INCH-POUND

MIL-PRF-83772C
30 September 2013
SUPERSEDING
MIL-PRF-83772B (USAF)
8 JULY 1998

PERFORMANCE SPECIFICATION

HOSE, ASSEMBLY, CRYOGENIC LIQUID, AIRCRAFT SERVICING

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

1. SCOPE

1.1 Scope. This specification covers a non-vacuum hose assembly for servicing aircraft with cryogenic liquids (liquid oxygen or liquid nitrogen).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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 these lists, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

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

ASME INTERNATIONAL

ASME-B1.20.1 - Pipe Threads, (Inch) General Purpose

(ASME documents may be obtained online at http://www.asme.org/ or from ASME International, Three Park Avenue, New York, New York 10016-5990, USA.)

Comments, suggestions, or questions on this document should be addressed to Oklahoma City Air Logistics Center/ENSDAA, 3001 Staff Drive, Suite 1AB81A, Tinker AFB, OK 73145 or emailed to af71@tinker.af.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQ-Z1.4 - Sampling Procedures and Tables for Inspection by Attributes

(ASQ documents may be obtained online at http://www.asq.org/ or from American Society for Quality, P.O. Box 3005, Milwaukee, WI 53201-3005 or 600 North Plankinton Avenue, Milwaukee, WI 53203 USA.)

2.3 Order of precedence. Unless otherwise noted herein or in the contract, 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 Design and construction. The hose assembly shall be designed and constructed as specified herein for use with cryogenic fluids such as liquid oxygen and liquid nitrogen (see 6.4).

3.1.1 Hose assembly. The hose assembly shall be capable of transferring oxygen or nitrogen through the hose and out the filler valve, as a liquid, at a minimum rate of 1 gallon per minute (gpm). The hose assembly shall conform to the weight, size, flexibility and other physical characteristics listed below:

a. The length of the hose assembly shall be 10 feet ±1 inch.

b. The outer diameter of the outer covering shall be 1.25 inches maximum. There shall be no sharp or frayed edges.

c. The weight of the hose assembly shall not exceed 7.20 pounds.

d. One end of the hose assembly shall terminate in a 0.75 inch National Pipe Thread (NPT) standard female fitting 14 threads per inch (tpi). The other end shall terminate in 1 inch NPT standard male fitting with 11.5 tpi. Guidance for pipe threads is provided in ASME B1.20.1. Both end fittings shall have hexagonal-type outer surface.

e. The hose assembly shall be constructed such that the hose shall not suffer damage if handled or installed with bends whose radius is greater than or equal to seven inches.

f. Provided that all other requirements of this specification are met, reclaimed materials may be used.

3.2 Performance. In addition to the design requirements, the hose assembly shall meet the performance requirements listed below.

3.2.1 Proof pressure. The hose assembly shall withstand a proof pressure of at least 150 psi without leakage for 1 minute.

3.2.2 Burst pressure. The hose assembly shall have a burst pressure of not less than 500 psi.

3.2.3 Operation. At an ambient temperature of 70 ±10°F and a service pressure of 45 ±5 psi, the hose assembly shall be capable of being purged in 2 minutes or less and then shall be capable of servicing liquid nitrogen through the hose and out the filler valve, as a liquid, at a minimum rate of 1 gallon per minute (gpm).

3.2.4 Outer hose surface temperature. The outer surface temperature of the hose assembly shall not drop below 15°F after 10 minutes of servicing with liquid nitrogen at an ambient temperature of 70 ±10°F.

3.2.5 Tensile strength. The hose assembly shall withstand a longitudinal tensile force of 300 pounds.

3.2.6 Abrasion. The hose assembly shall be capable of being dragged on a concrete surface for 20,000 feet without structurally damaging the hose assembly.

3.2.7 Continuity. The hose assembly shall have electrical continuity from one end fitting, through the hose, to the other end fitting.

