

MIL-H-81581A
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 SUPERSEDING
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MILITARY SPECIFICATION

HOSE ASSEMBLIES, BREATHING OXYGEN AND AIR, GENERAL SPECIFICATION FOR

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 utilized in oxygen, air and pressure suit systems and also those used with personal survival equipment. Detailed requirements of individual hose assemblies or groups of hose assemblies are covered in the applicable detail specifications.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

SPECIFICATIONS

FEDERAL

BB-N-411	Nitrogen, Technical
QQ-W-423	Wire, Steel, Corrosion-Resisting
CCC-C-419	Cloth, Cotton, Duck, Unbleached Plied-Yarns (Army and Numbered)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Engineering Specifications and Standards Department (Code 93), Naval Air Engineering Center, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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SPECIFICATIONS (Continued)

MILITARY

MIL-P-116	Preservation, Methods of
MIL-W-16878	Wire, Electrical, Insulated, High Temperature
MIL-W-16878/4	Wire, Electrical, Type E, 200 Degrees C and 260 Degrees C, 600 Volts, (Insulated, High Temperature)
MIL-O-27210	Oxygen, Aviator's Breathing, Liquid and Gas

DETAIL SPECIFICATIONS

(See Supplement 1 for list of associated detail specifications.)

STANDARDS

FEDERAL

FED-STD-191	Textile Test Methods
FED-STD-595	Colors

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MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-143	Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-794	Parts and Equipment, Procedures for Packaging and Packing of
MIL-STD-889	Dissimilar Metals
MS22058	Connector, Oxygen Hose to Regulator
MS22064	Clamp, Oxygen Hose

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

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ANSI/ASTM D 1149-78a Rubber Deterioration. Surface Ozone Cracking in a Chamber (Flat Specimen)

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

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

3. REQUIREMENTS

3.1 Detail specifications. The individual item requirements shall be as specified herein and in accordance with the applicable detail specifications (see supplement 1). In the event of any conflict between requirements of this specification and the detail specifications, the latter shall govern. In the event of any conflict between requirements of this specification, the detail specification and the applicable drawings, the applicable drawings shall govern.

3.2 Qualification. The hose or cable assembly furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.3, 4.3.1 and 6.3).

3.3 First article. When specified (see 6.2.1f), the contractor shall furnish sample unit(s) for first article inspection and approval (see 4.4 through 4.4.2 and 6.4).

3.4 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein or in the detail specifications shall be selected in accordance with MIL-STD-143.

3.5 Materials and components. Materials and components shall conform to applicable specifications, standards and drawings as listed or required herein. Materials and components which are not covered by applicable specifications or are not specifically described herein or in the detail specifications shall be of best quality, of the lightest practicable weight, and entirely suitable 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 more than 12 months prior to the date of delivery of the items.

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

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

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

3.5.2.2 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.

3.5.3 Talc. Talc, when used, shall be of the non-asbestiform type.

3.5.3.1 Talc limitations. In the event there is a change in the type, composition, or supplier of the talc utilized in the hose manufacturing process, the hose manufacturer shall submit a sample (see 4.3.1e) of the replacement talc or verification that the talc is of the non-asbestiform type (see 6.2.1j).

3.6 Design and construction. The design and construction of the hose assembly shall be in accordance with the applicable drawings listed in the applicable detail specifications.

3.6.1 Hose. Unless otherwise specified, the hose shall be of a nonstretch, nonkinking, smooth bore, flexible type suitably reinforced with an integral corrosion-resistant wire. The hose shall incorporate a tubular polyamide or polyester knitted or braided outer covering.

3.6.1.1 Reinforcing wire. The integral corrosion-resistant reinforcing wire shall conform to the requirements of QQ-W-423, form 1, condition B, composition 302.

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

3.6.1.3 Communication services requirements. 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.

3.6.1.3.1 Communication conductors. Each communication conductor shall consist of 19 silver coated copper strands (no. 36 AWG) bunched with a lay of not more than 3/4 inch. Unless otherwise specified on the applicable drawing, the required number of insulated conductors shall be

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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 3.6.1.3.4. The communication conductors shall be twisted with a lay or lays, which shall not exceed 1-3/4 inches.

3.6.1.3.1.1 Conductor strands. The conductor strands shall be uniformly coated in accordance with MIL-W-16878/4.

3.6.1.3.2 Conductor insulation. A uniform covering of polytetrafluoroethylene insulating material shall be placed over each conductor in accordance with MIL-W-16878/4. 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-W-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.

