INCH–POUND

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15 December 2004

SUPERSEDING
MIL–F–51525A(EA)
15 July 1996

PERFORMANCE SPECIFICATION

FILTER, GAS, 200 CFM, M98

Reactivated for New Design after 13 March 2000

This specification is approved for use by the U.S. Army Edgewood Chemical Biological 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 of gas filter rated at 200 standard cubic feet per minute (scfm) for use in a gas-particulate filter set (see 6.1).

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.

Comments, suggestions, or questions on this document should be addressed to: U.S. Army Edgewood Chemical Biological Center, ATTN: AMSRD–ECB–ENA–S, 5183 Blackhawk Road, Aberdeen Proving Ground, MD 21010–5424 or emailed to SpecsTeam@apgea.army.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

AMSC N/A FSC 4240

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following Government documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL−DTL−32101	–	Carbon, Activated, Impregnated, Copper-Silver-Zinc-Molybdenum-Triethylenediamine (ASZM-TEDA)
MIL-S-901	–	Shock Test, High-Impact Shipboard Machinery, Equipment, and Systems, Requirements for

DEPARTMENT OF DEFENSE STANDARDS

MIL−STD−130	–	Identification Marking of U.S. Military Property
MIL−STD−167−1	–	Mechanical Vibrations of Shipboard Equipment
MIL−STD−282	–	Military Standard, Filter Units, Protective Clothing, Gas−Mask Components and Related Products: Performance Test Methods
MIL−STD−810	–	Environmental Engineering Considerations and Laboratory Tests
MIL−STD−1168	–	Ammunition Lot Numbering and Ammunition Data Cards

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch or 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 or contract.

U.S. ARMY EDGEWOOD CHEMICAL BIOLOGICAL CENTER

Drawing 5−19−6120	–	Housing, Gas−Particulate Filter, 1 Filter
Drawing 5−19−6121	–	Housing, Gas−Particulate Filter, 2 Filter
Drawing 5−19−12983	–	Housing, NBC Filter, 200 CFM

(Copies are available from U.S. Army Edgewood Chemical Biological Center, ATTN: AMSRD−ECB−ENA−D, 5183 Blackhawk Road, Aberdeen Proving Ground, MD 21010−5424.)

NAVAL SEA COMMAND

Drawing 53711−6263500 – Filter System, CPS

SS200−AG−MMM−010 – Navy Shipboard Collective Protection System (CPS) Technical Manual, CBR Filter System Operation and Maintenance

(Copies are available from Naval Surface Warfare Center Dahlgren Division, 17320 Dahlgren Road, Code G52, Dahlgren, VA 22448−5100.)

CODE OF FEDERAL REGULATIONS

40 CFR Part 261 – Identification and Listing of Hazardous Waste

(Copies are available from the U.S. Government Printing Office, Washington, DC 20402 or http://www.access.gpo.gov.)

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 these documents are those cited in the solicitation or contract.

AIR−CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 700 – Specifications for Fluorocarbon and Other Refrigerants

(Copies are available from ARI, 4100 N. Fairfax Dr., Suite 200, Arlington, VA 22203 or http://www.ari.org).

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

Publication – Threshold Limit Values and Biological Exposure Indices

(Copies are available from ACGIH, 1330 Kemper Meadow Dr., Suite 600, Cincinnati, OH 45240 or http://www.acgih.org.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 209 – Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate

ASTM D 1056 – Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber

ASTM D 2867 – Moisture in Activated Carbon

(Copies are available from www.astm.org or ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428−2959.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3195 – Silicone Rubber Sponge, Closed Cell, Medium

(Copies are available from SAE, 400 Commonwealth Dr., Warrendale, PA 15096 or http://www.sae.org.)

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

3.2 Interface requirements.

3.2.1 Size and shape. Each gas filter shall be cylindrical in form. The filter shall be of a size that easily fits inside the intended filter housings (Drawings 5−19−6120, 5−19−6121, and 53711−6263500) and can be removed without damage. The filter shall conform to the interface dimensions in Figure 1. Each end of the filter or end cover shall contain one groove for gasket location. The gasket shall be grade number 2C1 of ASTM D1056 or silicone rubber per SAE−AMS−3195, be seamless, and have a thickness of 0.31 in. The gasket shall be permanently attached to the filter with an adhesive.

