Modern Safety Solutions for the Metals Industry

Safety is a challenge in all industries, but the metals industry has a combination of hazards that bridge several functional areas that include standard control, safety control and fluid-power control. This creates complex control needs that are often implemented with multiple control systems and solutions. The "best-in-class" companies are using standardized contemporary solutions that encompass all of these functional areas into one control system in order to increase performance, reduce complexity, increase reliability and reduce troubleshooting efforts. Table 1 shows how the best-in-class companies perform in relationship to other manufacturers.

Best-in-class companies are using new solutions that enhance safety and productivity. They are also using smart devices that provide more than simple on-off status over hard-wired connections. These devices connect via communication networks and provide diagnostic and service information that can be used to drive continuous improvement and proactive maintenance activities. The following paragraph from the ARC Advisory Group explains how companies are using big data to gain a competitive advantage in today's market:

> Connected machinery is a stepping stone to optimized manufacturing operations. As more machines and auxiliary equipment are connected through the Industrial Internet of Things (IIoT), manufacturers will use analytics-derived rules and complex events processing to close the loop in design and production systems and optimize production. Connected machines and devices will generate a tremendous amount of data. But all this data will only provide value if used intelligently to determine the root cause of product quality issues, identify critical operating parameters, model process changes, and implement condition-based predictive maintenance. Analytics promises to increase the speed and quality of decisions made on the production floor. ... Automation

Table 1

Maturity Class Categories[1]

Definition of maturity class	Mean class performance
Best-in-class: Top 20% of aggregate performance scorers	90% overall equipment effectiveness (OEE) 0.09% repeat accident rate 0.2 injury frequency rate 2% unscheduled asset downtime
Industry average: Middle 50% of aggregate performance scorers	83% OEE 0.64% repeat accident rate 0.4 injury frequency rate 4% unscheduled asset downtime
Laggard: Bottom 30% of aggregate performance scorers	75% OEE 4.54% repeat accident rate 3.9 injury frequency rate 12% unscheduled asset downtime

Hazards are ever-present in the steel plant environment, and a heightened awareness and emphasis on safety is a necessary priority for our industry. This monthly column, coordinated by members of the AIST Safety & Health Technology Committee, focuses on procedures and practices to promote a safe working environment for everyone.

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Comments are welcome.
If you have questions about this topic or other safety issues, please contact safetyfirst@aist.org.
Please include your full name, company name, mailing address and email in all correspondence.

suppliers that succeed in combining connected device-derived Big Data with analytics can gain a competitive advantage.[2]

These companies also have effective risk management programs that follow the risk assessment and risk reduction principles outlined in the American National Standards Institute (ANSI) B11.0 and International Organization for Standardization (ISO) 12100 standards, as shown in Fig. 1.

