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27 January 1986
SUPERSEDING
MIL-F-62309A(AT)
7 June 1985

MILITARY SPECIFICATION

FILTER ELEMENT, AIR

This specification is approved for use by US Army Tank-Automotive Command, 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 establishes the performance, inspection, and acceptance requirements for an air filter element used in the air induction system of the M60 tank.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS
FEDERAL

P-D-245	- Detergent, Laundry and Hand Dishwashing, (Granular).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000, 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 2940

STANDARDS
MILITARY

MIL-STD-105	- Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-810	- Environmental Test Methods and Engineering Guidelines.
MIL-STD-45662	- Calibration Systems Requirements.

2.1.2 Other Government documents, drawings, and publications. The following documents, other Government drawings, and publications form a part of this specification to the extent specified herein.

DRAWINGS
ARMY

10959032	- Efficiency and Dust Capacity Tester.
10959082	- Master Box Assembly Gage.
10959091	- Master Box Assembly Gage Calibration and Operating Procedures.
11669740	- Air Filter Element.
12251922	- Air Cleaner Assembly - Steel.

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 633 (DOD adopted)	- Electrodeposited Coatings of Zinc on Iron and Steel.
ASTM C 800	- Glass Fiber Blanket Insulation (Aircraft Type).
ASTM D 774 (DOD adopted)	- Bursting Strength of Paper, Test Method for.
ASTM D 828	- Tensile Breaking Strength of Paper and Paperboard, Test Method for.
ASTM D 1149 (DOD adopted)	- Rubber Deterioration - Surface Ozone Cracking in a Chamber (Flat Specimen), Test Method for.

(Application for copies should be addressed to the American Society for Testing Materials, 1916 Race Street, Philadelphia, PA 19103.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

ANSI/SAE AS478 - Identification Marking Method.

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.)

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

T414TS-65 - Internal Tearing Resistance of Paper.

(Application for copies should be addressed to the Technical Association of the Pulp and Paper Industry, Technology Park/Atlanta, P.O. Box 105113, Atlanta, GA 30348.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 First article. Unless otherwise specified (see 6.2), the contractor shall furnish two air filter assemblies which shall be subjected to first article inspection (see 4.4 and 6.3). First article inspection samples, properly marked with identifying information shall be representative of the unit to be furnished to the Government. All subsequent air filter elements delivered to the Government shall conform to these samples in all of their pertinent physical and performance attributes.

3.2 Materials. Materials shall be uniform and free from imperfections or defects which affect their serviceability. All non-metallic materials shall be inherently fungistatic or treated to resist fungus growth. (see 4.6.1).

3.2.1 Finish coating. Preparation and conditioning of the element shall consist of zinc plating in accordance with ASTM B-633, class SC4, type I, for metallic parts except corrosion resisting steels (see 4.6.1 and 4.6.2).

3.3 Design and construction. The air filter element, referred to herein as the element, shall be of the dry type for use as the second stage in a heavy duty two-stage air cleaner with a 900 cubic foot per minute (cfm) rating, and shall be in accordance with Drawing 11669740 (see 4.6.2).

3.3.1 Seal. The seal shall be properly seated and bonded in the seal retaining channel with adhesive. The seal base surface shall be free of any release agent. No separation shall exist between the seal body and the channel, and between channel and end cover. There shall be no excessive adhesive buildup between the seal and the top edge of the channel walls (see 4.6.3).

3.3.1.1 Seal compression. The seal shall be capable of being compressed to the stops (0.25 in) over a six-inch section with a force of 65 ± 20 pounds (lb) (see 4.6.4).

3.3.1.2 Seal adhesion. The seal shall be capable of withstanding a pull of five pounds per inch (lb per in) of length perpendicular to the surface (see 4.6.5).

3.3.1.3 Seal ozone resistance. The seal shall be capable of withstanding exposure for 72 hours to air having an ozone concentration of 45 to 55 parts per 100 000 000 parts of air by volume at a temperature of 100 ± 5 degrees Fahrenheit (°F) (see 4.6.6).

3.3.2 Media. The element media shall be securely bonded to the element end caps with adhesive. The adhesive shall be free of porosity, voids, and pin hole leak paths (see 4.6.7).

3.3.2.1 Internal tear strength. The element media shall have an internal tear resistance of 1000 grams (g), minimum (see 4.6.7.1).

3.3.2.2 Bursting strength. The element media shall have a bursting strength of 80 points, minimum (see 4.6.7.2).

3.3.2.2.1 Bursting strength definition. The hydrostatic pressure, in pounds per square inch, required to produce rupture of the material when the pressure is applied at a controlled increasing rate through a rubber diaphragm to a circular area 1.200 in in diameter, the area of the material under test being initially flat and held rigidly at the circumference, but free to bulge under the increasing pressure during test. To avoid confusion, this hydrostatic pressure is referred to as "points bursting strength".

3.3.2.3 Tensile breaking strength. The element media shall have a tensile breaking strength of 1000 pounds per square inch (psi), minimum (see 4.6.7.3).

3.3.2.4 Flame resistance. With the filtering media of the element exposed to a flame until it burns, the filtering media shall not continue to burn when the flame is removed (see 4.6.7.4).

3.3.3 Screen bonding and supports. Protective wire mesh screens shall be provided on the inside and outside of the element and shall be securely attached to the frame and bonded to the element media. In addition, structural channels shall be securely attached to the inside frame of the element and shall be bonded to the surface of the wire mesh screens in such a manner that flexure of the screens is minimized (see 4.6.8).

