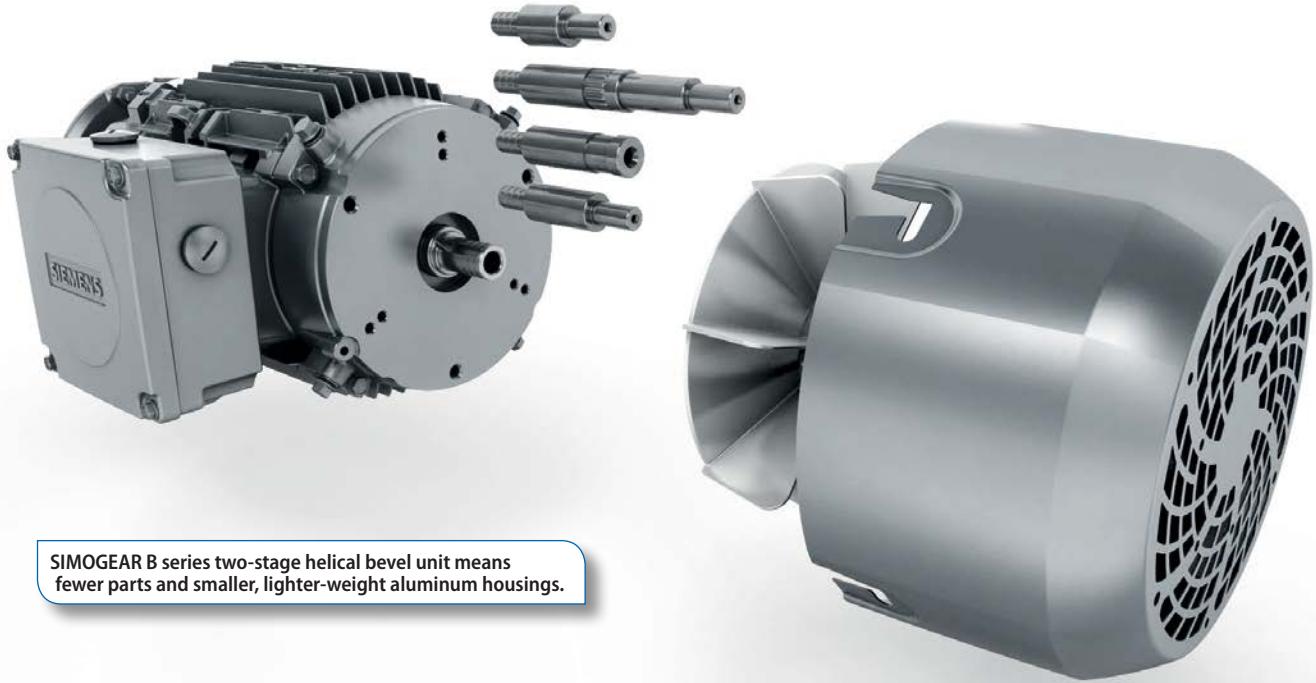
Compare that to two-stage helical bevel units, like the Siemens SIMO-GEAR B-series, which have an infinite gear life and operate at efficiencies of up to 96 percent. That means 96 percent of the energy used to produce speed and torque is actually used for that purpose.

Worm gears also require the use of larger motors to compensate for energy losses due to the friction inherent in their design. It's a case of throwing good money after bad. You're not only wasting money on energy, you're wasting it on an over-sized motor.

Worm gears wear over time due to their sliding friction design (compared to the rolling friction of helical bevel gears). Worm gears combine a steel gear with a bronze gear, a softer metal that wears more quickly than its counterpart.

**Comparison of two- and three-stage helical bevel gears vs. worm gears in conveyor application.**

	Helical Worm	Helical Bevel
Initial cost for end user	\$890	\$930
Gearbox efficiency	80%	96%
Required output power	1.4 HP	1.4 HP
Required motor power	2 HP	1.5 HP
Energy cost per year	\$366/year	\$305/year



SIMOGEAR B series two-stage helical bevel unit means fewer parts and smaller, lighter-weight aluminum housings.

This sliding friction generates excessive heat, which must be removed from the environment using fans or air-conditioning to protect workers and other equipment. It also means that the bronze gears—or the entire gear unit—must be periodically replaced.

The combination of bronze particulates from worn worm gears and the heat generated by friction also means that lubricants must be changed regularly to prevent bearing damage and to keep gear wear to a minimum. And since critical maintenance is often skipped, these units typically have an even shorter life than expected.

All told, the economic disadvantages of worm gears in non-intermittent duty applications far outweigh any initial savings on the purchase price for both OEMs and their customers.

**Improving margins**  
The two-stage helical bevel gearbox is a major advance in gearing technology that is poised to deliver significant benefits to the material handling industry by reducing the energy and maintenance costs of conveyor systems. With its proven economic benefits, this innovative design is gaining traction with both OEMs and end-users.

- Initial cost for end user
- Gearbox efficiency
- Required output power
- Required motor power
- Energy cost per year

Material handling equipment that incorporates an energy-efficient drive train utilizing the most efficient mechanical and electric components can ensure a more reliable, cost-effective and productive operation. It's a win-win scenario for both OEMs and end-users. **PTE**

#### For more information:

Siemens Corporation  
Phone: (800) 743-6367  
[www.usa.siemens.com/simogear](http://www.usa.siemens.com/simogear)

**Randy Summerville** is products marketing manager, SIMOTICS Motion Control Motors, Siemens Industry, Inc. He has more than 20 years' experience in system sizing, system selection, and operation of adjustable speed drive equipment for various applications in industries of machine assembly, plastic finishing and process automation. He has a bachelor's degree in electrical engineering (Kansas State) and a master's degree in business administration (Brenau University).

For Related Articles Search

gear drives

at [www.powertransmission.com](http://www.powertransmission.com)

