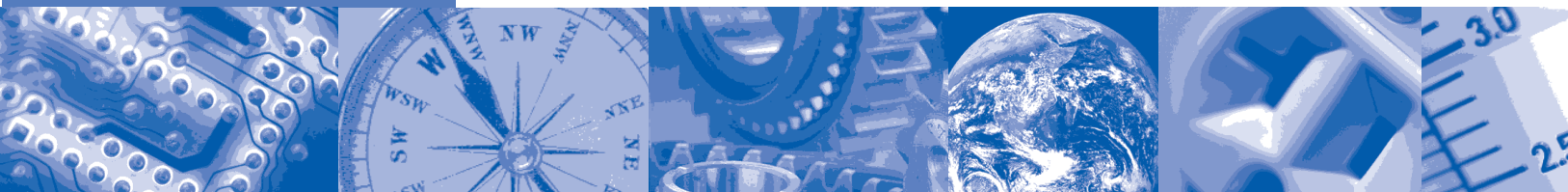


ISA-92.0.01, Part I-1998

Formerly ISA-S92.0.01, Part I-1998



Performance Requirements for Toxic Gas-Detection Instruments: Hydrogen Sulfide

(Replaces ISA-S12.15, Part I-1990)



ISA—The Instrumentation,
Systems, and
Automation Society

Approved 30 May 1998



Documents
Document Sharing Hub

ISA-92.0.01, Part I-1998, Performance Requirements for Toxic Gas Detection Instruments:
Hydrogen Sulfide

ISBN: 1-55617-674-0

Copyright © 1998 by the Instrument Society of America. All rights reserved. Printed in the United States of America. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), without the prior written permission of the publisher.

ISA
67 Alexander Drive
P.O. Box 12277
Research Triangle Park, North Carolina 27709

Preface

This preface, as well as all footnotes and annexes, is included for informational purposes and is not part of ISA-92.0.01, Part I-1998.

This Standard has been prepared as part of the service of ISA – the international society for measurement and control – toward a goal of uniformity in the field of instrumentation. To be of real value, this document should not be static but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms and asks that they be addressed to the Secretary, Standards and Practices Board; ISA; 67 Alexander Drive; P. O. Box 12277; Research Triangle Park, NC 27709; Telephone (919) 990-9227; Fax (919) 549-8288; Internet: INFO@ISA.ORG.

The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general, and the International System of Units (SI) in particular, in the preparation of instrumentation standards. The Department is further aware of the benefits to USA users of ISA standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Toward this end, this Department will endeavor to introduce SI-acceptable metric units in all new and revised standards, recommended practices, and technical reports to the greatest extent possible. *Standard for Use of the International System of Units (SI): The Modern Metric System*, published by the American Society for Testing & Materials as IEEE/ASTM SI 10-97, and future revisions, will be the reference guide for definitions, symbols, abbreviations, and conversion factors.

It is the policy of ISA to encourage and welcome the participation of all concerned individuals and interests in the development of ISA standards, recommended practices, and technical reports. Participation in the ISA standards-making process by an individual in no way constitutes endorsement by the employer of that individual, of ISA, or of any of the standards, recommended practices, and technical reports that ISA develops.

CAUTION—ISA ADHERES TO THE POLICY OF THE AMERICAN NATIONAL STANDARDS INSTITUTE WITH REGARD TO PATENTS. IF ISA IS INFORMED OF AN EXISTING PATENT THAT IS REQUIRED FOR USE OF THE STANDARD, IT WILL REQUIRE THE OWNER OF THE PATENT TO EITHER GRANT A ROYALTY-FREE LICENSE FOR USE OF THE PATENT BY USERS COMPLYING WITH THE STANDARD OR A LICENSE ON REASONABLE TERMS AND CONDITIONS THAT ARE FREE FROM UNFAIR DISCRIMINATION.

EVEN IF ISA IS UNAWARE OF ANY PATENT COVERING THIS STANDARD, THE USER IS CAUTIONED THAT IMPLEMENTATION OF THE STANDARD MAY REQUIRE USE OF TECHNIQUES, PROCESSES, OR MATERIALS COVERED BY PATENT RIGHTS. ISA TAKES NO POSITION ON THE EXISTENCE OR VALIDITY OF ANY PATENT RIGHTS THAT MAY BE INVOLVED IN IMPLEMENTING THE STANDARD. ISA IS NOT RESPONSIBLE FOR IDENTIFYING ALL PATENTS THAT MAY REQUIRE A LICENSE BEFORE IMPLEMENTATION OF THE STANDARD OR FOR INVESTIGATING THE

VALIDITY OR SCOPE OF ANY PATENTS BROUGHT TO ITS ATTENTION. THE USER SHOULD CAREFULLY INVESTIGATE RELEVANT PATENTS BEFORE USING THE STANDARD FOR THE USER'S INTENDED APPLICATION.

