

MIL-H-87961 (USAF)  
31 JUL 79

## MILITARY SPECIFICATION

### HOSE AND HOSE ASSEMBLIES, AIR DUCT, AIR BREATHING, OXYGEN SYSTEM, GENERAL SPECIFICATION FOR

This specification is approved for use by Code 99, Department of the Air Force, and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers the requirements for hose assemblies which supply breathing oxygen to aircrew during the operation of high-performance aircraft. These hose assemblies are part of the Aircraft Life Support System.

1.2 Classification. The hose covered by this specification will be furnished in the following types as specified (see 6.2):

Type I	Hose (MIL-H-87961/1)
Type II Assembly	Hose with MS22058-1 Connector Installed with an MS22064-5 Clamp (MIL-H-87961/2)
Type III Assembly	Hose with MS22058-2 Connector Installed with an MS22064-5 Clamp and retainer strap, P/N 7225317-10 (MIL-H-87961/3)

#### 2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on the date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: HQ AFLC CASO/LODS, Federal Center, Battle Creek, MI 49016, 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

## FEDERAL

BB-A-1034	Air, Compressed, for Breathing Purposes
BB-N-411	Nitrogen, Technical
CCC-C-419	Cloth, Duck, Cotton, Unbleached, Plied-Yarns (Army and Numbered)

## MILITARY

MIL-P-116	Preservation-Packaging Methods of
MIL-O-27210	Oxygen, Aviator's Breathing, Liquid & Gas

## STANDARDS

## FEDERAL

FED-STD-595	Colors
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## MILITARY

MIL-STD-105	Sampling Procedures & 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	Specifications & Standards, Order of Precedence for the Selection of
MIL-STD-794	Parts & Equipment, Procedures for Packaging and Packing of
MIL-STD-831	Test Reports, Preparation of
MS22058	Connector - Oxygen Hose to Regulator
MS22064	Clamp, Oxygen Hose

## DRAWINGS

Air Force

7225317	Retainer Strap Assy - Hose, Connector to Regulator
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## 3. REQUIREMENTS

3.1 Qualification. The hose assembly furnished under this specification shall be products which have been subjected to and

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which have passed the qualification tests specified herein, and which have been listed on or approved for listing on the applicable Qualified Products List at the time set for opening of bids.

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

3.3 Materials. Materials shall conform to applicable specifications and shall be as specified herein. Materials which are not covered by specifications, or which are not specifically described herein, shall be of the best quality, the lightest practicable weight, and suitable for the purpose intended.

3.3.1 Metals. Metals shall be of the corrosion-resistant type or suitably treated to resist corrosion due to fuels, salt spray, or atmospheric conditions. The use of any protective treatment that will crack, chip, or scale with age or extremes of atmospheric conditions shall be avoided.

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

3.3.2.1 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.

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

3.4 Design and construction. The design and construction of the hose assembly shall be in accordance with AF Drawing 7827165. The hose assembly shall be a nonkinking, flexible type, suitably reinforced with wire to prevent collapse during normal use.

3.4.1 Hose. The hose shall be constructed of a polyethylene liner (0.003 inch thick) tightly wrapped over the reinforcing wire and lapped over itself to form six plies minimum. Two plies of vinyl (0.005 inch thick) shall be tightly wrapped over the polyethylene liner. The hose shall have a tubular polyamide

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or polyester knitted or braided outer covering over the vinyl jacket. The hose shall have a molded rubber adapter securely attached to each end. These adapters shall have a minimum inside diameter of 0.875 inch and a maximum outside diameter of 1.23 inches to permit interface with the connector, MS22058 and allow installation of a clamp conforming to MS22064-5.

3.4.2 Reinforcing wire. The reinforcing wire shall be helically wound on the inside of the polyethylene liner to prevent collapse of the hose during normal use.

### 3.5 Performance.

3.5.1 Odor. The hose shall not be judged to have an objectionable odor, when tested as specified in paragraph 4.6.2.

3.5.2 Cleanliness. The hose shall not contain precipitates or be more turbid than a standard suspension of 5 milligrams of diatomaceous silica in 100 milliliters of distilled water, when tested as specified in paragraph 4.6.3.

3.5.3 Flexibility. The hose, when tested as specified in paragraph 4.6.4 shall not show any 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, there shall be no permanent set of the hose.

3.5.4 Delamination. The hose, when tested as specified in paragraph 4.6.5, shall not show any evidence of delamination of the inner layer of the hose.

3.5.5 Elongation. The hose assembly, when tested as specified in paragraph 4.6.6 shall show an increase in length of not less than 3%, nor more than 10%. The permanent set for the hose assembly shall not exceed 5%.

