INCH-POUND

MIL-DTL-81581B
24 July 2006
SUPERSEDING
MIL-H-81581A
01 June 1982

DETAIL SPECIFICATION

HOSE ASSEMBLIES, BREATHING OXYGEN AND AIR, GENERAL SPECIFICATION FOR

Reactivated after 24 July 2006 and may be used for new and existing designs and acquisitions.

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

1. SCOPE

1.1 Scope. This specification covers the general requirements for low pressure and high pressure hose assemblies used in breathing oxygen and air in pressure suit systems and individual survival equipment.

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 of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 491000B120-3, Highway 547, Lakehurst, NJ 08733-5100 or emailed to thomas.omara@navy.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

2.2.1 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 are those cited in the solicitation or contract.

FEDERAL STANDARDS

FED-STD-191	-	Textile Test Methods. (Inactive for New Design)
FED-STD-595	-	Colors Used in Government Procurement - Color number: 34079

COMMERCIAL ITEM DESCRIPTIONS

A-A-59503	-	Nitrogen, Technical

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-16878	-	Wire, Electrical, Insulated, General Specification for
MIL-PRF-27210	-	Oxygen, Aviator's Breathing, Liquid and Gas
MIL-C-43627	-	Cloth, Duck, Cotton, Plied Yarns, Fire, Water, Weather and Mildew Resistant Treated, Lightdry Finish
MS22055	-	Hose, Assemblies - Oxygen Breathing, Connector To Regulator. (Inactive for New Design)
MS22058	-	Connector, Oxygen Hose to Regulator

(See Supplement 1 for list of associated specification sheets.)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-129	-	Military Marking for Shipment and Storage
MIL-STD-130	-	Identification Marking of U.S. Military Property
MIL-STD-889	-	Dissimilar Metals

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Bldg 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQ-Z1.4 - Sampling Procedures and Tables for Inspection by Attributes. (DoD adopted)

(Copies of the above document are available from the American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203-4606 or http://www.asq.org.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) INTERNATIONAL

ASTM-A313/A313M - Wire Stainless Steel Spring. (DoD adopted)

ASTM-D1149 - Rubber Deterioration-Surface Ozone Cracking in a Chamber. (DoD adopted)

(Copies of the above documents are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or http://www.astm.org.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA-HP3 - Electrical and Electronic Polytetrafluoroethylene (PTFE) Insulated High Temperature Hook-up Wire; Types ET (250 volts), E (600 volts) and EE (1000 volts). (DoD adopted)

(Copies of the above document are available from the National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209 or http://www.nema.org.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), 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 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet (see supplement 1). In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern. In the event of any conflict between requirements of this specification, the specification sheet and the applicable drawings, the applicable drawings shall govern.

3.2 Qualification. The hose or cable assembly furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.3 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.3.

3.4 Materials and components. Materials and components shall conform to applicable documents as listed or required herein. Materials and components which are not covered by applicable specifications or are not specifically described herein or in the specification sheets shall be of best quality, of the lightest practicable weight, and for the purpose intended. Unless otherwise specified, the materials and components, except for the metallic parts, used in the construction of the hose or cable assembly shall have been manufactured not greater than 12 months prior to the date of delivery of the items.

3.4.1 Metal parts. Unless protected against electrolytic corrosion, dissimilar metals as defined in MIL-STD-889 shall not be used in intimate contact with each other.

3.4.2 Nonmetallic materials. Any nonmetallic material that is affected by continued use with oxygen shall not be used.

3.4.2.1 Age. Elastomer components, except silicone, shall be not greater than 12 months from the date of manufacture to the date of delivery to any Government service or to any airframe or accessory manufacturer.

3.4.2.2 Elastomer components. The elastomer components shall be composed of an ozone-resistant composition, which shall not bloom, and shall meet the specified ozone resistance performance requirements.

3.4.3 Talc. Talc shall be of the non-asbestiform type when tested as specified in 4.6.19.

3.4.3.1 Talc limitations. In the event there is a change in the type, composition, or supplier of the talc used in the hose manufacturing process, the manufacturer shall submit a sample (see 4.3.1) of the replacement talc or verification that the talc is of the non-asbestiform type (see 6.2.f).

3.5 Design and construction. The design and construction of the hose assembly shall be in accordance with the applicable drawings listed in the applicable specification sheets.

3.5.1 Hose. Unless otherwise specified, the hose shall be a non-stretch, non-kinking, smooth bore, flexible type reinforced with an integral corrosion-resistant wire. The hose shall incorporate an outer covering (see 3.5.1.2).

3.5.1.1 Reinforcing wire. The integral corrosion-resistant reinforcing wire shall conform to the requirements of ASTM-A313/A313M, type 302, class 1.

