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Over 40 years in business and still smiling: Owner J.D. Strite with his new Studer S31.

Ultra Precise Tolerances, Mixed Volumes & Tough Materials

This is the kind of diet that has made this Canadian manufacturer the operation of choice for R&D, aerospace, medical, automotive, telecommunications/ satellite and nuclear power plant work. But you don't get there by just being big. You need a highly skilled workforce and the right technology: the kind you can bet your reputation on.

CAMBRIDGE, ONTARIO CANADA — Strite Industries Ltd. was started by founder J.D. Strite and five employees in 1964. Since then the company has grown steadily to become one of the largest ultra-precision machining companies in the world, operating a 100,000 sq ft facility and employing 250 on two shifts per day.

"The hallmark for this company," says Graham Salt, sales manager, "is working with challenging materials and holding, in some cases, nano-precision tolerances for highly demanding industries. At any given time it's not unusual for us to be working with materials from carbon steels hardened to 58/62 Rc, to stainless steels, such as 17-5 PH and 13-8 PH, 304, Hasteloy, Titanium, Zircalloy, Berylium, Copper, Hymu-80, Inconel, Macro ceramics, Nitralloy, Nitrol (as well as other shapememory alloys), and many others."

Many companies simply won't or can't work with these materials. Salt says either they don't have personnel sufficiently versed in how these materials react to being machined to close tolerances-the metallurgy involved-or, they lack the technological breadth and depth.

"Some manufacturers have only certain internal specialties," Salt says, "like turning or milling. But Strite

provides all capabilities in house, which ensures that timelines, product quality and expertise are under full Strite control."

Salt says the company is known as a leader in specialty cylindrical grinding, including crush and form grinding processes, which are two of the most cost-effective grinding processes. Steve Clement, grinding supervisor, cites a common example: "We grind a Nitralloy aerospace part with six different diameters plus three flats—You can also think of the outer profile as a triangle with rounded points. The part is about nine inches long and we hold to within 0.000,200" on each diameter throughout the run, which is typically a batch of 50. We also grind spools and sleeves over seven inches long for the C-17 aircraft program, meeting their requirement for a surface finish of Ra 3 µin." Hitting these kinds of quality targets required the right technology.

The right technology

For Strite, the answer was a new Studer S31 universal cylindrical grinder, a compact machine for medium-size workpieces from United Grinding (Miamisburg, OH).

"This machine is loaded," Salt says, "giving us the capability to do out-of-round parts, threading, and of course ID and OD grinding in one setup. A triple wheel-head arrangement presents two external grinding wheels, one on the left for OD grinding and another on the right for angular in-feed grinding. The third wheel is for internal grinding in the same setup. The OD and ID wheels are on independent, variable speed spindles to fully optimize the grinding process. Clement says they've been using that right-left wheel combo to achieve OD tolerances down to 0.000,030". "Our manual machines held 0.000,500". The Studer commonly holds 0.000,050" part after part after part. That's a ten-fold improvement. Before the Studer, we'd get a surface finish of 11-12 µin. Ra. Now we routinely get 3.0 µin. Ra, even with Nitralloy at 68 Rc." Their average stock removal is 0.010" on diameter, but they've removed up to 0.200". "Due to the variable speed wheel-head, we haven't changed our wheels that much," he adds. "We've gone from 90-120 grit wheels to a 220 grit wheel."

Clement also made stark comparisons in terms of productivity: "I get twice the part volume from the Studer S-31s, and one person can do what three people used to do. You can imagine how hard it was to grind a part with multiple diameters and so forth on a manual machine."

Salt returned to the example of another Nitralloy spool, this one for Goodrich Aerospace. "There are some fifty process parameters involved in producing these spools, which gives you a glimpse into how complex and chal-

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lenging a job like this can be. It's also a good indicator why Goodrich works with Strite, where all this process control is resident under a single roof." The spools are turned between centers with excess material left on for grinding, then copper plated and nitrided. During this process the spool is "hung" during heat treatment, which produces a yield rate of 45% and a surface hardness exceeding 70 Rc.

The spools are re-centered to ensure concentricity and then OD ground and side ground on the S31. "It is most crucial," says Salt, "that the surface finishes of the groove edges are kept sharp and are not nicked or chipped in the process of side or OD grinding. This can only be achieved by using a machine like the S31, which has stable wheel bearings and fully balanced grinding wheels, all supported by a machine of remarkable rigidity. Side grinding dimensions must be held to 0.000,080" over a 4" span and are verified on a post-process optical measuring system."

