MIL-F-13455C(AT)
17 February 1988
SUPERSEDING
MIL-F-13455B(AT)
14 March 1974

MILITARY SPECIFICATION

FILTER, LIGHT (FOR BLACKOUT SECURE)

This specification is approved for use within the 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 covers one type of non-fluorescent, optical isotropic blue light filter for use in military vehicle interiors (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Standards. The following standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

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 6220

STANDARDS
MILITARY

MIL-STD-105	- Sampling procedures and tables for Inspection by Attributes.
MIL-STD-130	- Identification Marking for US Military property.
MIL-STD-45662	- Calibration systems requirements

2.1.2 Drawings. The following drawings form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

DRAWINGS
ARMY

12314082	- Lens, Blue

(Copies of standards and drawings required by the contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D1003	- Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
ASTM D1435	- Standard practice for Outdoor Weathering of Plastics.

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

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

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

3.2 Materials. Materials shall be as specified herein, on applicable drawings, and in applicable specifications. Materials not specifically designated shall be of good commercial quality (see 4.8.1).

3.2.1 Recycled, virgin and reclaimed materials. There are no requirements for the exclusive use of virgin materials. The use of recycled or reclaimed (recovered) materials is acceptable provided that all other requirements of this specification are met (see 4.8.1 and 6.3.1).

3.3 Design and construction. The design and construction of the light filter shall be fabricated and assembled to the form and dimenions shown on Drawing 12314082 and as specified herein (see 4.8.1 and 4.8.2).

3.3.1 Mounting equipment. Filters shall be furnished with mounting equipment. The mounting equipment shall conform to applicable drawings or specified requirements and shall be free from defects affecting the appearance or serviceability of the installed filters (see 4.8.2).

3.4 Performance.

3.4.1 Optical characteristics.

3.4.1.1 Spectral transmission. The emission transmitted by the light filter, of any vehicle interior or exterior light source, which may be illuminated (including warning lights) in the blackout mode, shall be limited to the visible spectrum (380 to 700 millimicrons) as shown in figure 1. No energy shall be emitted in the 700 to 1200 millimicron portion of the electromagnetic spectrum.

3.4.1.1.1 Selectivity. Light filters shall have the following transmission characteristics (see 4.9.1):

a. 50 percent (%) transmission at some point within the range of 620 to 640 millimicrons inclusive.
b. Less than 1% transmission at all points within the range of 360 to 580 millimicrons inclusive.