3.5.1.2 Outer covering. The outer covering shall be a tubular polyamide of polyester knitted or braided construction.

3.5.1.3 Communication services requirement. The communication cable assemblies which are manufactured separately from the hose assemblies of which they are a part shall be in accordance with MIL-H-81581/8. The following requirements are applicable to those groups of hose assemblies that incorporate integrated communications services as part of the hose assembly.

3.5.1.3.1 Communication conductors. Each communication conductor shall consist of 19 silver coated copper strands (no. 36 AWG) bunched with a lay of not greater than 0.75 inch. Unless otherwise specified on the applicable drawing, the required number of insulated conductors shall be imbedded into the wall of the hose; shall emerge from the hose at the molded ends as a single continuous cable; and shall have such termination as specified on the applicable drawing. The portion of the conductors external to the hose shall be fabricated as the communication cable in accordance with 3.5.1.3.4. The communication conductors shall be twisted with a lay or lays, which shall be not greater than 1.75 inches.

3.5.1.3.1.1 Conductor strands. The conductor strands shall be uniformly coated in accordance with NEMA-HP3.

3.5.1.3.2 Conductor insulation. A uniform covering of polytetrafluoroethylene insulating material shall be placed over each conductor in accordance with NEMA-HP3. For circuit polarity identification, the insulation of each conductor shall have a different distinctive color throughout its length, as specified on the applicable drawing, or color coded in accordance with the applicable requirements of MIL-DTL-16878. The color coding for conductors attached to the microphone terminals shall be red and green, and white and black for the conductors attached to the headphone terminals.

3.5.1.3.3 Conductor shielding. Conductor shielding shall be as specified on the applicable drawing and shall provide coverage of 85 to 95 percent. Shielding shall consist of tin-plated soft drawn copper (no. 40 AWG to no. 36 AWG).

3.5.1.3.4 Communication cable. The communication cable shall consist of insulated conductors, a restraint cord (if applicable), a protective covering and termination in accordance with the applicable drawing and shall conform to MIL-H-81581/8.

3.5.1.4 Connector integration. When the applicable control drawing specifies the integration of quick disconnects, end fittings, or electrical fittings with the hose, the connectors shall be integrated with the hose in a manner which will in no way impair the designed

performance of the connector. Hose assemblies having electrical fittings shall be tested for insulation resistance with or without the electrical fitting attached, at the discretion of the procuring activity. However, when tested with the electrical fittings attached, the specification requirements of the electrical fitting shall govern in the event of conflict between the insulation resistance requirements specified herein and the requirements of the specification for the electrical fitting (see 6.6).

3.6 Performance characteristics. Unless otherwise specified in the applicable specification sheets, the hose assemblies shall conform to the following performance characteristics:

3.6.1 Polarity (color code). When applicable, the hose assembly shall conform to the polarity (color code) listed in the applicable specification sheet when tested as specified in 4.6.2.

3.6.2 Electrical resistance. When applicable, each electrical conductor in the hose assembly or cable assembly shall have a resistance not greater than 0.2 ohms plus an allowable resistance based on a per foot length of the electrical conductor as specified in the applicable specification sheet when tested as specified in 4.6.3.

3.6.3 Insulation resistance. When applicable, the hose assembly shall not indicate an insulation resistance less than 100 megohms when tested as specified in 4.6.4.

3.6.4 Elongation. The elongation of the hose shall be as specified in the applicable specification sheet when tested as specified in 4.6.5.

3.6.5 Delamination. The hose shall not show any evidence of delamination of the inner layer of the hose or any other damage when tested as specified in 4.6.6.

3.6.6 Odor. The hose shall not have an odor when tested as specified in 4.6.7.

3.6.7 Cleanliness.

3.6.7.1 External cleanliness. The hose assembly, when inspected as specified in 4.6.8, shall be free of release agents or any other foreign matter which could affect safety, performance, or reliability.

3.6.7.2 Internal cleanliness. The hose shall not contain precipitates or be more turbid than a distilled water/Formazin solution which produces a turbidity of 5.0 Neplelometric Turbidity Units (NTU) when tested as specified in 4.6.8.1.

3.6.8 Leakage. The hose shall not exhibit a leakage rate greater than 1.00 cubic centimeters (cc) per minute per foot when tested as specified in 4.6.9.

3.6.9 Flexibility. The hose shall not show evidence of unraveling of any wire used in the hose, and there shall be no other damage as a result of this test when tested as specified in 4.6.10.

After release of the hose, there shall be no permanent set of the hose. For hoses tested in accordance with 4.6.10.1, flexibility procedure I, the following requirement shall also be applicable:

The overhanging last 10 inches of the free end of the hose shall at no time during the rotation deviate from the vertical by more than the following degrees:

Hose ID	Maximum deviation, degrees
0.5 inch and 0.625 inch	10
0.875 inch and 1.0 inch	15

3.6.10 Minimum burst pressure. The hose shall not show any evidence of structural failure when tested as specified in 4.6.11.

3.6.11 Strength.

3.6.11.1 Tensile load. The hose shall meet the requirements specified in the applicable specification sheet when tested as specified in 4.6.12.1.