Salt also praised the S-31's universal turret wheel head with B-axis, which has a fine adjustment to 0.000,1°. "It swivels automatically, so we can do external, internal and face grinding in a single setup. This provides extreme accuracy and repeatability for grinding even the smallest tapered angles. The C-axis permits out-of-round punch and thread grinding—both internally and externally."



Picking up on that point, operator Jeremy Clegg said he's impressed with the machine's ability to plunge grind up to seven threads in one and a half rotations using a wide form wheel. "I just import the DXF of the thread shape into the StuderThread software. I can even tweak the root form to flank angle tangency. The first part off will be good. That's doubly important because our typical batch size for this application is only 25 parts."

Clegg also uses StuderFORM software for out-of-round grinding, with the same DXF import functionality. "Form tolerance is extremely good. We hold 0.000,200" easily without in-process gauging. And we'll hold that on batches up to 100 parts. I may have to dress the wheel and then compensate for that, but I can be confident that the 100th part will be to spec. As a result, I don't use in-process gauging on 90% of our jobs."

S31 Overview

Axis	Travel		Speed		Resolution		Distance between guideways	
	inch	mm	in./min	mm/min	Inch	mm	Inch	mm
х	10	254	200	5	0.000,004	0.000,1	11	280
Y	31.5/45.3	1,150	400	10,000	0.000,004	0.000,1	7.8	200

• Z axis table tilts up to 8.5" for high precision grinding of tapers.

Grinding Spindles (twin spindles)

Power		Peripher	ral Speed	
HP	kW	inches/sec	m/sec	
10	7.5	2,000	50	Continuous control 3,200 RPM

High-precision roller bearings for precise, high-resistance, maintenance-free operation

Workhead

Roundness adjustment during grinding		Roundnes	s Tolerance	Straightness Deviation		
Inch	um	Inch	mm	Inch	mm	
+/- 0.002	+/- 40	0.000,020	0.000,400	0.000,100	0.002,500	

• High-precision roller bearings

• Handles grinding between dead centers as well as live grinding with revolving spindle.

The V and flat guideways are coated with abrasion-proof Granitan S200 and provide high vibration dampening and superior rigidity. Their patented design prevents the hydrodynamic effects found in conventional guideways and results in high load-bearing over the entire machine speed range. The machine's base is a proprietary mineral casting called Granitan S103, which delivers outstanding vibration dampening, rigidity, strength, and thermal stability.

Dressing

The operator can set wheel dressing intervals by pressing a button at any time during any grinding cycle; after a programmed number of specific machined parts or grinding operations; at programmed switchover points; at the programmed nominal size; after a specific number of strokes; or a combination of these, permitting the optimum solution for the specific grinding application. Grinding wheel reference points are referred to as "T" numbers, and together with Studer grinding cycles, "T" numbers permit programming with nominal size. The actual value indication on the control LCD refers in each case to the programmed wheel reference point. Values of the grinding wheel shape are entered in a dressing dialog display at the control.

Control & programming

The S31 features state-of-the-art Fanuc 21iTB digital control and axis drive components. Step-by-step Studer Pictogramming makes machine operation, setup, changeover, dressing, and programming even complex parts easy. Operators simply connect grinding cycles to one another and add necessary numerical values. The control then generates the machine program automatically. Advanced manual programming in G code is of course also possible. You can program directly at the machine or off-line on a PC and then downloaded to the machine control. You can also change process parameters on the fly, while the machine runs, without affecting the workpiece program.

A small sample of parts combining out-of-round and thread grinding: Easy work for the Studer S31



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After Grinding: Strite inspects nearly 100% of their parts on the optical measuring system to the right. The grinding software helps set-up the measuring program.

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After programming the machine off-line on a PC, Jeremy Clegg performs a quick changeover on the machine

The S31 control package features proven StuderGRIND as well as application-specific Studer grinding cycles for diameters, shoulders (left and right), tapers (negative and positive), contours, forms and threads.

New markets, new potential

Salt says their Studers (Strite also has an ECO 650 that they purchased in 2003) have given them opportunities to enter new markets, especially those that require high precision and multiple operations on a part. "If it's tight tolerance or includes ID grinding, it goes to the S31," said Clement. "It's also increased the part diameter we can tackle from 7.9 inches to 14 inches."

Industry undergoing change

It's not a new development, but it is one that is of increasing concern among the manufacturing

community: At the same time buyers are focusing on both price and delivery, their engineers are pushing for tighter and tighter tolerances as well as finer surface finishes. But Strite found that working with United Grinding gives them both the technological edge and the support to meet this challenge. Clements said United Grinding has handled parts requests with a one-day turnaround, while Clegg said most applications questions have been answered "right then and there with a call."

Salt says it's been a relief for them that "suppliers like Studer are staying ahead of the curve when it comes to these increasingly challenging demands."



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