HOWEVER, ISA ASKS THAT ANYONE REVIEWING THIS STANDARD WHO IS AWARE OF ANY PATENTS THAT MAY IMPACT IMPLEMENTATION OF THE STANDARD NOTIFY THE ISA STANDARDS AND PRACTICES DEPARTMENT OF THE PATENT AND ITS OWNER.

THE USER'S ATTENTION IS CALLED TO THE POSSIBILITY THAT COMPLIANCE WITH THIS STANDARD MAY REQUIRE USE OF AN INVENTION COVERED BY PATENT RIGHTS. BY PUBLICATION OF THIS STANDARD, NO POSITION IS TAKEN WITH RESPECT TO THE VALIDITY OF THIS CLAIM OR OF ANY PATENT RIGHTS IN CONNECTION THEREWITH. THE PATENT HOLDER HAS, HOWEVER, FILED A STATEMENT OF WILLINGNESS TO GRANT A LICENSE UNDER THESE RIGHTS ON REASONABLE AND NONDISCRIMINATORY TERMS AND CONDITIONS TO APPLICANTS DESIRING TO OBTAIN SUCH A LICENSE. DETAILS MAY BE OBTAINED FROM ISA.

The following people served as members of ISA Committee SP92:

NAME	COMPANY
J. Thomason, Chairman	Omni Industrial Systems, Inc.
D. Bishop, Managing Director	Chevron Production Technology
W. Alexander	Mine Safety Appliances Company
D. Alpha	Detcon, Inc.
K. Burden	Sensidyne, Inc.
J. Chang	Motorola SPA
M. Coppler	Ametek, Inc.
T. Donkin	Enmet Corporation
C. Groppetti	Detector Electronics Corporation
B. Henderson	Chevron U.S.A. Inc.
B. Holcom	Gas Tech, Inc.
K. Johnson	KWJ Engineering, Inc.
A. Maynard	Gas Measurement Instruments Ltd.
R. Mease	City of St. Johns
*R. Menot	Factory Mutual Research Corporation
D. Mohla	Union Carbide Chemicals & Plastics
*G. Naujoks	Keithley Instruments, Inc.
B. Northam	Munro Electronics
R. Novak	Ametek, Inc.
R. Pellissier	RKI Instruments, Inc.
M. Schaeffer	Control Instruments Corporation
W. Shao	Canadian Standards Association
A. Spataru	The Adept Group, Inc.

M. Stryker
* P. Stupay
* D. Wagner
* R. Warburton

NCASI
Keithley Instruments, Inc.
Industrial Scientific Corporation
Industrial Scientific Corporation

* One vote per company

This Standard was approved for publication by the ISA Standards and Practices Board on May 30, 1998.

NAME	COMPANY
R. Webb, Vice President	Altran Corporation
H. Baumann	H. D. Baumann, Inc.
D. Bishop	Chevron Production Technology
P. Brett	Honeywell Inc.
W. Calder III	Calder Enterprises
M. Cohen	Senior Flexonics Inc.
H. Dammeyer	The Ohio State University
W. Holland	Southern Company
H. Hopkins	(Retired)
A. Iverson	Ivy Optiks
K. Lindner	Endress + Hauser GmbH
V. Maggioli	Feltronics Corporation
T. McAvinew	Instrumentation and Control Engineering LLC
A. McCauley, Jr.	Chagrin Valley Controls, Inc.
G. McFarland	Honeywell Inc.
E. Montgomery	Fluor Daniel, Inc.
D. Rapley	VECO Rapley, Inc.
R. Reimer	Rockwell Automation
J. Rennie	Factory Mutual Research Corporation
W. Weidman	Parsons Energy and Chemical Group
J. Weiss	Electric Power Research Institute
J. Whetstone	National Institute of Standards & Technology
M. Widmeyer	Carnegie-Mellon University
H. Wiegler	CANUS Corporation
C. Williams	Eastman Kodak Company
G. Wood	Graeme Wood Consulting
M. Zielinski	Fisher-Rosemount Systems, Inc.