3.3.4 Pin loading.

3.3.4.1 End loading. The element shall be capable of withstanding a compressive, end to end load without damage when a 300 ± 3 lb static load is applied uniformly over a five inch diameter circular area (see 4.6.9.1).

3.3.4.2 Maximum loading. The element shall be capable of withstanding a compressive, (end to end) load without damage when a 600 ± 30 lb static load is simultaneously applied to each clamping pin, totalling 1200 ± 60 lb (see 4.6.9.2).

3.3.4.3 Nominal loading. Each of the two spring-loaded pins shall support a preload of 140 ± 30 lb at 5.44 inches from the rear of the pin to the element stops. Compression of the seal, and positioning of the pins 5.16 inches (from the rear of the pin) to the element stops, shall cause the load on each pin to be 280 ± 60 lb (see 4.6.9.3).

3.3.5 Weight. The weight of the element shall not exceed 34 lb (see 4.6.10).

3.4 Performance. Dust filtration requirements (see 3.4.1 through 3.4.7) shall be met by Master Box Assembly Gage 16959082 (referred to herein as the assembly) containing filter element 11669740. The terms "load capacity" and "loaded to capacity" shall mean that the dust load has caused the air cleaner restriction to reach 20 inches of water. Except as otherwise specified herein, requirements shall be met with a clean new element and under the following standard conditions:

a.	Temperature	73 ± 18 degrees Fahrenheit (°F).
b.	Humidity	35 ± 5 percent (%).
c.	Density of air	0.073 pounds per cubic foot at 80°F and 29.92 inches of mercury (Hg).
d.	Dust	Chemical analysis of the test dust shall be as shown in table I. Particle size distribution shall be as shown in table II.
e.	Air flow	900 cfm.
f.	Dust feed rate	0.025 ± 0.005 gram per cubic foot of air (g per cu ft).

TABLE I. Chemical analysis of test dust.

Substance	Percent by weight
Silicon dioxide (SiO_2)	67 to 69
Ferric Oxide (Fe_2O_3)	3 to 5
Aluminum Oxide (Al_2O_3)	15 to 17
Calcium Oxide (CaO)	2 to 4
Magnesium Oxide (MgO)	0.5 to 1.5
Total alkalis as sodium oxide (Na_2O)	3 to 5
Ignition loss	2 to 3

TABLE II. Particle size distribution.

Dust size (Microns)	Percent Dust of Total Weight	
	Coarse Grade	Fine Grade
0 - 5	12 ± 2	39 ± 2
5 - 10	12 ± 3	18 ± 3
10 - 20	14 ± 3	16 ± 3
20 - 40	23 ± 3	18 ± 3
40 - 80	30 ± 3	9 ± 3
80 - 200	9 ± 3	-----

3.4.1 Initial air flow restriction. The initial air flow restriction of the element shall not exceed nine in of water (see 4.6.12).

3.4.2 Dust capacity. When operating with a stepped air flow in accordance with table III and fed with coarse dust in accordance with table II, the time for the assembly to reach load capacity shall be not less than 80 hours. There shall be no dust tracking on the downstream side of the element (see 4.6.13).

TABLE III. Stepped air flow.

Time (minutes)	Rated flow (percent)	Air flow (cfm)
10	100	900
10	80	725
10	60	540
10	40	360
10	20	180
10	60	540

3.4.3 Dust efficiency. The assembly dust filtration efficiency shall be not less than 99.5% after 30 minutes of operation when fed with fine grade dust in accordance with table II (see 4.6.14).

3.4.4 Washing durability. The assembly shall meet the requirements of 3.4.3 after the filter element has been loaded to capacity (see 3.4), then washed with detergent conforming to P-D-245, and cleaned and dried (see 4.6.15).

3.4.5 Post service air flow restriction. After one operation to load capacity (see 3.4) in accordance with 3.4.2, followed by a cleaning in accordance with 4.6.17, the assembly air flow restriction shall not have increased by more than one inch of water above that recorded in 3.4.1 (see 4.6.16).

3.4.6 Air cleaning durability. When operated at a dust feed rate of 0.1 ± 0.02 g per cu ft of air, and after having been loaded to capacity and subsequently air cleaned three times, the time for the assembly to reach load capacity a fourth time shall not be decreased by more than 45 percent. Cleaning of the element shall be by application of 30 psi compressed air for one hour or until there is no visible evidence of dust being removed. Dust tracking shall not develop on the filter element up stream side during these cycles (see 4.6.17).

3.4.7 Environmental conditions. The element shall meet the requirement of 3.4.3 after being subjected to the environmental condition specified herein.

3.4.7.1 Low temperature. The element shall withstand exposure to a temperature of minus 65°F. The seal compression set shall not exceed five percent of its original height after subsequent stabilization at room ambient temperature (see 4.6.18).

3.4.7.2 High temperature. The element shall withstand a high temperature of plus 160°F. The seal compression set shall not exceed 25 percent of its original height after subsequent stabilization at room ambient temperature (see 4.6.19).

3.4.7.3 Vibration. The element shall be capable of withstanding the vibration at an amplitude of 0.9 gravity units (g) and frequency rate from 50 to 500 to 5 to hertz (Hz) in each of the three mutually perpendicular axes shown in figures 1 and 2 (see 4.6.20).

3.5 Marking. Identification and marking shall be in accordance with AS478, and shall include the maximum rated air flow, part number, month, and year of manufacture (see 4.6.2).

3.6 Workmanship. Workmanship shall be such that the element shall be free of cracked end caps, visually apparent surfaces out of alignment or out of contour, and missing portions of material. Sheet metal parts shall be free of blisters, tears, and excessive thinning at drawn sections. The element seal must be properly seated inside the end cap channel with no separation between the seal and channel. There shall be no excessive adhesive adjacent to the bonding surface. The interior shall contain no foreign particles. The media shall contain no tears, rips, or holes (see 4.6.2).