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

3.6.1.3.4 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.

3.6.1.4 Connectors.

3.6.1.4.1 Connector definitions. A connector shall be considered as any group of devices which are 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.

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

3.6.1.4.1.2 End fitting. A connector which is attached to the end of the pressure carrier only and serves the purpose of coupling the pressure carrier with a mating assembly.

3.6.1.4.1.3 Electrical fitting. A connector which is attached at a terminus of the communication conductors only and serves the purpose of coupling the communication services with a mating assembly.

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3.6.1.4.2 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 may be tested for insulation resistance with or without the electrical fitting attached, at the discretion of the test 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.

3.7 Performance characteristics. Unless otherwise specified in the applicable detail specifications, the hose assemblies shall conform to the following performance characteristics:

3.7.1 Polarity (color code) and electrical resistance.

3.7.1.1 Polarity (color code). When applicable, the hose assembly, when tested as specified in 4.7.2.1.1, shall pass the polarity (color code) listed in the applicable detail specification.

3.7.1.2 Electrical resistance. When applicable, each electrical conductor in the hose assembly or cable assembly, when tested as specified in 4.7.2.2.1, shall have a resistance no greater than 0.2 ohms plus an allowable resistance based on a per foot length of the electrical conductor as specified in the detail specification.

3.7.2 Insulation resistance. When applicable, the hose assembly, when tested as specified in 4.7.3, shall not indicate an insulation resistance less than 100 megohms.

3.7.3 Elongation. The elongation of the hose shall be as specified in the applicable detail specification, when tested as specified in 4.7.4.

3.7.4 Delamination. The hose, when tested as specified in 4.7.5, shall not show any evidence of delamination of the inner layer of the hose or any other damage.

3.7.5 Odor. The hose, when tested as specified in 4.7.6, shall not be judged to have an objectionable odor.

3.7.6 Cleanliness.

3.7.6.1 External cleanliness. The hose assembly, when inspected as specified in 4.7.7.1, shall be free of release agents or any other foreign matter which could adversely affect safety, performance or reliability.

3.7.6.2 Internal cleanliness. The hose, when tested as specified in 4.7.7.2, shall not contain precipitates or be more turbid than a distilled water/Formazin solution which produces a turbidity of 2.50 Nephelometric Turbidity Units (NTU).

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3.7.7 Leakage. The hose, when tested as specified in 4.7.8, shall not exhibit a leakage rate greater than 1.00 cubic centimeters (cc) per minute per foot.

3.7.8 Flexibility. The hose, when tested as specified in 4.7.9, 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. After release of the hose, there shall be no permanent set of the hose. For hoses tested in accordance with 4.7.9.1, procedure I, the following requirement shall also be applicable:

a. 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:

<u>Hose ID</u>	<u>Maximum deviation, degrees</u>
1/2 inch and 5/8 inch	10
7/8 inch and 1 inch	15

3.7.9 Minimum burst pressure. The hose, when tested as specified in 4.7.10, shall not show any evidence of structural failure.

3.7.10 Strength.

3.7.10.1 Tensile load. The hose, when tested as specified in 4.7.11.1, shall meet the requirements specified in the applicable detail specification.

3.7.10.2 Static load. The hose, when tested as specified in 4.7.11.2, shall meet the requirements specified in the applicable detail specification.

3.7.11 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 detail specification when tested as specified in 4.7.12.

3.7.12 Temperature.

3.7.12.1 Low temperature. The hose assembly, after completion of the conditioning period, shall pass the tests specified in 4.7.13.1.

3.7.12.2 High temperature. The hose assembly, after completion of the conditioning period, shall pass the tests specified in 4.7.13.2.

3.7.13 Flexibility endurance. The hose assembly, when tested as specified in 4.7.14, shall show no evidence of damage.

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3.7.14 Material composition.

3.7.14.1 Ozone-resistance. The test slabs and hose specimen or outer protective layer specimen, when tested as specified in 4.7.15.1, shall not show any evidence of checking, cracking or other damage.

3.7.15 Abrasion. The hose specimen, when tested as specified in 4.7.16, shall withstand an average of 10,000 revolutions of abrasion without exposing the reinforced wire in the hose.

3.7.16 Weight. The hose, when tested as specified in 4.7.17, shall meet the requirements specified in the applicable detail specification.