3.6.11.2 Static load. The hose shall meet the requirements specified in the applicable specification sheet when tested as specified in 4.6.12.2.

3.6.12 Restraint cord elongation and tensile strength. When the applicable control drawing specifies a restraint cord, the restraint cord shall meet the requirements specified in the applicable specification sheet when tested as specified in 4.6.13.

3.6.13 Temperature.

3.6.13.1 Low temperature. The hose assembly, after completion of the conditioning period, shall pass the tests specified in 4.6.14.1.

3.6.13.2 High temperature. The hose assembly, after completion of the conditioning period, shall pass the tests specified in 4.6.14.2.

3.6.14 Flexibility endurance. The hose assembly shall show no evidence of damage when tested as specified in 4.6.15.

3.6.15 Ozone-resistance. The test slabs and hose specimen or outer protective layer specimen, shall not show any evidence of checking, cracking, or other damage when tested as specified in 4.6.16.1.

3.6.16 Abrasion. The hose specimen shall withstand an average of 10,000 revolutions of abrasion without exposing the reinforced wire in the hose when tested as specified in 4.6.17.

3.6.17 Weight. The hose shall meet the requirements specified in the applicable specification sheet when tested as specified in 4.6.18.

3.7 Color. The color of the hose exterior, outer covering and the molded ends (if applicable) shall be green, approximately matching color number 34079 of FED-STD-595.

3.8 Identification of product. The hose assembly shall be marked for identification in accordance with MIL-STD-130, except that the National Stock Number shall be omitted from the label. The year and quarter of cure shall also be included.

3.8.1 Marking. Unless otherwise specified in the contract or order, marking shall he in accordance with MIL-STD-129.

3.8.1.1 Precautionary marking. The following precautionary marking shall appear on each package:

CAUTION: DO NOT ALLOW CONTAMINANTS OF ANY KIND TO BE USED ON OR ABOUT THE HOSE ASSEMBLY.

3.9 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. Where the specification sheets list requirements for interchangeability, they shall govern.

3.10 Workmanship. The hose or cable assemblies shall be uniform in quality and shall be free from irregularities, defects, or foreign matter which could affect safety, performance, reliability or durability.

4. VERIFICATION

4.1 Classification of inspection. The examination and testing of the hose or cable assemblies shall be classified as follows:

a. Qualification inspection. (See 4.2).
b. First article inspection. (See 4.3)
c. Conformance inspection. (See 4.4).

4.2 Qualification inspection. The qualification inspection of the hose assembly shall consist of the examinations and tests for all applicable requirements of this general detail specification and the applicable specification sheets.

4.2.1 Qualification samples. Unless otherwise specified in the applicable detail specification, the qualification inspection samples shall consist of the following:

a. Four hoses for which qualification is required.

b. Three test slabs, 6 by 6 by 0.075 inches, composed of the identical ozone-resistant composition that was used in manufacturing the hose.

c. One copy of the contractor's drawing containing the company's part number which shall be in accordance with the Government drawing for the product submitted (see 6.3.1).

d. Ten 30-inch long restraint cord specimens (applicable to MIL-DTL-81581/2, /4, /5, /6 and /8 only).

e. A one-pound bulk powder talc sample of the identical composition as that used in the manufacturing processes of the host (applicable to MIL-DTL-81581/4, /5, /6, /7 and /8) or a statement of certification that the talc used in the manufacturing process is of the non-asbestiform type (see 3.6.18 and 4.6.19).

Samples shall be forwarded to the address indicated in the letter authorizing submission of qualification samples (see 6.3). The samples shall be plainly identified by securely attached durable tags marked with the following information:

Samples for qualification inspection
HOSE ASSEMBLIES, BREATHING OXYGEN AND AIR
Manufacturer's designation or number
Name of Manufacturer
Submitted by (name) (date) for qualification
inspection in accordance with the requirements
of MIL-DTL-81581B and (applicable
specification sheet) under authorization (reference
authorizing letter and number).

4.3 First article inspection. First article inspection shall consist of examinations and tests performed on samples which are representative of the production item including MIL-DTL-81581/1 and /3, after the award of a contract to determine that the production item conforms to the requirements of this general detail specification and the applicable specification sheets. The first article inspection of the hose assembly shall consist of the examinations and tests specified in table I, not necessarily in the order listed.

TABLE I. First article examination and tests.

	Paragraph

Inspection	Requirement	Test Method
Visual examination	Applicable drawings	4..6.1
Polarity (color code) and electrical continuity (if applicable)	3.6.1	4.6.2
Insulation resistance (if applicable)	3.6.3	4.6.4
Elongation	3.6.4	4.6.5
Delamination (if applicable)	3.6.5	4.6.6
Odor	3.6.6	4.6.7
Cleanliness	3.6.7	4.6.8
Leakage 1/, 2/	3.6.8	4.6.9
Flexibility	3.6.9	4.6.10
Minimum burst pressure 1/	3.6.10	4.6.11
Tensile load 2/	3.6.11.1	4.6.12.1
Weight (if applicable)	3.6.17	4.6.18

1/ A sample hose assembly subjected to the tensile load shall not be used for this inspection.