3.5.6 Leakage. The hose, when tested as specified in paragraph 4.6.7 shall not exhibit a leakage rate greater than 0.25 cc/min/ft.

3.5.7 Tensile Load. The hose, when tested as specified in paragraph 4.6.8 shall not separate from the end connector or the molded end.

3.5.8 Static Load. The hose, when tested as specified in paragraph 4.6.9, shall not show a deflection, on the outside diameter of the hose, of more than 15% of the original value.

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The outside diameter of the hose, when checked as specified with the load removed, shall be within 5% of the original value.

3.5.9 High Temperature. The hose, after completion of the conditioning period, shall pass the tests specified in paragraph 4.6.10.

3.5.10 Low Temperature. The hose, after completion of the conditioning period shall pass the tests specified in paragraph 4.6.11.

3.5.11 Abrasion. The hose, when tested as specified in paragraph 4.6.12, shall withstand the abrasion test without exposing the white polyethylene liner of the hose.

3.5.12 Flexibility endurance. The hose, when tested as specified in paragraph 4.6.13 shall not show any evidence of deterioration or structural damage.

3.5.13 Minimum burst pressure. The hose, when tested as specified in paragraph 4.6.14, shall not show any evidence of structural failure.

3.5.14 Ozone resistance. The test slabs and hose specimen, when tested as specified in paragraph 4.6.15 shall not show any evidence of chipping, cracking, or other damage.

3.6 Weight. The weight of the hose assembly shall not exceed 5.0 ounces per foot of nominal specified length.

3.7 Color. The color of the hose shall be green, approximately matching color number 34410 of FED-STD-595. Other colors may be used for the hose ends when approved by the procuring activity.

3.8 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable.

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 nameplate. The year and quarter of cure of all elastomers shall also be included.

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3.10 Workmanship. The hose 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 supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 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.

(b) 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 specification.

4.3 Qualification inspection. Qualification inspection shall consist of all the examinations and tests of this specification.

4.3.1 Qualification samples. Three hose assemblies shall be prepared in accordance with this specification and shall be representative of production items; four test slabs, 6 x 6 x 0.075 inches, and two compression set specimens 1.129 inches in diameter by  $0.500 \pm 0.005$  inch in thickness composed of the identical ozone-resistant composition used in the manufacture of the molded rubber adapters. The samples shall be furnished to the qualifying activity at the same time as the test reports.

4.3.2 Test report. Three copies of a test report prepared in accordance with MIL-STD-831 shall be furnished to the qualifying activity. The test report shall include the results of all tests and a detailed statement of compliance or noncompliance with each requirement of this specification, identified by the applicable paragraph number.

4.4 Quality conformance inspection. The sampling and inspection levels shall conform to MIL-STD-105. Quality conformance inspection shall consist of the following examinations and tests.

- Visual Examination
- Odor
- Cleanliness
- Flexibility
- Delamination
- Elongation
- Leakage
- Preparation for delivery

4.4.1 Sampling.

4.4.1.1 Inspection lot. An inspection lot size shall be expressed in units of hose assemblies. The sample unit shall be one hose assembly of a specification part number. The inspection lot shall consist of hose assemblies manufactured under the same conditions and from the same materials and components.

4.4.1.2 Preparation for delivery. 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.

4.4.1.3 Sampling and acceptance criteria. Sample size and acceptance criteria shall be as specified in Table I.

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TABLE I  
 SAMPLE SIZE, ACCEPTANCE CRITERIA, TESTS  
 AND EXAMINATIONS OF THE HOSE ASSEMBLIES

INSPECTION	REQUIREMENT	METHOD	SAMPLE SIZE	ACCEPTANCE CRITERIA <u>1/</u>
Visual examination (See classification of defects)		4.6.1	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.
Odor	3.5.1	4.6.2	Inspection Level S-2	An acceptable quality level of 1.5 defects per 100 units.
Cleanliness	3.5.2	4.6.3	Inspection Level S-2	An acceptable quality level of 1.5 defects per 100 units.
Flexibility	3.5.3	4.6.4	Inspection Level S-2	An acceptable quality level of 1.5 defects per 100 units.
Delamination	3.5.4	4.6.5	Inspection Level S-2	An acceptable quality level of 1.5 defects per 100 units.

TABLE I (Continued)

Elongation	3.5.5	4.6.6	Inspection Level S-2	An acceptable quality level of 1.5 de- fects per 100 units.
Leakage	3.5.6	4.6.7	Inspection Level S-2	An accept- able quality level of 1.5 defects per 100 units.
Preparation for delivery			Inspection Level S-2	An accept- able quality level of 4.0 defects per 100 units.