3.7.17 Talc. The talc, when tested as specified in 4.7.18, shall be of the non-asbestiform type.

3.8 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.

3.9 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.

3.10 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. Where the detail specification details specific requirements for interchangeability, they shall govern.

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

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 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 assure supplies and services conform to prescribed requirements.

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

a. Qualification inspection. Qualification inspection consists of examinations and tests performed on samples submitted for approval as qualified products (see 3.2, 4.3, 4.3.1 and 6.3).

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b. First article inspection. First article inspection consists of examinations and tests performed on samples which are representative of the production item after the award of a contract to determine that the production item conforms to the requirements of this and the applicable detail specification (see 4.4).

c. Quality conformance inspection. Quality conformance inspection consists of examinations and tests performed on individual products or lots to determine conformance of the products or lots with the requirements set forth in this and the applicable detail specification (see 4.5).

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

4.3.1 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-H-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 hose (applicable to MIL-H-81581/4, /5, /6, /7 and /8) or a statement of certification that the talc used in the manufacturing process is of the non-abestiform type (see 3.5.3 and 4.7.17).

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-H-81581A and (applicable detail specifi-
 cation) under authorization (reference
 authorizing letter and number, see 6.3).

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4.3.2 Retention. The retention of qualification shall consist of periodic verification to determine compliance of the qualified hose assembly with the requirements of this and the applicable detail specification. 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.

4.4 First article inspection. 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.

4.4.1 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 detail specification. 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 acquiring activity (see 6.2.1f). Approval of the first article inspection samples or the waiving of first article inspection does not exempt the requirements for performing the quality conformance inspection. The first article inspection samples shall be furnished to the Government as directed by the contracting officer (see 6.2.1g). 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-H-81581A and
(applicable detail specification) under contract no.

4.4.2 First article information. Upon completion of the first article inspection program, pertinent comments and recommendations will be forwarded by the Government Activity responsible for the inspection program (see 6.2.1g) to the contracting officer. The hoses or cables will be consumed or destroyed in the first article inspection and shall not be considered as part of the quantity to be delivered under contract.

4.5 Quality conformance inspection. The sampling and inspection levels shall conform to MIL-STD-105. The quality conformance inspection shall consist of the inspections specified in the applicable detail specifications.

4.5.1 Sampling.

4.5.1.1 Inspection lot.

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

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4.5.1.1.2 Packaging. An inspection lot size shall be expressed in units of one fully prepared shipping container, containing hose assemblies of one size, fully prepared for delivery from essentially the same materials and components. The sample unit shall be one shipping container, containing hose assemblies of one size, fully prepared for delivery with the exception that it need not be sealed.

4.5.1.2 Sampling for tests and examinations of the hose assemblies. The sample size, acceptance criteria, 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 detail specifications.

4.6 Test conditions.

4.6.1 Gas. Unless otherwise specified, the gas used in testing the hose assemblies shall be oxygen conforming to MIL-O-27210, type I. When specified, nitrogen conforming to BB-N-411, type I, class 1, grade B, or water-pumped air equivalent in dryness to BB-N-411, type I, class I, grade B nitrogen may be used.

4.6.2 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.

4.6.3 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.

4.7 Inspection methods. The test procedure for the tests specified herein shall be the applicable procedure specified in the applicable detail specification for the hose assembly being tested.

4.7.1 Visual examination.

4.7.1.1 Hose assembly. 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, table III, shall be used to classify the defects found, as applicable.

4.7.1.2 Packaging. Each of the fully prepared shipping containers, containing hose assemblies of one size, selected as a sample unit from the lot shall be examined for defects listed in table IV to determine that the packaging, packing and marking conform to this specification.

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4.7.2 Polarity (color code) and electrical resistance.4.7.2.1 Polarity (color code).

4.7.2.1.1 Procedure I. Polarity (color code) of each conductor in the hose assembly shall be checked with the applicable drawing or military standard. 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 pass the requirements specified in 3.7.1.1.

4.7.2.2 Electrical resistance.

4.7.2.2.1 Procedure I. Using a low current (less than 10 ma) resistance bridge, capable of 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 assembly or cable assembly. The hose assembly or cable assembly shall pass the requirements specified in 3.7.1.2.

4.7.3 Insulation resistance (when applicable).

4.7.3.1 Procedure I. The relative humidity during this test shall not exceed 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 housing.
- c. The ground.

