

INCH-POUND

MIL-DTL-51193D(EA)
30 December 1996
SUPERSEDING
MIL-F-51193C(EA)
13 December 1989

DETAIL SPECIFICATION

FILTER, GAS, 10 CFM, M18A1

Inactive for new design after 28 September 1995

This specification is approved for use by the U.S. Army Edgewood Research, Development and Engineering Center, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers one type and one size of toxic gas filter.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to insure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of De-

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Technical Director, U.S. Army Edgewood Research, Development and Engineering Center, ATTN: SCBRD-ENE-S, Aberdeen Proving Ground, MD 21010-5423 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 4240

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fense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-F-46032 – Fungus-Resistant Treatment for Sandbags; Copper Processes

STANDARDS

FEDERAL

FED-STD-191 – Textile Test Methods

DEPARTMENT OF DEFENSE

MIL-STD-1168 – Ammunition Lot Numbering

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

U.S. ARMY EDGEWOOD RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

PURCHASE DESCRIPTIONS

EA-C-1704 – Carbon, Activated, Impregnated, Copper-Silver-Zinc-Molybdenum-Triethylenediamine (ASZM-TEDA)

DRAWINGS

5-19-2300 – Filter, Gas, 10 CFM, M18A1
E136-41-1755 – Tester, Filter Life, 12 CFM, Q223, Assembly

(Copies are available from Technical Director, U.S. Army Edgewood Research, Development and Engineering Center, ATTN: SCBRD-ENE-S, Aberdeen Proving Ground, MD 21010-5423.)

(Copies are available from Commander, U.S. Army Rock Island Arsenal, ATTN: SIORI-ITD, Rock Island, IL 61299-5000.)

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2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issue of the documents cited in the solicitation (see 6.2).

ASTM STANDARDS

D2867 – Standard Test Methods for Moisture in Activated Carbon

(Application for copies should be addressed to ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

AIR-CONDITIONING AND REFRIGERATION INSTITUTE

ARI STANDARD 700 – Standard for Specification for Fluorocarbons and Other Refrigerants

(Application for copies should be addressed to ARI, 4903 North Fairfax Drive, Arlington, VA 22203)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Materials. All materials cited on Drawing 5-19-2300 and on the subsidiary drawings shall conform to the specifications listed thereon or to the specific characteristics set forth on the drawings.

3.1.1 Cotton Cloth.

(a) **Mildew resistance.** The cotton cloth shall be made mildew resistant in accordance with MIL-F-46032, using Type III, method optional process except the leaching shall be omitted. No visible growth of mildew shall be evident when tested in accordance with method 5750 of FED-STD-191.

(b) **Water repellency.** The cotton cloth shall have a minimum spray rating of 50.0 when tested in accordance with 5526 of FED-STD-191.

3.1.2 Components. All components of the gas filter shall conform to the specifications and Drawing 5-19-2300 and subsidiary drawings.

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3.2 Assembly. The gas filter shall be assembled as specified on Drawing 5-19-2300.

3.3 Moisture content of gas filter. The moisture content of the filter immediately before packaging shall not exceed 3.0 percent when tested as specified in 4.3.6.3.

3.4 Air flow resistance. The air flow resistance of the filter shall not exceed 1.7 inches (43 millimeters) of water at a 10 standard cubic feet per minute (scfm) (0.75 lb/min) (340 gm/min) airflow with an air stream temperature of 21°C (70°F) and a barometric pressure of 760 millimeters (mm) Hg when tested as specified in 4.3.6.1.

3.5 Filter leakage. The filter shall not leak when a concentration of 1000 parts per million (ppm) of R-134a (1,1,1,2 Tetrafluoroethane) or R-12 (Dichlorodifluoromethane) refrigerant is introduced at the inlet of the filter at a flow rate of 2.0 scfm when tested in accordance with 4.3.6.2. The refrigerant (R-134a or R-12) shall conform to the characteristics of ARI STANDARD 700 and shall be dispersed in air at $24 \pm 3^\circ\text{C}$ ($75 \pm 5^\circ\text{F}$) and 50 percent maximum relative humidity (RH). A filter leak shall be defined as the detection of 1 ppm or more of R-134a or R-12 in the effluent air within two minutes after the introduction of the refrigerant at the inlet of the filter.

