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**Safety of machinery -- Guidance on the application of GB/T
16855.1 and GB 28526 in the design of safety-related control
systems**

机械安全 应用GB/T 16855.1和GB 28526设计安全相关控制系统的指南
(English Translation)

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Mechanical safety application GB/T 16855.1 and GB 28526 Guidelines for Designing Safety-Related Control Systems

1 Scope

This standard specifies guidelines on how to apply GB 28526 and GB/T 16855.11) to design safety-related control systems.

1) This standard considers GB/T 16855.1-2008, not GB/T 16855.1-2005 which has been replaced by it.

This standard applies to all safety-related components of control systems, regardless of the type of energy used, such as electrical, hydraulic, pneumatic, mechanical, etc.

2 Overview

2.1 GB 28526 and GB/T 16855.1 both specify the requirements for the design and use of safety-related control systems. These two standards the methods given are different, but if used correctly, all can achieve similar levels of risk reduction.

2.2 Both standards classify safety-related control systems that perform safety functions according to the probability of dangerous failure per hour.

GB/T 16855.1 is divided into five performance levels (PL): a, b, c, d and e, while GB 28526 is divided into three safety integrity levels (SIL).

1, 2 and 3.

2.3 The technical committee (TC) of the product standard (C standard) specifies the safety requirements for safety-related control systems and recommends these technical. The technical committee defines the level of the safety system according to PL and SIL.

2.4 The mechanical designer can choose to use GB 28526 or GB/T 16855.1 according to the specific application characteristics.

2.5 The choice and use of which standard may need to be determined by factors such as.

--- Previous knowledge and experience in designing machinery safety-related control systems are based on the categories given in GB/T 16855.1-2005 , it is more appropriate to use GB/T 16855.1-2008;

--- When the safety-related control system is not based on electrical technology, it is more appropriate to use GB/T 16855.1-2008;

--- When the customer needs to use SIL to describe the safety integrity of the machine safety-related control system, it is more appropriate to use GB 28526;

--- When the machine safety-related control system is used in the process industry and other fields, the safety-related system at this time (such as conforming to GB/T 21109) Safety Instrumented System) is characterized by SIL, it is more appropriate to use GB 28526.

3 Standard Comparison

3.1 Compare the technical requirements of GB/T 16855.1 and GB 28526 according to the following aspects.

---the term;

--- risk estimation and performance allocation;

--- Specification of safety requirements;

--- system integrity requirements;

---Diagnostic function;

--- Software security requirements.

3.2 In addition, a study was conducted on how the probability of dangerous failure (PFHD) and MTTFd were determined by simplified mathematical formulations according to these two criteria.

Evaluation.

3.3 The above work draws the following conclusions.

---By integrating uncomplicated safety-related electrical control systems designed in accordance with GB 28526 and GB/T 16855.1 respectively (SRECS) subsystems or control system safety-related parts (SRP/CS), which can be designed using either of the two standards Safety-related control systems to acceptable levels of functional safety.

--- By integrating electrical/electronic/programmable electronic subsystems designed in

accordance with GB/T 20438, these two standards can also be used to provide Design solutions for complex SRECS and SRP/CS.

---At present, users in the machinery industry can use these two standards, and experience shows that they will get great benefits. within a certain stage, Feedback on the actual application of these two standards will promote international standards equivalent to GB 28526 and GB/T 16855.1 A merger of IEC 62061 and ISO 13849-1.

--- There are still differences in details, and some concepts (such as functional safety management) need further study to achieve their respective design methods and some technical requirements.

4 Risk estimation and specification of required performance

4.1 The methods used to determine the SIL and/or PLr of a specific safety function have been compared, and each standard in Annex A of each standard has been identified.

There is a good correspondence between the self-given methods.

4.2 Regardless of the method used, it is important to take care to ensure that appropriate SIL and/or PLr of the specific safety function. Usually, this judgment is best made by relevant personnel (eg, designers, maintainers, operators) jointly Participate to ensure a correct understanding of possible hazards on the machine.

4.3 More information on risk estimation and performance determination process can be found in GB/T 15706 and GB/T 20438.5.

5 Specification of safety requirements

5.1 The respective methods of GB/T 16855.1 and GB 28526 are required in the first stage to specify the safety requirements performed by the safety-related control system Features.

5.2 Each safety function performed by the control circuit should be evaluated, such as using Appendix A of GB/T 16855.1 or Appendix A of GB 28526.

Record A. It should be determined how much risk reduction is required for each specific safety function of the machine, and then the amount of risk required for the control loop to perform the safety function.

grade.

5.3 The levels specified in PL and/or SIL relate to specific safety functions.

5.4 The information relevant to the safety function that should be given by the product standard (Criterion C) is given below.

Safety functions performed by the control circuit.

name of safety function Description of the function Performance level required to comply with GB/T 16855.1.PLra~e and/or Safety Integrity Level required to comply with GB