Datum-Point Clamping System Optimises Tool and Electrode Production

Cost-process universality cuts setting and throughput times at PSA

The performance potential of machine tools has largely been optimised today in virtually all plants. This is why further efforts are less effective if, at the same time, the workpieces need to be aligned and clamped tiresomely and in time-consuming manner on the relevant machine tables. This effort can be clearly reduced with datum-point clamping systems. For example by three to five times with throughput times as experience has proven in a French car plant.

Highly accurate and flexible solution to individual clamping problems

The basic element of the Delphin clamping system comprises the clamping units made of hardened steel. The number and arrangement of clamping units in the slots of a machine table can be freely selected. Alternatively, they can be supplied as a unit in a baseplate, including the supply lines, or the OEM integra-
tes them in accordance with customer requirements in the machine table. Fixing these clamping units in position defines the reference point of the machine and the standard measurements and the resultant securing system standardises the interface between machine and jig/fixture or workpiece. Reliable connection between the clamping units mounted on the workholding pallets, clamping elements or workpieces, is ensured by the clamping spigots. They position with a repeat-centring accuracy of +/- 0.003 mm, compensate for tolerances and transfer holding forces that also allow rough machining operations. The „Presence check“ function and automatic cleaning by blow-through after each clamping operation mean that the Z-rest also offers all preconditions for automatic change by robot or manipulator. A continuous bore in the clamping unit prevents jamming of swarf and cooling fluid. The clamping force of 15,000 N per clamping spigot is generated by a spring assembly. The „Ball on inclined tightening face“ force transmission and mechanical interlocking between clamping unit and clamping spigot achieve holding forces of 60,000 N. Hydraulic relaxation is used at 30 to 70 bar. At the same time, the jig-and-fixture plate is lifted out approximately 2 millimetres from the centring point, thus freeing up the Z-rest and protecting it against damage during lift-out.

Up to 5 times shorter throughput times

The concept for process-independent transport of workpieces and electrodes between the various machines, developed by Daniel Gasser, was put into reality in two project stages together with Gino Artuso, Head of Engineering at System 3R Schweiz AG. The first project was launched in early 2006, involving equipping four machines. Approximately 3 months later and after evaluation of the experience gained, the second project followed, with the aim of equipping further machines with Delphin successively, involving various processes.

Project 1, on introduction of Delphin, shortened part throughput times by a factor of 4 to 5, and, in view of the somewhat larger parts of Project 2, in this case by a factor of 3. These impressive times are also attributable to the commitment of Daniel Gasser and his team. For instance, the jig-and-fixture plates, for rea-

![Workpieces of various sizes and module dimensions can be clamped optimally in the baseplate with six clamping units.](image1)

Both the graphite electrode and the die form have been included in the Delphin clamping units for vertical erosion. In this application, the working level of the die is higher thanks to adapters in order to reduce the Z-path.

![The electrodes „migrate“ after machining into the measurement compartment for the interim or final inspection. The uniform reference dimension means that the datum point can be approached immediately and that the measurement sequences can be started if no time loss after fixing the jig-and-fixture plate in the baseplate hydraulically.](image2)
sons of time, are made by the company itself and equipped with clamping spigots procured from the System 3R Schweiz AG company. This is a process that does not pose problems for staff but whose effectiveness contributes to these extremely impressive results for the throughput times of electrodes and workpieces.

Cross-process clamping system for electrodes and workpieces

The diversity and the ease of handling of Delphin are, amongst other things, shown when producing die forms. The first operation involves cutting out the electrode from a graphite block that is clamped on a PSA-made jig-and-fixture plate. The clamping spigots, on their underside, connect the jig and fixture plate to the baseplate that is permanently fixed in position on the machine table. After cutting, the electrode is clamped upside down with no change to the clamping operation in a baseplate connected to the Z-axis of the erosion machine.

The in some cases very hard forgings are first eroded then cut owing to the tool wear. In order to shorten the

Many jig-and-fixture plates for accommodating the electrodes or workpieces are manufactured by PSA itself. Daniel Gasser points to the item that is crucial as regards function: the clamping spigots procured from System 3R Schweiz AG and mounted on the underside of the plate.

The dies can be connected to the clamping units even without jig-and-fixture plates. In this case, the clamping spigots are mounted directly in the underside of the workpiece, in accordance with the selected measures.

Z-path of the vertical erosion machines, the jig-and-fixture plate is set higher by four cylindrical adapters. The parts manufactured by PSA can be installed very easily thanks to the modularity of the Delphin elements, and the higher working level offers adequate space for swivelling the milling head even when cutting – five-sided machining poses no problems whatsoever.

Machining and measuring in one clamping operation

Depending on version and application, the electrodes and workpieces pass through machining stages such as milling cutting, vertical erosion, coordinate grinding and coordinate drilling. They “migrate” during this process in one clamping operation from machine to machine. The Delphin baseplates secured to the worktables ensure that the substituted jig-and-fixture plates are fixed in position accurate to the micrometer
and are securely held with the aid of the clamping spigots.

Since all electrodes and workpieces reach the machines position-oriented, the starting point for precise definition of the substituted workpiece are the position remaining the same and the standard setting dimension on the jig-and-fixture plate. This is particularly important for upstream, interim and final inspection in the measuring compartments. The coordinate measuring machines located there are also equipped with a Delphin baseplate and allow immediate start of manual measurement or start of automatic measurement programs thanks to the precisely defined reference dimensions.

**Rationalisation effect achieved and quality assured**

Since Project 1 was launched, the reduced setting times, the easier handling and the uniform interface have clearly enhanced the operating times of all machines. Since this also has an impact on machining quality despite erosion sludge and swarf of clamping accurate to the micrometer, it has been possible to improve competitive strength.

Introduction of the datum-point clamping system as well was very simple since, in accordance with Mr. Gasser, only tooling and organisation changed. The machines and the work sequence remained unchanged. Even the scepticism on the part of staff at the start in respect of possible effects on jobs gave way to enthusiasm for the system. Staff still working on machines not yet palletised were urging that their machines finally be equipped with the Delphin system.

Overall, Mr. Gasser and his team are very satisfied with the Delphin datum-point clamping system. The aim of cutting non-productive and setting times has been achieved. Today, they are substantially faster, primarily with a view to urgent parts, and they have thus clearly boosted their competitive strength both internally in competition in the PSA Group and as a component supplier. That is why it is the medium-term aim of Mr. Gasser to successively equip all machines with Delphin.