3.6 Rough handling. Sample filters shall be rough handled as specified in 4.3.6.4. Sample filters shall show no evidence of cracks, dents, or charcoal granule leakage upon visual inspection.

3.7 DMMP value (destructive). After meeting the requirements of 3.6, the filter shall have a DMMP gas life of not less than 100 minutes at rated flow (10 scfm) when subjected to a DMMP challenge of 3.0 ± 0.2 milligrams per liter with an air stream temperature of $27 \pm 5^\circ\text{C}$. Break concentration shall be 0.04 micrograms per liter. This requirement shall be met when tested in accordance with 4.3.6.5.

3.8 CK value (destructive). After meeting requirements of 3.6, the filter shall have a CK gas life of no less than 25 minutes at rated flow (10 scfm) when subjected to a CK challenge concentration of 4.0 ± 0.2 mg/l, with an air stream relative humidity of 80 ± 3 percent and air stream temperature of $24^\circ \pm 5^\circ\text{C}$. Break concentration shall be 8 micrograms per liter. Filters

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shall be equilibrated to 80 percent R.H. prior to test. This requirement shall be met when tested in accordance with 4.3.6.6.

3.9 First Article. When specified (see 6.2), a sample shall be subjected to the first article inspection in accordance with 4.2.

3.10 Workmanship. The filter shall be free from foreign matter and damage such as chipped or bent sections.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- (a) First article inspection (see 4.2)
- (b) Conformance inspection (see 4.3)

4.2 First article inspection.

4.2.1 Sample. The first article sample shall consist of 14 packaged filters manufactured using the same methods, materials, equipment, and processes as will be used during regular production. The first article sample shall be submitted for inspection and approval in accordance with the terms of the contract.

4.2.2 Inspection Procedure. As determined by the Government, the sample first article items may be subjected to any or all of the examinations and tests specified in this specification and be inspected for compliance with any or all of the requirements of the applicable drawings and special packaging instructions.

4.2.2.1 For examination. The sample filters shall be examined for all requirements of the applicable drawing and this specification.

4.2.2.2 For test. A sample of carbon shall be taken during the filling of the first, seventh and fourteenth filters and placed in an open container. Those samples of carbon shall be exposed to the same conditions of temperature and humidity as their associated filters. Each filter shall be tested for air flow resistance (4.3.6.1) and leakage (4.3.6.2). Following leakage testing, filters shall be packaged using the same methods, materials, equipment, and processes as will be used during regular production. Concurrent with or immediately following the packaging of the filters corresponding to each carbon sample, each of the three carbon samples shall be tested for moisture content in accordance with 4.3.6.3. If any carbon sample fails to meet the moisture requirement, the lot of filters represented by the sample shall be dried in accordance with 4.3.6.3, protected from moisture (e.g. repackaged), and moisture content of charcoal samples from filters shall be re-determined. The packaged sample filters shall then be forwarded to the Government, and subjected to rough handling in accordance with 4.3.6.4. Seven of the 14

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filters shall be tested by the Government in accordance with the DMMP value test (4.3.6.5) and the other seven filters shall be tested in accordance with the CK value test (4.3.6.6). Any filter failing leakage or air flow resistance requirements shall be rejected and removed from the lot. If any sample filter from the lot fails to meet the requirements for rough handling, DMMP value, or CK value, the lot represented shall be rejected.

4.2.3 Acceptance criteria. If any first article sample item fails to comply with any of the applicable requirements, the first article sample shall be rejected. The Government reserves the right to terminate inspection upon any failure to comply with any of the requirements. The contractor shall obtain written approval from the contracting activity prior to proceeding with regular production.

