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28 August 1989
SUPERSEDING
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MILITARY SPECIFICATION

DUCT ASSEMBLY, GROUND, CONDITIONED AIR, INSULATED, FLEXIBLE

This specification is approved for use by the Department of the Air Force and is available four use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers insulated, flexible air duct assemblies for portable ground support air conditioners and heaters.

1.2 Classification. The duct assemblies are of any length and of the following diameters and connector configuration specified in tables I and II (see 6.2).

TABLE I. Duct size.

Duct size	Code
16 Inches	A
12 Inches	B
8 Inches	C
5 Inches	D

TABLE II. Connector Configuration.

Connector configuration	Code
Male and Male	A
Female and Female	B
Male and Female	C
None	D

1.3 Specification reference number. The specification reference number is definitive and formatted to identify each item covered by this document. The reference number is formatted by selecting from the requirement options available in this specification as follows (see 1.2, 3.12, and 6.2).

Definitive specification reference number M38386 X X X XXX
Specification number
Size code (see 1.2)
Built in storage device required (1=yes, 2=no)
Connector configuration as required (see 1.2)
Length in feet (see 3.7.3 and 6.2)

Example: M38386A2A024 - A 16-inch duct assembly, without storage device, male to male connectors included, 24 feet in length.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to The Engineering Division, San Antonio Air Logistics Center, ATTN: MMDEMM, Kelly AFB TX 78241 by using the self-addressed Standard Standardization Document Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 4720

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document 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.

SPECIFICATIONS

FEDERAL

PPP-B-636	-	Box, Fiberboard

MILITARY

MIL-P-116	-	Preservation, Methods of

STANDARDS

FEDERAL

FED-STD-191	-	Textile Test Methods

MILITARY

DOD-STD-100	-	Engineering Drawing Practices
MIL-STD-129	-	Marking for Shipment and Storage
MIL-STD-130	-	Identification of U.S. Military Property
MIL-STD-970	-	Specifications and Standards, Order of Precedence for Selection of
MIL-STD-808	-	Finishes, Protective, and Codes for Finishing
MIL-STD-810	-	Environment Test Methods
MIL-STD-831	-	Test Reports, Preparation of
MS33561	-	Connectors, Aircraft Ground Air Conditioning, 5-Inch, Minimum Requirements for

2.1.2 Other Government drawings. The following other Government drawings form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation (see 6.2).

AIR FORCE DRAWINGS

64C1004	Connector-Air Duct Hose, Ground Cooling, Male
64C1005	Connector-Air Duct Hose, Ground Cooling, Female
64C1006	Packing, Performed, Air-Duct Hose, Ground Cooling

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

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

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME PTC-19.5:4	Power Test Code Supplement on Instruments and Apparatus

(Application for copies should be addressed to the American Society of Mechanical Engineers (ASME), 345 East 47th Street, New York, NY 10017.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D-430	Rubber Deterioration, Dynamic Fatigue, Test for
ASTM D-471	Rubber Property, Effects of Liquids

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

(Non-Government standards and other publications are normally available from the organizations that prepare or 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 document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), 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 inspection (see 6.3) in accordance with 4.4.

3.2 Selection of specifications and standards. Selection of specifications and standards for materials, parts, and Government certification and approval of processes and equipment which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with MIL-STD-970.

3.3 Materials. Materials shall be as specified herein. However, when a definitive material has not been specified, a material shall be chosen of the quality used for the purpose in good commercial practice. Materials shall be free from all defects and imperfections that might otherwise affect the serviceability of the finished product.

3.3.1 Recycled, reclaimed, or virgin materials. Recycled or reclaimed material may be used in lieu of virgin material provided that all the requirements of this specification are met and the material does not jeopardize the quality or life of the finished product.

3.3.2 Fabric. Fabric used in the duct construction shall be manufactured in such a manner as to meet all the requirements of this specification.

3.3.3 Fire resistance. All exterior materials used in construction of the duct assembly shall be fire resistant.

3.3.4 Metals. Metals selected for construction of the duct assembly shall be corrosion resistant or treated to resist corrosion caused by exposure to fuels, salt spray, or atmospheric conditions as may be encountered in storage or normal service.