1/ The sampling plan acceptance numbers shall apply collectively to all the characteristics within a stated acceptable quality level.

#### 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-O-27210, Type I. When specified, nitrogen conforming to BB-N-411, Type I, Class 1, Grade B, or water-pumped air conforming to Type II of BB-A-1034 may be used.

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 and 70° F. Test instruments shall be calibrated or adjusted according to their required usage in conducting individual tests.

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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.

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

TABLE II  
CLASSIFICATION OF DEFECTS FOR VISUAL EXAMINATION  
OF THE HOSE ASSEMBLY

CRITICAL	MINOR
1. 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. Any component loose or otherwise not securely retained	

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4.6.2 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 pass the requirements specified in paragraph 3.5.1.

4.6.3 Cleanliness. The hose shall be 75 percent filled with distilled water at 160° F and both ends shall be sealed. The hose shall be shaken for a minimum period of 2 minutes and the contents shall then be poured into a clean glass cylinder. The contents of the cylinder shall pass the requirements specified in paragraph 3.5.2. Upon completion of this test procedure, the hose shall be dried by passing (160° F Max) gas (oxygen, air or nitrogen) through the hose.

4.6.4 Flexibility. The hose shall be closely coiled about a 1-3/4 inch diameter rod 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. Then the hose shall be mounted in a fixture as shown in Figure 1. With one end of the hose assembly securely clamped in place and the overall hose distance held fixed by a pillow block loosely secured around the opposite hose end, flex the hose 5 times by turning the loosely secured end clockwise thru 2 complete (720 ) rotations. Repeat this procedure 5 times for the opposite end. The hose shall pass the requirements specified in paragraph 3.5.3.

4.6.5 Delamination. The delamination test shall be conducted by capping one end of the hose assembly. This cap shall contain an eye-piece. The other end of the hose shall be connected to vacuum source which contains a light. A vacuum of 16 inches of mercury shall be applied and, while at this condition, the interior of the hose shall be examined through the eyepiece. The hose shall pass the requirements specified in paragraph 3.5.4.

4.6.6 Elongation. The hose shall be suspended by one end in a vertical position and a 10-pound weight attached to the other end for 30 seconds. The increase in length shall then be measured. Two minutes after removal of the load, the permanent set shall be determined. The hose shall pass the requirements specified in paragraph 3.5.5.

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4.6.7 Leakage. The hose shall be pressurized with 10 PSIG internal air pressure and maintained for a period of 1 minute. The internal hose pressure shall then be reduced to 5 PSIG and during the succeeding 5 minute period, while the applicable pressure is still maintained, the leakage rate shall be measured and shall meet the requirements of paragraph 3.5.6.

4.6.8 Tensile load. A connector conforming to MS22058 shall be attached to one end of the hose by means of a clamp, MS22064-5. A tensile load of 40 pounds shall be applied to the connector on one end of the hose for a period of one minute. The hose shall pass the requirements of paragraph 3.5.7.

4.6.9 Static load. A static load of 125 pounds shall be applied normal to the longitudinal axis of the hose over a 4-inch section of the wire-reinforced portion of the hose for a period of 30 seconds. The outside diameter of the hose shall be measured and shall pass the requirements specified in para 3.5.8. Two minutes after the load is removed, the outside diameter of the hose shall be measured and shall pass the requirements specified in paragraph 3.5.8.

4.6.10 High temperature. The hose shall be conditioned at  $+160 \pm 5^\circ \text{F}$  for 48 hours. After the conditioning period and while still at this temperature, the hose shall be subjected to the tests specified in paragraph 4.6.2. The hose shall then be returned to room temperature and subjected to and pass the tests specified in paragraph 4.6.4, 4.6.5, 4.6.6, and 4.6.7.

4.6.11 Low temperature. The hose shall be mounted in a fixture as shown in Figure I and conditioned at  $-40^\circ \text{F} \pm 5^\circ \text{F}$  for 30 minutes. Immediately following the conditioning period, the hose shall be subjected to 5 test cycles as specified in paragraph 4.6.13. The hose shall then be returned to room temperature and subjected to and pass the tests specified in paragraph 4.6.5 and 4.6.7.

4.6.12 Abrasion test. Four sections of hose, obtained by cutting through the hose perpendicular to its longitudinal axis to be abrasion tested on a United States testing company model 8675 abrasion tester. The abrader to conform to CCC-C-419, Type I, hard texture, Duck No. 10. A one pound weight placed on the upper carriage shall provide constant pressure between the test specimen and abrader. The hose test specimens to be cut approximately 6-1/2 inches long and clamped to the specimen

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holders on each carriage. Each specimen to be subjected to 10,000 horizontal motions. The abrasive motions to be in the direction of the longitudinal hose axis. Each specimen to be checked at intervals of 500 abrasive motions and the condition of the hose surface noted and recorded.