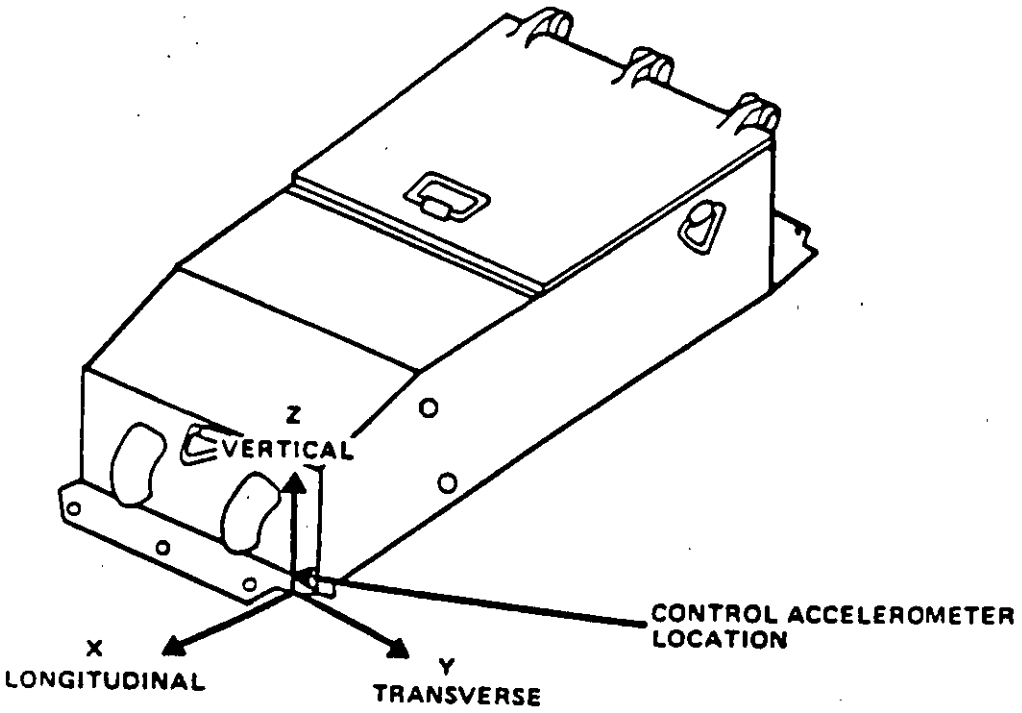

FIGURE 1. Vibration accelerometer location.

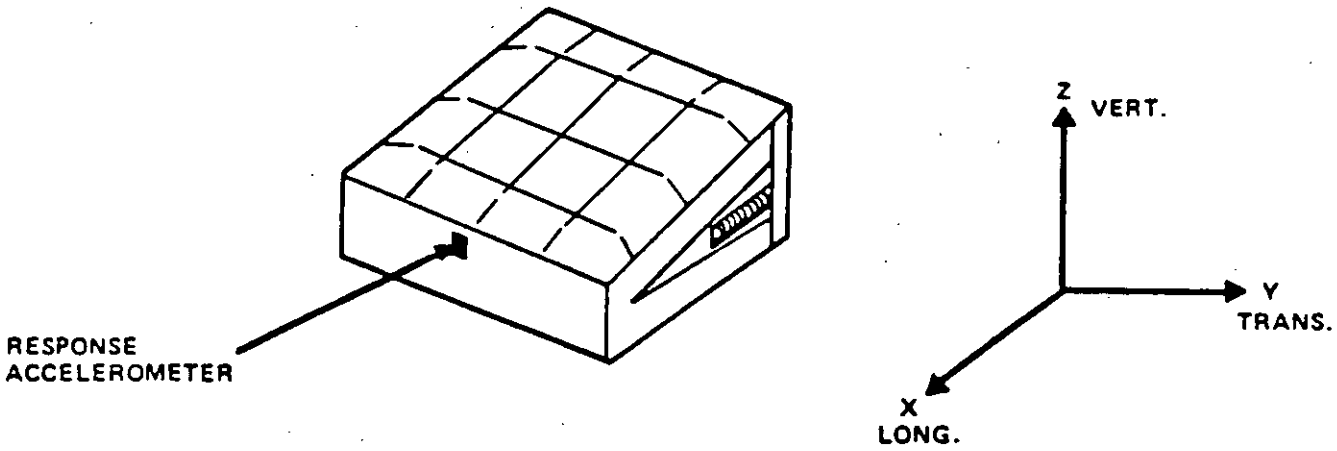

FIGURE 2. Vibration accelerometer location.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform or witness any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Inspection equipment. Unless otherwise specified in the contract (see 6.2), the supplier is responsible for the provision and maintenance of all inspection equipment necessary to assure that supplies and services conform to contract requirements. Inspection equipment must be capable of repetitive measurements to an accuracy of 10 percent of the measurement tolerance. Calibration of inspection equipment shall be in accordance with MIL-STD-45662. Where compliance with MIL-STD-45662 is not possible, special calibration requirements shall be prepared for approval by the acquisition. The following test equipment, or equivalent shall be used in the performance of the inspections and tests specified herein:

a. Elmendorf tear resistance testing equipment.
b. Dust capacity tester (see figure 3).
c. Mullen burst tester.
d. Tensile test machine.