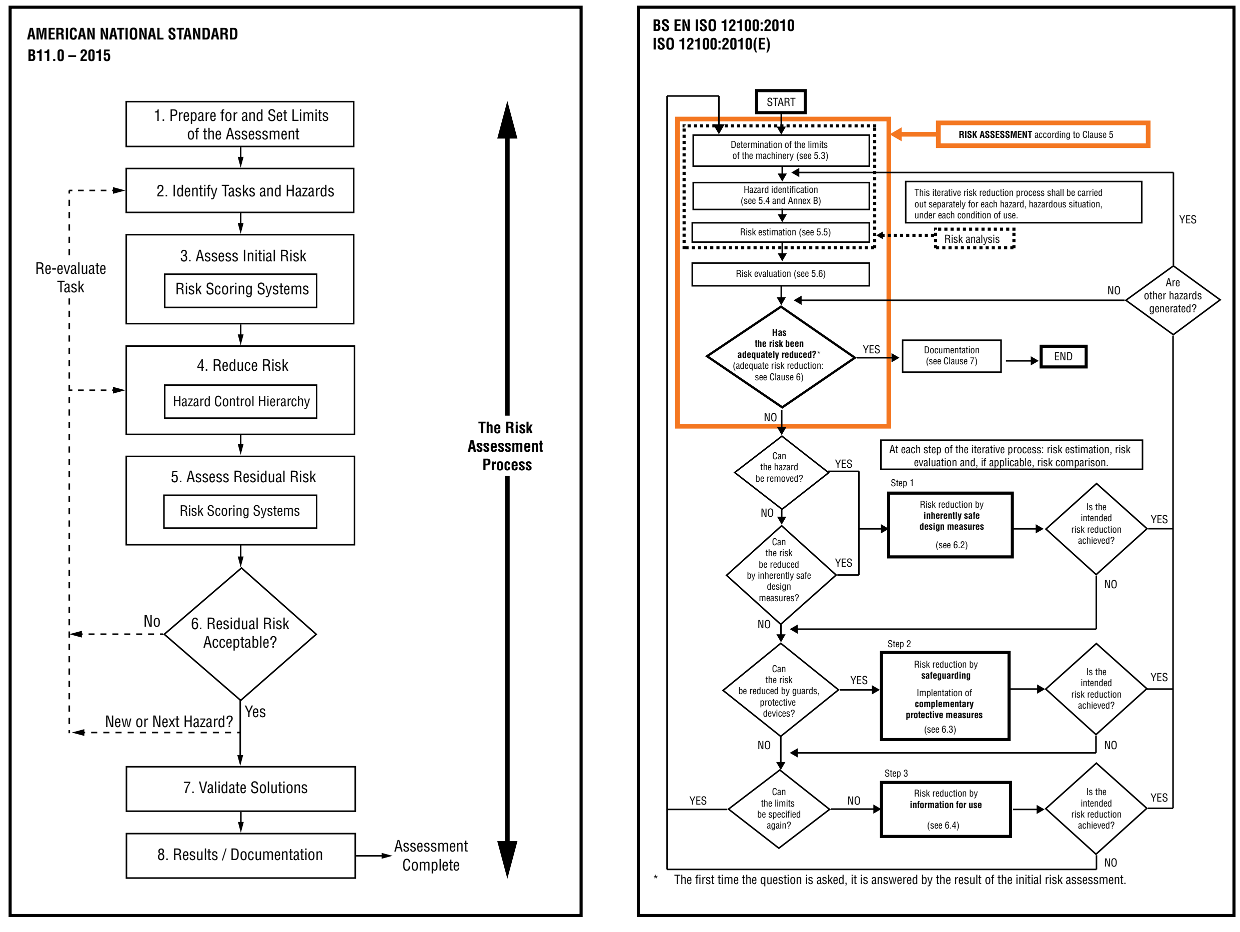
The risk assessment process flowcharts in Fig. 1 define the risk assessment process to identify, estimate, evaluate and reduce risk to meet the performance requirements identified in the assessment. This process requires the use of a risk estimation tool. There are a number of risk estimation tools that are available, along with numerous customer-developed tools. One of the most popular risk estimation tools is the ISO 13849 risk estimation method (Fig. 2).

The ISO 13849 risk estimation methodology defines the safety system performance that is required. One of the reasons that most companies use this method is because it addresses multiple types of energy, including electrical, electronic, programmable electronic and fluid-power systems, where other standards only deal with electrical, electronic and programmable electronic systems.

One benefit of using the ISO 13849 methodology is that system designers can verify/validate that they selected the correct products and structure to meet the required performance level (PL_r) before they order the first piece of hardware. ISO 13849 uses a combination of system reliability, diagnostic coverage, structure and common cause failure avoidance measures to determine the achieved performance level. The ISO 13849 table in Fig. 3 shows the relationship between performance levels and the factors mentioned above.