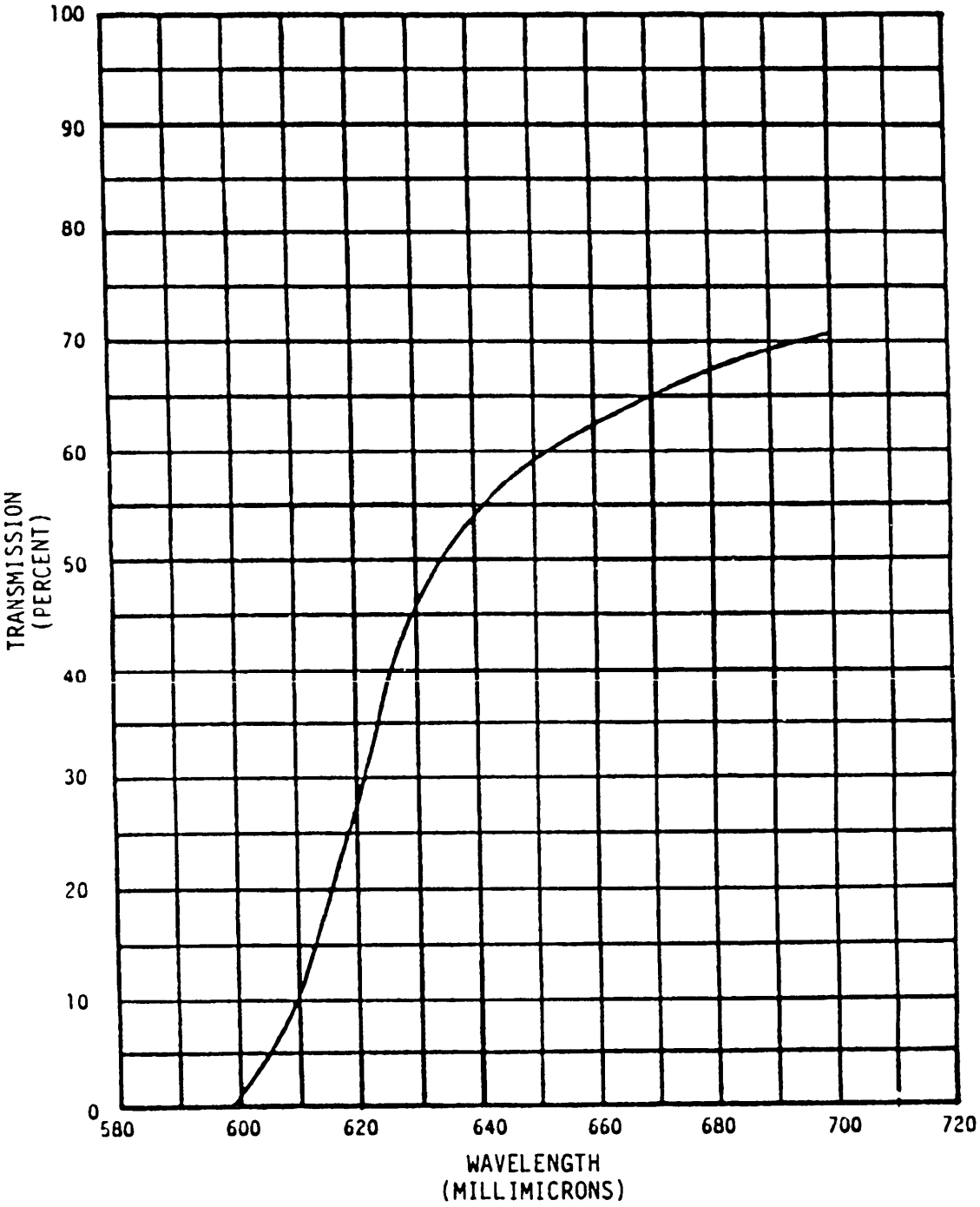

FIGURE 1. Transmission characteristics for light filter.

3.4.1.1.2 Transmission analysis. The sums obtained by means of the specified computations (see 4.9.2), using rod visibility factors and cone visibility factors respectively (see table I), shall be in accordance with the following:

Visibility factors	Sum obtained
Rod factors	11.0 maximum
Cone factors	90.0 minimum

TABLE I. Transmission data.

Wave length, millimicrons	Rod visibility factor, R	Cone visibility factor, C	Transmission T%	R x T	C x T
360	1.0000	1.0000	-	-	-
370	1.0000	1.0000	-	-	-
380	1.0000	1.0000	-	-	-
390	1.0000	1.0000	-	-	-
400	1.0000	1.0000	-	-	-
410	1.0000	1.0000	-	-	-
420	1.0000	1.0000	-	-	-
430	1.0000	1.0000	-	-	-
440	1.0000	1.0000	-	-	-
450	1.0000	1.0000	-	-	-
460	1.0000	1.0000	-	-	-
470	1.0000	1.0000	-	-	-
480	1.0000	1.0000	-	-	-
490	1.0000	1.0000	-	-	-
500	1.0000	1.0000	-	-	-
510	1.0000	1.0000	-	-	-
520	1.0000	1.0000	-	-	-
530	1.0000	1.0000	-	-	-
540	1.0000	1.0000	-	-	-
550	1.0000	1.0000	-	-	-
560	1.0000	1.0000	-	-	-
570	1.0000	1.0000	-	-	-
580	.3475	.9293	-	-	-
590	.2147	.8684	-	-	-
600	.1288	.7718	-	-	-
610	.0736	.6550	-	-	-
620	.0429	.5262	-	-	-
630	.0261	.3871	-	-	-
640	.0159	.2695	-	-	-
650	.0100	.1732	-	-	-
660	.0067	.1036	-	-	-

TABLE I. Transmission data - Continued.

Wave length, millimicrons	Rod visibility factor, R	Cone visibility factor, C	Transmission T%	R x T	C x T
670	.0044	.0568	-	-	-
680	.0028	.0315	-	-	-
690	.0018	.0158	-	-	-
700	.0011	.0082	-	-	-
710	.0007	.0044	-	-	-
720	.0005	.0023	-	-	-
730	-	.0012	-	-	-
740	-	.0006	-	-	-
750	-	.0003	-	-	-
760	-	.0001	-	-	-
			Total	11.0 Max.	90.0 Min.

3.4.2 Reflection. The light filter shall reflect not more than 15% of the light directed to it when placed in light conforming to standard illuminant C in accordance with procedure A of ASTM D1003, after being conditioned for not less than 2 hours at 77 ± 15 degree Fahrenheit (°F) (see 4.9.3).

