INCH-POUND
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01 June 2001
SUPERSEDING
MIL-F-16552E (SH)
28 October 1986

PERFORMANCE SPECIFICATION

FILTERS, AIR ENVIRONMENTAL CONTROL SYSTEM, CLEANABLE, IMPINGEMENT (HIGH VELOCITY TYPE)

This specification is approved for use within the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers air filters of permanent and cleanable types. They are for use in filtering dust and lint from the air passing through ventilating, heating and cooling systems.

1.2 Classification. Air filters are of the following classes as specified (see 6.2).

Classes:
- Class 1 - Air filters
- Class 2 - Air filters nonmagnetic

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 ensure 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.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, SEA 05Q, Naval Sea Systems Command, 1333 Isaac Hull Ave, SE, Washington Navy Yard, Washington DC 20376 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 4130

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following standards and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-2142 Magnetic Silencing Characteristics, Measurement of

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Documents 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.

PUBLICATIONS

NAVSEA TECHNICAL PUBLICATION

S9074-AR-GIB-010/278 – Requirements for Fabrication, Welding and Inspection, Casting Inspection and Repair for Machinery, Piping and Pressure Vessels

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

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM-E-662	Test method for specific optical density of smoke generated by solid materials
ASTM-E-800	Guide for measurement of gases present or generated during fires.
ASTM-F-1166	Standard Practice for Human Engineering Design for Marine Systems, Equipment and Facilities

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

THE AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS, INC. (ASHRAE)

52.1-1992 Gravimetric and Dust Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

(Application for copies should be addressed to the American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., Publication Sales, 1791 Tullie Circle, NE, Atlanta, GA 30329)

AMERICAN WELDING SOCIETY (AWS)

B2.1-84 Welding Procedure & Performance Qualifications, Standard
B2.2-91 Procedure and Performance Qualifications & Performance Quality, Standard Brazing

(Applications for copies should be addressed to the American Welding Society (550 NW LeJeune Road, Miami, FL 33216)

2.4 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 takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. A sample shall be subjected to first article inspection (see 6.3) in accordance with 4.2.

3.2 Materials. Materials used for the filter shall be corrosion-resisting or material shall be protected against corrosion after fabrication. Material degraded during the fabrication process shall be normalized to restore those properties before assembled in any filter. Selected materials shall be capable of meeting all of the operational and environmental requirements specified herein.

3.2.1 Composite material.

3.2.1.1 Filter components. Composite material to be used for filter shall be subject to small scale material specimen fire tests.

3.2.2 Hazardous materials. Material for use in the construction of filters shall have no effect on the health of personnel when the materials are used for their intended purpose. Regardless of other requirements, materials and parts containing asbestos, cadmium, lithium, mercury or radioactive material shall not be used.

3.2.3 Fasteners. Material for all bolts, nuts, studs, screws and similar fasteners shall be corrosion-resistant passivated or of a material rendered resistant to corrosion. Sheet metal screws shall not be used. Galling shall be prevented.

3.2.4 Nonmagnetic construction. When nonmagnetic filters are specified (see 6.2) all filter parts including frame, filter media, fasteners, and fittings shall be of nonmagnetic material. Nonmagnetic material is defined as a material which has a maximum permeability of less than 2 after fabrication.

3.2.5 Dissimilar metals. Filters shall not be degraded due to electrolysis (see 6.8).

3.2.6 Recovered materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and may be fabricated using recycled, recovered or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs. None

of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise expressly stipulated.

3.3 Painting. Filter and component items shall be delivered with the manufacturer's standard finish, except as to comply with the requirements of 3.2.

3.4 Welding and allied processes. Surfaces of parts to be welded or brazed shall be free from rust, scale, paint, grease, and other foreign matter. Welding and allied processes shall be performed by personnel certified to American Welding Society standards. NAVSEA Technical Publication S9074-AR-GIB-010/278 may be used for guidance.

