Swedish puzzle answered

The fact that Ronneby, Sweden, is such an important European waterjet cutting location is no puzzle. Rather, puzzles are the reason – jigsaw puzzles, that is. In 1976, special-purpose machine maker Best-Matic, Ronneby, was asked to come up with something to cut jigsaw puzzles more efficiently. The result was a waterjet cutting machine. The link between this and Water Jet Sweden, established in 1993, is Water Jet Sweden's founder, Jan Ryd, who was production manager at Best-Matic. And that is also why Water Jet Sweden boasts 30 years' experience with the technology and not the 14 you might expect.

Best-Matic is also the antecedent of nearby Swedish waterjet technology company KMT Cutting Systems of Ronneby. Best-Matic was acquired by Ingersoll-Rand in 1987 with ABB coming onboard through a joint-venture in 1991 (hiving off the robotic activities of the company) before Swedish company Karolin Machine Tool (KMT) acquired 49 per cent of the Ronneby waterjet cutting business in 2003 – along with the other elements of the Ingersoll-Rand waterjet activity – completing the purchase in 2004 when it bought out ABB's 51 per cent. Incidentally, the Swedish Waterjet Association is also headquartered in Ronneby.

KMT makes 'cutting boxes' at Ronneby (robot-based waterjet systems, mostly for automotive use – Best-Matic made the first in 1983) and does not compete with Water Jet Sweden which makes table-type waterjet cutting machines. In fact, Water Jet Sweden uses KMT water pumps (made in the US; a former Ingersoll-Rand activity).

But while the KMT Group has been expanding its waterjet cutting activities through acquisition, relative newcomer Water Jet Sweden has through organic growth in just 14 years leaped from nowhere to an installed base of 400-plus machines in 38 countries. This is set to grow massively because a current expansion programme, financed by the company's first public stock offering, will give it a manufacturing capacity of somewhere around 200 machines/year. And history demonstrates that whenever Water Jet Sweden expands, its new capacity is filled rapidly (see box, page 30).

SUB-CONTRACT ROOTS

Water Jet Sweden was spawned by the company Jan Ryd started in 1993, Water Jet Sweden Lego (lego means sub-contractor). Machine building started in 1994 – following an approach from an enthusiastic salesman who wanted to sell the technology – with the first machine being exported in 1996, to Germany. Exports today are 90 per cent of the company's business. Now in his mid-70s, the same salesman is still working and still enthusiastically selling machines.

Water Jet Sweden has not achieved its rapid growth by selling low-cost machinery, quite the contrary. The 65-employee company's position has been gained through the supply of accurate, robust machinery built using highest specification components on the back of attention to customer service. A number of patented technology areas help underpin its success.

Largest table-type waterjet profiler in the world?

Dillinger Hütte, one of the world's major steel makers supplying more than 3,000 clients from manufacturing plants around the globe, has installed what it believed at the time to be the world's largest waterjet cutting machine (above).

Installed at the company's main plant at Dillingen/Saar, Germany, the Water Jet Sweden NC 40180 T machine is custom-built, has three cutting heads and has a workbed cutting area of 18 m in length by 4 m wide. It also features linear motors in X and Y axes.

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Most important, and key to the very large yet accurate machines, is a patented system that accommodates alterations in distance between the two parallel Y-axis ballscrews, one either side of the machine along the length of the machine’s bed, which drive the bridge. If the bridge (X-axis) were a fixed length, any variation in the distance between the centres of the ballscrews would put a strain on the drive components, cause greater positional inaccuracy and generate greater wear, leading to shorter drive component life.

The Water Jet Sweden answer is a compliant connection at one end of the bridge such that only one of the sides of the machine is responsible for accuracy. It is also the case that the surfaces on which the ballscrews are located are planed not milled. This, says the founder’s son, Tony Ryd (pictured above, left, with the Dillinger Hütte machine), offers a flatter, straighter surface.

The compliant connection and planed surface allow Water Jet Sweden to assemble large machines without prejudicing their accuracy, it is claimed.

Standard machines are 3 by 1.5 m and 4 by 2 m, and represent 70 per cent of output by volume. They can be “grown” in steps of 1 m in Y and 0.5 m in X to offer customised-machines. A standard series of six customised machines is available – 1,100 by 1,100 to 4,200 by 6,700 mm. Custom-built machines supplied, include the Gee Graphite 10-head machine (photo, next page).

