



Digital tool data from the planning up to the machine – It's reality at Umformtechnik Erfurt for ten years!

TDM software from Tübingen at a machine press manufacturer in Thüringen, Germany

When producing its large-scale machine presses, Germany's Umformtechnik Erfurt relies on tool data management software from TDM Systems. TDM software generates tool lists and the programming simulates the manufacturing process in PEPS with real tool data. The presetting area also uses TDM for tool assembling and - via an interface - at the presetters.

Since becoming a part of Müller Weingarten AG (now a member of the Schuler Group since April 2007), Umformtechnik Erfurt has turned its attention primarily to the manufacture of large-scale parts and their assembly with construction-site readiness; small machine parts are provided by its sister companies and other component suppliers. Together with the Service Department, the Assembly Area and welding area, the large-scale machine production area constitutes the core of the company's operations, and it sets an example far beyond the whole region. The small parts manufacturing area includes not only parts weighing up to 25 tons but also large-scale parts weighing up to 230 tons. Udo Heyne, Director of NC programming in the competence center for Large Part Production, is more precise: „For us, stands with a weight of up to 5 tons are considered as small parts manufacturing, whereas headpieces and tables weighing up to 230 tons are large-scale parts.“



An interface between the presetting device and the TDM Software ensures that the tool lists are read directly and can be processed one after another at the calibration device. Once determined, the tool data are stored on 8 mm Balluff chips at the tool holder or, if the machine has no chip reading device, are communicated to the machine control system by means of a loading program.

Due to the high cutting volume, the number of required tools is also very high: the TDM-software currently contains the data of 4,000 tool assemblies, including about 6,700 items, and 4,600 tool lists. „For milling, up to 80% of our tools are Walter tools with indexable inserts - and that was the case even during the time of the German Democratic Republic,“ Hans-Jürgen Kneuse, who is in charge of tool preparation, processing and presetting. The Erfurt specialists have used Walter milling cutters since 1974: the first face milling cutter was the F2040. In 1980, a new generation of Walter milling cutters was introduced with the F2010 in Erfurt. „We're still using it today, and we've just ordered some more,“ says Kneuse.

CIP All the Way to the Tool

„A major factor in this is just-in-time preparation of production materials, tools and working materials. This is where the TDM software plays an absolutely central role



Ingo Joch, Deputy Director of NC Programming at Müller Weingarten

in increasing our efficiency," says Udo Heyne. „Our primary job is to manufacture as many parts as possible in the available machine time.“

a generalized catalogue for the conventional machines. These catalogues were the analog forerunners of today's TDM software, so to speak. Every operator had a data sheet containing the machine number, the tool, and a unique tool number, and each user wrote down the cutting data and presetting instructions individually.

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Nevertheless, only a standard set of some 20 tools stays at each machine; everything else is returned to the presetting room for disassembly. The task of the Production Scheduling Area, the NC programmers and the tool setting area is to minimize tool preparation and presetting times. To achieve this, the TDM software supports all processes with its vast store of tool data, graphic images, and production know-how. This has made it possible to optimize processes and improve the quality of work flow organization while reducing required times. Six to eight hours are now needed to set up a tool, parts then remain at the machine for up to 300 hours, where each may be re-clamped up to four times. „Our philosophy is to transfer as much preparation time as possible from the machine itself to the presetting room. That frees up machine capacities that we need

for the additional contract manufacturing of large-scale parts“, adds Udo Heyne.

In order to avoid downtimes during work-intensive and time-consuming tool assembly, the Erfurt specialists work with so-called „sister tools“: when one tool is at the machine, its sister is being assembled parallel to it at the same time, so that a new tool is immediately available at the end of the remaining running time. „This is no problem at all with the TDM software; presetter data and tool lists are sent via an interface directly to the presetting device“, confirms Hans-Jürgen Kneuse. And production quality is higher too: „All of our tools are always as good as new, reground and prepared; we always know we'll get 100% performance every time.“

From Paper Documents to Digital Tool Organization

The fact that the actual tool data in digital form is available for production planning, presetting and at the machine was not the case until 1997. Before that, it was customary to use specific tool catalogues for each NC machine and

a generalized catalogue for the conventional machines. These catalogues were the analog forerunners of today's TDM software, so to speak. Every operator had a data sheet containing the machine number, the tool, and a unique tool number, and each user wrote down the cutting data and presetting instructions individually.

The result was a tool folder with up to 100 pages which was kept in triplicate in the programming area, the presetting room, and at the machine.