3.3.5 Dissimilar metals. Dissimilar metals as defined by MIL-STD-889, shall not be used in intimate contact with each other unless adequately protected against galvanic corrosion.

3.3.6 Protective treatment. When materials selected for construction of the duct assembly would be subject to corrosion caused by exposure to fuels, salt spray, or atmospheric conditions likely to occur during service usage, they shall be protected against such corrosion in a manner that will in no way prevent compliance with the performance requirements of this specification. The use of any protective treatment that will crack, chip, peel, or scale with age or extremes of atmospheric conditions shall be avoided.

3.4 Design. The duct assembly shall be designed for outdoor use in all types of weather to include damp, salt laden air for extended periods of time.

3.5 Construction.

3.5.1 Duct. The duct shall be so constructed that during abusive handling, twisting, and bending, a minimum amount of damage or crimping of fabric shall occur.

3.5.2 Stiffener. The duct assembly shall include a continuous metal helical stiffener core to prevent transverse collapsing and excessive area reduction during sharp bends and retain an approximate circular cross-sectional area. The stiffener core shall be squared of at each end.

3.5.3 Cuff attachment. The duct assembly cuff on the connector shall be as narrow as practical to permit securing the connector close to the squared off stiffener core at each end of the duct. The stiffener core and attaching cuff shall not work loose under repeated normal usage.

3.5.4 Duct rigidity. The duct assembly stiffener core shall not be of such rigidity as to interfere excessively with the expansion/retraction from the storage device.

3.5.5 Duct stitching. When stitching is used, the materials shall be capable of meeting the requirements and tests specified herein. The stitching shall be of the lock type to prevent unraveling when a stitch is broken.

3.5.6 Connectors. When specified (see 6.2), connectors used as a part of the duct assemblies shall conform to those described in USAF drawings 64C1004 and 64C1005 with the preformed packing as described in USAF drawing 64C1006.

3.5.7 Storage devices. When specified (see 6.2), the duct assemblies shall be furnished with a built-in storage device. The built-in storage device shall be internally located in each duct assembly to act as a guide in expanding and retracting the duct assembly and to firmly retain it in the storage position. The storage device shall not damage the fabric during the expansion or retraction of the duct assembly. The carrier portion shall be firmly attached to the male connector. All welds on the storage device shall be of the fusion type. In the event that carrier cleats are riveted to the connector ends, two (2) rivets shall be used on each end of the cleat.

3.6 Performance.

3.6.1 Air flow. Each duct assembly shall be capable of satisfactorily delivering the volume (cubic feet per minute (CFM)) of conditioned air at temperatures of up to 250°F from portable ground support cooling and heating equipment for the specific duct size required per table III (see 4.6.2).

TABLE III. Air flow/leakage.

Dia (in)	Air flow (CFM)	Friction Air Loss (Inch H^2O)	Pressure (psig) Operating	Proof
16	3,500	0.15 device +0.025 per foot of duct	3.0	6.0
12	2,000	0.15 device +0.025 per foot of duct	4.0	8.0
8	1,140	0.15 device +0.025 per foot of duct	6.0	12.0
5	375	0.15 device +0.025 per foot of duct	10.0	20.0

3.6.2 Contamination. The duct assemblies shall not be contaminated by foreign objects or material residue when tested as specified (see 4.6.3).

3.6.3 Pressures.

3.6.3.1 Internal pressures. The duct assemblies shall be capable of withstanding the internal pressures per table III down to five (5) inches of water without permanent damage when tested as specified (see 4.6.4).

3.6.3.2 Leakage. Each duct assembly shall be constructed to prevent air leakage through the duct wall of 0.2 percent maximum of the specified airflow at the operating pressures specified in table III and the internal surface of the duct assembly and built-in storage device shall be so constructed that air friction losses shall not exceed the values shown in table III for the specific size when tested as specified (see 4.6.5).

3.6.4 Insulation. Insulating material shall be utilized, of a type that will not wad or powder during the life of the duct, to provide a maximum overall coefficient of heat transfer (U) of 0.75 BTU/hr^2-°F for each duct size when tested as specified (see 4.6.6).