4.2 Classification of inspections:

a. First article inspection (see 4.4).
b. Quality conformance inspections (see 4.5).
    1. Examination (see 4.5.2).
    2. Acceptance tests (see 4.5.3.1).
    3. Control tests (see 4.5.3.2).

4.3 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following conditions:

a. Air temperature 73 $\pm$ 18°F
b. Barometric pressure $^{28 + 2}_{- 3}$ inches Hg
c. Relative humidity 35 $\pm$ 5 percent

4.4 First article inspection. Unless otherwise specified (see 6.2), the Government shall select five elements from the first twenty produced under the production contract (see 6.2) for first article inspection. First article samples shall be numbered and inspected as specified in table IV. Approval of the first article sample by the Government shall not relieve the contractor of his obligation to supply air filter elements that are fully representative of those inspected as a first article sample. Any changes or deviation of the production units from the first article sample shall be subject to the approval of the contracting officer.

4.4.1 First article inspection failure. Test item deficiencies during, or as a result of the first article test, shall be cause for rejection of the items until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency found during, or as a result of the first article test, shall be prima facie evidence that all items already produced prior to completion of the first article test are similarly deficient unless evidence satisfactory to the contracting officer is furnished by the contractor that they are not similarly deficient. Such deficiencies on all items shall be corrected by the contractor at no cost to the Government. The Government shall not final accept products until first article testing is completed to the satisfaction of the Government.

4.5 Quality conformance inspection.

4.5.1 Sampling.

4.5.1.1 Lot formation. A lot shall consist of all air filter elements of one type, from an identifiable production period, from one manufacturer, subjected at one time for quality conformance inspection.

4.5.1.2 Sampling for examination. Samples for quality conformance examination shall be selected in accordance with general inspection level II of MIL-STD-105.

TABLE IV. Classification of inspections.

Title	Requirement	Inspection	First article					Quality conformance		
			1	2	3	4	5	Acceptance (100%)	Control 1	Control 2
Materials	3.2 thru 3.2.1	4.6.1	X	X	X	X	X	X		
Design and construction	3.3	4.6.2	X	X	X	X	X	X		
Defects (see table VI)		4.6.2	X	X	X	X	X			
Seal	3.3.1	4.6.3	X	X	X	X	X	X		
Seal compression	3.3.1.1	4.6.4				X	X	X		
Seal adhesion	3.3.1.2	4.6.5				X	X	X		
Seal ozone resistance	3.3.1.3	4.6.6		X						
Media	3.3.2	4.6.7	X	X	X	X	X	X		
Internal tear resistance	3.3.2.1	4.6.7.1		X						
Bursting strength	3.3.2.2	4.6.7.2		X						
Tensile breaking strength	3.3.2.3	4.6.7.3		X						
Flame resistance	3.3.2.4	4.6.7.4			X					
Screen bonding and supports	3.3.3	4.6.8	X	X	X	X	X	X		
Pin loading:										
End loading	3.3.4.1	4.6.9.1	X	X	X	X	X			
Maximum loading	3.3.4.2	4.6.9.2	X	X	X	X	X			
Nominal loading	3.3.4.3	4.6.9.3	X	X	X	X	X			
Weight	3.3.5	4.6.10	X	X	X	X	X			
Initial airflow restriction	3.4.1	4.6.12	X	X	X	X	X		X	X
Dust capacity	3.4.2	4.6.13	X	X					X	
Dust efficiency	3.4.3	4.6.14		X		X	X			X
Washing durability	3.4.4	4.6.15		X						
Post service airflow restriction	3.4.5	4.6.16	X						X	
Air cleaning durability	3.4.6	4.6.17			X					
Low temperature	3.4.7.1	4.6.18				X	X			
High temperature	3.4.7.2	4.6.19				X	X			
Vibration	3.4.7.3	4.6.20				X	X			

4.5.2 Quality conformance examination.

4.5.2.1 Acceptable quality level. Each sample selected in accordance with 4.5.2.1 shall be examined for conformance to the following acceptable quality levels (AQLs) on the basis of percent defective (see 6.4).

Classification	AQL
Major	1.0
Minor	2.5

4.5.2.1.1 Process average. Before sampling is initiated, at least twenty elements shall be subjected to a 100% examination to verify conformance to requirements listed in table V. Process average for each requirement shall be computed as specified below. In the computed process average for the requirements exceeds the specified AQL, 100% inspection shall be continued, until the process average for twenty percent consecutive elements is less than the specified AQL.

$$\text{Process average} = \frac{\text{Number of Defectives}}{\text{Number of Elements Inspected}} \times 100$$

4.5.2.2 Classification of defects. For examination purposes, defects shall be classified as listed in table V.

TABLE V. Classification of defects.

Category	Defect	Method of examination
Major	AQL 1.0% Defective	
101	Incorrect or faulty materials (see 3.2 through 3.2.1).	Visual
102	Dimensions affecting interchangeability not within tolerance (see 3.3).	Visual and Gage
103	Incorrect or illegible marking (see 3.5).	Visual
Minor	AQL 2.5% Defective	
201	Dimensions not affecting interchangeability, not within tolerance (see 3.3).	Visual and Gage
202	Poor workmanship (see 3.6)	Visual
203	Incorrect packaging (see 5.1)	Visual

4.5.3 Quality conformance tests.

4.5.3.1 Acceptance tests (100 percent). Each air filter assembly shall be subjected to the tests specified in table IV.

4.5.3.2 Control tests. Control tests shall be conducted on two air filter assemblies from each 100 units consecutively produced, except that not more than one test shall be performed in a three month period, nor less than one test in a six month period. The air filter assemblies shall be numbered and subjected to the tests specified in table IV.