3.5 Identification plate. Each air filter shall be provided with an identification plate. The plate shall be of corrosion-resisting material and shall be placed in such a manner as not to interfere with sliding the filter into a filter housing. The following data shall be provided on the identification plate:

a. Item name

b. Size (see 3.11)

c. National stock number

d. Contract number

e. Manufacturer's name and address

f. Whether item is non-magnetic

In addition, air filters requiring air flow in a single direction shall be provided with an arrow and the words "air flow" or similar means indicating the direction of air flow.

3.6 Interchangeability. In no case shall parts be physically interchangeable or reversible unless such parts are also interchangeable or reversible with regard to function, performance, and strength.

3.7 Human engineering. The air filter shall be arranged so as to achieve safe, reliable, and effective performance by maintenance personnel and to optimize personnel skill requirements. ASTM-F-1166 shall be utilized as a guideline in applying human engineering design criteria for the filter.

3.8 Maintainability. The filter shall be constructed so that:

a. The filter can be removed from the filter housing without special tools.

b. The filter frame will not distort when removed from a spring-loaded filter housing.

3.9 General shipboard design conditions.

a. The filter shall operate satisfactorily when exposed to soaking atmospheric spray (rain or sea) or seawater.

b. Able to perform in accordance with requirements herein under ambient temperatures between minus 10 and plus 95 degrees F.

c. Be capable of being washed in 190 degree F hot water with common detergents.

d. Be compatible for constant contact with food grade lubricating oil, United States Department of Agriculture rating USDA H1.

3.10 Corner shock resistance. Filter frames shall withstand shock or impact to the corners.

3.11 Interface requirements. To permit removability and interchangeability, sizes of air filters shall be limited to those shown on Figure 1.

3.11.1 Tolerances. Tolerances of the air filters shall be as shown on Figure 1.

3.12 Performance. The air filter, when tested at face velocities of 500 and 625 feet per minute, shall have initial efficiencies and a dust load capacity of at least 2.65 ounces per square foot of face area when loaded.

3.12.1 Pressure loss (resistance to air flow). At the specified face velocities, the initial resistance and the resistance when loaded with at least 2.65 ounces of test dust per square foot shall not exceed those shown in Table I.

TABLE I. Performance Requirements.

Face Velocity (feet per minute)	Average synthetic dust weight arrestance (per cent)	Pressure loss inches water gauge	
		Initial	Loaded
500	65	0.15	0.65
625	70	0.25	0.95

3.13 Cleanability. The air filter shall be capable of being cleaned using hot water at a temperature of 190 degrees Fahrenheit and detergent. The resistance of the filter shall be increased by not more than 0.01-inch water-gauge from the initial air-flow resistance after having been loaded with dirt and cleaned.

3.13.1 Drainage. Provide means on all sides of the filter frame to ensure complete drainage after cleaning.

3.14 Filter media support. The media shall be attached to the frame in a way that prevents splitting, dislodging, slumping or separation from the frame under maximum air velocity and filter resistance conditions. The filter media shall be protected on both faces by suitable guards.

3.15 Filter removal. An integral means for removal of a filter from a filter housing shall be provided on two adjacent sides of the filter. This provision shall not interfere with sliding the filter into a filter housing, shall be self-storing, and shall not project beyond the outer faces of the frame.

3.16 Operating life. The filters shall have an operating life of 100 wash and dry cycles.

4. VERIFICATION

4.1 Classifications of inspections. The inspections specified herein are classified as follows:

a. First article inspection (see 4.2)
b. Conformance inspection (see 4.3)
c. Periodic conformance inspection (see 4.4)

4.2 First article inspection. First article inspection shall consist of the examination of 4.6 and tests specified in Table II. The tests specified shall be performed on each size filter.

TABLE II. Test Agenda.