3.6.5 Expansion/retraction. Each duct assembly shall be so constructed that it will retain its approximate cross-sectional area when either expanded or retracted into the storage device. Each duct assembly shall be able to be

(c) Level of protection required

expanded or retracted with a minimum amount of physical effort when tested as specified (see 4.6.7 and 4.6.8).

3.6.6 Duct fabric/flex life. The duct fabric/flex life shall be 75 percent of the strength of new (unflexed) fabric, determined when tested as specified (see 4.6.9).

3.6.7 Bend. To prevent excess area reduction during 90 degree bends, normal pitch of the stiffener core shall be held to a minimum consistent with the retractability requirements and shall not exceed 95 percent of the nominal diameter of the duct assemblies, when tested as specified (see 4.6.10).

3.6.8 Tensile.

3.6.8.1 Tensile load. The duct assemblies shall have a tensile load capable of withstanding a tensile pull of 250 pounds without evidence of rupture, separation of duct from connectors or other damage, when tested as specified (see 4.6.11.1).

3.6.8.2 Tensile strength. The duct assemblies shall have a tensile strength capable of withstanding the tensile strength tests, when tested as specified (see 4.6.11.2).

3.6.9 Connector drop damage. The 5-inch male and female connectors shall be constructed to withstand repeated drops onto concrete from a height of 8.0 feet while attached to the duct assembly, when tested as specified (see 4.6.12).

3.6.10 Fire resistance. The fabric used for the duct assemblies shall be fire resistant to the extent that it shall not support a flame for more than three (3) seconds nor glow for more than five (5) seconds, when tested as specified (see 4.6.13).

3.6.11 Abrasion resistance. The duct assembly material shall be highly resistant to abrasion or so constructed that the basic fabric will be protected by means of a scuff strip or the like to prevent excessive abrasion, when dragged over level surfaces at speeds from four (4) to five (5) miles per hour, when tested as specified (see 4.6.14).

3.6.12 Repairability. When torn or punctured, the duct fabric shall be repairable by stitching or the cementing of patches. The stiffener core and carrier shall be so constructed that, after being seriously deformed, they can be manually repaired to approximate their original forms, when tested as specified (see 4.6.15).

3.6.13 Liquid absorption. The exterior duct fabric shall be a strong, nonpermeable material that has properties resistant to the absorption of gasoline, oils, grease, or water, when tested as specified (see 4.6.16).

3.6.14 Environmental. Each duct assembly shall be capable of withstanding the following environmental conditions without detrimental effect to subsequent operation.

3.6.14.1 Temperatures. The duct assemblies shall be capable of withstanding the temperature extremes encountered in normal storage, desert, and artic climates, when tested as specified (see 4.6.17).

3.6.14.1.1 Storage temperatures. The duct assemblies shall be capable of withstanding sustained ambient temperatures ranging from -80° to +160° Fahrenheit (F) during storage and be capable of withstanding operating temperatures from -65° to +250°F, when tested as specified (see 4.6.17.1 and 4.6.17.2).

3.6.14.2 Salt/fog. The duct assemblies shall be capable of withstanding a salt fog atmosphere, when tested as specified (see 4.6.17.3).

3.6.14.3 Fungus. The duct assemblies shall be capable of resisting fungus growth encountered in tropical climates, when tested as specified (see 4.6.17.4).

3.6.14.4 Radiant energy. The duct assemblies shall not deteriorate in any manner due to radiant energy, when tested as specified (see 4.6.17.5).

3.6.14.5 Rain. The duct assemblies shall be capable of repelling rain water, when tested as specified (see 4.6.17.6).

3.7 Dimensions. (see 4.6.1)

3.7.1 Inside diameter (ID). The ID of the duct assembly shall not exceed those shown in table IV for the size specified.

TABLE IV. Duct inside diameter.

Nominal ID	Allowable ID
16 in	16 +0.250/-0.000 in
12 in	12 +0.250/-0.000 in
8 in	8 +0.250/-0.000 in
5 in	5 +0.250/-0.000 in

3.7.2 Retracted outside diameter (OD). The retracted OD of the duct assembly shall not exceed those shown in table V for the size specified.

TABLE V. Duct outside diameter.