The basic principle of tool organization hasn't changed a bit, except that today the TDM software displays it all on a computer screen. „We talked to different providers and decided on TDM in 1997,“ recalls Udo Heyne. The biggest job at the beginning was to manually input tool data and 2D graphics which had been created earlier at the drawing board. But since the implementation of TDM, 2D graphics have been drawn in AutoCAD and then loaded into the TDM database. Today, all information required for any production order is stored transparently in TDM. „We use TDM to store not only our simple tool data but also technology data, data on working materials like gauges and calibration equipment, clamping diagrams, and presetting sheets as well,“ says Ingo Joch, Deputy Director of NC programming at Müller Weingarten's branch in Erfurt.

PEPS and TDM Get Along Smoothly

When creating a new NC program today, the programmer uses the reliable cutting parameters and technology data provided to him by the TDM software. Via an intermediate buffer (fileserver), the technology data are taken over from TDM to the



In Erfurt, stands weighing up to 5 metric tons fall under „small parts manufacturing“! Headpieces and tables may weigh up to 200 metric tons.

PEPS database, which is the programming system currently in use. TDM thus functions as the „Master of Ceremonies“ for all tool-related simulation data, the original data remains with TDM. This means that all data required for an NC program is available in PEPS as well: geometric data, the T-number, the tool designation, and the cutting parameters. The interface also functions, of course, in the other direction: PEPS uses a post-processor sequence to generate a tool list which is then sent back for digital storage in TDM and becomes available for tool preparation.

TDM makes it possible to store more than one set of technological data for a single tool, depending on the material to be processed and the type of processing to be done. The best example of this is offered by Walter side milling cutters, which are used both for slot milling (2.5 m over the entire width of a table) and for pestle plates. Depending on the respective design, they can cut 12 to 20 grooves; 20 grooves times 2.5 m results in 50 m of total milling travel path. „If we use the wrong feed rate in this work, the cutter is ruined, the base of the insert is useless, and we have unscheduled downtimes and added tooling costs,” says Ingo Joch from experience. „But when we use the technology data given to us by the TDM software, we recognize this right away during the programming phase and make sure it doesn’t happen.”

TDM automatically stores exactly the right tool list for every NC program and/or production order. Take for example a component that weighs 160 metric tons and is processed with four different chucking operations: four corresponding NC programs are sent – with tool lists - to the machine. Each machine operator then uses the information from TDM to prepare only those tools that are truly required at the machine or will have to be exchanged. Calling up this information in TDM is easy: the TDM „Difference List“ function is used to compare tool lists for each order or chucking procedure with the tools which are still at the machine. The result: a new list containing the tools which the machine operators have to prepare. What’s saved above all in this way is: time! A Microset calibration device accesses the TDM tool data and uses that data for measurement; the resulting up-to-date figures then go back into the TDM system.

Finally, the data are re-loaded via a Balluff chip or a digital program into the machine’s digital control system.

Simulation Versus Crash

Also the simulations are playing an ever-more important role at this Erfurt company. The reason: even though the assemblies often weigh many tons, their travel paths in the machines may be calculated with minimum tolerances. Often there are only tenths of a millimeter between them and the next interference contour. As Ingo Joch says, „After gauging our tools and tool holders and creating images of them in our CAM system, we slowly felt our way towards ensuring a risk-free production area.“ As he points out, images of the machine and the tool aggregates are represented in PEPS for this purpose. „True-to-life simulation in the production area is very important to us; it eliminates run-in times and downtimes due to tool breakage.“ To achieve such true-to-life travel path simulation in PEPS, simulation-ready 3D-tools are generated on the basis of geometric data. This was a further, important step on the way towards improving production process and increasing processing safety and accuracy.



Long overhanging tools like stands, pestles and headpieces are often required to make large-scale parts for presses. The interface between TDM and AutoCAD is indispensable during assembly in the tool presetting area.

Tool Assembly in Five Minutes

„Our production area would be unthinkable today without digital tool data,“ says Hans-Jürgen Kneuse. The data of items, tool assemblies and tool lists is kept on file in TDM, and only with the help of this TDM data can the Erfurt professionals today create tool lists and establish and check their cutting parameters. Our guide and tool expert shows us how quickly it’s done: he needs only a few mouse clicks to put together a tool assembly with the TDM software’s help. Using the different options offered by TDM for tool selection (e.g. based on the processing method to be used or the tool type and diameter), he quickly gets to the desired tool. Once the cutting item has been found, TDM automatically suggests appropriate items for assembly on the basis of different criteria. Then: one touch of a button, and the new tool is stored digitally, the internal T-number and CAD number are assigned, the respective data are stored, and that’s it! TDM automatically generates a parts list with tool holders and chucks. Hans-Jürgen Kneuse is visibly pleased at how much easier this makes work in the production area: „With our TDM software, we require only a few mouse clicks and not even 5 minutes to put a tool assembly together.