Tests	Requirements	Verifi-cation	First Article	Conformance	Periodic
Resistance	3.12.1	4.6.1	All	All	All
Arrestance	3.12.1	4.6.2	All	-----	-----
Dust Loading	3.12	4.6.3	All	-----	All
Cleanability	3.13	4.6.4	All	-----	-----
Shock Corner Drop Test	3.10	4.6.5	All	-----	-----
Composite Material	3.2.1	4.6.6	First Production Unit	-----	First Production Unit
Permeability	3.2.4	4.6.7	All	-----	-----
Strength	3.8.b	0	First Production Unit	-----	-----

4.3 Conformance inspection. Conformance inspection shall consist of the tests as specified in Table II. The tests specified shall be performed on each size filter. Any unit which fails to meet any specified requirements shall be rejected.

4.4 Periodic conformance inspection. Periodic tests are required to ensure continuing satisfactory operation of identical units. The tests are required under any contract or purchase order for air filters of existing design when the invitation to bid is dated 4 years or more subsequent to the date of the last previous test of an identical unit. Periodic tests shall consist of the tests specified in Table II.

4.5 Composite material. Filters constructed of composite material shall meet the material requirements of 4.6.6.

4.6 Tests. Tests shall be conducted in accordance with 4.6.1 through 4.6.7.

4.6.1 Resistance. Resistance shall be determined in accordance with ASHRAE 52.1-1992, resistance versus air flow measurements.

4.6.2 Arrestance. Arrestance shall be tested in accordance with ASHRAE 52.1-1992, determination of synthetic dust weight arrestance.

4.6.3 Dust loading. Dust loading effects shall be tested in accordance with the requirements for disposable and non-renewable filters of ASHRAE 52.1-1992.

4.6.4 Cleanability. Cleanability shall be determined after the filter is loaded with dust in accordance with 4.6.3. Cleaning shall be by means of a stream of hot water at a pressure of 60 to 80 pounds per square inch (lb/in^2). If cleaning by this means reduces the resistance to air flow to within 0.01 inch water gauge of its initial value, with the filter unoiled both before and after the test, the specimen shall be considered acceptable in regard to cleanability.

4.6.5 Shock corner drop test. The filter unit shall be subjected to one free fall drop on each of two adjacent corners. The filter unit shall be held by one corner and allowed to drop on the opposite corner. The impacting corner shall fall 36 inches onto an unyielding concrete surface. The filter unit shall show neither evidence of permanent damage nor distortion greater than the following limits:

a. Flatness distortion of the frame in datum plane “B” of Figure 1 shall not exceed 0.25 inch.

b. Perpendicular distortion of any corner shall not exceed 1 degree.

Filters made of composite materials shall meet the smoke obstruction (ASTM E-662) test as follows:

Ds During 300 Sec (flaming)	6 (4 minutes)
Ds During 30 Sec (nonflaming)	1 (4 minutes)
Dmax (flaming)	81
Dmax (nonflaming)	32

and the Combustion Gas (ASTM-E-800) test as follows:

Combustion Gas	Flaming	Nonflaming
CO	75	10
CO_2	2.0%	0.4%
HF	<1	<1
HC1	13	1
NO_x	1	<0.5
SO_2	<1	<1
HCN	1	<1
NH_3	<3	<3
COC_2	<0.1	<0.1

4.6.7 Permeability tests. A permeability test of nonmagnetic material used in construction of the filter shall be conducted in accordance with DOD-STD-2142, Test 501

4.6.8 Strength tests. The filter frame shall not be damaged or suffer permanent distortion when subjected to a tensile force of 50 pounds perpendicular to the longest filter side and parallel to the plane of the face area of the filter. The force shall be applied to the handle and shall be maintained for 20 seconds.

5. PACKAGING

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

6. NOTES

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

6.1 Intended use. The filters covered by this specification are for use in filtering dust and lint from air passing through duct cooling coils, fan coil assemblies, fan coil units, and as prefilters for HEPA filters.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification

b. Filter size(s) required (see Figure 1)

c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of the individual documents referenced (see 2.2.1)

d. If non-magnetic filter required (see 3.2.4)

e. Level of preservation, packing, and marking required (see 5.1).

f. Drawing approval is required (see 6.4)

g. Final drawings are required (see 6.4.1)

6.3 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a pre-production sample, a first article sample, a first production item, a sample selected from the first lot production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.2. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Approval. The Contract should require (see 6.2) that two prints of filter drawings be submitted for approval by the acquisition activity unless the drawings have been previously approved within the last three years.