Nominal OD	Allowable OD
16 in	20.0 in
12 in	16.0 in
8 in	12.0 in
5 in	9.0 in

3.7.3 Expanded length. Duct assembly lengths shall not be shorter nor more than twelve (12) inches longer than the specified length, in feet (see 6.2). When connectors are incorporated, the overall length shall include the connectors.

3.7.4 Retracted length. Duct assembly retracted length, including connectors shall not exceed 25 percent of the specified length when retracted for storage (see 6.2).

3.8 Color. The duct assembly exterior surface color shall be a dark green, color 24052 in accordance with MIL-STD-808 (see 4.6.1).

3.9 Weight. The weight of each complete duct assembly (including connectors) shall not exceed those shown in table VI (see 4.6.1).

TABLE VI. Weight.

Duct size	Allowable weight
16 in	13.6 lbs +4.2 lbs per foot
12 in	10.4 lbs +2.6 lbs per foot
8 in	8.2 lbs +1.7 lbs per foot
5 in	4.2 lbs +1.1 lbs per foot

3.10 Cleaning, painting, plating, chemical films, and chemical treatments. All cleaning, painting, plating, chemical films, and chemical treatments shall be in accordance with MIL-STD-808 (see 4.6.1).

3.11 Interchangeability. All items manufactured to this specification having the same specification part number and/or manufacturers part number shall be functionally and dimensionally interchangeable.

3.12 Product identification. Duct assemblies and components shall be marked for identification per MIL-STD-130. Marking shall include, but not be limited to the manufacturers name or CAGE code, part number, specification part number, contract number, and cure date. Product identification and changes thereto shall be governed by DOD-STD-100 (see 1.3 and 6.2).

3.13 Anti-counterfeiting protection. When it has been determined that the item is susceptible to counterfeiting by either alteration, duplication, or simulation, the product shall be protected in such a manner as to allow it to be traced to the true manufacturer and authenticated as their product. The manner of this protection shall be proprietary to the true manufacturer and released only to the final procuring activities quality assurance department by secure means.

3.14 Workmanship. The duct assemblies shall be uniform in quality, free from irregularities of fabric or other defects that might adversely affect performance, reliability, or durability. The finished duct assemblies (both internally and externally) shall be free from oil, grease, dirt, fabric or metal residue, and any other foreign material that may affect appearance or performance. All metal parts shall be free of any defect which would cause hazardous handling.

3.7.1.7 Other components. Consolidated packages and packaged and

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) 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 any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspections, as part of manufacturing operations, is an acceptable practice, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

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

a. First article inspection (see 4.4).

b. Acceptance inspection (see 4.5)

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified below.

4.3.1 Apparatus. The apparatus used for testing shall be of laboratory precision type and calibrated at properly spaced intervals to include laboratory accuracy. All measurements for the following test conditions shall be measured in accordance with AMSE PTC 19.5:4.

4.3.1.1 Air flow. Air flow shall be measured by means of smooth approach orifices or thin plate orifices. Apparatus such as pitot tubes, rotometers, etc, may be used only when specifically approved by the contracting activity. The rate of air flow shall be expressed in CFM.

4.3.1.2 Barometric pressure. Barometric pressure shall be measured by means of a mercurial barometer. The barometer pressure shall be corrected according to the temperature of the scale and mercury and the location of the barometer with regard to the altitude and latitude. Readings obtained by aneriod barometers shall not be acceptable.

4.3.1.3 Temperature. Temperature shall be measured by means of appropriately located thermocouples. The thermocouples shall be insulated to prevent contact with other metals. Temperatures shall be expressed in degrees Fahrenheit (F). Test temperatures shall be within $\pm 4^{\circ}$F of those specified herein.

4.3.1.4 Pressure. The pressure and pressure differentials shall be measured by means of water manometers having a scale graduated in 0.01 inch of water. Pressures that exceed the range of conventional water manometers shall be measured by properly calibrated bourbon-tube gages. Gages shall be laboratory precision type and shall have a dial diameter of not less than four (4) inches.

4.3.1.5 Atmospheric conditions. Unless otherwise specified, tests shall be conducted at atmospheric pressure of approximately 29.22 inches Hg and at temperatures ranging from +70° to +80°F.