3.4.3 Weathering. The light filter shall meet the requirement of 3.4.1.1 after being subjected to accelerated weathering in accordance with ASTM D1435 (see 4.9.4).

3.5 Identification marking. Identification marking on the filter shall be in accordance with MIL-STD-130 and the applicable drawings as a minimum shall include the following (see 4.8.2):

National stock number.
Manufacturers Identification including the Commercial and Government Entity (CAGE).

3.6 Workmanship. Light filters shall be free from scratches, sharp edges, cracks and any defects which may affect their optical characteristics or appearance. Dimensions shall be within specified limits shown on applicable drawings, and surfaces shall be of specified finish and without blemish (see 4.8.2).

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 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Inspection equipment. Unless otherwise specified in the contract (see 6.2), the contractor 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% of the measurement tolerance. Calibration of inspection equipment shall be in accordance with MIL-STD-45662.

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. Tests (see 4.5.3).
c. Control tests (see 4.6).

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 28.5 $^{+2}_{-3}$ inches mercury (in·Hg)
c. Relative humidity 50 $\pm$ 30%

4.4 First article inspection. Unless otherwise specified (see 6.2), the Government shall randomly select four filters properly identified and produced under the production contract (see 6.2) for first article inspection. First article samples shall be inspected as specified in table II. Approval of the first article sample by the Government shall not relieve the contractor of his obligation to supply filters 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.

TABLE II. Classification of inspections.

Title	Requirement	Inspection	First article	Quality conformance		Control
				Examination	Tests	
Material and construction	3.2 thru 3.3.1	4.8.1	X			
Defects (see 4.5.2 and table III)	3.3, 3.3.1, 3.5 & 3.6	4.8.2	X	X		
Selectivity	3.4.1.1.1	4.9.1	X		X	
Transmission analysis	3.4.1.1.2	4.9.2	X		X	
Reflection	3.4.2	4.9.3	X			X
Weathering	3.4.3	4.9.4	X			

4.4.1 First article inspection failure. Deficiencies found during, or as a result of, first article inspection shall be cause for rejection of the first article sample 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, first article inspection, shall be evidence that all items already produced prior to completion of the first article inspection are similarly deficient unless contrary evidence satisfactory to the contracting officer is furnished by the contractor. Such deficiencies on all items shall be corrected by the contractor. The Government will not accept products until first article inspection is completed to the satisfaction of the Government.

4.5 Quality conformance inspections.

4.5.1 Sampling.

4.5.1.1 Lot formation. An inspection lot shall consist of all the filters of one type and part number, from an identifiable production period, from one manufacturer, submitted at one time for acceptance.

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. Before sampling may be initiated, the contractor shall establish by examination of at least 20 consecutively produced filters that the process average percent defective, as defined in MIL-STD-105, is not greater than the specified AQLs.

4.5.1.3 Sampling for test. Samples for acceptance tests shall be selected in accordance with level S-3 of MIL-STD-105.

4.5.2 Examination.

4.5.2.1 Acceptable quality level. Each sample selected in accordance with 4.5.1.2 shall be examined to determine conformance to the following acceptable quality levels (AQL) on basis of % defective.

Classification	AQL
Major	1.0
Minor	2.5

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

TABLE III. Classification of defects.

Category	Defect	Method of examination
Critical	None	
Major	AQL 1.0% Defective	
101	Assembly incomplete (see 3.3).	Visual
102	Dimensions affecting interchangeability, out of tolerance (see 3.3).	SIE 1/
103	Improper marking (see 3.5).	Visual
104	Faulty workmanship affecting performance (see 3.6).	Visual
Minor	AQL 2.5% Defective	
201	Dimensions not affecting interchangeability, out of tolerance (see 3.3).	SIE
202	Improper marking (see 3.5)	Visual
203	Faulty workmanship affecting appearance (see 3.6).	Visual

1/ SIE = Standard Inspection Equipment.

4.5.3 Test. Samples selected in accordance with 4.5.1.3 shall be subjected to the quality conformance tests specified in table II.

4.6 Control tests. Control tests shall be conducted on four filters from each lot of 500 units consecutively produced, except that not more than eight nor less than four tests shall be performed in a one month period. The filter assemblies shall be subjected to the control tests specified in table II, and examinations in table III.

4.7 Failure. Failure of any filter to pass any of the specified quality conformance or control tests 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.