2/ A sample hose assembly subjected to the minimum burst pressure test shall not be used for this inspection.

4.3.1 First article samples. Unless otherwise specified, as soon as practicable after award of the contract or order, the manufacturer shall submit first article samples as required by the applicable specification sheet. The samples shall be representative of the construction, workmanship, components and materials to be used during production. When a manufacturer is in continuous production of these hose assemblies from contract to contract, submission of further first article samples may be waived at the discretion of the procuring activity (see 6.2). Approval of the first article inspection samples or the waiving of first article inspection does not exempt the requirements for performing the conformance inspection. The first article inspection samples shall be furnished to the Government as directed by the contracting officer (see 6.2). The samples shall be plainly identified by securely attached tags marked with the following information:

Samples submitted by (name) (date) for first article inspection
in accordance with the requirements of MIL-DTL-81581B and
(applicable specification sheet) under (contract number).

4.3.2 First article information. Upon completion of the first article inspection program, pertinent comments and recommendations shall be forwarded by the Government Activity responsible for the inspection program (see 6.2) to the contracting officer. The hoses or cables may be consumed or destroyed in the first article inspection and shall not be considered as part of the quantity to be delivered under contract.

4.4 Conformance inspection. The sampling and inspection levels shall conform to ASQ-Z1.4. The conformance inspection shall consist of the inspections specified in the applicable specification sheets.

4.4.1 Hose assembly inspection lot. An inspection lot size shall be expressed in units of one hose assembly made under the same conditions and from the same materials and components. The sample unit shall be one hose assembly.

4.4.2 Sampling for tests and examinations of the hose assemblies. The sample size and general examinations and tests required for the hose assemblies are listed in table II and shall be performed in the order listed. The tests and examinations from table II that are applicable to specific hose assemblies shall be as specified in the applicable specification sheets.

4.5 Test conditions.

4.5.1 Gas. Unless otherwise specified, the gas used in testing the hose assemblies shall be oxygen conforming to MIL-PRF-27210, type I; nitrogen conforming to A-A-59503, type I, class 1, grade B; or water-pumped air equivalent in dryness to A-A-59503, type I, class I, grade B nitrogen.

TABLE II. Sample size, tests, and examinations of the hose assemblies.

Inspection	Requirement	Test Method	Sample size 1/
Visual examination (see classification of defects)	Applicable drawings	4.6.1	Every hose assembly for critical defects. Inspection level II for minor defects.
Polarity (color code) and electrical continuity.	3.6.1	4.6.2	Inspection level S-2
Insulation resistance	3.6.3	4.6.4	Inspection level S-2
Elongation	3.6.4	4.6.5	Inspection level S-2
Delamination	3.6.5	4.6.6	Inspection level S-2
Odor	3.6.6	4.6.7	Inspection level S-2
Cleanliness	3.6.7	4.6.8	Inspection level S-2 .
Leakage	3.6.8	4.6.9	Inspection level S-2
Flexibility	3.6.9	4.6.10	Inspection level S-2

1/ ASQ-Z1.4, Sampling procedures and tables for inspection by attributes.

4.5.2 Temperature and pressure. Unless otherwise specified, tests shall be conducted at local ambient temperature and barometric pressure. The temperature and barometric pressure shall be recorded at the time of inspection. This information shall be available for computation of test data, where required, to normal temperature and pressure (NTP) conditions. NTP conditions are 29.92 inches of mercury (101.3 kPa) and 70 °F (21.1 °C). Test instruments shall be calibrated or adjusted according to their required usage in conducting individual tests.

4.5.3 Testing precautions. In the testing and examination of the hose assembly, whenever the possibility exists that a hose could be put into use after tests, no instrument or test set-up containing mercury shall be used for any test. Precautions must also be taken to prevent oil, grease, or other contaminants from being used on or about hose assemblies.

4.6 Inspection methods. The inspection methods for the tests specified herein shall be the methods specified in the applicable specification sheet for the hose assembly being tested.

4.6.1 Visual examination. Every hose or hose assembly shall be examined visually (for critical defects) to determine conformance to this specification and applicable drawings. The classification of defects in table III shall be used to classify the defects found, as applicable.

4.6.2 Polarity (color code). Polarity (color code) of each conductor in the hose assembly shall be checked with the applicable drawing. This test shall be the last test performed because the outer covering may require cutting to determine conductor color code. The hose assembly or cable assembly shall meet the requirements specified in 3.6.1.

4.6.3 Electrical resistance. Using a low current (less than 10 milliamperes (mA)) resistance bridge, measuring 0 to 1.0 ohm to an accuracy of 12 percent or better, measure the electrical resistance between all points designed to be electrically connected in the hose or cable assembly. The hose or cable assembly shall meet the requirements specified in 3.6.2.