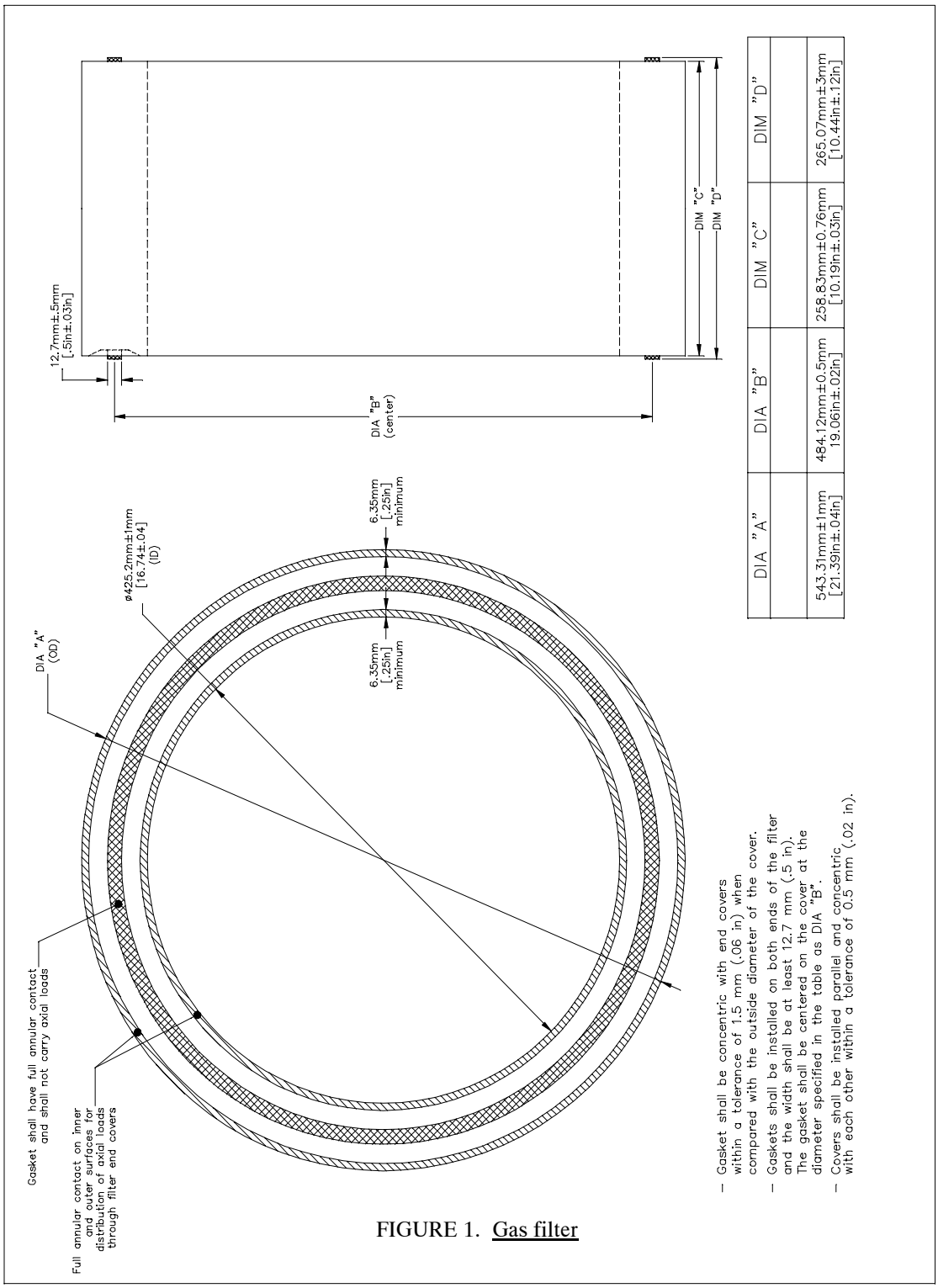

FIGURE 1. Gas filter

3.2.2 Weight. The weight of gas filter shall be no greater than 37 pounds while unpackaged.

3.2.3 Interchangeability. Each gas filter and any associated gasket shall be individually interchangeable (replaceable) by one of similar form, fit and function without modification of the filter housing.

3.3 Operating requirements.

3.3.1 Airflow resistance. The airflow resistance (pressure drop) of the filter shall not exceed 4.5 inches of water gage (iwg) at the rated airflow of 200 scfm. Standard conditions is defined as an airstream temperature of 70°F and a barometric pressure of 760 millimeters (mm) Hg.

3.3.2 Leakage. The gas filter shall not leak when a concentration of 1000 parts per million (ppm) of R−134a (1,1,1,2) tetrafluoroethane refrigerant is introduced at the filter inlet.

3.3.3 CK gas life. Each carbon adsorbent sample obtained from the filling process of the filter shall have a cyanogen chloride (CK) life of no less than that specified in MIL−DTL−32101 for unaged carbon.

3.3.4 DMMP gas life. Following filter rough handling, the dimethyl methylphosphonate (DMMP) gas life shall be as follows when the influent concentration is 5000 mg/m^3 at rated flow:

(a) The mean DMMP gas life minus 1.6 times the standard deviation of the filters shall be no less than 70 minutes.

(b) No individual sample filter shall have a DMMP gas life of less than 60 minutes (see 6.9).

3.3.5 Adsorbent media. The adsorbent media shall meet the requirements in MIL−DTL−32101 for ASZM−TEDA carbon.

3.4 Environmental requirements.

3.4.1 Hot/cold temperature. After temperature conditioning at −50 and 160°F, the gas filter shall show no ignition or structural damage, and shall pass airflow resistance (3.3.1) and DMMP gas life (3.3.4) requirements.

3.4.2 Structural integrity.

3.4.2.1 Structural deformation. The gas filter shall be capable of withstanding repeated applications of a quasi−static mechanical load of 2,900 pounds in the axial direction. Each gasket shall not become dislodged from the filter by the process of loading a filter into a housing and removing it. After load testing, the filter shall pass airflow resistance (3.3.1) and DMMP gas life (3.3.4) requirements.