3.3 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.4 Identification of product. The hose assembly shall be marked for identification as prescribed by the authority. The marking shall be clearly readable (see 6.2). In addition to markings required by the procuring activity, hose containers and shipping containers shall be marked as follows:

HOSE ASSEMBLY, CRYOGENIC LIQUID, AIRCRAFT SERVICING

3.4.1 Precautionary markings. The following marking also shall be included on the hose containers and shipping containers:

DO NOT ALLOW OIL OF ANY KIND TO BE USED ON OR COME IN CONTACT WITH THIS HOSE

3.5 Cleaning. All parts of the hose assembly which come in contact with liquid oxygen shall be cleaned in accordance with accepted industrial practices for breathing class oxygen using an oxygen-safe cleaning solvent. The same batch of cleaning solvent shall be used to clean quantities not greater than 50 hoses. Immediately following cleaning, hoses shall be dried with

oil-free air or gaseous nitrogen (see 6.4) and shall then have their ends sealed. The interior of the inner hose and end fittings of the cleaned hose assemblies shall meet the requirements listed below:

a. Particle (metal or non-metal;) count and sizes

(1) No particle greater than 2500 microns.

(2) No more than 1 particle between 700 and 2500 microns.

(3) No more than five particles between 175 and 700 microns.

b. Non-volatile residue shall not exceed 0.001 grams per square foot of the inner hose interior surface area.

4. VERIFICATION

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

a. Qualification inspection (see 4.4).

b. Conformance inspection (see 4.5).

4.1.1 Requirements cross-reference matrix. Table I provides a cross-reference matrix of the section 3 requirements tested or verified in the paragraphs below.

4.2 Test conditions. Unless otherwise specified, all tests shall be performed at an ambient temperature of 70 ±10°F.

4.3 Test report. The results of this testing shall be documented as prescribed by the procuring activity (see 6.2).

TABLE I. Requirements cross-reference matrix.

Requirement	Verification	Requirement	Verification
3.1.1	4.4.3, 4.4.4	3.2.6	4.4.6
3.2.1	4.4.4	3.2.7	4.4.8
3.2.2	4.4.9	3.4	4.4.3
3.2.3	4.4.7	3.4.1	4.4.3
3.2.4	4.4.5.1	3.5	4.4.2
3.2.5	4.4.5.2		

4.4 Qualification inspections. These qualification tests shall be performed on 1 hose assembly. The tests shall be performed in the order presented below.

4.4.1 Test article. The test hose assembly shall be randomly selected by an authorized government representative from hose assemblies which have been manufactured in the same manner that all hose assemblies to be bought per the contract will be manufactured. If the test is successful, the remaining hose assemblies shall be included in the first lot of hose assemblies to be delivered to the Government.

4.4.2 Cleaning test. The cleaning test shall consist of particulate test and a non-volatile residue (NVR) test.

4.4.2.1 Particulate test. A 15-ounce sample of an acceptable oxygen-safe commercial cleaning solvent shall be poured through the selected test sample hose assembly held vertically, such that the interior walls are rinsed and flushed with solvent. The liquid leaving the bottom of the hose shall be collected in a clean container and filtered by means of a vacuum pump through a 10 micron-pore membrane filter. The filtered solvent, in its cleaned container, shall be saved for later use in the non-volatile residue test. The particulate (metal or nonmetal) found on the membrane filter surface shall have (1) no particle greater than 2500 microns, (2) no more than 1 particle between 700 and 2500 microns and, (3) no more than 5 particulates between 175 and 700 microns. Immediately after the rinsing of this test sample hose assembly, it shall be thoroughly dried and its ends shall be resealed.

4.4.2.2 Non-volatile residue test. To determine the amount of NVR, the solvent used in the particulate test (4.4.2.1) shall be dried using an evaporate process and the residue weighed (see 6.9). The weight of the NVR shall be divided by the interior surface area of the hose assembly and the value obtained shall be less than 0.001 grams per square foot.

4.4.3 Examination of hose. The hose assembly shall be physically inspected to ensure the following:

a. The total length is 10 feet ±1 inch.

b. The outer diameter of the outer covering is not more than 1.25 inches.

c. The total weight does not exceed 7.20 pounds.

d. The hose assembly terminates in a 0.75 inch NPT standard female fitting having 14 tpi at one end, and a 1 inch NPT standard male fitting with 11.5 tpi at the other end. Both end fittings shall have a hexagonal-type outer surface.

e. The outer covering is free from sharp or frayed edges.

f. The markings are as prescribed by the procuring authority and all hoses carry the precautionary labeling (see 6.2).