Utilizing a megohmmeter with a range to 1000 megohms and 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 pass the requirements specified in 3.7.2. Upon completion of this test procedure, the normal electrical continuity of each of the conductors shall then be verified in accordance with 4.7.2.2.

4.7.4 Elongation.

4.7.4.1 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) and a 10 pound dead weight attached to the other end for 30 seconds with gage marks initially a minimum of 10 inches apart. The hose shall meet the elongation requirements of 3.7.3. All measurements shall be taken with the hose suspended in a vertical position.

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4.7.4.2 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 pass the requirements specified in 3.7.3.

4.7.5 Delamination.

4.7.5.1 Procedure I. 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 while the interior of the hose is examined through the eyepiece. The hose shall meet the requirements of 3.7.4.

4.7.6 Odor.

4.7.6.1 Procedure I. 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 pass the requirements specified in 3.7.5.

4.7.7 Cleanliness (listed sequence mandatory).

4.7.7.1 Procedure I (external). The hose assembly shall be visually examined externally for conformance to the requirements of paragraph 3.7.6.1.

4.7.7.2 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 at 70-90,000 cycles and a minimum of 120 watts output for a period of five minutes. After this exposure, the water/Aerosol solution shall be poured from the hose into a clean glass cylinder. A sample of the solution from each hose shall be tested for turbidity by means of a Hach turbidimeter or equivalent. The contents of the sample shall pass the requirements specified in paragraph 3.7.6.2. Upon completion of this test procedure, the hose shall be dried by passing (160°F (49°C) maximum) gas (oxygen, air or nitrogen) through the hose.

4.7.8 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 3.7.7.

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4.7.8.1 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.

4.7.8.2 Procedure II. This test procedure shall be the same as procedure I, except that the pressure shall be 5 psig.

4.7.8.3 Procedure III. This test procedure shall be the same as procedure I, except that the pressure shall be 150 psig.

4.7.9 Flexibility. Hose assemblies that have been subjected to this 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 3.7.8.

4.7.9.1 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 7/8 inch ID, and 1-1/2 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.

4.7.9.2 Procedure II. This test procedure shall be the same as procedure I, part (b), except the rod diameter shall be 1-1/2 inches.

4.7.9.3 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, and 5 inches in diameter for tests at low temperature.

4.7.9.4 Procedure IV. This test is applicable for all electrically wired hoses and should 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 in the manner specified in 4.7.3. This test shall be performed four times, except that for each successive test, the hose shall be turned

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90° 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 electrical circuit of the hose is checked for electrical continuity in the manner specified in 4.7.2 and for electrical shorts. This test shall be performed four times, except that for each successive test the hose shall be turned 90° on its longitudinal axis prior to being coiled about the rod.

4.7.10 Minimum burst pressure.

4.7.10.1 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 pass the requirements specified in 3.7.9.

4.7.10.2 Procedure II. This test procedure shall be the same as procedure I, except the pressure shall be 20 psi.

4.7.10.3 Procedure III. This test procedure shall be the same as procedure II, except the pressure shall be 450 psi.

4.7.11 Strength.

4.7.11.1 Tensile load. The hose shall meet the requirements of 3.7.10.1.

4.7.11.1.1 Procedure I. Connectors suitable 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 suitable 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.

4.7.11.1.2 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.

4.7.11.1.3 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 a suitable 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.

4.7.11.1.4 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 MS22064 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.

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4.7.11.1.5 Procedure V. Connectors suitable 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 4.7.2 and 4.7.3.

4.7.11.2 Static load.

4.7.11.2.1 Procedure I. 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 pass the requirements specified in 3.7.10.2. Two minutes after the load is removed, the diameter of the hose shall be measured and shall pass the requirements specified in 3.7.10.2.

4.7.12 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 pass the requirements specified in 3.7.11.

4.7.13 Temperature. (Procedure Ia of 4.7.9 is not applicable for the following temperature tests.)

4.7.13.1 Low temperature.

4.7.13.1.1 Procedure I. The hose shall be conditioned at $-65^{\circ} \pm 5^{\circ}\text{F}$ ($-53.9^{\circ} \pm 2.8^{\circ}\text{C}$) for 48 hours. After the conditioning period and while still at this temperature, the hose shall be subjected to the flexibility test specified in 4.7.9. The hose shall then be returned to room temperature and subjected to and pass the tests specified in 4.7.2 (if applicable), 4.7.3 (if applicable), 4.7.5 (if applicable) and 4.7.8.