3.4.2.2 Shock. After shock treatment, the gas filter shall pass the DMMP gas life requirement (3.3.4).

3.4.2.3 Vibration. After sinusoidal vibration between 4 and 50 Hz, the gas filter shall pass the DMMP gas life requirement (3.3.4).

3.4.2.4 Rough handling. After rough handling, consisting of two hundred 3/4−inch drops per minute for 15 minutes, the gas filter show no evidence of cracks or dents, and shall pass airflow resistance (3.3.1) and DMMP life (3.3.4) requirements.

3.4.3 Fungus. The materials of construction, except for ASZM−TEDA carbon, shall not support fungus and mildew growth beyond trace levels.

3.4.4 Corrosion. Any construction material shall resist salt fog corrosion to an extent equal or greater than anodized aluminum when the aluminum alloy number is in the 3000 to 5000 series of ASTM B 209.

3.5 Ownership and support requirements.

3.5.1 Shelf life. Filter shelf life shall be at least 5 years (extendable) (see 6.8). Shelf life is the maximum time an item may be in sheltered storage within its packaging and still remain fit for use.

3.5.2 Moisture content. Prior to packaging the filter in a sealed container, the moisture content of the carbon shall not exceed 3.0 percent by weight to enhance shelf life.

3.5.3 Safety, health, environment.

3.5.3.1 Materials. The materials of construction shall be non−toxic, non−hazardous, and non−carcinogenic. They shall not be capable of having any adverse effects on human health during normal use. If special use conditions create a health hazard potential, the equipment shall have appropriate hazard warning labels in accordance with 29 CFR 1910.1200.

3.5.3.2 Particulate emissions. The filter shall pose no potential inhalation hazard to the user, and whose normal use will not exceed the lower of (a) 8−hour time weighted average Threshold Limit Values (TLVs) published by the American Conference of Governmental Industrial Hygienists (ACGIH), or (b) 8−hour time weighted average Permissible Exposure Limits (PELs) regulated by Occupational Safety and Health Administration (OSHA) and found in Material Safety Data Sheets (MSDS) (see 6.7).

3.5.3.3 Odors. When air is forced through the filter at 200 scfm, it shall not emit an irritating level of particulate emissions or obnoxious odors.

3.5.3.4 Hazardous waste. At the time of disposal, uncontaminated filters (including any coatings) shall not be a Resource Conservation Recovery Act hazardous waste according to characteristics cited in 40 CFR 261.21−261.24 and shall not be listed as specific hazardous waste chemicals in 40 CFR 261.33(e) and (f).

3.5.3.5 Sharp edges. Filters shall be free from burrs and sharp edges that might injure personnel, damage filter media, or damage Mission Oriented Protective Posture (MOPP) IV gloves during handling.

3.5.4 Identification markings. All markings shall be accessible, legible and permanent.

(a) The filter shall contain markings on the outside surface which include the name "FILTER, GAS, 200 CFM", contract number, lot number, serial number, national stock number, cage code, manufacturer's name, and manufacture date. Letters shall be at least 0.2 inch high.

(b) The filter shall also contain a barcode from which the following may be read: name, contract number, lot number, serial number, national stock number, cage code, manufacturer's part number, manufacture date, expiration date, and measured airflow resistance and penetration percent. Barcode dimensions and characteristics shall comply with MIL−STD−130.

3.5.5 Workmanship.

(a) The filters shall be free from foreign matter (dirt, oil, or viscous materials).

(b) The filter units shall be free from cracked, bent, or dented metal sections, and abraded gaskets.

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 19 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 Inspections to be performed. Unless otherwise specified by the terms of the contract, the sample first article items shall be subjected to all of the verifications specified in this specification. Verification of requirements shall be by examination, (examination includes visual inspection with or without simple commercial measuring devices), demonstration, test data, or by Certificate of Compliance (COC) with analysis or supporting evidence. The Government reserves the right to accept or reject each COC. First article filters shall be inspected according to Figure 2, or as determined by the Government (see 6.2). Each filter shall be examined for interface characteristics, identification markings, workmanship, and safety hazards. Each filter

shall then be tested for airflow resistance and leakage. Following airflow resistance, leakage testing of sample filters, and moisture content testing of adsorbent material, sample filters shall be packaged using the same methods, materials, equipment, and processes as will be used during regular production. Packaged filters shall then be forwarded to the Government for rough handling and additional tests. Any packaged sample filters forwarded to the Government shall be protected from moisture in the air. Requirements and verification methods are cross referenced in Table I.

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.