6.4.1 Final drawings. When final drawings are required (see 6.2) and comments on new drawings are approved, adjudicated or reconciled, the contractor is responsible to: (1) forward final filter drawing to the acquisition activity; and (2) include special requirements of the contract or order prior to distribution of final drawings.

6.5 Identifying numbers. A national stock number (NSN) and a component identification number (CID No.) will be assigned by the Government after drawing approval. The contractor is responsible to: (1) identify these numbers in shipping papers; and (2) mark these numbers on each filter identification plates.

6.6 Technical manuals. The requirement for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, military specifications and standards that have been cleared and listed in DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL) must be listed on a separate Contract Data Requirements List (DD Form 1423), which in included as an exhibit to the contract. The technical manuals must be acquired under separate contract line item in the contract.

6.7 Definitions.

6.7.1 Air filter. The air filter consists of a filtering media enclosed in a frame or binding channel, media retaining guards, and handles.

6.7.2 Face area. The face area of a filter is the area, in square feet, obtained by multiplying the inside dimensions of the face of the filter frame or binding channel.

6.7.3 Face velocity. The face velocity of a stream of air passing through a filter, expressed in feet per minute, is the rate of flow of air measured in cubic feet per minute divided by the face area of the filter.

6.7.4 Dust load. Dust holding capacity is the amount of synthetic dust fed to the test filter times its average arrestance when the test filter reaches the rated final resistance.

6.7.5 Arrestance. Arrestance is an efficiency value. A standardized dust consisting of various particle sizes is fed into an air cleaner and the weight fraction of dust removed is determined. Under ASHRAE 52.1-1992, this type of efficiency measurement is named synthetic dust weight arrestance to distinguish it from other efficiency values.

6.7.6 Resistance (to air flow). Resistance is the static pressure drop across the filter at a given air flow rate. The term “pressure drop” is used interchangeably with resistance.

6.8 Recommended practices. The following documents provide information for the design, manufacture, testing, and qualification of vaneaxial fans used for cooling of gas turbine machinery previously supplied to the United States Navy, and may be used for guidance:

a. MIL-F-16552 – Filters, Air Environmental Control System, Cleanable, Impingement (High Velocity Type)

