



Standard Specification for Chemical Warfare Vapor Detector (CWVD)¹

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INTRODUCTION

The primary function required for the chemical warfare vapor detector (CWVD) is as a chemical warfare agent (CWA) point detector that can be used to detect, identify, quantify, and warn personnel of the presence of vapor or gas phase CWAs. The CWVD will provide visual and audible indicators and alarms, it will display the CWA class and point concentration, and it will record and store CWA concentrations as a function of time. This information will be made available locally and for transmission to a remote location.

1. Scope

1.1 This specification covers the technical and mission requirements for the use of a CWVD and relates each of the performance and electrical shock and fire parameters to a detector requirement. Refer to **Table 1** for reference material correlation.

1.2 This specification also defines the interfaces between the CWVD, communication systems, service platforms, and power sources. Refer to **Table 1** for reference material correlation.

1.3 The CWVD will be used to sample air and report concentrations of the following nerve and blister CWAs: GA, GB, GD, GF, VX, HD, L, and HN_3 . The CWVD is required to distinguish between agent types with the exception of G type agents. The CWVD may work in conjunction with other detection devices to provide a broader range of detection and identification.

1.4 The definitions in this specification apply only to this specification and shall be the determining factor(s) when interpreting any word or combination(s) of words. Definitions for selected terms are in Section 3. The reader is strongly encouraged to review these definitions before reading the requirements section.

1.5 The values given in SI units are to be considered the standard. The values given in parentheses are for information only.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

D 543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D 2240 Test Method for Rubber Property—Durometer Hardness

2.2 Federal Standards:³

10 CFR 30 Rules of General Applicability to Domestic Licensing of Byproduct Material

10 CFR 31 General Domestic Licenses for Byproduct Material

AMCR 385-100 Army Materiel Command Regulation

AR 190-59 Chemical Agent Security Program

AR 200-2 Environmental Effects of Army Actions

AR 50-6 Chemical Surety

ATT 178 Edgewood Chemical and Biological Center, Applied Test Team - Method for Evaluating Detectors

CFR 40 Protection of Environment

49 CFR, Parts 171 -179, International Civil Aviation Organization—Technical Instructions for Safe Transportation of Dangerous Goods by Air (ICAO-TDGA)

FM 3-5 Army Study Guide - NBC Decontamination

MIL-HDBK-217F Reliability Prediction of Electronic Equipment

MIL-HDBK-781A Department of Defense Handbook for Reliability Test Methods, Plans, and Environments for Engineering, Development Qualification, and Production

MIL-STD-461E Department of Defense Interface Standard:

¹ This specification is under the jurisdiction of ASTM Committee E54 on Homeland Security Applications and is the direct responsibility of Subcommittee E54.01 on CBRNE Sensors & Detectors.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://www.dodssp.daps.mil>.