TABLE I. First article inspection

Description	Requirement Paragraph	Verification Paragraph
Interface requirements	3.2	4.4.1
Size and shape	3.2.1	4.4.1.1
Weight	3.2.2	4.4.1.2
Interchangeability	3.2.3	4.4.1.3
Operating requirements	3.3	4.4.2
Airflow resistance	3.3.1	4.4.2.1
Leakage	3.3.2	4.4.2.2
CK gas life	3.3.3	4.4.2.3
DMMP gas life	3.3.4	4.4.2.4
Environmental requirements	3.4	4.4.3
Hot/cold temperature	3.4.1	4.4.3.1
Structural integrity	3.4.2	4.4.3.2
Structural deformation	3.4.2.1	4.4.3.2.1
Shock	3.4.2.2	4.4.3.2.2
Vibration	3.4.2.3	4.4.3.2.3
Rough handling	3.4.2.4	4.4.3.2.4
Fungus	3.4.3	4.4.3.3
Corrosion	3.4.4	4.4.3.4
Ownership and support	3.5	4.4.4
Shelf life	3.5.1	4.4.4.1
Moisture content	3.5.2	4.4.4.2
Safety, health, environment	3.5.3	4.4.4.3
Identification markings	3.5.4	4.4.4.4
Workmanship	3.5.5	4.4.4.5

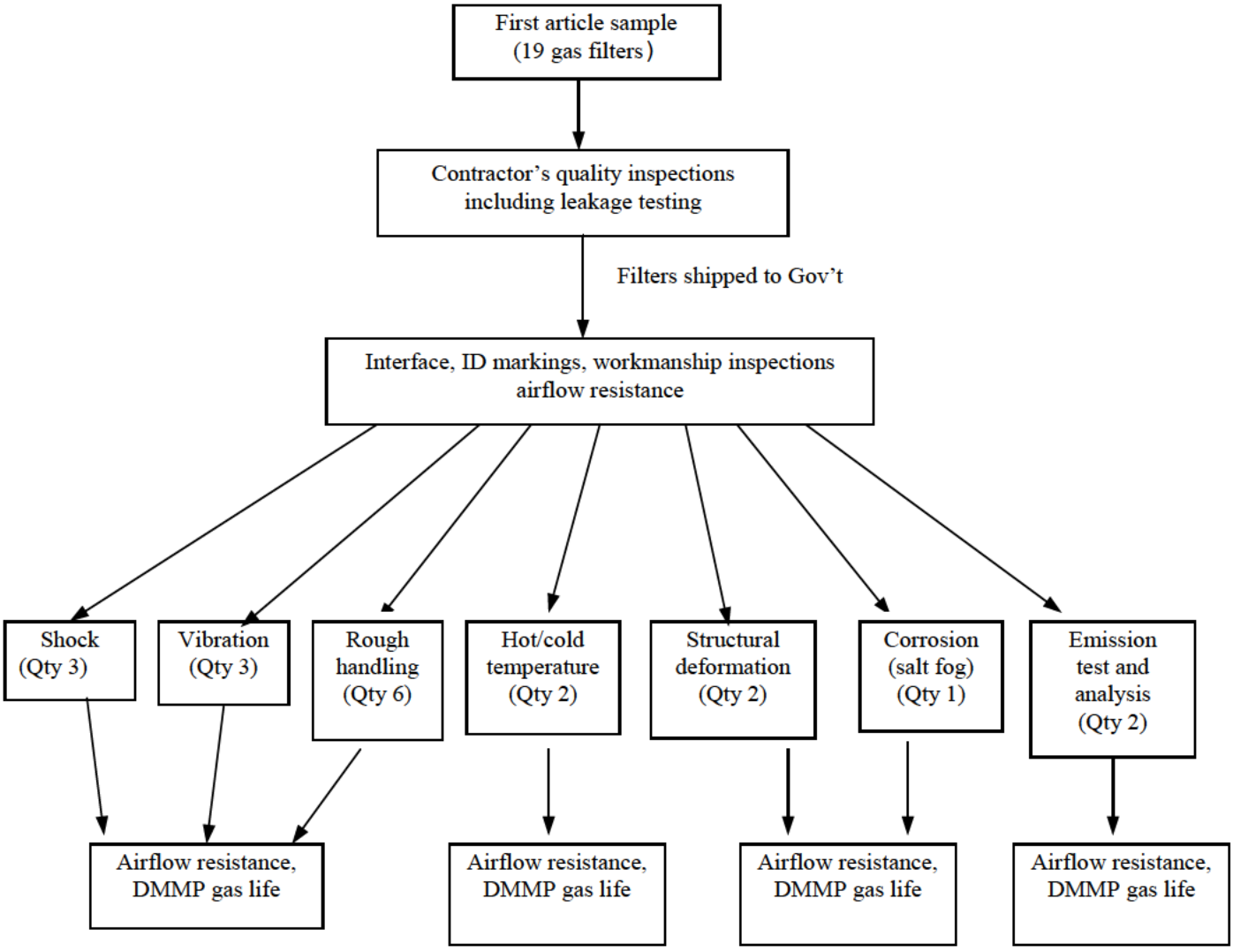

FIGURE 2. First article inspection sequence

4.3 Conformance inspection.

4.3.1 Lotting. A lot shall consist of gas filters produced by one manufacturer at one plant, from the same materials, by the same process, and without a break in production of more than 10 calendar days. Any one lot of gas filters shall contain no more than one lot of adsorbent media. Each lot shall be identified and controlled in accordance with MIL−STD−1168.

4.3.2 Sampling. Inspection and test of random samples shall be conducted in accordance with the classification of characteristics in 4.3.5, and when specified in Table II.