Downloaded from https://www.industrydocuments.ucsf.edu/docs/920201



Documents
Document Sharing Hub

Content

1 Purpose.....	9
2 Scope	9
3 Definitions	10
4 General requirements.....	12
5 Construction.....	12
5.1 General.....	12
5.2 Meters, indicators, and outputs.....	13
5.3 Alarm/output function(s) (where provided)	13
5.4 Trouble signals	14
5.5 Controls and adjustments.....	14
5.6 Consumables.....	14
6 Instrument markings and instruction manuals.....	15
6.1 Markings on instruments	15
6.2 Instruction manual	16
7 Performance tests.....	17
7.1 General.....	17
7.2 Sequence of tests	18
7.3 Preparation of the instrument.....	18
7.4 Conditions for test and test area.....	18
7.5 Non-powered transportation.....	19
7.6 Drop test	19
7.7 Vibration.....	20
7.8 Initial calibration and set-up	20
7.9 Accuracy.....	21



7.10	Repeatability	21
7.11	Step change response and recovery	22
7.12	Supply voltage variation	22
7.13	Temperature variation	24
7.14	Humidity variation	25
7.15	Position sensitivity	26
7.16	Air velocity variation	26
7.17	Radio frequency interference (RFI)	27
7.18	Long-term stability	27
7.19	Battery and low-battery voltage alarm	29
7.20	Exposure to high concentration gas	30
Annex A—(Informative) References		31
Annex B—Applicability & Acceptance Criteria (Normative)		37

Copyright The Instrumentation, Systems, and Automation Society

CAUTION—EXPOSURE TO TOXIC GASES MAY BE HAZARDOUS TO HEALTH AND LIFE.

1 Purpose

1.1 This Standard provides minimum performance requirements of electrical instruments for the determination of toxic gas content in air in order to enhance the safety of personnel.

1.2 ISA-RP92.0.02, the companion Recommended Practice for this Standard, establishes user criteria for the installation, operation, and maintenance of toxic gas-detection instruments.

2 Scope

2.1 This Standard addresses the details of construction, performance, and testing of portable, mobile, and stationary electrical gas-detection instruments operating at ambient temperatures and pressures used to provide a warning of the presence of toxic gases in air. Instruments used to detect flammable (explosive) concentrations of toxic gas(es) when the LEL exceeds the TLV are excluded.

Hereafter, the term “instruments” will refer to “gas-detection instruments.”

Parts of the instruments may be installed or operated in hazardous (classified) locations.

Reference Annex B, Item 1, for applicable ranges for specific instruments.

2.2 This Standard applies to mains-connected instruments rated at 250 V nominal or less, and to portable, mobile, and stationary battery-powered instruments.

2.3 This Standard applies to instruments suitable for use in an ambient temperature range indicated in Annex B, Item 2.

2.4 This Standard addresses instruments that provide at least one detection range that includes the short-term exposure limit (STEL) as listed by the current NIOSH or ACGIH documents.

2.5 This Standard does *not* address laboratory- or scientific-type instruments used for analysis or measurement in process control and process monitoring applications, instruments intended for residential purposes, or instruments with full-scale gas concentration ranges that do not include a level covered by paragraph 2.4 above.

NOTE – The user should specify instrumentation that will provide a higher level of accuracy than the minimum tolerances of this Standard if required by the application risk.

2.6 The user should be aware of environmental effects on both the instrument and the toxic gas. The effects are not intended to be evaluated by this Standard.

3 Definitions

For the purposes of this Standard, the following definitions apply:

3.1 alarm: An audible, visual, or physical presentation designed to alert the instrument user that a specific level of gas concentration has been reached or exceeded.

3.2 alarm-only instrument: An instrument that provides alarm(s), but does not have an integral display device indicating gas concentration levels.

3.3 alarm setpoint: The selected gas concentration level(s) at which an alarm is activated.

3.4 ambient air: Air to which the sensing element is normally exposed.

3.5 calibration: The procedure to adjust the instrument for proper response (e.g., zero level, span, alarm, and range).

3.6 calibration gas: The known concentration(s) of gas used to set the instrument span or alarm level(s).

3.7 clean air: Air that is free of any substance that will adversely affect the operation of or cause a response from the instrument.

3.8 consumables: Materials or components that are depleted or require periodic replacement through normal use of the instrument.