TABLE 1 Test Method Matrix

Requirement	Test Method
4.1.2 In the personal detector application (see Table 2 , which includes detector, alarm, and battery), shall weigh 5 lbs (2.25 kg) or less and be 40 in3 (655 cm3) or less in volume.	00-LC-S0314
4.1.3 In survey, fixed site, and mobile applications, shall weigh 20 lbs (9 kg) or less and be 0.5 ft3 (0.014 m3) or less in volume.	00-LC-S0315
6.1.1 Provide the functional modes described in Table 3 .	00-LC-S0315
6.1.2 Allow no more than 15 min for setup and initialization, not including establishment of communication links.	00-LC-S0316
6.1.3 Provide a confidence check for operational use.	00-LC-S0317
6.1.4 Provide a design in which the personal detector system, with or without add-on(s), can meet all other application characteristics as described in Table 2 .	00-LC-S0316
6.1.5 Operate in accordance with the characteristics described in Table 2 .	00-LC-S0317
6.2.1 Automatically and simultaneously detect, identify, and quantify chemical agent vapors by agent class of nerve, blister, and blood and identify by specific agent type (G, VX, HD, L, and HN3).	ATT 178 AR 50-6, AR 190-59
6.2.2 Detect and provide an alarm for nerve agent vapors, and blister agent vapors, within the response times at the threshold concentrations listed in Table 4 . The detection success rate shall be at least 90 % under all conditions.	ATT 178 AMCR 385-100
6.2.3 Detect and provide an alarm for nerve agent vapors, and blister agent vapors, without degradation in the presence of the interferents listed in Table 5 in accordance with Table 4 . The false positive alarm rate shall not exceed 10 %.	ATT 178 AR 200-2
6.2.4 Reject the common environmental interferents as identified in Table 5 while maintaining detection capabilities in accordance with Table 4 with a detection success rate of 90 % or more.	ATT 178 AR 50-6, AR 190-59
6.2.5 Measure agent concentration (mg/m3) throughout the concentration range listed in Table 4 . The measurement shall be within 10 % of the actual sample concentration, where the actual sample concentration is measured by independent method of at least ± 5 % accuracy.	ATT 178, MIL-HDBK-217F
6.2.6 Reset to no-alarm status (cleardown) automatically, within 2 minute, after the CWA concentration falls within the no hazard level.	ATT 178 MIL-HDBK-781A
6.3.1 Provide audible and visual alarms or trouble signals, or both, in accordance with Table 4 .	CENELEC EN ISO 3741, incl. rev. through 2002, UL 2034, §3.2, §3.15, §3.16, §60, 79.1 l), §80.1 f), §SA NFPA 72 – 02-2: 04/16/03, Chapter 7, §7.4.2, §7.4.3 ANSI/ISA S12.13.01-2002, §3.2.7.2, §3.2.7.2 UL 2034, §3.2, § 3.15, §3.16, §3.19 ATT 178
6.3.2 Display agent class, agent type, and point concentration within 5 s of an alarm. Display changes in concentration at least every 15 s while in an alarm.	UL 1638, §S11 UL 864, §3.60, §33, §39.2.5 UL 1638, §S13
6.3.3 Provide the minimum light output and flash rate for the alarm visual indicator(s) in accordance with Standard UL 1638 , Visual Signaling Appliances – Private Mode Emergency and General Utility Signaling	CENELEC EN ISO 3741, incl. rev. through 2002, UL 2034, §3.2, §3.15, §3.16, §60, 79.1 l), §80.1 f), §SA NFPA 72 – 02-2: 04/16/03, Chapter 7, §7.4.2, §7.4.3 UL 864, §39.2
6.3.4 Provide variable intensity control that produces not less than 15 candelas for all visual displays.	UL 1638.4, §13.8, §32.1 e), §33.1 e), UL 864, §3.101, §33, §34, §38.2, § 38.3, §40.3.2.12, §52, §53 UL 2034, § 4.5, §3.2, §3.5, §3.15, §3.16, §37, §SA UL 2034, §36.2, §37.3, §52, § 59