4.3.3 Inspection procedure. Every item in the lot shall be inspected for critical characteristics. Sample filters shall be examined and tested in accordance with the classification of characteristics in 4.3.5. If a filter is found that does not conform to any characteristic inspected 100%, such as leakage and pressure drop requirements, the non−conforming filter shall be rejected and removed from the lot. For characteristics other than leakage and pressure drop, failure of any sample filter 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 (see footnote, Table II).

4.3.3.1 Filter inspection. Each gas filter shall be examined for identification markings, workmanship, and safety hazards. Each gas filter shall then be tested for airflow resistance and leakage. Following leakage, airflow resistance, and moisture content testing, sample filters shall be packaged using the same methods, materials, equipment, and processes as will be used during regular production and then forwarded to the Government for additional inspection (see 4.3.5 and table III, classification of characteristics). Any sample filters forwarded to the Government for testing shall be packaged such they will be protected from moisture in the air.

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 who use or maintain the product. Characteristics whose nonconformance to specified requirements is likely to prevent performance of the tactical function of a major end item are also critical characteristics. 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 Table III. 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.

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.

TABLE III. Classification of characteristics

PARAGRAPH	TITLE	SHEET 1 OF 1	DRAWING NUMBER
4.3.5	Filter, Gas, 200 CFM		NEXT HIGHER ASSY

CATEGORY	CHARACTERISTIC	SAMPLING AND ACCEPTANCE CRITERIA	REQUIREMENT PARAGRAPH	INSPECTION METHOD
Critical				
1	Leakage	100 percent	3.3.2	4.4.2.2
2	CK gas life	See 4.4.2.3.2	3.3.3	4.4.2.3.2
3	DMMP gas life	Table II, level XI*	3.3.4	4.4.2.4
Major				
101	Airflow resistance	100 percent	3.3.1	4.4.2.1
102	Moisture content	See 4.4.4.2.2	3.5.2	4.4.4.2.2
Minor				
201	Identification markings	Table II, level VII	3.5.4	4.4.4.4
202	Workmanship	Table II, level VII	3.5.5	4.4.4.5

NOTES:

* Except no lower than five samples.

4.4 Verification methods and procedures.

4.4.1 Interface verification.

4.4.1.1 Size and shape. Verify by examination and measurement using commercial inspection equipment.

4.4.1.2 Weight. Verify by examination and measurement using commercial inspection equipment.

4.4.1.3 Interchangeability. Verify by certification and analysis of filter design and surrounding interfacing hardware.

4.4.2 Operating verification.

4.4.2.1 Airflow resistance. The airflow resistance shall be determined at the rated airflow of 200 scfm. (Air shall flow through the filter radially outward). The measured pressure drop across the filter, when corrected to standard conditions of 70˚F and 1 atm (760 mm Hg), shall be no greater than that specified in 3.3.1. The up−stream 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 airflow resistance as follows:

(a) Connect the filter to a source of forced air.
(b) Set the flow of air through the filter to 200 cfm.
(c) Record the barometric pressure.
(d) Measure and record the air stream temperature. This temperature should be no higher than 125˚F.
(e) Determine and record the difference between up-stream and downstream static pressure.

If the recorded air stream temperature and barometric pressure is different than 70˚F and 1 atm (760 mm Hg), calculate and record the air flow resistance (ΔP (cal)) using the equation below to correct the measured airflow resistance to airflow resistance at standard conditions:

$$\Delta P\ (cal) = \Delta P\ (measured) \times P\ (test) \times 86.21 / [(460 + T)^{1.768}]$$

where:

ΔP (cal) – air flow resistance corrected to standard conditions in inches of water gage (iwg)
P (test) – barometric pressure at time of test in millimeters of mercury (mm Hg)
ΔP (measured) – air flow resistance from test measurement in iwg
T – temperature of air stream flowing through the filter in degrees F

Note: Correction for nonstandard conditions is not required when it is clear that the passage or failure of the filter is not in doubt.

4.4.2.2 Leakage. Rigidly position the sample gas filter in the test fixture. Orient the filter in the fixture with the cylindrical axis in the horizontal direction and end faces in the vertical direction. Use R−134a refrigerant that conforms to the characteristics of ARI STANDARD 700. Connect the filter to a source of forced air and place a mixing chamber at the influent side. Regulate the flow of air from the blower to $1/5^{th}$ the rated airflow of the filter (40 cfm). Introduce R−134a into the intake of the blower; monitor and maintain a concentration of 1000 ppm by volume of R−134a in airflow of 40 cfm on the influent side of the filter at 75 ±9°F and relative humidity of no higher than 50 percent. Leakage shall be determined using a suitable leak detector (see 6.5) for sampling and detecting R−134a at the effluent side of the filter. Monitor the effluent airstream for at least 2 minutes and record the highest effluent penetration percent during that period. Determine whether the effluent concentration exceeds 1 ppm {.5 ppm} within 2 minutes after the introduction of the refrigerant at the inlet of the filter. Purge the filter by passing clean air in the reverse direction through the filter at rated flow for 3 minutes. Keep the exposure of the filter to air to a minimum.