4.5.3.3 Failure. Failure of any air filter assembly to pass any of the specified inspections shall be cause for the Government to refuse acceptance of the production quantity represented, until action taken by the contractor to correct defects and prevent recurrence has been approved by the Government.

4.6 Methods of inspection.

4.6.1 Materials and construction. To determine conformance to 3.2 through 3.2.1, air filter element inspection and material certification records shall be maintained by the contractor. Records shall be subject to review by the Government and shall include date, part, or characteristic identification, inspection results, and disposition of lot (accepted or rejected). Corrective action taken on noted defects shall be subject to approval by the Government.

4.6.2 Defects. Conformance to 3.3 through 3.3.5 shall be determined by examination for the defects listed in table V. Examination shall be visual, tactile, or by measurement with standard inspection equipment.

4.6.3 Seal. To determine conformance to 3.3.1, the seal shall be examined for proper seating and bonding to the retaining channel. The retaining channel shall also be checked for proper sealing to the end cover.

4.6.4 Seal compression. To determine conformance to 3.3.1.1, immobilize the element and apply force over a 6 inch section until the seal is depressed to the stops or 56% of its free height. Measure the force required and verify that it is between 45 and 85 lbs.

4.6.5 Seal adhesion. To determine conformance to 3.3.1.2, make a transverse cut through the seal to the end cap with a sharp instrument. Attach a one inch clamp to one side of the cut seal, and measure the perpendicular force required to pull the seal from the end cap. Verify that the seal does not detach itself from the end cap with a pull force of five lbs per in of length perpendicular to the surface.

4.6.6 Seal ozone resistance. To determine conformance to 3.3.1.3, two or more test specimens of the element gasket seal shall be subjected to the ozone resistance test in accordance with ASTM D 1149 for accelerated ozone cracking of vulcanized rubber. The resistance test apparatus shall include an insulated test chamber with an ozone generating source outside the chamber. Means shall be provided for measuring the ozone concentration, for controlling the temperature of the air in the chamber, and for circulating air. The apparatus shall also include a means for holding and stretching the

specimens. The procedure to be followed will permit specimens to be elongated 12 1/2%. The stressed specimens, while still elongated in the stretching apparatus, shall be conditioned at room temperature for 45 minutes, and then exposed for 72 hours in the test chamber in which air, having an ozone concentration of 45 to 55 parts per 100 000 000 parts of air by volume, is circulated at a temperature of 95°F to 105°F. Test specimens shall be examined frequently without magnification to determine conformance to 3.3.1.3.

4.6.7 Media. To determine conformance to 3.3.2, element media bonding areas shall be examined for secure bonding and the absence of porosity, voids, and leak paths.

4.6.7.1 Media internal tear resistance. To determine conformance to 3.3.2.1, element media samples shall be tested for tear resistance in accordance with TAPPI T414TS-65, using Elmendorf tear testing equipment, or its equivalent.

4.6.7.2 Media bursting strength. To determine conformance to 3.3.2.2, element media samples shall be tested for bursting strength in accordance with ASTM D-774.

4.6.7.3 Media tensile breaking strength. To determine conformance to 3.3.2.3, element media samples shall be tested for tensile strength in accordance with ASTM D-828. The following formula shall be used to calculate tensile strength:

$$\text{Tensile strength (psi)} = \frac{\text{Breaking force (lbs per in)}}{\text{Thickness (inches)}}$$

4.6.7.4 Media flame resistance. To determine conformance to 3.3.2.4, the media side of the element shall be exposed to a flame for three seconds and then removed. The media side of the element shall cease burning when removed from the flame.

4.6.8 Screen bonding and supports. To determine conformance to 3.3.3, the wire mesh screens for secure attachment to the frame and bonding to the media should be examined as specified in 3.3.3. Also, the structural supports for secure attachment to the frame and minimal flexure of the wire mesh screens shall be examined as specified in 3.3.3.

4.6.9 Pin loading.

4.6.9.1 End loading. To determine conformance to 3.3.4.1, the element shall be placed on its stops in a device capable of measuring a 300 $\pm$ 3 lb load equally distributed over a five inch diameter circular area, and applied to the element as shown in figure 3. The element shall be subjected to three successive non-overlapping static loads of 300 $\pm$ 3 lb. It shall be verified that no damage has resulted to the element.

4.6.9.2 Maximum loading. To determine conformance to 3.3.4.2, the element shall be placed in a device capable of measuring two 600 ± 30 lb loads simultaneously applied to the element clamping pins as shown in figure 3. The element shall be subjected to a static load of 600 lb simultaneously applied to each clamping pin (total 1200 ± 60 lb), until the seal is compressed to the stop. It shall be verified that no damage has resulted to the element.

4.6.9.3 Nominal loading. To determine conformance to 3.3.4.3, position element as in figure 3, and perform the following with a force applied equally to each pin:

a. Apply force until a point on the rear of the pin reaches a position of 5.44 ± 0.06 inches from the element stops. Record the force, and verify that it is between 110 and 170 lb.
b. Apply additional force, until the point on the rear of the pin reaches a position of 5.16 ± 0.06 inches from the stops. Record the force, and verify that it is between 220 and 340 lb.
c. With a feeler gage, verify that the seal is seated at all points about the perimeter of the seal.