4.3 Conformance inspection.

4.3.1 Lotting. A lot shall consist of the filters produced by one manufacturer on one production line, from the same materials, with the same process, and without a break in production of more than 10 calendar days. However, any one lot of filters shall contain no more than one lot of carbon, and a new lot shall be started whenever any carbon filling or final assembly process equipment change is made. Each lot shall be identified and controlled in accordance with MIL-STD-1168.

4.3.2 Sampling.

4.3.2.1 For examination. Sampling of packaged filters shall be conducted in accordance with the classification of characteristics in 4.3.5 and, when specified, table I. Samples shall be selected at random.

4.3.2.2 For tests. Sample sizes for DMMP tests and for CK tests shall be as follows:

TABLE I. Sampling Plan for Filter Gas Life

Lot size	DMMP sample size	CK sample size
160 to 500	8	8
501 to 3200	13	13
3201 and higher	15	15

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4.3.3 Inspection procedure.

4.3.3.1 For examination. Sample items (filters) shall be examined and tested in accordance with the classification of characteristics in 4.3.5. Failure of any sample item to conform to any characteristic in the classification of characteristics based on the sampling and acceptance criteria specified therein shall be cause for rejection of the lot represented.

4.3.3.2 For test. A sample of carbon shall be taken during the filling of the first and last filter manufactured each day and placed in an open container. Those samples of carbon shall be exposed to the same conditions of temperature and humidity as their associated filters. Each filter shall be tested for air flow resistance (4.3.6.1) and leakage (4.3.6.2). Following leakage testing, filters shall be packaged. Concurrent with or immediately following the packaging of the filters corresponding to each carbon sample, the carbon sample shall be tested for moisture content in accordance with 4.3.6.3. If any carbon sample fails to meet the moisture requirement, the lot represented by the sample shall be dried in accordance with 4.3.6.3, protected from moisture (e.g. repackaged), and moisture content of charcoal samples from filters shall be re-determined. Packaged sample filters shall then be forwarded to the Government and subjected to rough handling in accordance with 4.3.6.4. Following rough handling, the Government shall conduct gas life tests on sample filters (see Table I) in accordance with 4.3.6.5 and 4.3.6.6. Any filter failing leakage or air flow resistance requirements shall be rejected and removed from the lot. If any sample filter from the lot fails to meet the requirements for rough handling, DMMP value, or CK value, the lot represented shall be rejected.

4.3.4 Inspection characteristics. Critical characteristics are characteristics whose nonconformance to specified requirements is likely to result in hazardous or unsafe conditions for individuals using, maintaining, or depending upon the product or whose nonconformance to specified requirements is likely to prevent performance of the tactical function of a major end item. Major characteristics are characteristics whose nonconformance to specified requirements is likely to result in failure or to reduce materially the usability of the item for its intended purpose. Minor characteristics are characteristics whose nonconformance to specified requirements is not likely to reduce materially the operation or usability of the item for its intended purpose.

4.3.5 Classification of characteristics. Conformance examinations and tests shall be as specified in the following classification of characteristics paragraphs. When specified herein, accept on 0 and reject on 1 attributes sampling inspection shall be performed on the designated characteristics using the stated levels in table II for selection of sample sizes.

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TABLE II. Sampling

Lot size	Inspection levels and sample sizes										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
2 to 8	*	*	*	*	*	*	*	*	5	3	2
9 to 15	*	*	*	*	*	*	13	8	5	3	2
16 to 25	*	*	*	*	*	20	13	8	5	3	3
26 to 50	*	*	*	*	32	20	13	8	5	5	5
51 to 90	*	*	*	50	32	20	13	8	7	6	5
91 to 150	*	*	125	50	32	20	13	12	11	7	6
151 to 280	*	*	125	50	32	20	20	19	13	10	7
281 to 500	*	315	125	50	48	47	29	21	16	11	9
501 to 1200	*	315	125	75	73	47	34	27	19	15	11
1201 to 3200	1250	315	125	116	73	53	42	35	23	18	13
3201 to 10000	1250	315	192	116	86	68	50	38	29	22	15
10001 to 35000	1250	315	294	135	108	77	60	46	35	29	15
35001 to 150000	1250	490	294	170	123	96	74	56	40	29	15
150001 to 500000	1250	715	345	200	156	119	90	64	40	29	15
500001 and over	1250	715	435	244	189	143	102	64	40	29	15