4.4.2.3 CK gas life. Verify by sampling and testing as described below.

4.4.2.3.1 First article. A sample of adsorbent shall be taken during the filling of each of 8 first article filters, placed in an open container, and exposed to the same conditions of temperature and humidity as its associated filter. Each adsorbent sample taken during the filling of those filters shall weigh at least 100 grams (0.22 pounds). The 8 samples shall then be sealed in their containers and sent to the Government. At least 4 of the samples shall be tested for CK life. Perform CK life testing on each unaged carbon sample placed in tubes in accordance with procedures, conditions and parameters in MIL−DTL−32101. Compare CK gas life of each individual specimen and their average value against the required values specified in MIL−DTL−32101.

4.4.2.3.2 Conformance. For each lot, 8 samples of adsorbent, each sample weighing at least 100 grams, shall be taken at random times during the filling of 8 respective filters and placed in an open container. Those samples shall be exposed to the same conditions of temperature and humidity as their associated filters. The 8 samples shall then be sealed in their containers and sent to the Government. At least 4 of the samples shall be tested for CK life. Compare CK gas life of each individual specimen and their average value against the required values specified in MIL−DTL−32101.

4.4.2.4 DMMP gas life. After filters have been rough handled or exposed to shock and vibration (see figure 2), they shall be tested for airflow resistance and DMMP gas life. Test for DMMP gas life as follows:

(a) Place the test filter in the test apparatus with the filter in its normal service orientation (cylindrical axis in the horizontal position). Switch airflow control to the “purge” mode and pass

200 scfm of clean, 125°F air through the test filter for approximately 30 minutes or until effluent conditions are stable.

(b) Start DMMP test. Switch airflow control to "test" mode, turn DMMP pump on (pump control pre−set to 5 mg/l) and start timer. Airflow and temperature should be automatically controlled within ±5%.

(c) Determine the DMMP gas life (the total time from the start of the DMMP challenge until the breakthrough concentration is reached) of the filter at the following test conditions:

Airflow rate: 200 scfm
Challenge concentration* of DMMP: 5000±400 mg/m^3
Breakthrough concentration of DMMP: 0.04 mg/m^3
Relative humidity: less than or equal to 50%
Airstream and filter temperature: 120±5°F

*The DMMP challenge concentration in the air shall be monitored to ensure uniform mixing of the DMMP vapor with the air once it reaches the test item.

(d) While the challenge concentration is permitted to vary within the stated range during the course of the test, the breakthrough time measured must be normalized to the 5000 mg/m^3 concentration by the following calculation:

$$\text{Corrected breakthrough time} = \text{Measured breakthrough time} * \text{Average concentration during test} \div 5000\ \text{mg/m}^3$$

4.4.2.5 Adsorbent media. Verify adsorbent media complies with all of the physical and chemical characteristics in MIL−DTL−32101 by testing according to that specification.

4.4.3 Environmental verification.

4.4.3.1 Hot/cold temperature. Condition two filters for 8 hours at −50°F in an environmental chamber. Remove filters from chamber and examine them for damage at room temperature. When temperature of filters returns to 70 ±10 °F, check airflow resistance. Then, condition two filters for one week at 160°F in an environmental chamber. Remove filters from chamber and examine them for damage at room temperature. When temperature of filters returns to 70 ±10 °F, check airflow resistance and DMMP gas life.

4.4.3.2 Structural integrity.

4.4.3.2.1 Structural deformation. The gas filter shall be subjected to a quasi−static mechanical load of 2900 pounds in the axial direction for 3 cycles of one minute per cycle. Then test filters for airflow resistance and DMMP gas life.

4.4.3.2.2 Shock. Shock testing shall be performed on gas filters when gas−particulate filter sets are fully loaded in the U.S. Navy CPS Filter System (53711−6263500). The CPS system has a flow capacity of 600 cfm. Filters shall be installed in accordance with the operation and maintenance manual, SS200−AG−MMM−010. The filter housing shall be filled to capacity. The filter system (housing with gas−particulate filter sets) shall be shock tested per MIL−S−901 using an approved mounting fixture. Shock test procedures shall be based on Class I (no resilient mountings), Type B (subsidiary component), and medium weight category defined in MIL−S−901.

4.4.3.2.3 Vibration. Vibration testing shall be performed on gas filters when gas−particulate filter sets are loaded in the U.S. Navy CPS Filter System (53711−6263500). The CPS system has a flow capacity of 600 cfm. Filters shall be installed in accordance with the operation and maintenance manual, SS200−AG−MMM−010. The filter housing shall be filled to capacity. The filter system (housing with gas−particulate filter sets) shall be vibration tested per MIL−STD−167−1 using an approved mounting fixture. Test procedure shall be based on MIL−STD−167−1, Type I− Environmental Vibration, 4 Hz to 50 Hz, and consist of 3 parts : (1) Exploratory test to determine resonances (2) Variable frequency test (4 to 50 Hz with 5 minute dwell time per hertz), and (3) Two−hour endurance test for each of the 3 orthogonal axes.

4.4.3.2.4 Rough handling. Perform rough handling testing on gas filters that have not previously undergone shock and vibration testing. All sample filters shall be mounted with the cylindrical axis in a vertical orientation and parallel to the direction of movement. No filter shall be allowed to touch any other filter. Filters shall be rough handled in accordance with Method 105.11 of MIL−STD−282. The rough handling shall consist of 200 3/4−inch drops per minute for 15 minutes. Following rough handling, examine bottom plate and surrounding area for evidence of carbon dust, and test for airflow resistance and DMMP gas life.