4.7.13.2 High temperature.

4.7.13.2.1 Procedure I. The hose shall be conditioned at $160^{\circ} \pm 5^{\circ}\text{F}$ ($71.1^{\circ} \pm 2.8^{\circ}\text{C}$) for 48 hours. After the conditioning period and while still at this temperature, the hose shall be subjected to the tests specified in 4.7.6 and 4.7.9. The hose shall then be returned to room temperature and subjected to and pass the tests specified in 4.7.2 (if applicable), 4.7.3 (if applicable), 4.7.5 (if applicable) and 4.7.8.

4.7.14 Flexibility endurance. The rod size used in this test shall be the same rod diameter as used in the applicable procedure of 4.7.9.

4.7.14.1 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:

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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 pass the requirements specified in 3.7.13. The hose shall then be subjected to and pass the tests specified in 4.7.5 and after an elapsed period of 24 hours to 4.7.8.

4.7.14.2 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 of 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 pass the requirements specified in 3.7.13. The hose shall then (in the order indicated) be subjected to and pass the tests specified in 4.7.5 (if applicable), 4.7.9.4 (if applicable), and after an elapsed period of 24 hours to 4.7.8.

4.7.15 Material composition tests.

4.7.15.1 Ozone resistance test (elastomer components).

4.7.15.1.1 Procedure I. The test slabs 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 D 1149-78a. 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 $100^{\circ} \pm 2^{\circ} F$ ($37.8^{\circ} \pm 1.1^{\circ} C$) and to give an exposure of ozone concentration of 325 ± 10 parts by volume of ozone per million parts by volume of air. The air ozone velocity in the chamber shall be at least 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 10X magnification and shall pass the requirements specified in 3.7.14.1.

4.7.15.1.2 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 million parts by volume of air.

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4.7.16 Abrasion.

4.7.16.1 Procedure I. 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 CCC-C-419, type I, hard texture, duck, no. 10. A one pound weight shall be placed upon 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 3.7.15.

4.7.17 Weight.

4.7.17.1 Procedure I. The hose shall be weighed on a scale capable of weighing to a tenth of an ounce and shall meet the requirements of 3.7.16.

4.7.18 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 the Occupational Safety and Health Administration. The talc shall meet the requirement specified in 3.7.17.

5. PACKAGING

5.1 Preservation. Preservation shall be level A or C, as specified (see 6.2.1h).

5.1.1 Level A. The hose or hose assembly shall be packaged in accordance with MIL-STD-794. Preservation shall be in accordance with MIL-P-116, method 1A, and no contact preservative is required. All openings shall be wrapped or sealed to prevent entry of foreign matter into the hose. If the hose or hose assemblies are coiled, the inside diameter of the coil shall be not less than 12 inches to minimize permanent set.

5.1.2 Level C. Each hose or hose assembly shall be packaged in a manner that will afford adequate protection against contamination and physical damage during shipment from supply source to the first receiving activity for immediate use.

5.2 Packing. The hose or hose assembly shall be packed in accordance with MIL-STD-794, level A, B or C, as specified in the contract or order (see 6.2.1h). As far as practical, containers shall be of minimum tare and cube consistent with the protection required and contain identical quantities.

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

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

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

6. NOTES

6.1 Intended use. The intended use of the hose or hose assemblies covered by this general specification shall be specified in the applicable detail specifications.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Title, number and date of the applicable detail specification, and the applicable type and style.
- c. Applicable drawings including latest revisions.
- d. Applicable Government part number.
- e. Title, number and date of the applicable Qualified Products List.
- f. Whether first article inspection is required or waived (see 3.3 and 4.4.1).
- g. Name and address of the first article inspection laboratory (see 4.4.1) and the name of the Government Activity responsible for conducting the first article test program (see 4.4.2).
- h. Applicable levels of preservation, packaging and packing (see 5), including marking requirements (see 5.3 and 5.3.1).
- i. Items of data required (see 6.2.2).
- j. Whether talc samples or verification that the talc is of the non-asbestiform type shall be required (see 3.5.3.1).

