

SMART PROCESS CONTROL – IT COULDN'T BE EASIER

Process optimization, production monitoring and tool life analysis in bevel gear manufacturing – with the Smart Process Control software, users have a comprehensive process documentation tool at their disposal. All the key data for the cutting process, the tool and the machine tool are just a click away with the app.



The cutting process is a basic component in bevel gear manufacturing. It must be highly productive and lead to high-quality gearing results that can be reproduced every time. This can be achieved only with a perfectly matched combination of machine tool, tool and cutting process. The Smart Process Control software option for the Oerlikon C series bevel gear cutting machine makes it possible to modify and optimize the process directly on the machine. The Smart Process Control app enables an in-depth analysis and evaluation of the machine, process and tool data to identify irregularities in production and obtain insights into factors influencing tool life quantities.

The Problem ...

Two things are essentially required for specifying a machining process on a bevel gear cutting machine: comprehensive knowledge and a far-reaching understanding of the interplay between the machine, the tool and the process. Until now, however, it has been impossible even for the most experienced machine operators to perform a sound evaluation and optimization of a cutting process while taking into account tool costs, component quality and cycle time. This was due in part to the fact that critical data such as tool utilization could not be provided when needed. Another factor was the absence of software tools that enable an analysis and evaluation of a comprehensive range of machine data collected over short or long periods while taking into account process variations in production quality and tool service life.

... and the Solution

Klingelnberg's answer is the Smart Process Control system, comprising two key components. Firstly, as part of the machine software, it continually records the tool spindle utilization on C series bevel

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gear cutting machines. This utilization is visualized on the graphical user interface – in the form of easy-to-understand diagrams with an exact assignment to the working position of the tool for the entire process sequence (immersion, generating grinding). From the accessibility and presentation of this data, vital information is provided regarding possible or required process modifications for optimizing tool utilization while taking into account component quality and cycle time.

Secondly, the machine software option forms the basis for subsequent process documentation and evaluation, as well as for further analysis in bevel gear production and tool life analysis. The tool utilization sensor data recorded for each workpiece and tooth gap can be exported, making it available for further processing by standard Office programs. With the web-based Smart Process Control app, Klingelberg also offers a tailor-made solution that clearly visualizes this data and its analysis with regard to production quality and tool life. Noticeable variations in spindle utilization provide clues about material irregularities, for example, and also point to changes in the wear characteristics of the tool.

Comprehensive Process Documentation

During the machining process, the machine data is stored via a data logger in a database or in Klingelberg GearEngine®. As a result, there is already an exact assignment of the machine data to a specific bevel gear cutting machine. Combined with the SmartTooling system, the data continues to be linked specifically to the tool and protective device used. In the app, users can specify additional characteristics that can also impact

production quality and tool life, making this data available for subsequent analyses. Examples of this include the material specification for stick blades, stick blade coating, additional cutting process parameters and data on component and stick blade geometries. Finally, the Smart Process Control app makes it possible to select data of interest (machine, workpiece, tooth gap, tool, etc.) and visualize it in the form of diagrams and graphs on a production dashboard (see figure 1).

This gives users a tool for comprehensive process documentation. Users also gain deeper insight into their bevel gear production and can evaluate it for anomalies or irregularities by means of data comparisons and trend analyses. Ultimately, data is the essential basis for analyzing a manufacturer's own cutting processes and optimizing service life over the long term, in line with component quality and cycle time. ◆



Fig. 1: Workflow of the Smart Process Control app based on machining data for an Oerlikon bevel gear cutting machine



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