ACCURACY AS STANDARD

On the subject of accuracy, it should be understood that there is no standard against which waterjet cutting machines are calibrated, but Water Jet Sweden puts positioning accuracy and repeatability at 0.05 mm and 0.025 mm per metre of travel, respectively, in X and Y. — “but this is underselling it; in reality we achieve much better”, offers Tony Ryd.

As a guide, when cutting material 300 mm thick, a part accuracy of 0.1 mm can be achieved.

The company’s latest Renishaw XL80 interferometer investment (£36,000) has the potential to improve accuracy and repeatability with its ability to allow more linear compensation points to be taken into the control system when calibrating the machine, but Tony Ryd adds that built-in accuracy, by using highest quality components, will remain critical.

Of course, while accurate positioning of the nozzle is assured, with waterjet cutting, just as with other similar cutting processes, a straight cut edge cannot be achieved with a vertical nozzle. This has been addressed by the introduction within the last year or so of the two-axis Bevel Jet head system which gives its...
machines a 5-axis capability, although the cutting of bevel edges is the main focus. The first machine has gone to China for cutting apertures/holes in jet engine casings.

Areas of technological novelty also include the incorporation of a mechanical shut-off valve into the water/abrasive mixing head. Other manufacturers put a valve into the feed tube. Tony Ryd says this is a weaker, less secure connection and so is less safe.

The mixing head also features a patented adjustable needle position, required to alter the open/shut speed when switching between pure water and water-plus-abrasive, for example. In other manufacturers’ systems, the needle would have to be changed, and since this might not be done, the shortest open/shut action might not be achieved.

In similar vein, it is also the case that operators may neglect to change the orifice (because it is expensive – sapphire, ruby or diamond) when changing the mixing chamber with consequential loss of cut quality. The Water Jet Sweden design, patented, integrates the mixing tube and orifice so that one cannot be changed without the other. And after changing the mixing tube/orifice, aligning mixing chamber entrance is achieved with a simple tool before clamping the tube/orifice in place.

Simple, innovative, robust, measured and pragmatic are the words that encapsulate the Water Jet Sweden approach to technology, but that doesn’t make it a technology follower. Water Jet Sweden claims to be the first waterjet profile machine maker, in 2006, to incorporate linear motors.

But it is also the way the company does business, as managing director Lennart Svensson explains. “We never offer a customer a machine that is not 100 per cent right for the job. We have over 100 combinations of machine; nobody else can match this. And if we get a request and we don’t have it in our programme, we will have a serious look at it to see if we can do it.

“A very close relationship with the customer is also an important aspect of business – it must be a partnership. And we do not do as others do and charge for the machine, then for installation and then training. We give a full package price; we don’t just sell a machine.”

The level of repeat orders is testament to the company’s machines and business approach, and with new applications arising all the time, according to Mr Svensson, yet more expansion at Water Jet Sweden cannot be far off.

Ronneby’s position as waterjet mecca seems safe.

UK sub-contractor Gee Graphite’s CNC 10-head waterjet cutting system with automated load/unload is an example of a fully customised machine from Water Jet Sweden.

Growth begets expansion begets more growth

Water Jet Sweden’s machine building factory is separate, physically and legally, from the sub-contract facilities of Water Jet Sweden Lego, although they share the same site. The first separate machine assembly hall (assembly hall 1) was built in 2001 (this comprises an 800 m² assembly area plus offices). A separate building, accommodating a showroom/storage, followed in 2005. An extension, assembly hall 2, was made to assembly hall 1 in 2006, doubling its assembly floor area. Yet another, this time separate extension is under construction. Expected to be complete early next year, it adds another 1,600 m² of assembly space plus it will include additional offices. This will be joined to assembly halls 1 and 2 by a covered area. Total assembly area now totals 3,200 m².

This latest expansion has, in fact, doubled in size since it was first conceived and was to have been financed by the company’s first public offering of stock in August. Now it won’t be but this is not a problem, finance from elsewhere will be available. The stock offer was also intended to give employees a stronger interest in the company.

Annual sales of machines saw 38 made in 2002, 31 in 2003, 34 in 2004, 44 in 2005 and 64 in 2006, with an expected 90-100 this year (supported by sub-contract assembly at nearby company Swede Matic), but this depends on supplies of ballscrews and so forth. Capacity will grow to around 200/year following completion of the latest extension. The company has now purchased the whole site on which it stands, including the road.

The order book to the end of June 2006 was £5.8 million and this year was standing at around £9 million. Currently employing 65 people, managing director Lennart Svensson believes the company payroll will stand at 70 to 75 by the end of the year. The low number is perhaps surprising, but all machining and fabrication is undertaken externally by local sub-contractors.