**PRESS RELEASE**

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**German machine tools are the safest in the world**

**Technology Conference at the METAV will clarify what needs to be done in terms of functional safety**

**Frankfurt am Main, 26 November 2013.** – *Better safe than sorry, and this applies most emphatically to German machine tools – but functional safety at machine tools cannot be globally standardised. At the METAV 2014, to be held in Düsseldorf from 11 to 15 March, this issue will be elucidated by a high-profile VDW Technology Conference. It will map out how far implementation of the new ISO 13849 has progressed, and where the new assessment methods are causing difficulties for the manufacturers concerned.*

Functional safety is an important aspect of machine tools, e.g. ensuring activities can be performed safely when the guard doors have been opened. What’s in dispute among actual practitioners is risk assessment and its reproducibility, as laid down in the new control system standard ISO 13849. This is because the new computations based on probability theory (technically known as “probabilistic methods”) call into question the operational efficacy achieved so far and lead to unrealistically pessimistic assessments.

For liability-related reasons alone (product liability and personal liability), machine tool manufacturers have always endeavoured to comply with the relevant safety regulations and standards, and spend substantial sums of money on achieving appropriately compliant standards of safety. However, the new regulations, according to a widely held opinion voiced by experts, cannot in fact be applied successfully in all areas, because the mathematic fail-safe characteristics stipulated for field-proven technical solutions cannot be evidenced on paper.

# The theory and practice of risk assessment

The discrepancies between theory and practice in terms of risk assessment are summarised as follows by Professor Dominic Deutges from the Lower Rhine University of Applied Sciences in Krefeld, who is also a technology consultant at A. Monforts Werkzeugmaschinen GmbH, Mönchengladbach: “In the practical application of ISO 13849, in some categories it emerges that current and safety-proven circuits used in the German machine tool industry do not comply with the new mathematical rules. In the field of hydraulic clamping technology, particularly, there is a manifestly significant discrepancy between the proven safety of many thousand machines in the field and the safety calculated in accordance with ISO 13849. For years now, we have had a very low incidence of accidents, and studies of the German Employers’ Liability Insurance Association show that the biggest problem nowadays is the manipulation of safety features.”

Another critical element here, however, is risk assessment using what is called the “risk graph” of ISO 13849, since here the figures required without being substantiated from accident incidence are often higher than has hitherto been the case. ISO 13849 “should before being published have been tested on real but difficult circuits from machine tool construction, which unfortunately was not done”.

ISO 13849 is a simplificatory approach, intended to describe safety using probabilistic methods – in contrast to the deterministic approach of the preceding standard EN 954. It should be noted that the standard is based on the methodology of ISO 61508 and requires extensive fail-safe calculations. The calculation documents generated for this purpose comprise about 200 pages even for a simple standard lathe, for example, to be supplemented by a risk assessment in accordance with ISO 12100 taking up about 80 pages – an immense amount of work “that without assistance from appropriate tools can no longer be accomplished with practical efficacy”, to quote Deutges.

To quote technology consultant Deutges again: “We need a risk assessment that evaluates the entire risk entailed by a machine over its operating lifetime and correlates it with absolute guideline values. This means that there is then automatically a focus on manipulated control states, which (as studies commissioned by the German Employers’ Liability Association show) are definitely a widespread phenomenon.” It’s also vital, he adds, to have an alternative risk model that evidences the safety of machines or their safety functions on the basis of their operational efficacy. This goes hand in hand with a continuance of field-proven safety circuits that have been used successfully in past years.

The new regulations, says Deutges, “will become critical for the machinery manufacturers at the points where current safety-engineered solutions do not meet the calculation criteria. The question often arises here of what is technically feasible, not just of increased costs”. In addition, machinery manufacturers nowadays are obligated in the new Machinery Directive to take measures to prevent manipulation of protective features.

One realistic approach to this involves functionally restricted special operating modes. The current problem with this is the lack of a normative framework for many types of machine: “The manufacturers are operating in a grey zone on this issue.” The VDW and its member companies have for years now been working on implementation of ISO 13849 and on developing alternative approaches. An above-average number of manufacturers are involved here, though the current accumulation of international standardisation projects entails a daunting workload for many of the mid-tier companies.

**Divergence is widening between Europe and Japan on the one hand and other Asian countries**One sore point, says Professor Deutges, is the difference in functional safety between German and Asian manufacturers: “ISO 13849 is a globally valid standard, meaning that the safety concept on which it is based should be taken on board in Asia as well. However (as my personal observation shows), the divergence in terms of safety engineering is continuing to widen. Leading manufacturers from Europe and Japan are working hard on implementation, whereas in nations like China and Taiwan, especially, there are almost no discernible activities aimed at developing standard-compliant solutions: there is anyway still a significant discrepancy here in the level of safety – even before the introduction of ISO 13849.”

