

Grinding Gears for Racing Transmissions

When you push 850 horsepower and 9,000 rpm through a racing transmission, you better hope it stands up. Transmission cases and gears strewn all over the racetrack do nothing to enhance your standing, nor that of your transmission supplier.

So when Sprint Cup teams build cars, there's one transmission firm on the short list: G-Force Transmissions. Long's Machine and Tool, headquartered in Cleona, PA is the parent company of G-Force Transmissions and Long's Shifters. Since 1979, they've developed an excellent reputation with oval track and drag racers, becoming the largest custom stick shift transmission builder in the country. Up to half of all Sprint Cup teams on any given Sunday are running with G-Force transmissions. Many NHRA professionals and Sportsmen's Class

continued



Kasey Kahnes, #9, Richard Petty Motorsport. Sprint Cup car running with a G-Force transmission.



Kevin Harvick's first victory with his Nationwide car running with a G-Force transmission.

GROUND GEARS



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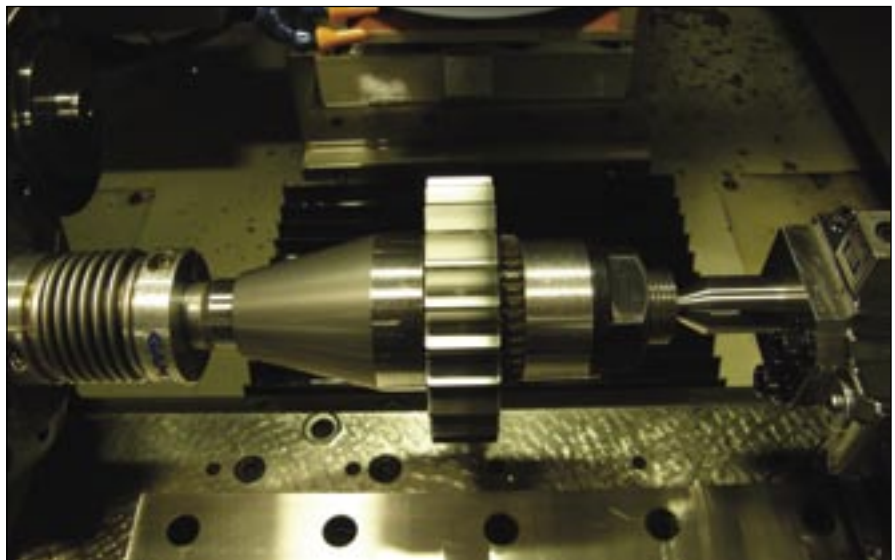
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Drake GS:G2 Linear Motor Profile Gear Grinder.



Transmission gear in machine for G-Force Transmission.

Typical Menu Entries - Drake GearSmart™ Program

NUMBER OF TEETH	000	DIAMETRAL PITCH	00
		MODULE	00
FACE WIDTH	0.0000	HELICAL ANGLE	00.000
BLANK O.D.	0.0000	TIP MOD	0.00000
TOTAL DEPTH	0.0000	CROWN	0.00000
WHEEL DIA	00.00	FIN STOCK	0.0000
RUF PASSES	00	FIN PASSES	00
RUF WHEEL SFM	00000	FIN WHEEL SFM	00000
RUF WORK SFM	000	FIN WORK SFM	00
DRESS COUNT	00	DRESS WHL SFM	0000
DRESS AMOUNT	0.0000	DRESS FEED IPM	00

Drake GearSmart software menu entries. Operators enter values and software converts it into a part program.

drag racers also rely on G-Force transmissions.

The reason is simple. G-Force focuses on quality and performance. Prototypes are tested in the company's own race cars before they enter production. Each production transmission is continually checked and rechecked throughout the machining and assembly process.

All G-Force transmission gears are made from 9310 VAR (vacuum arc remelt) steel, which produces a stronger internal structure and improves gear strength. Processing steps on gears are hob, heat treat and grind.

When it came time to improve production on these gears, Long's Machine and Tool looked for a machine tool builder who shared their commitment to quality.

Lew Reinbold, manufacturing manager, said, "We were looking for an American builder who really understood gear making and was easy to deal with. We manufacture in small quantities and change jobs frequently, so we needed a profile grinder that was easy to set up, easy to operate and that was capable of holding our tight tolerances all day long."

After considering several builders, they settled on Drake Manufacturing of Warren, OH. The machine they picked was the Drake GS:G2 4-Axis Linear Motor Profile Gear Grinder.

No Programming Required

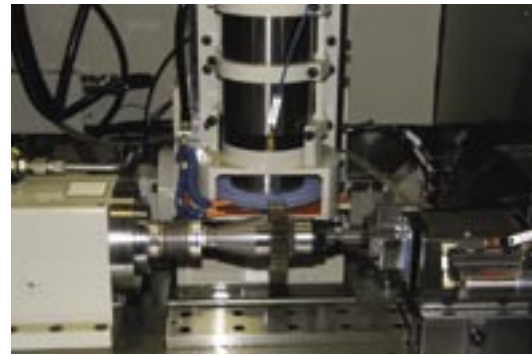
The runoff at the plant proved the machine could do the job, but it was Drake's programming service that really impressed Reinbold. "Drake was able to program our gear processing information into the control—even rewriting the menu prompts, so they read just like our gear data sheets. They even rewrote the software modules to change involute profiles and tip modifications to our specifications. By entering our data into the on-screen menus, we can set up and program a new job in 15 minutes or less."

GearSmart is the name Drake gives to its gear processing software. All Drake gear grinders (as well as rack mills, external, universal and thread

grinders) are programmed before delivery to run customers' specific parts. Dressing forms, grind paths, spindle and work rpm are generated based on the operator's menu inputs. Menu prompts are based on specific customers' existing terminology. Operators just fill in the values. No customer programming knowledge is required.

Two AGMA Classes Better than Expected

As for repeatability, Reinbold
continued



A gear ready to be ground in Drake GS:G2 Gear Grinder.

TSA Growing With Our Customers

Hobs
Shaper cutters • Shaver cutters
Chamfering & Deburring tools
Master gears • Spline gages

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explains, "The Drake grinder is very thermally stable, varying no more than 50 millionths from one gear to the next. We grind our gears to DIN standard 3962, looking for Q4. But in almost all cases, we achieve Q1 to Q2, which is 2-3 classes better."

Linear motor axis positioning with 0.05 µm-resolution linear scale feedback helps the G2 achieve its accuracy. Its mineral-filled, cast polymer base

contributes significantly by damping vibration and controlling thermal growth. Also enhancing accuracy is the machine's direct-drive synchronous torque motor that controls C-axis positioning. It has an 8-million-count encoder providing feedback resolution of 0.2 arc seconds and guaranteed index accuracy better than 10 arc seconds.

Acoustic Emissions Monitoring

The Drake G2 grinder is equipped



Close up of a G-Force transmission gear.

with an acoustic emissions (AE) stock dividing system that automatically locates the rough-cut gear teeth and positions the wheel spindle to grind equal amounts of stock from adjacent gear teeth.

Dyno Tests

Independent testing of G-Force transmissions, subsequent to the addition of ground gears, showed improvements in durability and a reduction in gear noise and vibration. Parasitic drag tests indicated less horsepower is taken from the engine by the transmission, meaning more power is available at the wheel.

While credit must be given to G-Force's team of designers, the pay-off is reserved for the gears they produce on the Drake GS:G2 Gear Grinder. ⚙️

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