4.3.2 Readings. Unless otherwise specified, temperatures, and other data necessary to demonstrate compliance with the applicable portions of Section 3, 4, or 5 shall be recorded at intervals not to exceed 30 minutes during the testing periods.

4.4 First article inspection.

4.4.1 Examination. When required, first article inspection shall be performed on two (2) duct assemblies of each size being furnished and samples of all materials used in their construction (see 3.1 and 6.2). This inspection shall include the examinations as defined in 4.4.3. Failure of any inspection condition shall be cause for rejection. Any redesign or modification of the contractor's standard product to comply with specified requirements or any necessary redesign or modification following failure to meet specified requirements, shall receive particular attention for adequacy and suitability.

4.4.2 Inspection report. A first article inspection report shall be prepared in accordance with the procedures outlined in MIL-STD-831 upon completion of the first article inspection.

4.4.3 First article inspection. First article inspection shall consist of the tests listed below, in the sequential order listed, for each sample as described under 4.6.

Sample 1 Test	Paragraph	Sample 2 Test	Paragraph
Examination of product	4.6.1	Examination of product	4.6.1
Air flow	4.6.2	Drop	4.6.12
Pressure	4.6.4	Retractability	4.6.7
Leakage	4.6.5	Expansion	4.6.8
Tensile lead	4.6.11.1	Bend	4.6.10
High temperature	4.6.17.1	Insulation	4.6.6
Low temperature	4.6.17.2	Contamination	4.6.3
Salt/fog	4.6.17.3	Fire resistance	4.6.13
Radiant energy	4.6.17.5	Abrasion resistance	4.6.15
Contamination	4.6.3	Absorption	4.6.16
Repairability	4.6.15	Tensile strength	4.6.11.2
Rain	4.16.17.6	Fabric/flex life	4.6.9
		Fungus resistance	4.6.17.4

4.5 Acceptance inspection.

4.5.1 Individual test. Each duct assembly shall be subjected to the tests specified in 4.6.1.

4.6 Test methods.

4.6.1 Product examination. The duct assemblies shall be examined to determine compliance with the requirements specified herein with respect to materials, workmanship, proper assembly, dimensions, weight, color, and marking.

4.6.2 Air flow test. Air flow test shall be conducted on full length duct assemblies with storage racks using air flow values listed in table III. During testing, the duct shall be extended to full length, but shall not be placed under tension. For air friction loss tests, the inlet end of the duct assembly shall be connected to the air flow and static pressure measuring duct with the outlet of the air duct unrestricted. Friction loss values exceeding those specified in table III shall be cause for rejection.

4.6.3 Contamination test. Contamination tests shall be conducted under the same physical arrangement as 4.6.2, except that the outlet of the air duct end shall be monitored for any loose debris originating from the walls of the duct. The monitoring may be by any method that shall detect particles as small as 0.02 inch maximum dimension. These tests shall be performed for two (2) hours under the conditions specified in 4.6.2 for each size of duct being produced. Particles of any type, as described above, coming from the duct shall be cause for rejection.

4.6.4 Pressure test. One duct assembly of each size shall be subjected to pressure tests. Blank fittings shall be attached to the end connections and shall form airtight seals when subjected to the internal pressures specified in table III. One fitting shall have provisions for regulating the internal pressure and the other shall have provisions for pressure measurement. Each duct assembly shall be fully extended when pressurized. The end connections shall be anchored to maintain at least a 90 percent extended length, when negative pressure is applied. The duct assembly shall the pressure specified in 3.6.3.1 without rupture or other damage. Any failure to withstand these pressures shall be cause for rejection.

4.6.5 Leak test. One duct assembly of each size shall be subjected to a leak test to demonstrate compliance with 3.6.3.3. The test shall consist of a two (2) hour run with readings recorded at ten (10) minute intervals. Leakage in excess of that specified in table III shall be cause for rejection.