3.9 control unit: The portion of a multi-part gas-detection instrument that is not directly responsive to the gas, but which responds to the electrical signal obtained from one or more detector heads to produce an indication, alarm, or other output function.

3.10 detector head: The gas-responsive portion of a gas-detection instrument located in the area where sensing the presence of gas is desired. Its location may be integral to or remote from its control unit.

NOTE – The detector head may incorporate the gas-sensing element and additional circuitry such as signal processing or amplifying components or circuits.

3.11 diffusion: A process by which the atmosphere being monitored is transported by natural random molecular movement to and from the gas-sensing element.

3.12 gas-detection instrument: An assembly of electrical, mechanical, and (possibly) chemical components that senses and responds to the presence of gas in air mixtures.

NOTE – For convenience, the term "instrument" is used as an abbreviation for "gas-detection instrument" within this Standard.

3.13 gas-sensing element: The particular subassembly or element in the gas-detection instrument that, in the presence of a gas, produces a change in its electrical, chemical, or physical characteristics.

3.14 IDLH (Immediately Dangerous to Life and Health): The maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing (e.g., severe eye irritation) or irreversible health effects.

3.15 mobile instrument: A continuous-monitoring instrument mounted on a vehicle, such as, but not limited to, a mining machine or industrial truck.

3.16 nominal voltage: The voltage given by manufacturers as the recommended operating voltage of their gas detection equipment. If a range (versus a specific voltage) is given, the nominal voltage shall be considered as the midpoint of the range, unless otherwise specified.

3.17 PEL (Permissible Exposure Limit): Time-weighted average (TWA) concentration that must not be exceeded during any 8-hour work shift of a 40-hour work week, as defined by the Occupational Safety and Health Administration (OSHA).

3.18 portable instrument: An instrument that is self-contained, battery-operated, transportable, and can be carried by an individual.

NOTE – This type of instrument is intended to operate continuously for 8 hours or more.

3.19 range: The values of concentrations of toxic gas over which accuracy is ensured by calibration.

3.20 sample-draw: A method to cause deliberate flow of the atmosphere being monitored to a gas-sensing element.

3.21 signal-processing detector head: An instrument intended to be incorporated with separate signal processing, data acquisition, central monitoring, or other similar systems in which the instrument provides a conditioned electronic signal or output indication to systems of the aforementioned type that typically process information from various locations and sources including, but not limited to, gas-detection instruments.

3.22 span: The algebraic difference between the upper and lower values of a range.

3.23 stationary instrument: A gas-detection instrument intended for permanent installation in a fixed location.

3.24 STEL (short-term exposure limit): A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the 8-hour TWA is within the Threshold Limit Value - Time-Weighted Average (TLV-TWA). Exposures above the TLV-TWA up to the STEL should not be longer than 15 minutes and should not occur more than 4 times per day. There should be at least 60 minutes between successive exposures in this range. An average period

other than 15 minutes may be recommended when this is warranted by observed biological effects.

3.25 test gas: Toxic gas diluted with clean air or inert gas and to a known concentration within the test gas tolerance stated in Annex B, Item 9.

3.26 TLV-TWA (Threshold Limit Value - Time-Weighted Average): The time-weighted average concentration for a normal 8-hour workday in a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

3.27 trouble signal: A signal (contact transfer or signal [visible or audible]) that alerts an instrument user to abnormal conditions such as input power failure, an open circuit breaker, a blown fuse, loss of continuity to the detector head, defective gas-sensing element, or significant downscale indication.

4 General requirements

4.1 Gas-detection instruments shall meet the applicable electrical and electronic measuring instrument requirements of ANSI/ISA-S82.01. See Annex A.

4.2 Any portion of a stationary gas-detection instrument and all portable instruments that are intended for installation or use in a hazardous (classified) location shall be suitable for use in the location. For example, refer to the *National Electrical Code*®, NFPA 70, Articles 500-505.

4.3 All toxic gas-detection instruments shall meet the minimum construction and test requirements contained in this Standard. If the manufacturer makes performance claims that exceed these requirements, all such claims shall be verified to the satisfaction of the testing laboratory.

5 Construction

5.1 General

5.1.1 Gas-detection instruments, their components, and remote detector heads specifically intended for use in the presence of corrosive vapors or gases shall be constructed of materials resistant to, or protected against, corrosion.

5.1.2 Instruments of the sample-draw type shall include the necessary sample-pumping mechanisms.