TABLE III. Classification of defects for visual examination of the hose assembly.

Critical	Minor
I. Dimensions, not within specified tolerances.	201. Marking - missing, insufficient, incorrect, illegible, or not permanent.
2. Material imperfections - foreign matter embedded.	202. Color not as specified.
3. Surface - unclean, rough, misaligned, or containing cracks, nicks, or other flaws.	
4. Any opening not capped.	
5. Any component missing, malformed, fractured, or otherwise damaged.	
6. Incorrect assembling or improper positioning of components.	
7. Any component loose or otherwise not securely retained.	
8. Any functioning part that works with difficulty.	
9. Faulty workmanship or other irregularities.	

4.6.4 Insulation resistance (when applicable). The relative humidity during this test shall be not greater than 95 percent. The insulation resistance of each circuit of the hose or cable assembly shall be measured with respect to the following:

a. All other nonconnected circuits shorted together.

b. The electrical connector hosing.

c. The ground.

Utilizing a megohmmeter with values to 1000 megohms and an accuracy of ± 10 percent, the insulation resistance shall be measured at a test potential of 500 ± 50 volts DC applied for not less than 0.1 second for each point measured. The insulation resistance shall meet the

requirements specified in 3.6.3. Upon completion of this test procedure, the normal electrical continuity of each of the conductors shall then be verified in accordance with 4.6.3.

4.6.5 Elongation-procedure I. The hose shall be suspended by one end in a vertical position utilizing the same fittings used for tensile load test - procedure I (see 4.6.12.1.1) and a 10 pound dead weight attached to the other end for 30 seconds with gage marks initially at a minimum of 10 inches apart. The hose shall meet the elongation requirements of 3.6.4. All measurements shall be taken with the hose suspended in a vertical position.

4.6.5.1 Elongation-procedure II. The overall length of the hose shall be measured. The hose shall then be suspended by one end in a vertical position and a 10 pound dead weight attached to the other end for 30 seconds. The increase in overall length shall then be measured. Two minutes after removal of the load, the permanent set shall be determined. All measurements except the stretched length shall be determined with the hose lying in an unstrained condition. The hose shall meet the requirements specified in 3.6.4.

4.6.6 Delamination. The hose shall be capped at one end. This cap shall contain an eyepiece. The other end of the hose shall be connected to a vacuum source which contains a light. A vacuum of 20 inches of mercury shall be applied internally. While at this condition, the hose shall be flexed (see 4.6.10) while the interior of the hose is examined through the eyepiece. The hose shall meet the requirements of 3.6.5.

4.6.7 Odor. Gaseous oxygen shall be allowed to pass through the bore of the hose at a rate not greater than 10 liters per minute for 2 minutes. After a five-minute period, with the hose assembly open to the environmental conditions at both ends, the hose assembly shall be tested for odor in a manner that will prevent extraneous odors from influencing the test. The hose shall meet the requirements specified in 3.6.6.

4.6.8. Cleanliness-procedure I (external). The hose assembly shall be visually examined externally for conformance to the requirements specified in 3.6.7.1.

4.6.8.1 Cleanliness-procedure II (internal). The hose shall be 75 percent filled with a distilled water/Aerosol OT solution consisting of nine parts distilled water and one part of a 10 percent Aerosol OT. The Aerosol OT is a wetting agent which aids in freeing talc from the hose surface. Each hose end shall be capped and the hose placed into a water filled ultrasonic cleaner operating between 20,000 and 90,000 cycles for a period of five minutes. After this exposure, the water/aerosol solution shall be poured from the hose into a clean glass cylinder and allowed to stabilize for four minutes ± 15 seconds. The sample shall then be tested for turbidity by means of a Hach turbidimeter or equivalent calibrated using a 5.0 NTU distilled water/Formazin solution. The contents of the sample shall meet the requirements specified in 3.6.7.2. Upon completion of this test procedure, the hose shall be dried by blowing [160 °F (49 °C) maximum] oxygen, air, or nitrogen through the hose.

4.6.9 Leakage. The hose shall be sealed off at one end and the applicable gaseous pressure shall be applied to the other end at a rate of 10 ± 5 psig/second. The following applicable tests shall be performed while the hose is maintained at the specified pressure. The hose shall meet the requirements of 3.6.8.

4.6.9.1 Leakage-procedure I. A gaseous pressure of 20 psig shall be applied and maintained for 10 minutes, which is the duration of the test. The hose shall be submerged in water within the first 2 minutes of the 10-minute period. After the first 5 minutes have elapsed, and while the hose is still submerged, leakage readings shall start and shall continue for the final 5-minute period. This leakage test shall not be performed on a hose more than once within a period of 24 hours.

4.6.9.2 Leakage-procedure II. This test procedure shall be the same as procedure I, except that the pressure shall be 5 psig.