4.6.6 Insulation shift test. One duct assembly of each size shall be tested to insure compliance with 3.6.4. A three (3) foot section of each duct size shall be mounted to an extended vertical position on a vibration stand and subjected to 10,000 vibration cycles with a stand deflection of 0.125 inch. Immediately following the vibration test, the duct section shall be checked for an insulation shift and shall not show more than a 0.250 inch shift per foot of duct. Upon completion of this test, this duct section shall be tested per 4.6.3. Insulation shifts in excess of that specified shall be cause for rejection.

4.6.7 Retractability test. One duct assembly of each size shall be tested to insure compliance with the retraction requirements of 3.5.2, 3.5.7, and 3.6.5. The duct assembly shall be extended and retracted 20 times with a maximum effort required by an individual of 35 pounds force. A force in excess of 35 pounds

required to retract the duct assembly to at least 25 percent of its full extended length shall be cause for rejection.

4.6.8 Expansion test. One duct assembly of each size shall be tested to insure compliance the expansion requirements of 3.6.5. The duct assembly shall be extended and retracted 20 times. Any evidence of the helical stiffener core failing to extend the duct assembly to at least 70 percent of its full extended length shall be cause for rejection.

4.6.9 Fabric/flex life test. Flex life of the duct assembly fabric shall be tested by subjecting six (6), one (1) by six (6) inch pieces of each material to 10,000 band flex cycles in a DeMattia Flexing Machine, or its equal, in accordance with ASTM D-430. Half of the samples shall be cut in the direction of the warp and the other half in the direction of the fill. The groove described for 0.250 inch thick samples shall not be used. Following band flexing, the duct material shall be checked for breaking strength in accordance with 4.6.10 and shall exhibit 75 percent of the strength of unflexed fabric. Failure of the fabric test shall be cause for rejection.

4.6.10 Bend test. A section of each size duct shall be submitted to 500 each, 90° degree bends over a drum, the diameter of which is twice the outside diameter size of the duct being tested. No damage shall be noted, particularly to the scuff strip, stiffener core, or attaching cuff.

4.6.11 Tensile inspection.

4.6.11.1 Tensile load test. One duct assembly of each size shall be subjected to a tensile load test. In testing the duct assembly, blanks shall be secured to the end connectors and the duct subjected to a tensile load of 250 pounds. All forces shall be applied to the center of the blanks. No rupture, other damage or separation of the duct assembly from connector shall occur as a result of this test. Failure of this test shall be cause for rejection.

4.6.11.2 Tensile strength test. The breaking strength of non-metallic materials used in the duct and tear strength of the duct fabric shall as specified by methods 5102 and 5132, FED-STD-191. Pieces of material cut from ducts that have been subjected to the sample 1 testing sequence (see 4.4.3) shall exhibit a minimum of 75 percent of the strength of the same material when new. Failure to meet the minimum requirements for this test shall be cause for rejection.

4.6.12 Drop test. One (1), five (5) inch duct assembly, with end connectors and built-in storage device, shall be subjected to a drop test. Each end of the duct assembly shall be raised to a height of eight (8) feet and dropped onto a concrete surface 20 consecutive times. Any damage as a result of this test which would cause difficulty in making connections or leakage of the connection shall be cause for rejection.

4.6.13 Fire resistance test. Samples of materials used in the fabrication of the exterior surface of the duct assembly shall be tested for fire resistance in accordance with method 5904, FED-STD-191. Failure of this test shall be cause for rejection.

4.6.13.1 Material samples. Four (4), 2.750 x 12.500 inch sample pieces of each type of material shall be used. One-half of each set shall be cut with the long dimension in the direction of the warp and the other half with the long dimension in the direction of the fill. Pieces of stitching material or nonmetallic scuff strips shall be 12.500 inches long.

4.6.13.2 Flame and glow. The duration of flame and glow in the samples shall be timed. After complete extinction of all flame and glow, the char length shall be measured. No specimen shall support a flame for more than three (3) seconds nor a glow for more than five (5) seconds after the flame is withdrawn. The average char length of any set of test specimens shall not exceed five (5) inches. Char length shall be the distance from the exposed end of the specimen in which any portion of the material is destroyed or transformed from its normal state into an incoherent, softened, or ashlike substance.