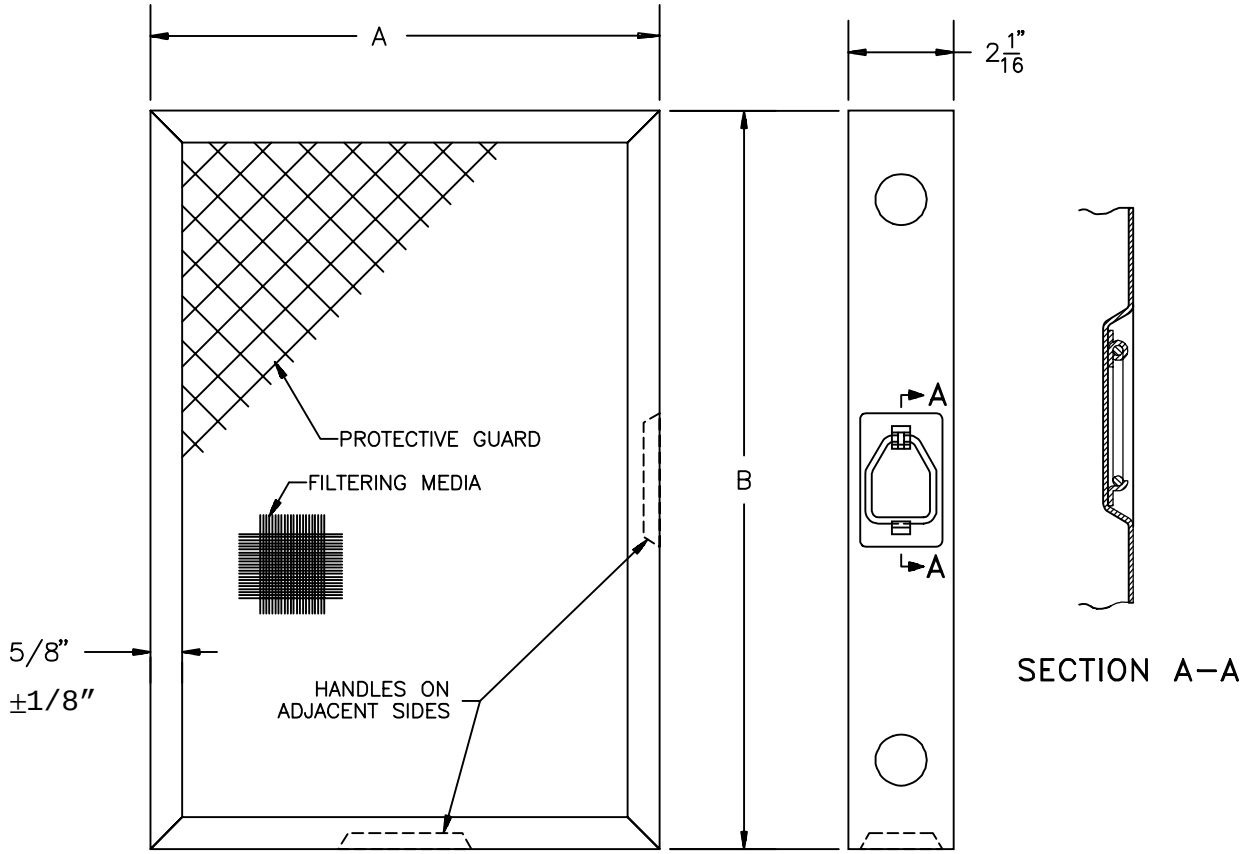
b. NAVSHIPS Drawing 804-1170895 – Filters, Air, Navy Standard

c. MIL-STD-889 – Dissimilar Metals

6.9 Subject term (key word) listing.

Air filters
Air filters, nonmagnetic

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



SIZE NUMBER	DIMENSIONS (INCHES)		NET FACE AREA (SQ. FT.)
	A	B	
10AF	7 1/4	7 1/4	0.25
11AF	8	12 1/2	0.53
12AF	10	14 1/2	0.81
13AF	10	22	1.26
14AF	15 1/2	24 1/2	2.30
15AF	19 1/2	19 1/2	2.30
16AF	19 1/2	29 1/2	3.58

All tolerances are +/- 1/16 inch except as noted.

FIGURE 1. Sizes and physical interface dimensions of air filters.

Custodian:
Navy - SH

Review activities:
DLA - IS

Preparing Activity
Navy - SH
(Project 4130-N001)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4,5,6, and 7 and send to preparing activity.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-16552F	2. DOCUMENT DATE *(YYYYMMDD)* 01 June 2001

3. DOCUMENT TITLE FILTERS, AIR ENVIRONMENTAL CONTROL SYSTEM, CLEANABLE, IMPINGMENT (HIGH VELOCITY TYPE)

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER		
a. NAME *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE *(Include Area Code)* (1) Commercial (2) DSN	7. DATE SUBMITTED *(YYYYMMDD)*

8. PREPARING ACTIVITY	
a. NAME Ruth Butler	b. TELEPHONE *(Include Area Code)* (1) Commercial (202) 781-3726 (2) DSN 326-3726
c. ADDRESS *(Include Zip Code)* Commander, Naval Sea Systems Command ATTN: SEA 03Q, 1333 Isaac Hull Ave, SE, Washington Navy Yard, Washington DC 20376	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman Road, Suite 2533