



Machining Master Class

Internal triumph for Super Mini at Nutter Aircrafts

At Nutter Aircrafts Ltd., Blackburn, machining of an internal chamber profile for a hydraulic valve choke has been made significantly more straightforward through application of Horn Super Mini 110 tooling. Cycle time is halved to 2 min:30s, tool life is hugely improved, accuracy and finish are now well in excess of customer requirements and it has been possible to allocate the job to a CNC machine.

Despite its name and Blackburn location, Nutter Aircrafts Ltd has no connection with the modern aerospace industry and has never built aircraft. However, from its foundation in 1939 until the late 1960s it was heavily involved in subcontract supply of precision machined components to locally based aircraft manufacturers; hence 'air crafts'.

High Value

Today it concentrates on high value added component production for mining, electronic equipment, printing machinery and materials handling equipment OEMs. A long history of investment in CNC equipment has led to ownership of facilities from two axis CNC turning up to C-axis/driven tool/sub-spindle equipped mill-turning machines. Chucking capacity up to 300 mm and bar capacity up to 51 mm is available. In addition the company has a four-axis machining centre with 1050 mm by 510 mm by 560 mm work envelope, plus a variety of conventional machine tools.

Production quantities range from one-off prototypes up to scheduled work calling for thousands per annum. The median batch quantity is between 20 and 500-off, based on a wide range of materials including titanium, bronzes, brass and a lot of stainless steels. Machining tolerances are in the 0.01 mm to 0.025 mm range.

A lot of Nutter Aircrafts' throughput falls into that category labelled 'less straightforward than it looks'. This calls for flexibility among the workforce as well as the machining facilities. The management and staff are open minded so far as problem solving is concerned, and it was this that led to use of Horn grooving tool technology in the first instance.



Says Alan Dixon, Nutter Aircrafts managing director. "We manufacture a family of gland blocks from 150M19 material for hydraulic rams. These have tight finish requirements on internal and external grooves - the customer wanted 0.8 microns Ra across a 25 mm wide, 10 mm deep feature. Our existing tooling was only gave acceptable finish across part of the groove."

Horn solved the problem using a development of the S229 insert with a fish-tail cutting edge form. Combined with the highly rigid Horn clamping system this provided the necessary reach and cutting performance, while the range of holders available from Horn covered all internal and external machining requirements.

Thus began an ongoing relationship which has seen Horn become the grooving system supplier of choice for Nutter Aircrafts as Mr Dixon confirms. "In the company's experience, not only does Horn tooling tend to out-perform the alternatives on machining capability but the basic rigidity of the system improves tool life by 50 per cent on average. Moreover the technical support is extremely good."

The valve choke application is one of a number that have followed that experience. Initial attempts to generate the internal profile using HSS and carbide form tools on a capstan lathe proved unsuccessful. Machining cycle times were lengthy and product quality was poor despite regular tool maintenance.

Using Horn Super Mini tooling allowed the job to move onto a CNC lathe where the profile is generated using optimised speeds and feedrates, rather than plunge the form. Cycle time has fallen from 'at least' five minutes to 2 minutes 30 seconds with greatly extended tool life, far superior part quality, consistently good finish and dimensional accuracy.

Very marginal

Alan Dixon comments. "Before we brought in the Horn tooling the job was very marginal, both technically and in terms of us covering our costs. Transferring the job onto a CNC machine has significantly reduced the direct labour cost as making it on a capstan lathe demanded a skilled operator - and productivity is doubled. Horn tooling isn't inexpensive but we are probably making an overall saving here as well as maintenance on the form tools was frequent and time consuming whereas the Horn inserts last very well."

The component is manufactured from EN56 / 416 stainless in two operations. The material is supplied as one inch bar stock and turned to external diameter of 22.95 mm; the centre is then drilled through to 9 mm diameter and a 45 degree conical 'funnel' entry section is then profiled, and a chamfer put on the lip. This conic section blends with a 10.15 mm diameter bore. An internal chamber is, produced as a second operation.

For this the component is chucked in extended jaws to give plenty of clearance for swarf evacuation. The Horn Super Mini 110 then enters through the drilled 9.0 mm hole and profiles the chamber to a maximum internal diameter of 14.2 mm. The insert is 'semi-special' supplied with a 2 mm full cutting edge radius. This generates smooth internal and external radii at the internal profile transition points. In addition bores the access hole to 9.2 mm finished diameter. A facing operation completes the part.



The problem with using a form tool was lack of space for swarf removal when the tool was in cut as the form tool and support shank occupied most of the available volume. This was combined with a relatively long, thin neck on the tool shank which impaired rigidity and led to chatter. Chippings regularly became trapped between the cutting edge and the inside of the workpiece, blunting or chipping the cutting edge.

With the Horn tooling, swarf build-up is less of a problem as the tooling is more compact and rigid. However the material tends to form 'stringy' chippings which are difficult to evacuate from the confined space. The solution to this has been to program pauses into the CNC cycle for the machine operator to clear the accumulation using a high pressure air blast. Were it not for this the time advantage for the Horn Super Mini 110-based route would be even greater.

Mr Dixon concluded. "Horn have supplied a well engineered solution on this job. Our experience with Super Mini means we will certainly consider its application for other jobs where difficult-to-access internal profiles are needed."