4.6.10 Weight. To determine conformance to 3.3.5, weigh the element to verify that it does not exceed 34 lb.

4.6.11 Filtering performance. Except as otherwise specified herein, air filtration performance tests shall be performed on the element installed in Master Box Assembly Gage 10959082; this installation is an instrumented functional equivalent to Assembly 12251922. Except as otherwise specified herein, test conditions and procedures shall be in accordance with 3.4 and the following.

a. The test set-up for all tests requiring air flow shall be conducted on an Efficiency and Dust Capacity Tester 10959032 shown in figure 4.
b. Dust feed rates shall be averaged over ten minute intervals. Measured air restriction values shall be corrected to the specified air density to an accuracy of 0.1 inch of water.
c. Actual air flow values used in tests shall be corrected to standard conditions (see 3.4.c) and shall be within plus or minus two percent of specified values.
d. The assembly shall be mounted in its normal operating attitude as shown in figure 1, and shall be electrically grounded.
e. The scavenge air flow shall be as specified on Drawing 10959091.
f. Air shall be drawn through the assembly with a turbine vacuum source to ensure filter element dryness before starting tests.

4.6.12 Initial airflow restriction. To determine conformance to 3.4.1, the assembly shall be subjected to a dust free flow of 900 cfm through the assembly. The restriction to flow shall be measured, recorded, and shall not exceed nine inches of water.

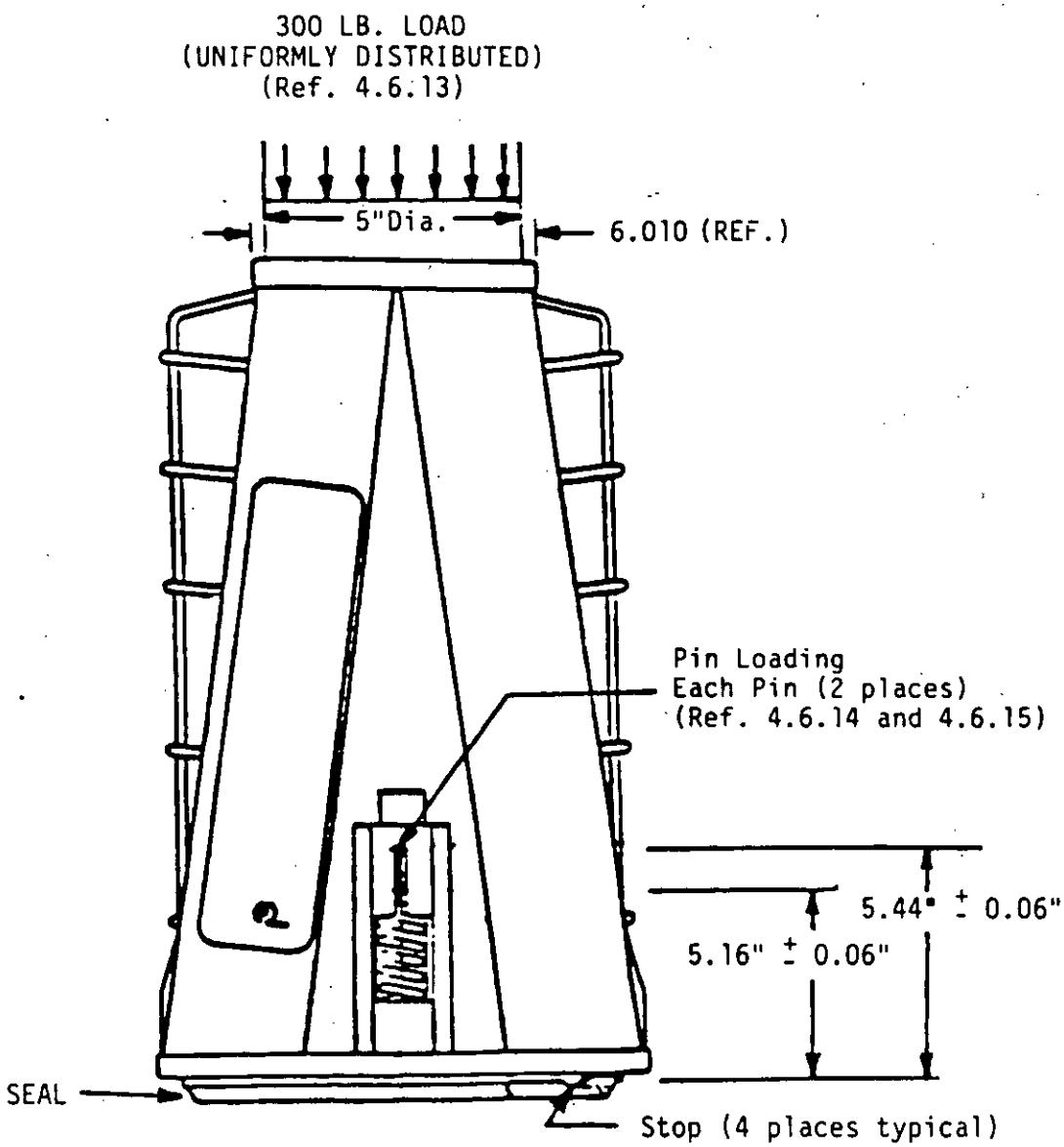

FIGURE 3. Static load test setup (filter element 11669740).