4.4.4 Bend radius test. The hose assembly shall be installed in a fixture as shown in figure 1, and shall be rotated at a rate of at least 10 rpm for 45 minutes – fifteen (15) minutes at each of three different heights (H) of 1, 3 and 6 feet, with a liquid nitrogen flow rate of at least 1

gpm. The hose shall neither rupture nor leak as a result of this test, nor shall it develop sharp or frayed edges that would be dangerous in operational use. The integrity of the hose shall be verified after the test by pneumatically pressurizing the hose to 150 ±5 psig and then submerging the hose in water. There shall be no steady stream of air bubbles evidencing leakage from the hose assembly.

4.4.4.1 Alternate bend radius test. When specified by the procuring authority as an alternate to paragraph 4.4.4, the hose assembly shall be attached to a solid support, stretched out straight, and the hose shall have liquid nitrogen pumped through it at a rate of at least 1 gpm for 15 minutes. After the 15 minutes, the flow of liquid nitrogen shall be turned off.

a. Within two minutes, the hose shall be completely coiled around a 10 inch square mandrel and then it shall be uncoiled and straightened out.

b. Liquid nitrogen shall be pumped through the hose at a rate of 1 gpm, or more, for at least 1 minute. After this minute, turn off the liquid nitrogen source. Repeat steps a and b above a total of 100 times; 50 times coiling clockwise; then 50 times coiling counterclockwise. Following the completion of the 100 coils, hose assembly integrity shall be verified by pneumatically pressurizing the hose to 150 ±5 psig, and then submerging the hose in water. There shall be no steady stream of air bubbles evidencing leakage from the hose assembly.

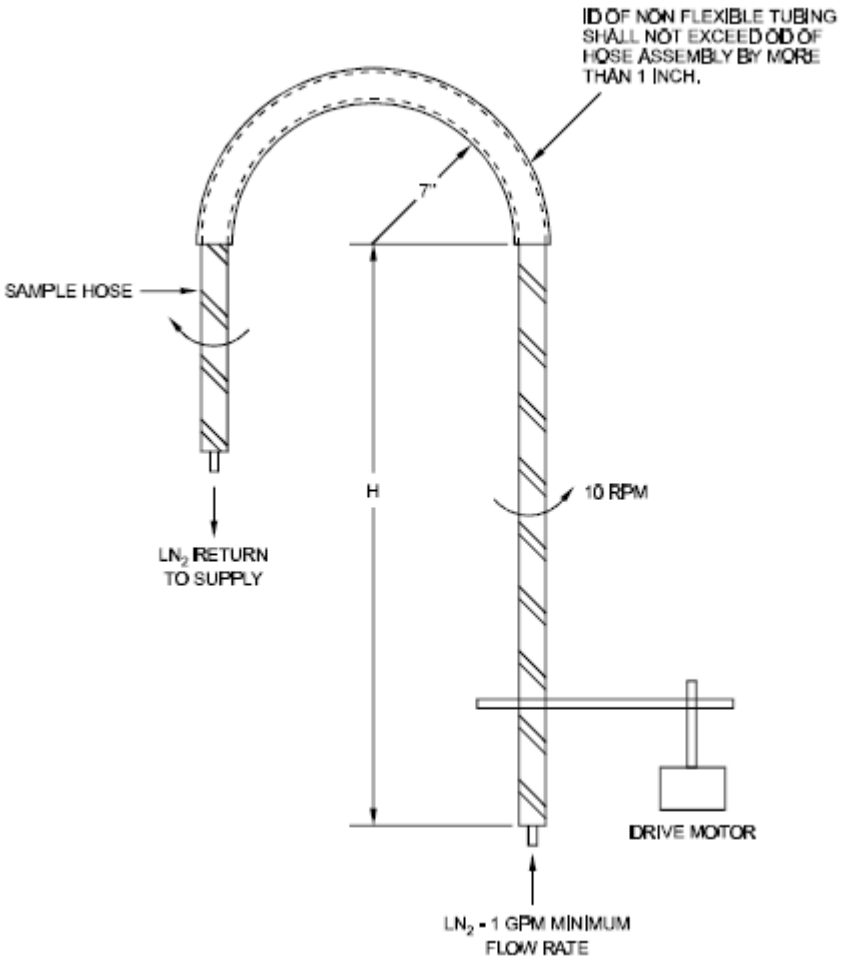

FIGURE 1. Bend radius test.

4.4.5 Tensile and temperature tests. The temperature test shall be run during the first 10 minutes of the 30 minute tensile test.