*Indicates one hundred percent inspection. If sample size exceeds lot size, perform one hundred percent inspection.

Accept the lot represented on zero nonconforming characteristics and reject the lot represented on one or more nonconforming characteristics for all inspection levels.

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CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE	SHEET 1 OF 1		DRAWING NUMBER
4.3.5	Filter, gas, 10 cfm, M18A1			5-19-2300
CATEGORY	CHARACTERISTIC	SAMPLING AND ACCEPTANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD
Critical				
1	Leakage	100 percent inspection	3.5	4.3.6.2
Major				
101	Air flow resistance	100 percent inspection	3.4	4.3.6.1
102	Components and materials correct	Table II, level VII	3.1.	VI
103	Components correctly assembled	Table II, level VII	3.2	VI
104	Overall dimensions correct	Table II, level VII	3.1	CE
105	Workmanship	Table II, level VII	3.10	VI
Minor				
201	Marking correct and legible	Table II, level IX	3.1	VI
202	Protective finish correct	Table II, level IX	3.1	VI
NOTES:				
CE – Commercial inspection equipment VI – Visual inspection				

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4.3.6 Tests.

4.3.6.1 Air flow resistance. The pressure drop across the filter shall be in accordance with 3.4 and shall be determined at the rated air flow. The up- and down-stream static pressure measuring tubes shall be as close as possible to the filter and shall not be on a section of duct that has a changing cross sectional area. Test for air flow resistance as follows:

- (a) Connect the filter to a source of forced air.
- (b) Set the flow of air through the filter to 10 scfm
- (c) Record the barometric pressure.
- (d) Measure and record the air stream temperature.
- (e) Determine and record the difference in static pressure head up-stream of the filter to that down-stream of the filter. NOTE: If using test parameters different than those stated in 3.4, calculate and record the air flow resistance $\Delta P(\text{cal})$ using the equation below to correct test measurements to standard conditions.

$$\Delta P(\text{cal}) = \frac{P(\text{test}) \times \Delta P(\text{measured}) \times 86.2}{(460 + T)^{1.768}}$$

$\Delta P(\text{cal})$ – Air flow resistance corrected to standard conditions in inches of water gage (iwg)

$P(\text{test})$ – Barometric pressure at time of test in mm Hg

$\Delta P(\text{measured})$ – Value recorded from test measurement (iwg)

T – Temperature of air stream flowing through filter in degrees F

If $\Delta P(\text{cal})$ is more than the air flow resistance stated in 3.4, the filter shall be rejected.

4.3.6.2 Leakage. Position the filter to be tested rigidly with the long axis in the vertical position. Connect the filter to a source of forced air and place a mixing chamber at the influent side of the filter. Regulate the air flow from the blower to 2.0 scfm. Introduce R-134a or R-12 into the intake of the blower; monitor and maintain a concentration of 1000 ppm by volume of R-134a or R-12 in air at an air flow of 2.0 scfm on the influent side of the filter at the proper temperature and relative humidity for the specified period of time (see 3.5). Leakage shall be in accordance with 3.5 and shall be determined using a suitable leak detector (see 6.5) for sampling and detecting R-134a or R-12 at the effluent side of the filter. Purge the filter by passing fresh air in the reverse direction of that indicated above through the filter at 10 scfm for 1 minute. Keep the exposure of the filter to air to a minimum. The air flow time for leakage should not exceed 3 minutes.