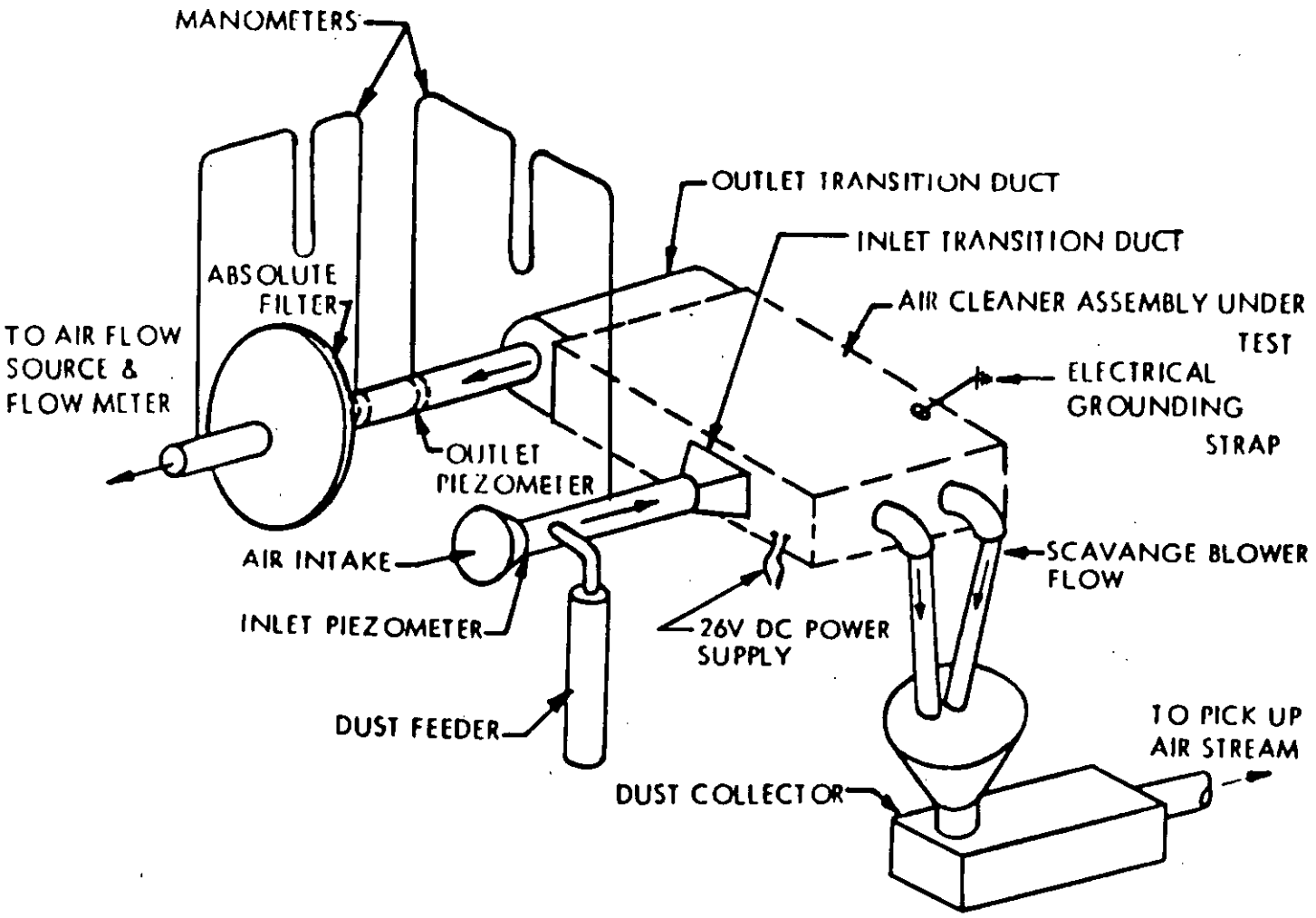

FIGURE 4. Test set up utilizing efficiency and dust capacity tester 10959032.

4.6.13 Dust capacity. To determine conformance to 3.4.2, install an element in the test setup of 4.6.11.a, and complete one hour cycles with stepped flow rates as specified in table III. The restrictions to flow pressure drop through the assembly and absolute filter shall be recorded each time the flow is adjusted to 900 cfm. The test shall be conducted, until the assembly air flow restriction at 900 cfm reaches load capacity (see 3.4). Verify that the operational time is at least 80 hours. At approximately twenty hour intervals of continuous operation, or whenever the test setup is required to be shut down, the filter element shall be viewed through the air cleaner outlet for visual signs of dust tracking on the clean side of the seal or the filter media. Any visual signs of dust tracking shall be cause for rejection.

4.6.14 Dust efficiency. To determine conformance to 3.4.3, the element shall be mounted in the test setup of 4.6.11.a with an absolute filter (see 4.6.14.1) at the output end of the assembly. Dust shall be placed in a dust feeder, and fed into the input side of the assembly for 30 minutes with an airflow of 900 cfm. Restriction at the start of the test, and at 10 minute intervals throughout the test shall be recorded. The absolute filter shall be removed from the test setup taking care not to disturb the entrapped dust, redried, and reweighed. Dust and absolute filter weighings shall be accurate to 0.01 gram (g). The efficiency of the assembly shall be computed using the following formula:

$$\text{Assembly Efficiency (\%)} = \frac{W_1 - (W_2 - W_3)}{W_1} X\ 100$$

Where: W_1 = Weight of dust fed into the assembly.

W_2 = Weight of absolute filter and its entrapped dust.

W_3 = Weight of absolute filter before test.

4.6.14.1 Preparation of the absolute filter. An absolute filter in accordance with ASTM C 800, shall be placed in an air oven and dried for 6 hours at a temperature of 200°F to 240°F, prior to insertion in the test setup. This drying time may be reduced, and the absolute filter considered as completely dry, if there is no change in weight of the absolute filter over two consecutive 10 minute intervals.