4.6.9.3 Leakage-procedure III. This test procedure shall be the same as procedure I, except that the pressure shall be 150 psig.

4.6.10 Flexibility. Hose assemblies that have been subjected to this flexibility test shall not be subjected to the leakage test until a period of at least 24 hours has elapsed. The hose shall be tested for flexibility as follows and shall meet the requirements of 3.6.9.

4.6.10.1 Flexibility-procedure I.

a. The portion of the hose to be tested shall be flexed for 30 seconds immediately preceding this test. The hose shall be placed on a horizontal flat surface with 20 inches of its length overhanging the edge. A 2-ounce weight shall be attached to the overhanging end. Roll the part of the hose on the flat surface so that it rotates through 360 degrees.

b. The hose shall be closely coiled about a rod (1-inch diameter for hose sizes through 0.875 inch ID and 1.5 inch diameter rod for larger hose sizes) and released. This test shall be repeated four times, except that for each successive test, the hose shall be turned 90 degrees about its longitudinal axis and recoiled on the rod.

4.6.10.2 Flexibility-procedure II. This test procedure shall be the same as procedure I, part (b), except the rod diameter shall be 1.5 inches.

4.6.10.3 Flexibility-procedure III. This test procedure shall be the same as procedure I, part (b), except the rod diameter shall be 3 inches for tests at room temperature and high temperature (see 4.6.14.2), and 5 inches in diameter for tests at low temperature (see 4.6.14.1).

4.6.10.4 Flexibility-procedure IV. This test is applicable for all electrically wired hoses and shall be performed at room temperature only:

a. The hose shall be sealed off at one end and the applicable leakage test gaseous pressure shall be applied at the other end. While the pressure is maintained, the hose shall be closely coiled about a rod of the applicable diameter. While the hose is in this condition the insulation resistance of the hose assembly shall be checked as specified in 4.6.4. This test shall be performed four times, except that for each successive test, the hose shall be turned 90 degrees on its longitudinal axis and recoiled on the rod. At the completion of this test, the hose shall be uncoiled from the rod.

b. While the hose is still pressurized, the hose shall then be alternately coiled and uncoiled about a rod of the applicable diameter as each circuit of the hose is checked for electrical continuity in the manner specified in 4.6.2 and for electrical shorts. This test shall be performed four times, except that for each successive test the hose shall be turned 90 degrees on its longitudinal axis prior to being coiled about the rod.

4.6.11 Minimum burst pressure.

4.6.11.1 Burst pressure-procedure I. The hose shall be submerged in water and a gaseous pressure of 60 psi shall be applied internally to the hose at a rate of 10 ± 5 psig/second and maintained for a period of 5 minutes. The hose shall meet the requirements specified in 3.6.10.

4.6.11.2 Burst pressure-procedure II. This test procedure shall be the same as procedure I, except the pressure shall be 20 psi.

4.6.11.3 Burst pressure-procedure III. This test procedure shall be the same as procedure II, except the pressure shall be 450 psi.

4.6.12 Strength.

4.6.12.1 Tensile load. The hose shall meet the requirements of 3.6.11.1.

4.6.12.1.1 Tensile load-procedure I. Connectors for a tensile load test shall be attached to each end of a one foot length of hose. One connector shall be retained by the stationary jaws and the other connector retained by the movable jaws of a test device. A tensile load of 60 pounds shall be applied to the hose, at a uniform pulling speed of 12 ± 0.5 inches per minute, and maintained for a period of 1 minute.

4.6.12.1.2 Tensile load-procedure II. A tensile load of 60 pounds shall be applied to the molded ends of the hose at a uniform pulling speed of 12 ± 0.5 inches per minute and maintained for a period of 1 minute.

4.6.12.1.3 Tensile load-procedure III. For hoses containing end fittings, one end fitting shall be retained by the stationary jaws and the other fitting retained by the movable jaws of the

test device. A tensile load of 75 pounds shall be applied to the hose at a uniform pulling speed of 12 ± 0.5 inches per minute and maintained for 1 minute. Long hoses may be coiled and clamped at the coil to shorten the length.

4.6.12.1.4 Tensile load-procedure IV. A connector simulating type I or type II shown on MS22058 shall be attached to one end of the hose by means of an MS22055 clamp. The clamp shall be tightened and a tensile load of 40 pounds shall be applied to the hose by means of the connector at a uniform pulling speed of 12 ± 0.5 inches per minute and maintained for a period of 1 minute.

4.6.12.1.5 Tensile load-procedure V. Connectors for a tensile load test shall be securely attached to each end of the hose. A tensile load of 35 pounds shall be applied to the hose by means of the connectors at a uniform pulling speed of 12 ± 0.5 inches per minute and maintained for a period of 1 minute. The hose shall then be subjected to and pass the tests specified in 4.6.2, 4.6.3, and 4.6.4.