4.6.14 Abrasion resistance test. Samples of materials used in the fabrication of the exterior surface of the duct assemblies shall be tested for abrasion resistance in accordance with method 5306, FED-STD-191. Failure of this test shall be cause for rejection.

4.6.14.1 Fabric abrasion test. Pieces of new exterior duct fabric and exterior duct fabric removed from ducts which have been subjected to sample No. 1 testing sequence shall be used for this test. The Taber Abraser shall have mounted H-22 abraser wheels under a load of 1,000 grams. Tests shall be conducted on the side of the material which would be the external side of the duct. At the end of 1,000 wear cycles, the fabric coating shall not be worn to such extent that the basic fabric is torn by the abraser wheel. Magnification shall be used to aid in the determination of the extent of wear.

4.6.14.2 Scuff strip abrasion. A four (4) inch diameter disc with a swatch of the scuff strip material attached shall be subjected to an abrasion resistance test simulating wear that would occur over a clean, dry, brush-finish concrete surface. The test shall be conducted using a Taber Abraser, equipped with a H-22 calibrate wheel with an applied load of 1,000 grams. The specimen shall be rotated for a total of 10,000 cycles with an inspection of the swatch being made at the end of each 1,000 cycles to note any wear. Any wear through the scuff strip to the backing material so as to damage the duct shall be cause for rejection.

4.6.15 Repairability test. Repairability of the duct shall be determined by a demonstration of patching methods. Repairability of the stiffener core shall be determined by flattening samples of each size duct to one-third of its original diameter and then returning the duct to the approximate original shape without the use of special tools. After repair, the duct assembly shall be subjected to the air flow test specified in 4.6.2 and shall not show an air friction loss in excess of 0.05 inches of water and a demonstrated compliance of 4.6.7 and 4.6.8.

4.6.16 Absorption test. All materials on the exterior surface of the duct shall be tested for resistance to gasoline, oil, and water in accordance with ASTM D-471. Sample pieces of duct fabric, scuff strip fabric, and stitching shall be soaked in 91 octane gasoline, SAE No. 10 oil, and water. At the end of 48 hours, the material shall be examined to determine that the increase in

thickness, weight, and volume does not exceed 10, 15, or 20 percent respectively. All other materials shall be tested in the same manner, but for resistance to water only.

4.6.17 Environmental test.

4.6.17.1 High temperature test. One (1) complete duct assembly of each size shall be subjected to a high temperature test. The duct assembly shall be retracted to a storage position, placed in a test chamber, and the temperature raised to and maintained at +160 ±5°F for 24 hours. Following this exposure, the duct assembly shall be fully extended from and retracted to its storage position 20 times. Following this portion of the test, the extended duct assembly shall be attached to an air source having a temperature of 200 ±5°F and shall be arranged so as to be supported only by the floor of the test space with the complete length of the duct assembly in contact with the floor. The air flow through each size duct assembly shall not be more than 90 percent recirculated air. The ambient air temperature of the test chamber, measured at a point one (1) foot from the periphery of the duct assembly shall be +50°F. If air moving devices are used in testing, baffles shall be placed around the duct assembly to prevent air from blowing on the duct assembly. Each duct assembly shall be tested for a period of 150 hours. At the end of the 150 hour test, the temperature of the air passing through the duct assembly shall be increased to +250 ±5°F and the duct assembly tested at this temperature for two (2) hours with all other test conditions remaining the same. At the conclusion of this test, evidence of scorching nor other harmful effects within the duct assembly shall be cause for rejection. During this test the requirements of 3.6.4 shall be demonstrated.

4.6.17.2 Low temperature test. Following the test of 4.6.17.1, the duct assemblies shall again be placed into the test chamber in the retracted position, cooled to and maintained at -80 ±5°F for 24 hours. Damage to the duct assembly as a result of this exposure shall be cause for rejection. The temperature shall then be raised to and maintained at -65 ±5°F for the remainder of the test. After an additional 24 hour soak in the retracted position, the duct assembly shall be fully extended from and retracted to the storage position for 30 cycles. The duct assembly shall then be given another 24 hour soak in the extended position. The duct assembly shall again be expanded from and retracted to the storage position for 20 cycles. The flexibility and retractability of the duct assembly shall be observed and recorded. The time required to retract the duct assembly to the storage position shall not exceed one (1) minute. At the conclusion of this test, any evidence of harmful effects due to the flexing or exposure shall be cause for rejection. The duct assembly shall then be tested as specified in 4.6.4 and 4.6.11.