4.6.15 Washing durability. To determine conformance to 3.4.4, the dust looded element shall be immersed and agitated for six hours in a solution of warm water (80°F to 110°F) and detergent conforming to specification P-D-245, after completing the dust capacity test of 4.6.13. The element shall then be removed from the solution and flushed with cool water (35°F to 80°F) at low pressure from inside to outside for three minutes, or until all solution and

dirt are removed. The rinse water shall be flowing clean. The excess water shall be allowed to drain from the element for one hour. The element shall then be placed in a circulating air oven at 215°F to 235°F and dried for 24 hours, or until the element is dry. Return the element to the cleaned assembly and draw air through the assembly with a turbine vacuum source to ensure element dryness. The element shall then be subjected to the efficiency test of 4.6.14 and shall conform to 3.4.3.

4.6.16 Post service airflow restriction. To determine conformance to 3.4.5, after the dust capacity test of 4.6.13 the element shall be removed and cleaned of dust by using clean, dry, compressed air with 100 (+0, -10) psi line pressure, and a nozzle inner dimension of at least 1/8 inch. The air nozzle shall be inserted into the element, using a back and forth motion along the length of each serration, and a direct flow into each pocket from inside out. After the element is thoroughly air cleaned, it shall be reassembled in the assembly and tested for airflow restriction. The assembly shall not exceed its previously recorded restriction by more than one inch of water.

4.6.17 Air cleaning durability. To determine conformance to 3.4.6, install the filter element in the test setup of 4.6.11.a, and load it at the dust feed rate of 0.1 $\pm$ 0.02 g per cu ft until load capacity is reached, and record the time. Prior to removal of the filter element from the air cleaner, carefully observe the clean side of the filter element for visial signs of dust tracking. Visual observation will be made through the air cleaner outlet. Any visual signs of dust tracking on the clean side of the filter media, or seal shall be cause for rejection. Air clean the filter element with clean, dry, compressed air as specified in 4.6.16, until there is no visible evidence of dust being removed. Repeat the above procedure three times. The filter dust loading time shall not be decreased by more than 45% after third cleaning.

4.6.18 Low temperature. To determine conformance to 3.4.7.1, the element with the seal in compression to the element stops shall be subjected to a low temperature test as specified in MIL-STD-810, method 502.2, procedure I. The conditions of 3.4.7.1 shall apply during exposure to the low temperature. Seal height shall be measured to verify conformance to the compression limit and to the dust efficiency test of 4.6.14.

4.6.19 High temperature. To determine conformance to 3.4.7.2, the element with the seal in compression to the element stops shall be subjected to a high temperature test as specified in MIL-STD-810, method 501.2, procedure I. The conditions of 3.4.7.2 shall apply during exposure to the high temperature. Seal height shall be measured to verify conformance to the compression limit and to the dust efficiency test of 4.6.14.

4.6.20 Vibration. To determine conformance to 3.4.7.3, the element shall be mounted in the test setup of 4.6.11.a, and shall vibrate for a period of 80 minutes at specified amplitude and frequncy in each of three orthogonal axes. Connections and instrumentation shall be attached to permit testing as follows:

a. The vibration test level shall be conducted at -40°F and +160°F. The time schedule shall be 80 minutes for each axis including forced dwells of 13-1/3 minutes each (see figures 1 and 2).
b. Resonance search. - Resonant frequencies of the element shall be determined by varying the frequency of applied vibration slowly through the specified range at reduced test levels, but with sufficient amplitude to excite the element. Sinusoidal resonance search may be performed using the test level and cycling time specified for sinusoidal cycling test, provided the resonance search time is included in the required cycling test time.
c. Resonance dwell. - The test element shall be vibrated along each axis at the most severe resonant frequencies. If more than four significant resonant frequencies are found for any one axis, the four most severe resonant frequencies shall be chosen for the dwell test. If a change in the resonant frequency occurs during the test, its time of occurrence shall be recorded and immediately the frequency shall be adjusted to maintain the peak resonance condition. The final resonant frequency shall be recorded.
d. After vibration, the assembly shall be subjected to the efficiency test of 4.6.14 and shall be returned to room temperature and the element shall be examined for any damage.

5. PACKAGING

5.1 Preservation, packaging, packing, and marking. Preservation, packaging, packing, and marking for the desired level of protection shall be in accordance with the applicable packaging standard or packaging data sheet specified by the contracting authority (see 6.2).

6. NOTES

6.1 Intended use. The filter element is intended specifically for use on Tank, Combat, Full-Tracked, M60 Series.

6.2 Ordering data. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Part number of element required (see 3.4).
c. If first article is not required (see 3.1).
d. If responsibility for inspection shall be other than as specified (see 4.1).
e. If responsibility for inspection equipment shall be other than as specified (see 4.1.1).
f. If inspection conditions shall be other than as specified (see 4.3).
g. If first article inspection is not required (see 4.4).
h. Selection of applicable level and packaging standard or packaging data sheet (see 5.1).

6.3 First article. First aticle samples shall be tested and approved under the appropriate provisions of 7-104.55 of the Defense Acquisition Regulation. The contracting officer should include specific instructions in all acquisition instruments regarding arrangements for examination, tests, and acquisition of the first article (see 3.1).

6.4 Certification. The following item under the manufacturer's designation shown have been certified under purchase description M60PD-F-62309(AT) (see 6.6).

Manufacturer's Designation	Manufacturer's Name and Address
P14-3304	Donaldson Co., Inc. 1400 W. 94th Street Mineeapolis, Minn.
W260D2 (6-29-83)	United Air Cleaner 9705 S. Cottage Grove Avenue Chicago, Illinois 60628

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

6.6 Supersession data. This specification supersedes MIL-F-62309A(AT).

Custodian:
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(Project No. 2940-A130)

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	☐ OTHER *(Specify)*: _____

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a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

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