4.6.12.2 Static load. The hose shall be placed on a flat surface and a static load of 225 pounds shall be applied normal to the longitudinal axis of a 4-inch section of the wire reinforced portion of the hose for a period of 30 seconds. While under load the diameter of the hose shall be measured and shall meet the requirements specified in 3.6.11.2. Two minutes after the load is removed, the diameter of the hose shall be measured and shall meet the requirements specified in 3.6.11.2.

4.6.13 Restraint cord elongation and tensile strength. The restraint cord shall be tested in accordance with FED-STD-191, method 4108. The restraint cord elongation and tensile strength shall meet the requirements specified in 3.6.12.

4.6.14 Temperature. (4.6.10.1 is not applicable for the following temperature tests.)

4.6.14.1 Low temperature. The hose shall be conditioned at -65 ± 5 °F (-53.90 ± 2.8 °C) for 48 hours. After the conditioning period and while still at this temperature, the hose shall be subjected to the flexibility test specified in 4.6.10. The hose shall then be returned to room temperature and subjected to and pass the tests specified in 4.6.2 and 4.6.3 (if applicable), 4.6.4 (if applicable), 4.6.6 (if applicable), and 4.6.9.

4.6.14.2 High temperature. The hose shall be conditioned at 160 ± 5 °F (71.1 ± 2.8 °C) for 48 hours. After the conditioning period and while still at this temperature, the hose shall be subjected to the tests specified in 4.6.7 and 4.6.10. The hose shall then be returned to room temperature and subjected to and pass the tests specified in 4.6.2 and 4.6.3 (if applicable), 4.6.4 (if applicable), 4.6.6 (if applicable), and 4.6.9.

4.6.15 Flexibility endurance. The rod size used in this test shall be the same rod diameter as used in the applicable procedure of 4.6.10.

4.6.15.1 Flexibility endurance-procedure I. A two-foot section of hose shall be used for this test. The hose shall be sealed off at one end and a gaseous pressure of 20 psig shall be applied at the other end. While the 20 psig pressure is maintained, the hose shall be subjected to the following tests:

a. The hose shall be closely coiled about the applicable size rod and released for 500 cycles.

b. Maintaining a preload of 1 to 5 pounds along the longitudinal axis, the hose shall then be twisted 180 degrees about its longitudinal axis and released for 500 cycles.

The hose shall meet the requirements specified in 3.6.4. The hose shall then be subjected to and pass the tests specified in 4.6.6 and after an elapsed period of 24 hours to 4.6.9.

4.6.15.2 Flexibility endurance-procedure II. The hose shall be sealed off at one end and the applicable leakage test gaseous pressure shall be applied at the other end. While the applicable pressure is maintained, the hose shall be subjected to the following tests:

a. The wire reinforced portion of the hose assembly shall be closely coiled about the applicable size rod and released for 500 cycles.

b. Maintaining a preload of 1 to 5 pounds along the longitudinal axis, the hose shall then be twisted on its longitudinal axis and released for 500 cycles. The degrees of twist to which the hose is subjected shall be in proportion to 90 degrees per foot length of the wire reinforced portion of the hose. At the completion of cycling, the gaseous pressure shall be removed from the hose.

The hose shall meet the requirements specified in 3.6.4. The hose shall then (in the order indicated) be subjected to and pass the tests specified in 4.6.6 (if applicable), 4.6.10.4 (if applicable), and after an elapsed period of 24 hours to 4.6.9.

4.6.15.3 Flexibility endurance-procedure III. This test shall be performed at room temperature. The coupling nut end of the hose assembly shall be attached to the output shaft of a gear reduction motor which shall rotate at two revolutions per minute (RPM). A 50 ± 1 pound weight shall be attached to the opposite end of the same hose assembly. The motor shall be mounted at a 40 degree angle from the horizontal. The hose shall be rotated in this manner for 3000 cycles. After every 1000 cycles the hose shall be removed from the test fixture and inspected for conformance to the requirements specified in 3.6.14. Upon successful completion of the above tests, the hoses shall be subjected to and pass the tests specified in 4.6.6; and after an elapsed period of 24 hours, the tests specified in 4.6.9. The above tests shall be repeated for each hose of the assembly.

4.6.16 Ozone resistance (elastomer components)-procedure I. The test slab submitted for qualification inspection and a specimen of the elastomer portion of the hose or outer protective layer of the cable shall be tested for ozone resistance. The test apparatus shall be in accordance with ASTM-D1149. The test slabs and hose specimen shall be elongated 20 percent, placed in an ozone-free atmosphere for 24 hours, then placed in the ozone chamber. The chamber shall be adjusted to 100 ± 2 °F (37.8 ± 1.1 °C) and given an exposure of ozone concentration of 325 ± 10 parts by volume of ozone per one million parts by volume of air. The air ozone velocity in the chamber shall be not less than 2 feet per second. The material shall be exposed to these conditions for 60 minutes. The test slabs and hose or cable specimen shall be examined under 10 times magnification and shall meet the requirements specified in 3.6.15.

