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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 21109.2-2023

**Functional safety of safety instrumented systems for the
process industry sector - Part 2: Guidelines for the application
of GB/T 21109.1-2022**

过程工业领域安全仪表系统的功能安全 第2部分：GB/T 21109.1 - 2022的应用指南

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Foreword

This document is drafted in accordance with the provisions of GB/T 1:1-2020 "Guidelines for Standardization Work Part 1: Structure and Drafting Rules for Standardization Documents": This document is part 2 of GB/T 21109 "Functional Safety of Safety Instrumented Systems in the Process Industry": GB/T 21109 has The following parts were released:

--- Part 1: Framework, definition, system, hardware and application programming requirements;

--- Part 2: Application Guidelines for GB/T 21109:1-2022;

--- Part 3: Guidelines for determining the required safety integrity level: This document replaces GB/T 21109:2-2007 "Functional Safety of Safety Instrumented Systems in the Process Industry - Part 2: GB/T 21109:1 "Application Guidelines", compared with GB/T 21109:2-2007, the main changes are as follows:

---Change the chapter and article numbers of the original GB/T 21109:2: On the premise that they are consistent with the corresponding chapter and article numbers in GB/T 21109:1, the Add the symbol "A" (see Appendix A, changed Chapter 1~Chapter 19 of the old version);

---Changed the content of A:12, and changed the original application software requirements, including the selection criteria of tool software, to SIS application development published content (see Appendix A:12, Chapter 12 of the:2007 edition);

--- Deleted the technical example of the original Appendix A to calculate the failure probability of an instrument safety function requirement (see Appendix A of the:2007 edition);

---Changed the content of Appendix B, changed the typical SIS structure development of the original Appendix B to the use of reliability block diagrams to develop SIS logic

Examples of serial solver applications (see Appendix B, Appendix B of the:2007 edition);

---Changed the content of Appendix C, and changed the application characteristics of the original Appendix C safety PLC to the conversion from NP technology to PE technology Precautions when (see Appendix C, Appendix C of the:2007 edition);

---Changed the contents of Appendix D, and changed the example of the original appendix DSIS logic solver application software development method to how to convert from Piping and Instrumentation Diagram (P

---Changed the content of Appendix E, the original Appendix E developed an example of an external diagnostic program for a PE logic solver with a safe configuration Change to methods and tools for application programming (see Appendix E, Appendix E of the:2007 edition);

--- Added Appendix F: SIS project example to illustrate each stage of the safety life cycle of the application program developed using the relay ladder diagram language (see Appendix F);

--- Added Appendix G: Guidelines for application development practices (see Appendix G): This document is equivalent to IEC 61511-2:2016 "Safety Instrumented Systems in Functional Safety Process Industry Field Part 2: Guidelines for the Application of IEC 61511-1:2016: The following minimal editorial changes have been made to this document:

--- Change the name of the standard to "Functional Safety of Safety Instrumented Systems in the Process Industry - Part 2: Application Guidelines for GB/T 21109:1-2022": Please note that some contents of this document may refer to patents: The issuing agency of this document assumes no responsibility for identifying patents: This document is proposed by China Machinery Industry Federation: This document is under the jurisdiction of the National Industrial Process Measurement Control and Automation Standardization Technical Committee (SAC/TC124): This document is drafted by: Mechanical Industry Instrumentation Comprehensive Technology and Economic Research Institute, National Pipe Network Group Southwest Pipeline Co., Ltd., China Petroleum Group Safety and Environmental Protection Technology Research Institute Co., Ltd., Beijing Longdingyuan Technology Co., Ltd., Shanghai Chenzhu Instrument Co., Ltd., Beijing Jingyi Group Co., Ltd., Hangzhou Pangu Automation System Co., Ltd., Beijing United Purken Engineering Technology Co., Ltd., Ji Nanshi Changqing Computer Application Company, Jinan Ningtong Automation Technology Co., Ltd: The main drafters of this document: Liu Yao, Shi Xueling, Zhou Youzheng, Li Yuming, Xu Deteng, Zhang Tao, Zhang Jianguo, Zhu Minglu, Qiu Kun, Xiong Wenzhe, Zhang Aisen, Wei Zhenqiang, Chen Xiaohua, Sun Wenyong, Wu Zuoxiang, Jin Jianghong, Wang Yue, Zhang Xinguo, Shen Yufu, Yang Liu, Jiang Ronghuai, Qian Fuqun, Zhou Ting, Han Zhanwu, Ma Xinxin, Shuai Bing, Wang Li, Zhang Hong, Yu Wenguang, Cheng Xiangguo, Zuo Xin, Zhu Hongyi, Nie Zhongwen, Tian Yucong, Li Qiujuan, Shi Suijing, Zhu Xuying, Chen Hongxin: The release status of previous versions of

this document and the documents it replaces are as follows:

1 Scope

GB/T 21109.2-2023 is Part 2 of the Chinese series on the functional safety of safety instrumented systems in the process industries, and is the application guide to Part 1. A safety instrumented system is the layer of protection that shuts a plant down when the process runs away, and Part 1 states the requirements in the abstract language of the safety lifecycle. This part is what an engineer actually works from: it explains, clause by clause, what the requirements mean for a real SIS - how to determine the safety integrity level, how to apply the architectural constraints and the proof test interval, what the requirements imply for the logic solver, the sensors and the final elements, and how to develop and validate the application program, with worked examples in the annexes. It took effect on 1 October 2023.

This document provides specifications for safety instrumented functions and related safety instrumented systems defined in GB/T 21109.1-2022, Guidelines for design, installation, operation and maintenance:

Note 1: Appendix A (informative) has been sorted out: Except for the symbol "A" in front of the chapter number, the rest are consistent with the corresponding chapter and article numbers in GB/T 21109.1-2022:

Note 2: Appendix A contains the materials in the main text of GB/T 21109.2-2007: This is to prevent the situation that the main text of the standard is all informative clauses: Write rules to conform to standards:

Note 3: In order to maximize the use of this document:

---When using the guideline of a specific clause, it is also necessary to review the guideline of the corresponding chapter (for example: when viewing the guideline of 5:2:6:1:3, the guideline of 5:2:6 should also be considered);

--- When there is no relevant guidance for a specific clause (for example: no further guidance is provided), consider referring back to the chapter guidance when applicable:

Note 4: The examples given in the appendix of this document are only specific examples of implementing the requirements of GB/T 21109 in specific situations: Users can choose according to their own conditions: Select appropriate methods and techniques:

2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text: Among them, dated references, Only the version corresponding to the date applies to this document; for undated references, the latest version (including all amendments) applies to this document:

GB/T 21109:1-2022 Functional safety of safety instrumented systems in the process industry - Part

1 Framework, definition, system, hardware Software and application programming requirements (IEC 61511-1:2016, IDT)

3 Terms, Definitions and Abbreviations The terms, definitions and abbreviations defined in GB/T 21109:1-2022 apply to this document:

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