4.6.17.3 Salt fog test. One (1) duct assembly of each size shall be subjected to a salt fog test in accordance with Method 509, procedure I, MIL-STD-810 for 50 hours. Upon completion of this test, evidence of serious corrosion of metallic parts or other damage that might affect subsequent operation shall be cause for rejection.

4.6.17.4 Fungus resistance test. One (1) duct assembly of each size shall be subjected to the fungus resistance test specified in Method 508.1, procedure II, MIL-STD-810, when fungus nutrient materials are used in the duct assembly. Upon

completion of this test, evidence of major fungus growth or other damage that might affect subsequent operation shall be cause for rejection.

4.6.17.5 Radiant energy test. One (1) duct assembly of each size shall be subjected to radiant energy test specified in Method 505.1, MIL-STD-810. Upon completion of this test, evidence of material deterioration or other damage that might affect subsequent operation shall be cause for rejection.

4.6.17.6 Rain test. One (1) duct assembly of each size shall be subjected to the simulated rain test specified in Method 506, MIL-STD-810. Upon completion of this test, evidence of water absorption or other damage that might affect subsequent operation shall be cause for rejection.

4.7 Inspection of packaging. Inspection of sample items or packs and the inspection of preservation, packaging, and marking for shipment and storage shall be in accordance with the requirement of Section 5 and the documents specified therein.

5. PACKAGING.

5.1 Packaging. Packaging shall be level A or C, as specified (see 6.2).

5.1.1 Level A. Packaging shall be in accordance with Method III, MIL-P-116. Each section shall be retracted as specified in 3.7.4 for packaging in the unit container.

5.1.2 Level C. Packaging shall be in accordance with the contractor's standard commercial practice.

5.2 Packing. Packing shall be level A, B, or C as specified (see 6.2).

5.2.1 Level A. Duct assemblies, packaged as specified in 5.1.1, shall be packed one each in domestic type containers conforming to PPP-B-636.

5.2.2 Level B. Duct assemblies, packaged as specified in 5.1.1, shall be packed one each in domestic type containers conforming to PPP-B-636.

5.2.3 Level C. Duct assemblies shall be packed for shipment in commercial exterior shipping containers in a manner that will insure safe transportation at the lowest rate to the point of delivery.

5.3 Marking. In addition to any special marking required by the contract or purchase order (see 6.2), interior packages and shipping containers shall be marked in accordance with MIL-STD-129.

5.3.1 Anti-counterfeit marking. When an item has been deemed to be susceptible to counterfeiting, each item shall be marked in such a manner as to provide the contracting activity with an authentication and traceability track to the true manufacturer. The method in which this is done shall be proprietary to the true manufacturer and provided to the quality assurance office of the contracting activity by secure means.

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 duct assemblies covered by this document are intended for use in conjunction with ground support heating and air conditioning equipment to deliver the conditioned air from the ground equipment to aircraft, missile electronics equipment, personnel compartments, portable maintenance shelters, hangers, and similar enclosures.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of the specification.

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).

c. Specification reference number (see 1.3).

d. When first article is required (see 3.1 and 4.4).

e. When connectors and built-in storage device are required (see 1.2).

f. Lengths of duct required (see 3.7.3).

g. Required level of packaging and packing (see section 5).

h. Special shipment markings (see 3.12 and 5.3).

6.3 First Article. When first article inspection is required, the contracting officer should provide guidance that the two (2) first article items should be samples selected from the first ten (10) production items of each size. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of the first articles. Invitation 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 Subject term (key word) listing.

Air, ground support
Conditioned air
Duct assembly
Duct, aircraft
Duct, conditioned air
Duct, missile
Duct, shelter

6.5 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.

Custodians:
Air Force - 99

Preparing activity:
Air Force - 82

Agent:
Air Force - 99

Project 4720-F011

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-D-38386E	Duct Assembly, Ground, Conditioned Air, Insulated, Flexible

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ 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
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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