4.6.16.1 Ozone resistance (elastomer components) - procedure II. This test procedure shall be the same as procedure I except that the ozone concentration shall be 120 ± 10 parts by volume of ozone per one million parts by volume of air.

4.6.17 Abrasion. Four 2-inch sections of hose, which shall be obtained by cutting through the hose perpendicular to the longitudinal axis of the hose, shall be subjected to the abrasion test in accordance with FED-STD-191, method 5308.1, dry condition. The abradant shall be in accordance with MIL-C-43627, greige condition. A one pound weight shall be placed on the upper end of the shaft, to produce a constant pressure between the abradant and specimen throughout the test. The jaws of the Schiefer machine shall be modified to retain a 2-inch section of the hose. The hose shall meet the requirements of 3.6.16.

4.6.18 Weight. The hose shall be weighed on a scale calibrated to one tenth of an ounce and shall meet the requirements of 3.6.17.

4.6.19 Talc. The talc, when used, shall be tested using the technique of energy dispersive x-ray analysis coupled with transmission or scanning electron microscopy in the manner recommended by Occupational Safety and Health Administration (OSHA). The talc shall meet the requirement specified in 3.4.3.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. 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 which may be helpful, but is not mandatory.)

6.1 Intended use. The hose assemblies covered by this specification are used in oxygen breathing systems for military pressure suits and individual survival equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

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

b. Title, number and date of the applicable detail specification and the applicable type and style.

c. Applicable drawings including latest revisions.

d. Whether first article inspection is required (see 3.3 and 4.3).

e. Name and address of the first article inspection Laboratory (see 4.3.1) and the name of the Government activity responsible for conducting the first article test program (see 4.3.2).

f. Whether talc samples or verification that the talc is of the non-asbestiform type is required (see 3.3.3.1).

g. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List, QPL-81581, whether or not such products have actually been so listed by that date. The attention of contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for

qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Commander, Naval Air Systems Command, Code 4.6.2.2, 48110 Shaw Road, Bldg 2187, Patuxent River, MD 20670.

6.3.1 Drawings. When requested, the manufacturer should submit engineering drawings and inspection reports in accordance with SD-6, Provisions Governing Qualification. Prior to automatic listing of qualification approval of all hoses within a group, the manufacturer should submit a copy of the drawing containing the company part numbers that correspond to the Government drawing for individual part numbers.

6.3.2 Retention of qualification. The retention of qualification shall consist of periodic verification to determine compliance of the qualified hose assembly with the requirements herein and the applicable specification sheets. The time and method of periodic verification shall be specified by the activity responsible for the Qualified Products List and shall be included in the Notice of Qualification letter.

6.4 First article. When a first article is required, the item will be tested and should be a preproduction sample. The contracting officer should include specific instructions in all acquisition documents, regarding arrangements for examinations, tests, and approval of the first article.

6.5 Supersession data. Previous specification and applicable NAVAIR Index Drawings appear below:

Specification Sheets	Previous Specification	Applicable NAVAIR Index Drawing
MIL-DTL-81581/1B	MIL-H-23927	277AS100
MIL-DTL-81581/2B	MIL-H-22489, Type II	278AS100
MIL-DTL-81581/3B	MIL-H-22489, Type I	279AS100
MIL-DTL-81581/4B	MIL-D-22486	280AS100
MIL-DTL-81581/5B	MIL-H-7138	(Not applicable)
MIL-DTL-81581/6B	WS 6722	281AS100
MIL-DTL-81581/7A	(Not applicable)	282AS100
MIL-DTL-81581/8A	(Not applicable)	283AS100

6.6 Definitions.

6.6.1 Connector. A connector is any group of devices attached to the pressure carrier or communication conductors of the hose. In accordance with the design and performance requirements of the hose assembly, the connector may be permanently attached such as by means of swaging, soldering, or mounting frame or may be semi-permanently attached by means of a clamp. For purposes of this specification, the following definitions shall apply for the various

connectors which are permanently attached to the hose assemblies covered by this specification (see 3.5.1.4).

6.6.2 Electrical fitting. The connector, which is attached at a terminus of the communication conductors only, serves the purpose of coupling the communication services with a mating assembly.

6.6.3 End fitting. The connector, which is attached to the end of the pressure carrier only, serves the purpose of coupling the pressure carrier with a mating assembly.

6.6.4 Quick disconnect. The connector, which is attached to the pressure carrier and communication conductors, serves the two purposes of coupling the pressure carrier with a mating assembly and housing connections for communication services continuity.

6.7 Subject term (key word) listing.

Elastomer
Pressure
Rubber

6.8 Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

CONCLUDING MATERIAL

Custodians:
Army - AV
Navy - AS
Air Force - 11

Preparing activity:
Navy - AS

(Project 4720-2005-011)

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