6.2.2 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423 and invokes the provisions of 7-104.9(n) of the Defense Acquisition Regulations (DAR), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (DD Form 1423) incorporated into the contract. When the provisions of DAR 7-104.9(n) are not invoked, the data specified below should be delivered by the contractor in accordance with the contract requirements. Deliverable data required by this specification is cited in the following paragraph:

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<u>Paragraph</u>	<u>Data Requirement</u>	<u>Applicable DID</u>
3.5.3.1	Certification of Compliance	DI-E-2121
4.4.2	First Article Inspection Reports	DI-T-5329 Inspection Test Reports

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the contractors is called to this requirement, 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. The activity responsible for the Qualified Products List is the Commander, Naval Air Systems Command, Department of the Navy, Washington, DC 20360; however, information pertaining to qualification of products may be obtained from the Commanding Officer, Naval Air Development Center, Warminster, PA 18974, Attention: Code 6031. Prior to submission of the samples for qualification inspection, the manufacturer shall submit a request to the Naval Air Development Center, Code 6031, indicating a date on which samples can be forwarded and also request an authorization number to accompany the samples.

6.3.1 Drawings. When requested, the manufacturer shall 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, it shall be mandatory that the manufacturer submit one copy of a drawing containing the company part number which shall be in accordance with the Government drawing for individual part numbers.

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 instruments, regarding arrangements for examinations, tests and approval of the first article.

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

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

Preparing Activity:
Navy - AS
(Project No. 1660-0443)

Review Activities:
Air Force - 99

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TABLE I. First article examinations and tests.

Inspection	Paragraph	
	Requirement	Method
Visual examination	Applicable drawings	4.7.1.1
Polarity (color code) and electrical continuity (if applicable)	3.7.1	4.7.2
Insulation resistance (if applicable)	3.7.2	4.7.3
Elongation	3.7.3	4.7.4
Delamination (if applicable)	3.7.4	4.7.5
Odor	3.7.5	4.7.6
Cleanliness	3.7.6	4.7.7
Leakage <u>1/</u> <u>2/</u>	3.7.7	4.7.8
Flexibility	3.7.8	4.7.9
Minimum burst pressure <u>1/</u>	3.7.9	4.7.10
Tensile load <u>2/</u>	3.7.10.1	4.7.11.1
Weight (if applicable)	3.7.16	4.7.17

1/ A sample hose assembly subjected to the tensile load test 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.

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

Inspection	Requirement	Method	Sample size	Acceptance criteria
Visual examination (see classification of defects)		4.7.1.1	Every hose assembly for critical defects. Inspection level II for minor defects	Reject all units with any critical defects. An acceptable quality level of 2.5 defects per hundred units for minor defects.
Polarity (color code) and electrical continuity	3.7.1	4.7.2	Inspection level S-2	An acceptable quality level of 1.5 defects per 100 units.
Insulation resistance	3.7.2	4.7.3	Inspection level S-2	An acceptable quality level of 1.5 defects per 100 units.
Elongation	3.7.3	4.7.4	Inspection level S-2	An acceptable quality level of 1.5 defects per 100 units.
Delamination	3.7.4	4.7.5	Inspection level S-2	An acceptable quality level of 1.5 defects per 100 units.
Odor	3.7.5	4.7.6	Inspection level S-2	An acceptable quality level of 1.5 defects per 100 units.
Cleanliness	3.7.6	4.7.7	Inspection level S-2	An acceptable quality level of 1.5 defects per 100 units.
Leakage	3.7.7	4.7.8	Inspection level S-2	An acceptable quality level of 1.5 defects per 100 units.
Flexibility	3.7.8	4.7.9	Inspection level S-2	An acceptable quality level of 1.5 defects per 100 units.
Packaging		4.7.1.2	Inspection level S-2	An acceptable quality level of 4.0 defects per 100 units.

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

Critical	Minor
<ol style="list-style-type: none"> 1. Dimensions not within specified tolerances. 2. Material imperfections - foreign matter embedded. 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. 	<ol style="list-style-type: none"> 201. Marking - missing, insufficient, incorrect, illegible, or not permanent. 202. Color not as specified.

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TABLE IV. List of defects for packaging for delivery

Item	Defects
Exterior and interior markings	Missing, incorrect, incomplete, illegible; of improper size, location, sequence or method of application; markings not the same on the interior and exterior containers.
Packaging and packing materials	Any nonconforming components; any component missing, damaged, or otherwise defective.
Workmanship	Inadequate application of the components such as incomplete closure of the unit package, intermediate packing, container flaps, or loose strapping, etc.; bulging or distortion of the containers.
Exterior and interior weight or content.	Number per container is more or less than required; <u>gross or net weight exceeds the requirement.</u>

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