In the old days, it took us up to 1½ hours, and we had less information available than today with TDM!“

Umformtechnik Erfurt often uses TDM’s AutoCAD interface. For example, it is not unusual for a large assembly undergoing processing to have a long tool overhang. „When I need a longer tool, I just click once to take over the 2D graphic image of the tool assembly from TDM into AutoCAD; then I increase the length in the 2D DXF graphic image and reload it back to TDM, again with only one click,“ says Hans-Jürgen Kneuse. TDM makes it much easier for any NC programmer to select the right tool due to the reliable technology data stored in TDM: he can utilize it for his selection procedures. First he selects the processing technique e.g. deep-hole drilling or slot milling, then he defines the material, the machine group, the cutting speed, and the rotary feed rate. The technology stored in the TDM software flows into this search-and-find system even at the tool selection stage, since this is where the productivity is determined, since each processing step needs the most suitable tool. And that is what can be defined quickly and precisely with TDM software!

Software Amortization in Only 1 Year!

Udo Heyne has calculated the benefits derived from using TDM software at some of the company’s machines. For example: component processing at a Heavy-Cut horizontal drill and milling machine: based on one year of 3-shift operation, this machine may be in use for up to 5,300 hours. About 50 different subassemblies went through this machining station in 2008, with 104 chucking operations and the same number of NC programs and tool lists. „Without our TDM software, the additional amount of time and effort required in production scheduling, NC programming, and presetting would be enormous. Chucking alone would take roughly three hours more for programming and another two hours in the presetting room.“

Since 2005, the Erfurt professionals have worked with an upgrade of TDM’s version 4. This has greatly simplified data management. Ten years before, significant amounts of time and effort were required to create new data for a tool in TDM. Today, this has been transformed as if by magic: all data, including 2D and 3D formats, can be



Contract Manufacturing“ or subcontracting, is growing in volume in Erfurt alongside the company’s own parts manufacturing activities. Not many companies can process gigantic parts weighing up to 160 tons with their own machines; the biggest part to date weighed a full 230 tons. The picture shows a 46-ton housing for a ship diesel which required more than 200 hours just for direct processing. Here a huge housing for compressor systems is being built for a Swiss company, with a direct work time of 350 hours.

taken over directly from the tool supplier into the TDM database. What's more, the manufacturer's recommended cutting parameters are delivered with the tool and can be taken over as base values at the same time. „Everything is far quicker than in the past," as Ingo Joch confirms. „We simply move a new tool into position using the manufacturer's cutting parameters, then optimize at the machine. This alone saves time and money, since we no longer need feel our way to the optimum position bit by bit.“

TDM at All Plant Locations

The Erfurt company already has its next project in view; it wants to create a complete chain of company-wide information, from the design stage to the final product. To this end, a project team with company-wide responsibility was brought together at the end of 2008. The target is to establish TDM at all company locations and to introduce TDM's tool data management software at the other production plants. Further plans include automatically supplying the NC machines in Erfurt with TDM data in DNC operations. And in order to simulate absolutely true-to-life production processes, it is planned in the near future to establish a link to TDM's Data and Graphic Generator software in order to generate the required 2D and 3D tool graphics.

„Collaboration among all plant locations has really been excellent," says Udo Heyne with pleasure. He now communicates regularly with his colleagues Uwe Herre (Director of NC Programming at Schuler in Göppingen), Thomas Vujica (Director of NC Programming at Müller Weingarten in Weingarten, Germany), and Udo Tirolf (Director of NC programming at Schuler Co. in Waghäusel, Germany). Especially in the contract manufacturing for non-pressed parts, it frequently happens that the Design Area finishes a technical drawing only shortly before the beginning of production. „We may suddenly discover a molded part that requires a special tool. In order to avoid a delivery delay of up to 12 weeks, in future we want to search for that tool first in the tool stocks of all our plants - all of which will use TDM. That saves our company time and hard cash: special tools are then no longer ordered in duplicate, when they are already available somewhere else, and we also do not need to break them in, since the cutting parameters are delivered with them.“

But first a challenge must be surmounted: the individual plant locations currently use different TDM class & group structures: Schuler Co. in Göppingen uses TDM's

user-oriented class & group structure, while Erfurt has developed a structure of its own. To avoid differences when comparing data, the professionals in Erfurt have already tested TDM's structure-matching features by using programmed routines from TDM when the Erfurt plant changed over from TDM Release V2 to the new, up-to-date TDM V4. „TDM has developed a program routine for changing over to a new structure without difficulty - and without error," says Heyne. „That showed us once more that TDM is a reliable and experienced partner at our side. I expect the same results for our global company project, and I'm absolutely certain that I'll get professional, fast support from TDM in the process.“

For this purpose, TDM provides TDMconvert, one of its most up-to-date software tools. „TDMconvert makes the changeover as easy as can be: its menu shows the present class & group structure at the left and the new, target structure at the right. Then, step by step, the software reallocates the parameters of the old structure to the new one, and the classification changeover process is finished in only a short time," says Uwe Haller, Area Sales Manager for TDM Systems GmbH.