4.4.5.1 Outer hose surface temperature test. The male end of the hose assembly shall be attached to a solid support and liquid nitrogen flowed through it and out of the other end at a flow rate of at least 1 gpm. Three thermocouples shall be placed on the outer covering of the hose assembly in order to record the surface temperature throughout the first 10 minutes of liquid nitrogen flow. Two of the thermocouples shall be attached approximately 1 foot from either end of the hose assembly, and the third shall be attached near the middle. No external heat source shall be directed toward the hose or thermocouples during this test. The hose assembly temperatures shall not fall below 15°F after liquid nitrogen has flowed through the hose for 10 minutes.

4.4.5.2 Tensile strength test. Without a break in the flow of liquid nitrogen per paragraph 4.4.5.1, a flow of 1 gpm shall continue for additional 20 minutes. Immediately following these 20 minutes, and just after the flow is stopped, a tensile force of 300 pounds shall be applied at the free end of the hose. This pulling and stretching force shall remain for 1

minute. The hose shall then be proof pressure tested per paragraph 4.4.4. The hose assembly shall maintain the 150 ±5 psig pressure for at least 1 minute.

4.4.6 Abrasion drag test. The hose assembly shall be placed on a dry, brushed concrete surface, such as a runway, and dragged a distance of at least 20,000 feet at a speed of 4 to 5 MPH. The end of the hose with the male end fitting shall be approximately 18 inches above the ground, held stationary, and shall be horizontally oriented with the centerline of the hose pointing in the direction being dragged. The hose shall be visually inspected each 5,000 feet and at the end distance of 20,000 feet. The extent of wear shall be recorded, as specified by the test documentation requirements (see 6.2), at each inspection. Fraying or the development of sharp edges that would be dangerous in operational use shall be considered structural damage.

4.4.7 Servicing test. The hose assembly shall be connected to a source capable of providing 45 ±5 psi pressurized liquid nitrogen. The environment to which the hose assembly is exposed during aircraft servicing shall be duplicated to the maximum extent practical:

a. With a service of 45 ±5 psi, purge the hose assembly and record the time it takes to complete purging (see 6.3.3). The total purging time, from opening of the pressurized liquid nitrogen source to when liquid nitrogen begins flowing out through the hose and aircraft filler valves, shall not exceed 2 minutes. Once liquid nitrogen begins flowing, close off the source of the liquid nitrogen to the hose assembly.

b. The hose assembly shall next be subjected to a series of 50 servicing cycles. Each cycle shall consist of:

(1) Opening the source of liquid nitrogen.

(2) Flowing liquid nitrogen through the hose assembly into a discharge vessel.

(3) Discharging 30 to 45 ounces of liquid nitrogen into the discharge vessel.

(4) Shutting of the source of liquid nitrogen.

(5) Repeating the cycle after a 3 minute waiting period, until 50 cycles are accomplished.

The hose assembly shall complete the 50 servicing cycles without leakage or visible damage as the result of the servicing test.

4.4.8 Continuity test. The hose assembly shall be checked to verify that there is electrical continuity through the hose assembly when measured from one end fitting to the other end fitting.

4.4.9 Burst pressure test. The hose assembly shall be hydrostatically pressurized at the completion of all tests at rate not to exceed 50 psig per minute until ruptures. There shall be no failure of the hose or its end fittings at a pressure less than 500 psig.

4.5 Conformance tests. Prior to acceptance by the Government, all hose assemblies shall pass test presented in paragraphs 4.4.1, 4.4.2 and 4.4.3, as appropriate.

4.5.1 Inspection test. Each hose assembly shall meet the requirements defined in 4.4.3.

4.5.2 Pressure test. Each hose assembly shall meet the requirements defined in 4.4.4.

4.5.3 Cleaning test. Prior delivery of the hose assemblies, a random sample shall be selected using an appropriate inspection level from accepted commercial sampling procedures such as those contained in ASQ-Z1.4. The samples chosen shall pass the particulates and non-volatile residue tests listed in 4.4.2.1 and 4.4.2.2.

4.5.4 Retest. Any hose assembly not meeting the conformance or the qualification test requirements may be retested once in accordance with the applicable paragraph or paragraphs of this specification. If required, adjustments to the sample size shall be made in accordance with the sampling specification or as determined by the procuring authority.

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 that may be helpful, but is not mandatory.)

6.1 Intended use. The hose assembly covered by this specification is intended for use as a flexible line transmitting liquid oxygen or liquid nitrogen from servicing equipment to an aircraft.