4.4.3.3 Fungus. Verify, if possible, by analysis of technical documentation such as specifications, design data, existing test reports, and operating experience. Otherwise, verify requirement by performing a fungus test in accordance with Method 508.5 of MIL−STD−810.

4.4.3.4 Resistance to corrosion. The manufacturer shall provide objective evidence and certify that any metallic construction materials will resist corrosion to an extent equal or greater than anodized aluminum or aluminum alloys in the 3000 to 5000 series of ASTM B 209. Objective evidence includes test data or past service life data. If objective evidence does not exist or is disapproved by the Government, perform the following tests: conduct salt fog testing in accordance with Method 509.3 of MIL−STD−810 except the total duration shall be 20 days corresponding to five 96−hour exposure cycles. Each 96−hour exposure cycle is defined as 48 hours of salt fog challenge followed by 48 hours of storage at ambient laboratory conditions with no salt fog challenge. After the five 96−hour exposure cycles, rinse the external surfaces with clear water if desired, dry, install/remove the filter in its housing, and inspect filter for evidence of damage and corrosion. If there is evidence of corrosion, test each gas filter for airflow resistance and DMMP gas life.

4.4.4 Ownership and support verification.

4.4.4.1 Shelf life. Verify shelf life by analysis (engineering evaluation) of materials of construction, packaging, surveillance data if available, and the quantity of moisture in the carbon sorbent. Assume storage temperatures up to 160˚F and relative humidities up to 100%. The shelf life estimate should also consider the likelihood and extent of carbon settling with time for both the vertical and horizontal filter orientation.

4.4.4.2 Moisture content. Verify by sampling and testing as described below.

4.4.4.2.1 First article. A sample of carbon adsorbent shall be taken during the filling of the first, middle, and last filter in the first article sample lot. Each carbon sample taken during the filling of those 3 filters shall weigh at least 100 grams (0.22 pounds). Each sample shall be placed in an open container whose diameter is such that the depth of the carbon will be 1.5±0.5 inches deep. Those samples of carbon shall be exposed to the same conditions of temperature and humidity as their associated filters and be used for subsequent moisture testing. Concurrent with or immediately following the packaging of the filters corresponding to each carbon sample, each of 3 carbon samples shall be tested for moisture content in accordance with ASTM D 2867, Oven–Drying Test Method, except that the oven temperature shall be 217 to 224˚F (103 to 107˚C) and the drying time shall be 3 hours. If the moisture content of the adsorbent exceeds the requirement, the first article lot of filters represented by the samples shall be rejected.

4.4.4.2.2 Conformance. A sample of carbon adsorbent shall be taken during the filling of the first and last filter manufactured each day. Each carbon sample taken during the filling of those 2 filters shall weigh at least 100 grams. Each sample shall be placed in an open container whose diameter is such that the depth of the carbon will be 1.5±0.5 inches deep. Those samples of carbon shall be exposed to the same conditions of temperature and humidity as their associated filters and be used for subsequent moisture testing. Concurrent with or immediately following the packaging of the filters corresponding to each carbon sample, each carbon sample shall be tested for moisture content in accordance with ASTM D 2867, Oven–Drying Test Method, except that the oven temperature shall be 217 to 224˚F (103 to 107˚C) and the drying time shall be 3 hours. If the moisture content of the adsorbent exceeds the requirement, the production run of filters fabricated that day shall be rejected.

4.4.4.3 Safety, health, and environment.

4.4.4.3.1 Materials. Verify no adverse effects on health by health hazard assessment or analysis. In the assessment, consider the probability and consequences of failing to meet each requirement. If warning labels are justified, examine the labels for legibility and permanence.

4.4.4.3.2 Particulate emissions. Verify no inhalation hazard by measuring particulate emission concentration downstream of the gas filter while air passes through a vibrating filter. This test simulates use in a mobile shelter or vehicle. Pass 200 scfm of forced air through the filter into a settling chamber with approximate volume 500 ft^3 for 8 hours. Concurrently, during 6 of the 8 operating hours, vibrate filter for 2 hours in each of 3 orthogonal axes according to MIL–STD–810, method 514.5, procedure I–general vibration, figure 514.5C–3 to simulate vehicle vibration. During the 8–hour operating period, pass the entire 200 scfm of air through the filter, a leak–proof settling chamber (approximately 500 ft^3), and through a secondary High Efficiency Particulate Filter (HEPA). Monitor the airflow at least once every hour. Collect all particulate on the secondary HEPA filter, weigh the amount collected and analyze material for quantity of carbon and impregnant metals (copper, zinc, silver, molybdenum). Compare 8–hour time averaged concentration measurements within the chamber for carbon and its impregnants copper, zinc, silver, molybdenum against the concentration limits in 3.5.3.2 (see 6.7). Alternate method for total particulate: During the 8–hour operating period in which 200 scfm of forced air is passed, at least once every hour, monitor the dust concentration within the chamber using a commercial inhalable dust sampler which meets ACGIH sampling criteria. Note: a settling chamber may be by-passed if the measured 8-hour time averaged concentrations comply with 3.5.3.2.