4.6.13 Flexibility endurance. The full length of hose shall be closely wound, in tight coils, about a rod 1-3/4 inch in diameter, and released 500 times. The hose shall then be mounted in a fixture as shown in Figure 1. With one end of the hose assembly securely clamped in place and the overall hose distance held fixed by a pillow block loosely secured around the opposite hose end, flex the hose 500 times by turning the loosely secured end clockwise thru an angle of  $270^\circ$  (3/4 of a turn). The hose shall pass the requirements specified in paragraph 3.5.12. The hose shall then be subjected to and pass the tests specified in paragraphs 4.6.5 and 4.6.7.

4.6.14 Minimum burst pressure. The hose shall be submerged in water and a gaseous pressure (oxygen, air or nitrogen) of 20 pounds per square inch shall be applied internally to the hose for a period of 5 minutes. The hose shall pass the requirements specified in paragraph 3.5.13.

4.6.15 Ozone resistance test. (Elastomer Components). Two of the four test slabs submitted for qualification inspection and a specimen of the elastomer portion of the hose shall be tested for ozone resistance. The test apparatus shall be in accordance with ASTM Method No. D 1149. 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  $100 \pm 2^\circ$  F and to give an exposure of ozone concentration of  $120 \pm 10$  parts by volume of ozone per 100 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. Inspect and note the condition of the specimen. The test slabs and hose specimen shall be examined under 10X magnification and shall pass the requirements specified in paragraph 3.5.14.

## 5. PACKAGING

5.1 Preservation and packaging. Unless otherwise specified by the procuring activity, each hose of hose assemblies shall be prepared for delivery in accordance with MIL-STD-794, Level A, B, or C.

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5.1.1 Level A.

5.1.1.1 Cleaning. Each hose or hose assembly shall be cleaned in accordance with Method C-7 of Specification MIL-P-116.

5.1.1.2 Drying. Each hose or hose assembly shall be dried to remove any residue, moisture or cleaning solution by utilizing any of the drying methods of Specification MIL-P-116, providing the method is not injurious to the hose.

5.1.1.3 Preservation application. Preservation of each oxygen hose or hose assembly shall be accomplished without the use of preservative compounds, oil or grease. All hoses or hose assemblies shall be individually enclosed in a sealed dustproof bag.

5.1.1.4 Unit Packaging. All wrapping, cushioning, dunnage and containers used in the packaging shall be completely free of contamination by oil or grease. Each hose or hose assembly packaged in accordance with Method 1A8 of Specification MIL-P-116. If 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 B. (Same as Level A).

5.1.3 Level C. Cleaning, drying, preservation and packaging shall be in accordance with the manufacturer's commercial practice.

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

5.2.1 Level A. Each hose or hose assembly preserved and packaged as specified in 5.1.1.4 shall be packed in exterior type containers. The containers used shall be closed, sealed, and reinforced in accordance with the applicable specification thereto.

5.2.2 Level B. All hoses or hose assemblies preserved and packaged as specified in 5.1.1.4 shall be packed in domestic type containers. The containers used shall be closed, sealed, and reinforced in accordance with the applicable specification thereto.

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5.2.3 Level C. All packaged hoses or hose assemblies which require over-packing for acceptance by the carrier, shall be packed in exterior type shipping containers in a manner that will insure safe transportation at the lowest freight rate, to the point of delivery. Containers shall meet the uniform freight classification rules or regulations of the common carrier as applicable to the mode of transportation.

5.3 Marking. In addition to any special markings required by the contract or order, unit packages, intermediate packages and shipping containers shall be marked in accordance with the requirements of MIL-STD-129.

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

<p>LIFE SUPPORT ITEM</p> <p>ALL OIL, GREASE, SHOP RESIDUE, OR OTHER CONTAMINANTS HAVE BEEN REMOVED.</p> <p>DO NOT OPEN UNTIL READY FOR USE</p>
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## 6. NOTES

6.1 Intended use. The hose assembly covered by this specification is intended for use in supplying breathing oxygen to aircrew in the operation of aircraft. The hose assembly extends from the oxygen breathing regulating device to the connector.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date for this specification.
- (b) Part Number.
- (c) Selection of applicable levels of preservation, packaging, and packing required.
- (d) Applicable methods of cleaning and preservation.
- (e) Items of data required (see 6.3).

