

Self-made is worth each time

*Profitable production management
strengthens in-house production*



While the motto „Retreat from the in-house production offers a substantial help to the structure improvement“ was valid until now, meanwhile the understanding gains ground that a balanced in-house production can offer advantages. Especially to manufacturers of machine tools in-house production competence brings a market-relevant profit. A technologically and organisationally controlled production is as well a characteristic of the machine tool producer Klingelberg Söhne GmbH, Hückeswagen.

The tightened up competition conditions in the German industry and especially for the machine tool production are well-known. The company Klingelberg Söhne, rich in tradition, is also exposed to adequate challenges to economy, quality and flexibility in order to win by producing gear-cutting machines. The in-house production is seen as know-how-supporter for the prod-

uct manufacturing and it therefore has adequate significance. The production of gear cutting machines for the single part and small batch production with following spare part obligation over many years means to Klingelberg in the part production that the lot sizes for identical parts are marginal and the use of serial effects appears hardly usable. But today's level of manufacturing equip-

ment designed for flexibility offers production possibilities for profitable workpiece machining even for single parts and small batches. However, the provision of this equipment by itself does not bring sufficient effects. Thus also at Klingelberg it was important to include the organisational environment considering the part-, process- and company-specific general guidelines.

The production is characterized by 16 NC production machines of various kind, beginning from boring mills over lathes, milling and complete machining centres up to tool pre-set devices. 65% of the production orders to be executed are repeated parts, 15% concern single parts and 20% new parts. In-house production orders and wage orders are exe-

cuted. The product management in the industry is more and more supported by suitable systems. But the functions of these systems for production are not reaching far enough, because the coordination of production devices, procedures and process sequences is decisive to manufacture the product true to specifications only. An adequate production management and corresponding specific systems can fulfil the specific production requirements.

The request for the profitability of production reveals a high throughput and consequently both the run times for workpieces and the strain for the machines have to be held as low as possible. A market-oriented flexibility is as a result inevitable. All losses

are to avoid along the process chain. That means to use volume effects by the following measures:

- ▲ the formation of pseudo lots, i. e. arrangement of an order-related part mix that can be processed set-up-time-optimal on an NC machine
- ▲ setting-up-time-minimization by the use of high precision quick change-clamping systems and adapted tool organisation
- ▲ high reuse of already existing information (NC control data, clamping plans, set-up information, time data etc.) to reduce the forerunning expenses for production

Thus fast and decentralized availability of current technique- and organisation-determining information is profitable for all staff participating in the production process for means of optimal decision- and flexible handling-orientation. The CAD data of designed parts have to be used for generating NC production data just as the order-related data from the ERP system to compose pseudo lots. The use of an adaptable, efficient and also economical hard- and software-platform is therefore essential.

With these requests it was possible to purposefully define a demand-oriented targeted specification for the selection of a convenient IT solution. All

The systems work in the integrated use with database-supported organisation of all NC production data.



Tool optimization for pseudo lots: The gross need of tools for the machining of the three parts in altogether seven clampings lies at 73. The net need against it determined by EXA-BMO lies at 26.

demands were related to the company-, production-, part- and organisation-specific conditions at Klingelberg and marked with priorities. The ideas for expansion and profundity of system functions were clearly visible and so it was avoided to lose time and orientation through an inefficient excessive maximal catalogue. Several systems were checked with regard to this specification. Quantified comparisons were made in the last decision round - as far as reasonably practicable. The winner of the decisive battle was the EXAPT Systemtechnik GmbH in Aachen with their software, execu-

table on PC under the operating system Windows NT. The following systems are meantime in productive use:

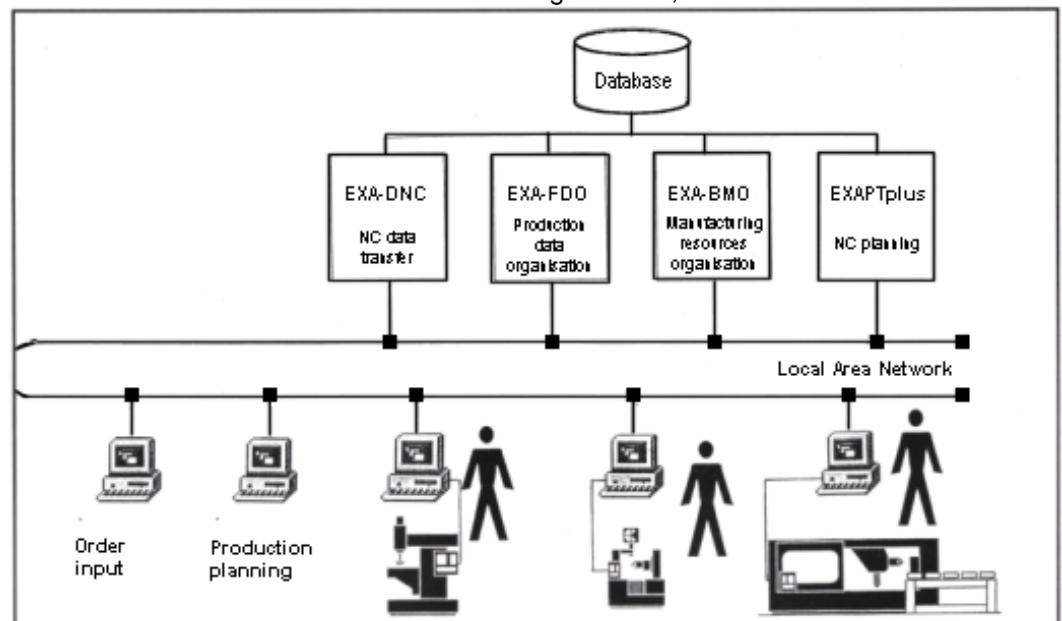
- ▲ EXAPTplus for the generation of NC control data and all required escorting information like tool list, time calculation, clamping plans etc. including diverse additional functions for the CAD data transfer, automatic technology determination, cross-side machining, programming of complete machining devices, having regard to additional aggregates on the NC machines
- ▲ EXA-BMO for the manufacturing resource organisation,

especially for determination of a net demands list for compiled pseudo lots

- ▲ EXA-FDO for the production data organisation, especially to support an efficient running through of repeat orders
- ▲ EXA-DNC for the fast NC data transfer in the shopfloor in connection with the EXA-FDO system as data storage and the NC devices in the production (machine tools and tool preset devices with nominal and actual data keeping).