When companies connect their systems together, there is another concern that needs to be considered. This is information technology (IT) and network security. Connected and networked systems have a higher risk of tampering or hacking when they are connected together and to a plant network. A number

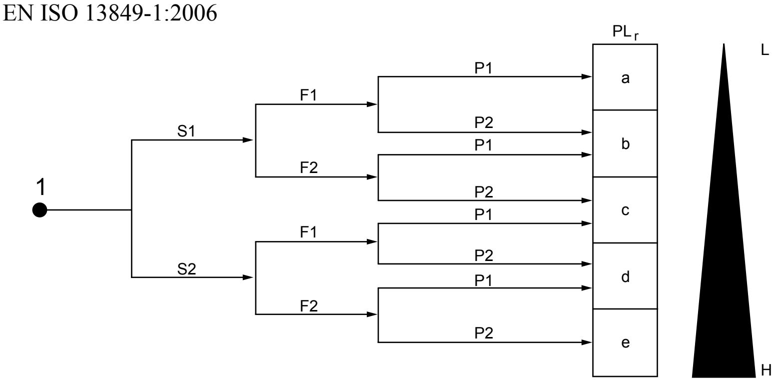
Figure 1



ANSI B11.0 (left) and ISO12100 (right) standards.

Figure 2

EN ISO 13849-1:2006



Key:

1 starting point for evaulation of safety function's contribution to risk reduction

L low contribution to risk reduction

H high contribution to risk reduction

PL_r required performance level

Risk parameters:

S severity of injury

S1 slight (normally reversible injury)

S2 serious (normally irreversible injury or death)

F frequency and/or exposure to hazard

F1 seldom-to-less-often and/or exposure time is short

F2 frequent-to-continuous and/or exposure time is long

P possibility of avoiding hazard or limiting harm

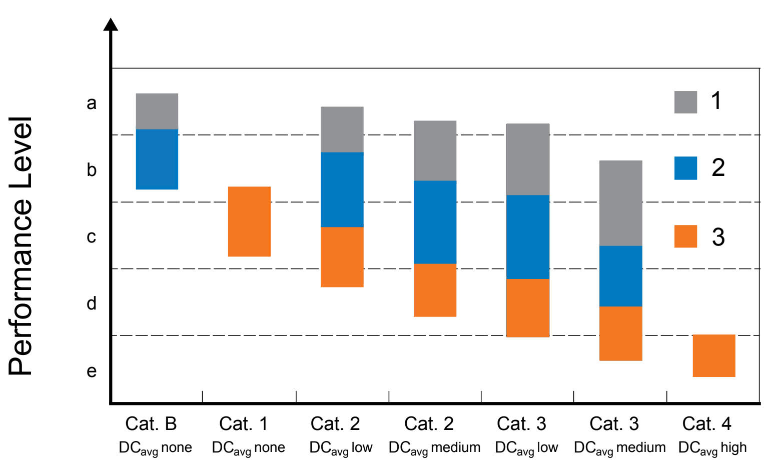
P1 possible under specific conditions

P2 scarcely possible

Risk graph for determining required performance level (PL_r).

Figure 3

EN ISO 13849-1:2006



Key

1 $MTTF_d$ of each channel = low

2 $MTTF_d$ of each channel = medium

3 $MTTF_d$ of each channel = high

DC = Diagnostic Coverage

$MTTF_d$ = Mean Time to Failure – Dangerous

Relationship between PL and select parameters such as system reliability, diagnostic coverage, structure and common cause failure avoidance.

of manufacturing companies are adding IT and network security to their machinery specifications and are requiring original equipment manufacturers and integrators to follow strict network and hardware precautions using robust methods and hardware to prevent tampering and hacking.

The fact is the world and manufacturing have changed and companies are having to adapt to compete in this competitive global market. This includes the metals industry. Continuing into the future, safety will have an increasingly interactive role in Industry 4.0 and the Connected Enterprise.

References

1. Aberdeen Group, October 2011.
2. ARC Advisory Group. ✦