6.3.5 Provide a variable intensity audible alarm consisting of a minimum sound power of 80 dBA at 1.5 m (3 ft) with a maximum setting not to exceed 120 dBA at 1.5 m (3 ft) for the applications indicated in Table 2 .	UL 864, §54 UL 1998, §A2
6.3.6 Provide a muting capability while maintaining visual displays.	UL 2034, §79.1 b ANSI/TIA-232-F-1997 (R2002)
6.3.7 Provide an auxiliary visual indicator device capable of use in high ambient noise environments.	UL 864, §54.1.4, 54.2
6.3.8 Provide a specific audible and visual trouble signal, different from the alarm that warns the operator to a malfunction of the detector.	UL 864, §54.1.5, 54.1.6, 54.1.7 to be migrated into 00-LC-S0317 UL 864, §54
6.3.9 Provide an audible or visual low-power trouble signal, or both.	UL 864, §39
6.3.10 Provide an audible or visual trouble signal, or both, that memory is nearly full, giving operator time to download collected data or to confirm overwrite.	UL 864, §39.2.5 c) 2), §71
6.3.11 Display date/time in a standard, easily understandable format, e.g. ddmmyyy, hh:mm:ss.	00-LC-S0318
6.4.1 Provide a data port for upload or query.	UL 864, §54.2
6.4.2 Accommodate future software upgrades to improve instrument performance.	NFPA 72, clause 8.5.3.1.5 to be migrated into 00-LC-S0317
6.4.3 Provide an internal mechanism that stores and maintains data collected for 40 h of operation.	00-LC-S0317
6.4.4 Operate the data port concurrently with normal CWVD functions in the operation mode.	UL 1998
6.4.5 Provide within CWVD data stream the following information: the detector identification, detector status, agent class, agent type, agent concentration, date and time of the last reset of the CWVD, self-test and diagnostic status, memory status, and internal clock time.	UL 864, §39
6.4.6 Record the concentrations of CWAs as a function of date and time as part of the CWVD data stream.	UL 1998 UL 864, §33.2
6.4.7 Perform the following system operational functions when remotely activated through the data port: activate or deactivate audible and visual indicators, conduct self-test cycle, and reset (restart) detector and determine operating status of detector.	MIL-HDBK-217F UL 2034, §40
6.4.8 Allow data to be erased or overwritten only with confirmation. Provide security mechanism to avoid errors or loss of data.	00-LC-S0318
6.4.9 Transmit data to the data port within 5 s of alarm, if configured for real time download.	
6.5.1 Provide CWVD training features that are embedded in the CWVD and may include a self-training module that is not integral to the CWVD, for example compact disc, video, etc..	
6.5.2 When using the embedded training system, the CWVD shall allow transition between the normal operation and training modes without compromising the normal operation of the detector.	
6.5.3 When using the embedded training system while in the presence of a CWA, the CWVD shall automatically transition to the normal operational mode and properly detect, alarm, and identify the CWA.	
6.6.1 Monitor and identify 100% of mission critical failures and 80 % of noncritical failures.	
6.6.2 Provide a means to check, test, and verify that all visual and audible indicators function on demand.	
6.6.3 Provide capability to perform diagnostics on CWVD either directly or through the data port.	