6.2 Acquisition requirements. Acquisition documents should specify the following:

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

b. Special shipment markings (see 3.4).

c. Location, conditions and sampling requirements for testing (see section 4).

d. Test documentation requirements (see 4.3).

e. Required level of preservation and packaging, and packing (see 5.1).

f. Reporting requirements (see 6.6).

g. Hose marking requirements (see 6.7, 6.8).

6.3 Definitions. For the purpose of this specification, the following definitions will apply.

6.3.1 Hose assembly. The ten foot hose including the male and female end fittings attached at either end.

6.3.2 Servicing pressure. The pressure of the cryogenic liquid (45 ±5 psi) which will be transmitted through the hose assembly to the aircraft requiring liquid nitrogen or oxygen.

6.3.3 Purging. The process of flowing liquid nitrogen or oxygen fluid through the hose assembly which was previously empty. Gaseous vapor of the cryogenic fluid is usually seen first, and purging is complete when the hose assembly has cold soaked sufficiently such that liquid cryogenic fluid begins to flow out the end of the hose assembly.

6.3.4 Servicing cycle. A servicing cycle is defined as transferring cryogenic liquid under pressure from one vessel to another.

6.3.5 Hose filler valve. A valve which attaches to the end of the hose, is cylindrical with an OD of 2.25 inches, a length of 7 inches and a weight of approximately 2 lb 11oz. The USAF part number is 20C-0021-2.

6.3.6 Aircraft filler valve. The aircraft filler valve is a valve to which the hose filler valve connects in order to transfer cryogenic liquid. It is 2.375 inches long and weighs approximately 9oz. The USAF part umber is 20C-0003-6.

6.4 Liquid or gaseous oxygen and nitrogen. MIL-PRF-27210 provides the characteristics and requirements for type I (gaseous) and type II (liquid) oxygen when used for aviator's breathing purposes. Commercial Item Descriptions (CIDs) A-A-59503 and A-A-59155 prescribes the characteristics and requirements for type I (gaseous) and type II (liquid) nitrogen.

6.5 Hose assembly. In the past, a metal braid was used to surround and protect the inner hose.

6.6 Test Report. In the past, a test report was written based upon the results of preproduction testing within 20 days after the completion of the tests. The test report was submitted to the procuring activity. MIL-HDBK-831 was used as guidance for writing the report.

6.7 Markings for shipment and storage. In the past, the provisions of MIL-STD-129 have been specified as guidance for marking for shipment and storage.

6.8 Parts marking. In the past, the provisions of MIL-STD-130 have been specified as guidance for parts marking.

6.9 NVR determination. The following process has been used successfully in the past to determine the amount of NVR in the solvent samples.

a. Dry a 125 milliliter capacity platinum (or high-silica glass) evaporating dish in an oven at 221 ±9°F and cool in a desiccator. Repeat until the weight is constant or within 0.1 milligram of the previous weighing. Using a scale accurate to 0.1 mg or less, record this last weight. Rinse a clean-dry 1000 milliliter volumetric flask with an acceptable oxygen-safe solvent, and then fill it with the filtered solvent saved from the particulate test. Invert the evaporating dish, place it over the mouth of the flask, hold it firmly in place and invert the flask. In this position, place both dish and flask on a steam bath or suitable heat source. Adjust a ring support to hold the flask so the mouth of the flask is 1 in. above the bottom of the evaporating dish. Thus held, the flask automatically feed the solvent to the dish during evaporation (Caution – the test should be run in a ventilated, dust-free area).

b. Evaporate the sample of filtered solvent to dryness. Remove the dish from the steam bath or suitable heat source with metal tongs and blot the outside of the dish with a lint-free tissue or equivalent.

c. Place the dish in an oven at 221 ±9°F for approximately 1 hour. Cool in a desiccator and weigh the dish. From this weight, subtract the weight of the empty dish obtained in a. above. The difference is the weight of the NVR.

6.10 Subject term (key word) listing.

Abrasion
Nitrogen, liquid
Oxygen, liquid
Pressure
Purge
Solvent
Test, non-volatile residue
Test, particulate
Valve

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

Custodians:
Air Force - 71

Preparing Activity:
Air Force - 71

(Project 4720-2013-011)

Review Activities:
Air Force - 99
DLA - CC

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 https://assist.dla.mil/.