The METAV 2014 in Düsseldorf will provide an overview of how far implementation of the safety requirements laid down in ISO 13849 has progressed: “I believe it will become clear in this context that many VDW firms have done their homework properly. The planned VDW Technology Conference will map out where the assessment methods are causing difficulties for the manufacturers.” In addition, he continues, it will also become clear “that the new standard will widen still further the divergence in regard to machine safety between the European and Japanese manufacturers, who are working hard on this, and manufacturers from other Asian countries”.

# Theoretical considerations featuring the “what-if” principle

In the estimation of Eberhard Beck, Head of Control System Technology at Index-Werke GmbH & Co. KG Hahn & Tessky, Esslingen, risk assessment in accordance with ISO 13849 is based very largely on theoretical considerations featuring the “what-if” principle. This approach incorporates neither a ratio analysis, which takes due account of the probability of this (theoretical) failure case occurring, nor an empirical index, which covers the actual cases of failure during a time period in the past.

This inevitably entails collisions with specific safety standards for individual product groupings (C-standards), in which experts define the “state of the safety art” on the basis of their empirical knowledge – detached from ISO 13849. The result is that safety requirements based solely on the latter standard cannot be implemented, or only with a high level of additional expenditure, and are therefore not encountered in actual practice.

Whereas the earlier EN 954-1 is based on a purely statistical approach to the safety function (“How is it structured and how does it react in the event of a fault?”), in the case of ISO 13849 time is also an issue: “What behaviour does the safety function itself exhibit regarding a failure over the following 20 years?” However, your own empirical knowledge is irrelevant: “What’s valid is only anonymous safety coefficients of safety-related components from subsuppliers, combined with probability theory”.

Nonetheless, the design engineer nowadays does not have to totally jettison tried-and-tested design principles in order to meet the new safety standards: “The EN 954-1 categories are still contained in ISO 13849, after all.” But in every design, all “what-if” considerations have to be adduced. Quite irrespective of whether the empirical knowledge concerned ever contains a failure of this kind. Coupled with the “hard to grasp” probability theory, this leads to a “certain reality loss”.

An improved risk assessment would accordingly have to incorporate influencing factors in regard to incidence and failure probabilities, plus empirical values from the machine’s operation and the accident history as well: “Moreover, the C-standards should be given back their leading role for defining the state of the safety art for specific categories of machine, nor should the impression be given that ISO 13849 enables the state of the safety art to be calculated analytically!”

For German manufacturers, the new regulations entail a “new wave of spiralling costs for a level of increased safety founded solely on theory”. Now that the legislators, the accident insurers and the standardisation bodies, “driven by the large electrical engineering corporations as vendors”, are pursuing the goal, says Beck, “of standardising safety and its components under the motto of “same methods and same safety in a nuclear power plant and a machine”, the influence of the machine tool manufacturers and their trade associations, however, with a preponderance of small and mid-tier companies, on the content and formulation of new standards is low to non-existent”.

From the METAV 2014 in Düsseldorf, standardsexpert Beck expects “further explanatory work– not least among the proponents of ISO 13849 – elucidating whyaccident-free machines and safety concepts do not become less safe and more dangerous simply because new safety standards in their theoretical methodology exhibit more stringent safety requirements in the calculated result!”

**For your diary**

**What: VDW Technology Conference “Safety engineering for metal-cutting machining”**

**When: Tuesday, 11 March 2014, 10.00 a.m. to 2.00 p.m.**

**Where: Düsseldorf Exhibition Centre**

**Advance**

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*Author: Walter Frick, specialist journalist from Weikersheim*

**Background**

**METAV 2014 in Düsseldorf**

The next METAV will be held in Düsseldorf from 11 to 15 March 2014. In the even-numbered years, it is now firmly established as an important technology window showcasing the entire spectrum of production technology for manufacturers and customers from all over Europe. The METAV showcases the entire spectrum of production technology, focusing primarily on machine tools, manufacturing systems, high-precision tools, automated materials flows, computer technology, industrial electronics, and accessories. The target group for the METAV’s visitors includes all branches of industry that machine metal, particularly machinery and plant manufacturers, the automotive industry and its component suppliers, the aerospace sector, the electrical engineering industry, energy and medical technology, plus metalworking and the craft sector. At the last METAV in 2012, around 700 exhibitors from 26 different countries showcased their products, their manufacturing solutions and their service capabilities. They attracted around 40,700 experts from more than 30 different nations.

New at METAV 2014: in conjunction with Messe Erfurt, the METAV’s organiser VDW will for the first time be addressing the issue of generative production in medical technology under the aegis of the special show “Metal meets Medical”.

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