TABLE 1 *Continued*

Requirement	Test Method
7.1.1 Provide a MTBOF of 750 h and a MTBHF of 2400 h for man-mounted, survey, and ground vehicle applications.	MIL-HDBK-781A
7.1.2 Provide a MTBOF of 1200 h and a MTBHF of 2400 h for fixed-site applications.	MIL-HDBK-781A
7.1.3 Mean time between false alarms (MTBFA) shall be 168 h or more.	MIL-HDBK-781A
7.2.1 Provide a design that allows basic operator level corrective maintenance to be performed in less than 30 min.	UL 2034, §13.3, §14.1.4, §14.1.5, § 56, §63, §72A.8.1, §79.1 m), Appendix E1 UL 1678.4 §2.5
7.2.2 Provide a design that uses common (standard) maintenance tools.	UL 2075, §15.6.1
7.2.3 If calibration is required, provide a design so that the time between calibrations is greater than six months.	UL 864, §56.2, §61.6.1.8, §86.5.1, § 89.1.9, §90.17
7.2.4 Provide a design so that all spare and repair parts are interchangeable between units without adjustment or modification.	MIL-HDBK-217F MIL-HDBK-781A 00-LC-S0318
7.3 Storage Maintenance—Provide a design that requires no storage maintenance.	
8.1.1 Provide a means to allow the detector to be used as a survey instrument, installed for fixed site detection, and mounted for detection on the move.	
8.1.2 In the personal application, provide a design compatible with the first responder's activities and equipment.	OSHA Technical Manual, Section VIII: Chapter 1, Chemical Protective Clothing NFPA 1981.2002, 1982.2003, 1994.2001 revisions through 2/4/04
8.2.1 Provide for an open system, industry standard, and nonproprietary interface to support remote communications.	CAN/CSA-ISO/IEC 11179 and UL 864, § 40.3.1.1 to be migrated into 00-LC-S0317, 00-LC-S0320
8.2.2 Provide security access control that identifies and authenticates with passwords, keys, or security certificates, or a combination thereof.	
8.2.3 Provide security integrity that identifies the source of data and prevents acceptance of unauthorized, modified or retransmitted messages or displays, if CWVD has capability of receiving messages/displays.	UL 864.9, §54 UL 1998, §A2
8.2.4 Provide a standard physical interface in accordance with ANSI/TIA-232-F-1997 (R2002).	
8.3.1 Provide built-in noise, over-voltage, spike suppression, and automatic system reset.	ANSI/TIA-232-F-1997 (R2002) UL 864.9, §78, §79 IEC 61000-4-3 UL 2075, §32
8.3.2 Capable of using commercially available rechargeable or non-rechargeable batteries without hardware modifications that provide 12 h of use at 15°C without replacement/recharge.	UL 1642 UL 217, §3.10, §3.11, §3.12, § 14, §15, §16, §35, §36.3, §44.7.2, §47, § 48.1, §56.2, §61.2.3, §63, §68, §69, §70.3 UL 864, §23.2, §50.3 c), §81 UL 1642, §4.3, §11 UL 864, §50.3.4, §63, §50.2.3 UL 2089
8.3.3 Provide the capability to recharge the battery when connected to an external power source.	UL 864, §50.1
8.3.4 Automatically change between external and internal power without interruption.	UL 864, §50
8.3.5 Provide a design where external power overrides internal power.	UL 864, §33.3.4 d), §51.6.3
8.4.1 Provide a design that protects controls from inadvertent activation.	
8.4.2 Provide a design so that CWVD can be installed, operated, and removed by one operator dressed in Level A ensemble.	OSHA Technical Manual, Section VIII: Chapter 1, Chemical Protective Clothing NFPA 1981.2002, 1982.2003, 1994.2001 revisions through 2/4/04
8.4.3 Provide a design such that an operator wearing a Level A ensemble can replace the power source within 5 min.	NFPA 1994.2001 revisions through 2/4/04
8.4.4 Provide displays in English and readable from 1 m away under all light conditions.	ULC-S527-99 §3.11.1.6,
9.1.1.1 Operating temperature—Operate within temperature range of -32 to 49°C.	MIL-STD-810F Methods 501.4 and MIL-STD-810F Methods 502.4
9.1.1.2 Storage temperature—Survive the stored temperature range of -39 to 71°C.	MIL-STD-810F Methods 501.4 and MIL-STD-810F Methods 502.4 UL 2034
9.1.1.3 Solar radiation—Operate while exposed to direct sunlight at 49°C.	MIL-STD-810F Method 505.4
9.1.1.4 Humidity—Operate within relative humidity range of 5 to 95 %.	UL 2034 Section §46A, §41.3
9.1.1.5 Blowing rain—Operate during and after exposure to blowing rain.	MIL-STD-810F Method 506.4
9.1.1.6 Dust—Operate during and after exposure to blown dust.	MIL-STD-810F Method 510.4
9.1.1.7 Freezing rain—Operate during and after exposure to ice buildup as a result of rain, drizzle, fog, or splash after exposed ports are freed from ice or frozen debris.	MIL-STD-810F Method 521.2
9.1.2.1 Shock	
(1) Survive a 3 foot operator drop without protection.	
(2) Survive a 4 foot transit drop while in the transport mode.	
9.1.2.2 Vibration	
(1) Operate while subject to vibration of common wheeled vehicles.	
(2) Survive loose cargo vibration profiles of common wheeled vehicles in the transport mode.	
9.1.3.1 Meet EMI requirements set forth in MIL-STD-461E excluding space systems.	MIL-STD-810F Method 516.5
9.1.3.2 Survive the lightning environment as specified in MIL-STD-464A, Section, 5.4, Table IIB, Electromagnetic Fields from Near Strike Lightning (Cloud-to-Ground).	
9.1.4 Explosive Environment	
9.1.4.1 Operate safely in an atmosphere of explosive vapors.	MIL-STD-810F Method 511.4
9.1.4.2 Operate safely in proximity to explosives/munitions.	UL 913 and UL 1203
10.1.1 Transportable by air, land, and sea without restrictions.	NFPA 70.2005, Articles 500-505
10.1.2.1 Provide a design such that the function or operation of the system components is not compromised during shipment and storage.	UL 2075, Section 29.2
10.1.2.2 If applicable, provide special packaging and handling procedures to comply with hazardous material regulatory requirements (49 CFR, Parts 171-179 and ERG2004 (IMO-IMDGC) and ESD packaging protection.	CENELEC EN 61779-1 section 4.4.14
10.1.3.1 Provide a design such that packaging materials shall not compromise the performance the CWVD by off-gassing as a result of storage and shipment conditions.	CSA C22.2 No. 152 section 6.6.2 MIL-STD-810F for "air" and "sea" references