4.3.6.3 Moisture content of gas filter. The filters shall meet the moisture content specified in 3.3 when the moisture content of the carbon is determined in accordance with ASTM D 2867,

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Oven-Drying Test Method, except that the oven temperature shall be 103°–107°C and the drying time shall be 3 hours. If the moisture content of the carbon exceeds the requirement, the filters represented by the samples shall be considered unacceptable. Filters not meeting the moisture requirement shall be dried by passing contaminant free air at a temperature not to exceed 100°C through the filters. After drying, two filters shall be chosen at random and disassembled. The moisture content of the carbon from these filters shall be redetermined in accordance with ASTM D 2867, Oven-Drying Test Method, except that the oven temperature shall be 103°–107°C and the drying time shall be 3 hours.

4.3.6.4 Rough handling. Each sample unpackaged filter shall be positioned and clamped on a steel movable plate. The plate shall measure 30 by 30 inches and have a total weight of 240 ± 20 pounds including the holding clamps. When the filter is securely clamped in place, there shall be no distortion of the frame or body of the filter. The steel movable plate and filter shall be raised and let fall (free) $3/4 \pm 1/8$ inch onto a steel base plate at the rate of 200 drops per minute for 15 ± 0.1 minutes. The steel base plate shall be part of the apparatus and shall be firmly anchored to a concrete floor capable of absorbing the impact of the vertical vibrations. The test shall be performed at a room temperature of 70 ± 25 F. Throughout the test the filter shall remain in a firm position. Filters may be padded or blocked where clamps press against the side or top of the frame, but not the bottom, to prevent distortion of the filter. The movable steel plate must be parallel to the base plate at all times.

4.3.6.5 DMMP value (destructive). The DMMP value shall be determined by the Government laboratory in accordance with 3.7 using the Q223 tester (Drawing 136-41-1755).

4.3.6.6 CK value (destructive). The CK value shall be determined by the Government laboratory in accordance with 3.8 using the Q223 tester.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The gas filter covered by this specification is intended to be used as a component of NBC filtration systems in military vehicles.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of this specification.
- (b) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1).
- (c) First article:
 - (1) Time allowed for contractor submission of samples for Government test and evaluation after award of contract when testing is performed by the Government.
 - (2) Name and address of test facility and shipping instructions when testing is performed by the Government.
 - (3) Time required for the Government to notify the contractor whether or not to proceed with production.
- (d) Packaging requirements.
- (e) Additional identification or marking requirements, if required, must be in the contract and cite the identification method and responsibility for the items affected, such as test units, components, serial numbers, Julian date, lot numbers, etc.

6.3 DMMP value and CK value tests. Samples for these tests shall be forwarded by the contractor, together with DD Form 1222, to Director, U.S. Army Edgewood, Research, Development and Engineering Center, ATTN: SCBRD-ENM-N, Building E5165, Aberdeen Proving Ground, MD 21010-5423.

6.4 Submission of alternative inspection provisions. Proposed alternative inspection provisions should be submitted by the contractor to the procuring contracting officer for evaluation and approval by the technical activity responsible for preparation of this specification.

6.5 Leakage detector. The halide leak detector, model F1000, manufactured by Nuclear Consulting Services, Inc. has been found suitable for this purpose. When using this detector, the presence of high vapor pressure halogenated contaminants in the refrigerant could interfere with the filter leak test, resulting in false indications of filter leakage. Should false leakage in-

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dications be suspected, the refrigerant should be checked for the presence of such contaminants.

6.6 Changes from previous issues. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

6.7 Subject term (key word) listing.

CK (cyanogen chloride)
DMMP
Filtered air
Gas filter
R-12 (dichlorodifluoromethane)
R-134a (1,1,1,2 tetrafluoroethane)
Toxic gas filter

Custodian:

Army - EA

Preparing activity:

Army - EA

Project No. 4240-A223