4.4.4.3.3 Odors. Verify by using human subjects who inhale chamber air for the first hour during particulate emission test. Alternatively, verify by COC based on existing human factors data collected on filters of the same design that are used in shelters.

4.4.4.3.4 Hazardous waste. Verify by certification based on analysis of construction materials and coatings. Certify that all construction materials including any CARC primer coatings are free of hexavalent chromium and do not qualify as hazardous waste as defined by the the Code of Federal Register.

4.4.4.3.5 Sharp edges. Verify by examination of edges on external surfaces.

4.4.4.4 Identification markings. Verify by examination.

4.4.4.5 Workmanship. Verify by examination.

5. PACKAGING

5.1 Packaging. For acquisition purposes, packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of material is to be performed by DOD personnel or in–house contractor 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 or Defense Agency's automated packaging files, CD−ROM products, or by contacting the responsible packaging activity.

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 is part of a gas−particulate filter set, which is intended for use as part of a Nuclear Biological Chemical (NBC) air handling system of a collective protection system. The filter may be used in shipboard Collective Protection Systems (CPS), in land−based CPE such as the Modular CPE and Simplified CPE, and in the fan & filter housing of the transportable CPS. Filters are normally mounted with the axis in the horizontal position.

6.2 Acquisition requirements.

(a) Title, number, and date of this specification.
(b) 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 Govern ment.
    (2) Name and address of test facilities and shipping instructions when testing is performed by the Government (see 6.3).
    (3) Time required for the Government to notify the contractor whether or not to proceed with production.
(c) Packaging requirements.
(d) Data requirements (e.g. health hazard or risk assessment reports)
(e) Marking requirements if different than in section 3.
(f) Whether any Government Furnished Equipment is supplied.
(g) Label requirements. Adhesive−backed labels may need to be purchased so that user may record filter installation date.

6.3 Test facilities. Suggested shipping addresses for Government portion of First Article test are as follows:

(a) For navy−type shock and vibration testing:
NU Laboratories, Inc.
312 Old Allerton Road
Annandale, NJ 08801
(908) 713−9300

(b) For receipt, examination, and distribution to test activities at ECBC:
U.S. Army ECBC
AMSRD−ECB−ENE−M
Building E5165
APG, MD 21010−5424

6.4 Technical data. These drawings of gas filters are provided for information: Drawing 53711-6573660 (Navy), 5-19-6368 (Army). NSN is 4240−01−518−4765.

6.5 Leakage detector. A halide leak detector manufactured by Nucon Systems, 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 indications be suspected, the refrigerant should be checked for the presence of such contaminants.

6.6 Adsorbent media. Although manufacturers may consider using alternate adsorbent media, development tests comparable to or beyond those done on ASZM−TEDA carbon per MIL−DTL−32101 would first have to be performed by the contractor and approved for use by the Government. Such testing, which includes gas life capacity testing, using a variety of chemical agents before and after open−air environmental exposure, may be lengthy and costly. All development and test costs would be borne by the contractor.

6.7 Inhalation thresholds. The lower of the 8−hr ACGIH TLVs and OSHA PELs values are extracted from the 4 April 2003 MSDS and summarized in table III. Only current (most recent) values should be used for requirements.

TABLE III. Inhalation thresholds

Constituent in ASZM−TEDA carbon	Maximum allowed inhalation threshold (mg/m^3)	Cumulative mg in 8 hours
Carbon	5*	13600
Copper	1	2720
Zinc oxide	5	13600
Silver	0.01	27.2
Molybdenum	5	13600

*This is equivalent to a maximum of 13.6 g of carbon collected on a secondary HEPA filter if average airflow is 200 cfm (340 m^3/hr) over 8 hours.

6.8 Shelf life. This specification covers items where shelf life is a consideration. Specific shelf life requirements should be specified in the contract or purchase order. The shelf life codes are contained in the Federal Logistics Information System Total Item Record. Additive information for shelf life management may be obtained from DoD 4140.27−M; Shelflife Management Manual, or the designated shelf life Points of Contact (POC). The POC should be contacted in the following order: (I) the Inventory Control Points (ICPs), and (2) the DoD Service and Agency administrators for the DoD Shelf Life Program. Appropriate POCs for the DoD Shelf Life Program can be contacted through the DoD Shelf Life Management website: htm:/ /www.shelflife.hg.dla.mil/ .

6.9 Useful life. A useful life goal for the filter is 2 years or more of peace time use with no more than 10% degradation in gas life. The useful life is the maximum period of time an unpackaged item can remain fit for use. Exposure to moisture is known to diminish gas life. A DMMP gas life of 60 minutes and challenge of 5000 mg/m^3 is equivalent to 15 chemical attacks, whose average concentration−time is 20,000 mg−min/m^3.

6.10 Subject term (key word) listing.

Collective protection
Filtered air

Custodian:

Army − EA
Navy − SH
Air Force − 99

Preparing activity:

Army − EA
(Project No. 4240 −0690)

Review activities:
Army − MR
DLA − IS

Note: The activities listed above were interested in this document as of the date of this document. Since organizations change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.