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6.3 Data. For the information of contractors and contracting officers, any of the data specified in applicable documents listed in Section 2 of this specification or referenced lower-tier documents need not be prepared for the Government and shall not be furnished to the Government unless specified in the contract or order. The data to be furnished shall be listed on DD Form 1423 (Contractor Data Requirement List), which shall be attached to and made a part of the contract or order.

6.4 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 suppliers 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 HQ AFLC CASO/LODS, Federal Center, Battle Creek, MI 49016, and information pertaining to qualification of products may be obtained from that activity.

6.5 Reclaimed materials. The use of reclaimed materials shall be encouraged to the maximum extent possible.

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Preparing Activity:  
Air Force - 99

Project Number:  
1660-F368

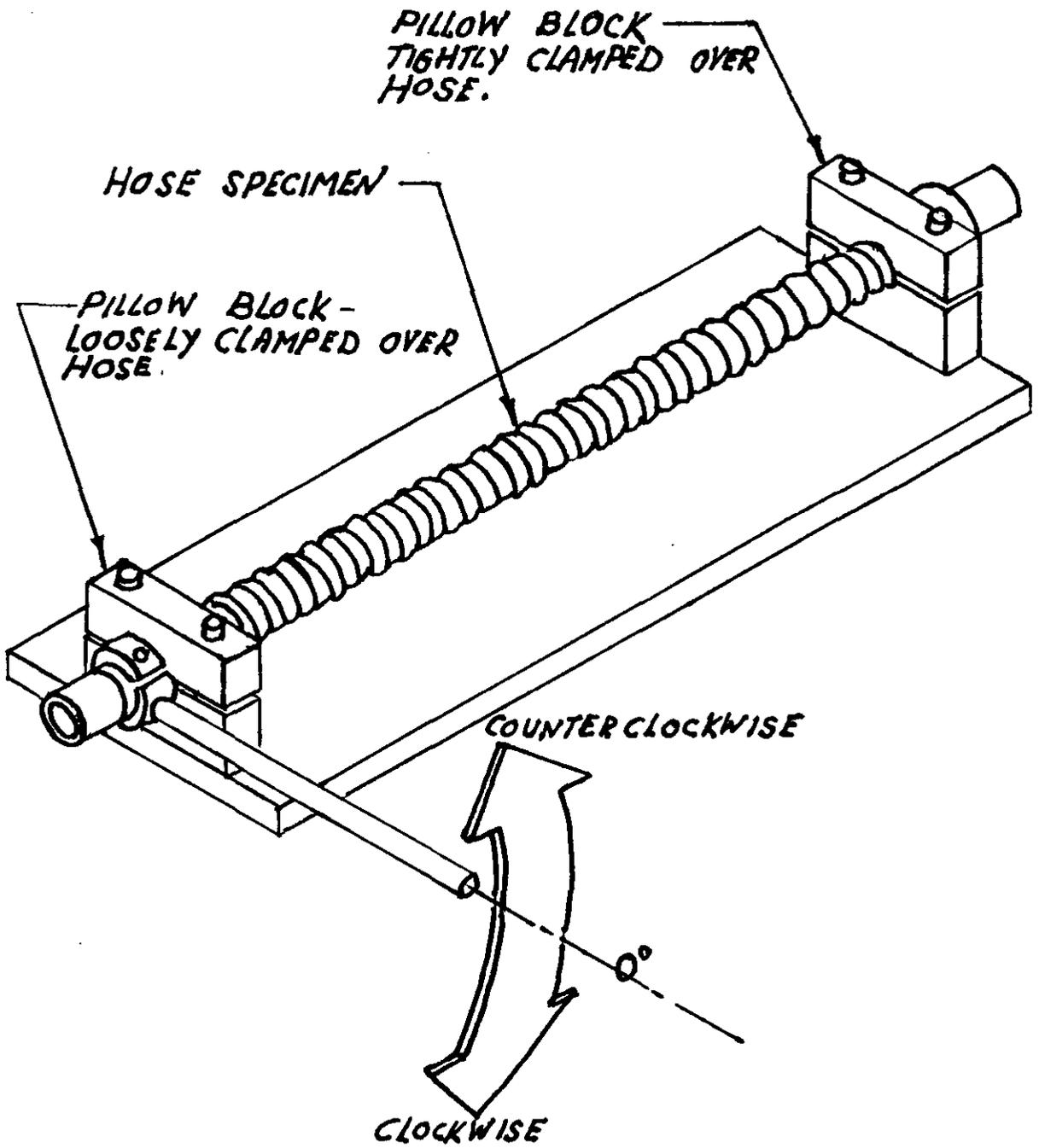


FIGURE 1.



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