4.8 Methods of inspection.

4.8.1 Materials and construction. Conformance to 3.2 thru 3.3.1 shall be determined by inspection of contractor records providing proof or certification that design, construction, processing, and materials conform to requirements. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, vendor catalogs and certifications, industry standards, test reports, and rating data.

4.8.2 Defects. Conformance to 3.3, 3.3.1, 3.5 and 3.6 shall be determined by examination for the defects listed in table III. Examination shall be visual, tactile, or by measurement with standard inspection equipment.

4.9 Performance tests.

4.9.1 Selectivity. This test shall be conducted in conjunction with the test specified in 4.9.2. If a continuous-recording instrument is used, the entire transmission curve shall be examined for conformance to the curve shown in figure 1 and to the requirements of 3.4.1.1.1. If readings have been taken at 10 millimicrons intervals only, the values shall be compared with the values shown on figure 1 for each corresponding wave length. A value of 50% or less for the 620 millimicrons reading and a value of 50% or more for the 640 millimicrons reading shall constitute conformance to requirement "a" of 3.4.1.1.1.

4.9.2 Transmission analysis test.

4.9.2.1 Apparatus. The instrument used for this test shall be a spectrophotometer capable of isolating a spectral band in the order of magnitude of 1 millimicron or less in width and employing photometric means for measuring the percentage of the incident light transmitted.

4.9.2.2 Procedure. Light of the wave length range, 360 to 760 millimicrons inclusive, shall be directed at the surface of incidence of the light filter, from a direction normal to it, and the % of transmission measured at the wave length values specified in table I.

4.9.2.3 Computation. At each specified step, the spectral transmission in % (T) shall be multiplied by the rod visibility factor (R) and by the cone visibility factor (C), and the two products thus obtained shall be recorded in the blank spaces provided in table I. When both products have been obtained for each specified step, the sum of all the products of times and the sum all the products of C times T shall be computed to determine conformance to 3.4.1.1.2.

T = Spectral transmission, %.
R = Rod visibility factor.
C = Cone visibility factor.

4.9.3 Reflection. To determine conformance to 3.4.2, the light filter shall be conditioned for not less than 2 hours at 77 ± 15°F. And while at that temperature, shall be placed in light conforming to standard illuminant C in accordance with procedure A of ASTM D1003. The percentage of reflection shall be measured with photometric equipment. The filter shall be placed in the light path at any angle above the critical angle of refraction, and adjusted to achieve maximum reflection from the outer (normally exposed) surface.

4.9.4 Weathering test. Light filters shall be subjected to accelerated weathering in accordance with ASTM D1435. Filters shall be attached to panels of a size and shape to permit their installation on the apparatus turntable. Filters shall be located on the panels in such manner that, when the panels are mounted on the turntable, the area to be tested for light transmission will be 4 1/2 ± 1/4 in. from the center of turntable rotation. Filters shall be mounted with the outer side exposed. At the completion of the weathering procedure, filters shall be subjected to the test specified in 4.9.2 to determine conformance to 3.4.3.

5. PACKAGING

5.1 Preservation, packaging, packing, and marking. Preservation, packaging, packing, and marking for the desired level shall be in accordance with the applicable packaging requirements specified by the contracting authority (see 6.2).

6. NOTES

6.1 Intended use. Filters covered by this specification are intended for interior use in combat vehicles, trailers, and similar applications for maintaining blackout security by providing a blue light which will permit performance of the tasks required of dark-adapted vehicle personnel while preserving the maximum practicable degree of dark adaptation and which will be visible for the minimum possible distance.

6.2 Ordering data. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Applicable drawings of the filter shall be as specified by the procuring activity (see 3.3).
c. First article inspection and testing, if required (see 3.1 and 4.4).
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 4.1.2).
f. Selection of applicable level and packaging requirement (see 5.1).

6.3 Definitions.

6.3.1 Recovered materials. Recovered materials means materials that have been collected or recovered from solid waste (see 6.3.2).

6.3.2 Solid waste. "Solid waste" means (a) any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and (b) other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. It does not include solid or dissolved material in domestic sewage, or solid or dissolved material in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Clean Water Act, (33 U.S.C. 1342 et seq.), or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.) (Source: Federal Acquisition Regulations, section 23.402).

6.4 Subject term (key word) listing.

Blackout secure light filter
Light filter (for blackout secure)
Secure light filter, blackout

Custodian:
Army - AT

User activity:
Army - ME

Preparing activity:
Army - AT

(Project 6220-A357)

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	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
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