The hardware platform for the efficient production management consists of 18 PCs connected in LAN together with an additional PC as server for the manufacturing order input, manufacturing preparing, NC programming, data transfer, machine set-up/control, data stock maintenance and network management.

The integrated use of all systems offers above all a continuous support to the production sequences. For all staff participating in shopfloor or office the PCs are linked in the



network. From here all EXAPT systems can be used to supply with the required actual technique- and organisation-specific information as decision- and acting-base. Therefore the different sequences of order variants for parts to remake, for new or similar parts, can pass flexibly. To start production orders, EXA-FDO is used to clear up if all information is together. If all is ok, the order can start as repetition order at once. If the order can be worked off bundled in a pseudo lot, the systems EXA-FDO and EXA-BMO are used, to determine from all gross tool lists of the single parts a net loading for the pseudo lot. In the case that standard tools are stored in a magazine of an NC machine, a tool preset list will be generated containing only the additionally required tools. This list is used for the tool presetting to prepare and provide the appropriate set of tools. To execute these tasks manually leads quickly to time and capacity limits. With the integrated use of the EXAPT organisation systems it is easy to generate this net tool list and to avoid a magazine overflow on the NC machine and 'order throughput holes' by optimization runs.

The data transfer necessary for nominal and actual data of tools is made by interaction of EXA-FDO, EXA-BMO and EXA-DNC using the PC network. The compilation of pseudo lots will also be checked against the need of clamping devices that result from

the clamping plans deposited in EXA-FDO. The main point is that the workpieces of a pseudo lot do not all occupy the same clamping device, because this would foil a time-parallel machining set-up. Fixture duplicates are uneconomical, because of the small number of pieces to be made. So all information necessary for the machine set-up, clamping and workpiece machining can be made available in time. Furthermore key information for time economy and calculation is available.

If it is not a matter of a repetition part-order, then a new part-, simi-

EXAPT systems. Main item in this field is the EXAPT subroutine technique, intensively used at Klingenberg to generate only once geometric, technologic or formal standards and to use them often for further demands, both by the machine operators and the tool setters as well as in the production planning. But to be able to take full advantage of this possibility it is essential in case of larger NC data stocks to find out the right items fast and well-directed from the existing storage. Otherwise the users will over and over again process a repetition case like a new case.

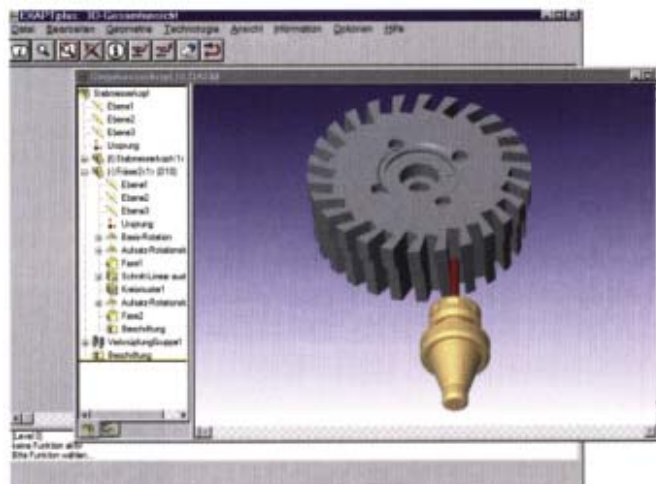
tions to exploit the repeat usage of already available information and therefore avoid double work optimally assists all users at Klingenberg. The user-definable configuration of the system surface makes it also possible to reach a very high acceptance in the shopfloor. The adaptable integrated use, whether on the NC machine or in the office, is guaranteed. The access flexibility of the EXAPT systems allows by the way all Klingenberg staff participating in the process to be sufficiently informed and to solve problems or make optimizations by prompt interventions. After a short habituation phase to such far reaching possibilities it is now made use of it regularly. This strengthens the personal responsibility and improvement potential can be used in a short way.

The installation of the systems was frictionless made during running production and the system users have found a gliding entry into it. Failures could be held minimized. The flexible and competent support by the EXAPT staff helped to the successful use in the production.

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Not alone the NC programming with transfer of CAD data is made with EXAPT.

lar part- or variant part-order has to be processed. The use of uniform templates and sequence schemes deposited in the systems and the use of manufacturing planning and escorting information effects profitable advantages. So not the 'Throw-away programming' is required at Klingenberg, but the multiple uses of generated NC-manufacturing data is a particular advantage of the

To use effort-lowering repeat effects in a profitable way, the EXAPT systems EXA-FDO and EXA-BMO are successfully based on an efficient database system.

The integrated systems offer decisive advantages to master and use the in-house production profitably. The centre of attention is here the fast, secure, integrated and flexible support of the process chain. In the present case it was crucial that handling identical or similar part-orders via balanced system op-