

MIL-H-27301D(USAF)

17 June 1970

Superseding

MIL-H-27301C(USAF)

18 December 1969

MILITARY SPECIFICATION

HOSE ASSEMBLY, METAL, CRYOGENIC LIQUID, TRANSFER

1. SCOPE

1.1 This specification covers a nonvacuum insulated metal hose assembly for transferring cryogenic liquids.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

Federal

| | |
|-----------|---------------------------------------|
| L-P-378 | Plastic Film (Polyethylene Thin Gage) |
| BB-N-411 | Nitrogen |
| QQ-S-561 | Solder, Silver |
| PPP-B-636 | Boxes, Fiberboard |

Military

MIL-O-27210 Oxygen, Aviators' Breathing, Liquid and Gas

STANDARDS

Military

| | |
|--------------|---|
| MIL-STD-129 | Marking for Shipment and Storage |
| MIL-STD-120 | Identification Marking of US Military Property |
| MIL-STD-831 | Test Reports, Preparation of |
| MIL-STD-1186 | Cushioning, Anchoring, Blocking, and Waterproofing, with Appropriate Test Methods |

DRAWING

Air Force

59C6671 Hose, Transfer, Cryogenic Liquid, Assembly of

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

FSC 3655

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3. REQUIREMENTS

3.1 Preproduction. This specification makes provisions for preproduction testing.

3.2 Design and construction. The hose assembly shall be designed and constructed in accordance with Drawing 59C6671 and as specified herein for use with fluids such as type II liquid oxygen conforming to MIL-O-27210 and type II liquid nitrogen conforming to BB-N-411. (See 6.2.)

3.2.1 Outer braid. The outer diamond lay or basket braid shall be permanently fastened. The braid shall not work loose during tests specified herein.

3.2.2 Spiral guard. The hose shall be provided with a spiral wire guard designed as shown on figure 1. The maximum spacing between each spiral in the guard shall not exceed 1 inch. The guard shall be so constructed that it can be easily replaced when it has worn to the extent that it fails to protect the outer hose braid against abrasion. The guard shall be so retained that it will not work loose when subjected to the tests specified herein.

3.2.2.1 Guard retainer. A split guard retainer shall be provided as shown on figure 2 and Drawing 59C6671.

3.2.3 Silver soldering. The inner corrugated hose and braid shall be silver-soldered to connectors at each end of the hose. The outer corrugated hose and braid shall be silver-soldered to the sleeve at each end of the hose. Silver soldering operations shall be accomplished with class 5 silver solder in accordance with QQ-S-561.

3.2.4 Retainer nut. A nut having a minimum width of 3/16 inch shall be provided on each end of the hose to secure the spiral guard and insulation retainer.

3.2.5 Retaining ring slot. Each insulation retaining ring shall be designed to facilitate tightening during assembly. The -2, 1-inch ID and -3, 2-inch ID retainers shall have $\frac{1}{4}$ -inch holes as shown on Drawing 59C6671

3.3 Performance.

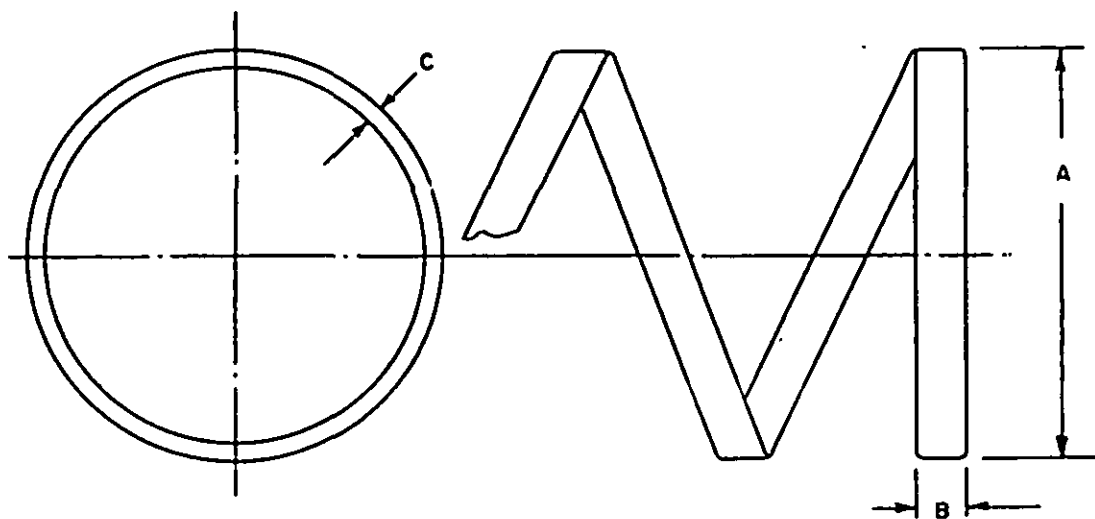
3.3.1 Bend radius. The hose assembly, including spiral guard, shall have a bend radius equal to or less than the value specified in table I for the size hose specified.

TABLE I. Bend Radii

| Hose ID | Size Mandrel | Maximum Bend Radius |
|---------|------------------|----------------------|
| 1 Inch | 22-Inch Diameter | 20 Inch/15 ft length |
| 2 Inch | 30-Inch Diameter | 30 Inch/15 ft length |

3.3.2 Proof pressures. The outer corrugated hose shall withstand a proof pressure of at least 75 psig without leakage. The inner corrugated hose sub-assembly shall withstand a proof pressure of at least 150 psig without leakage.

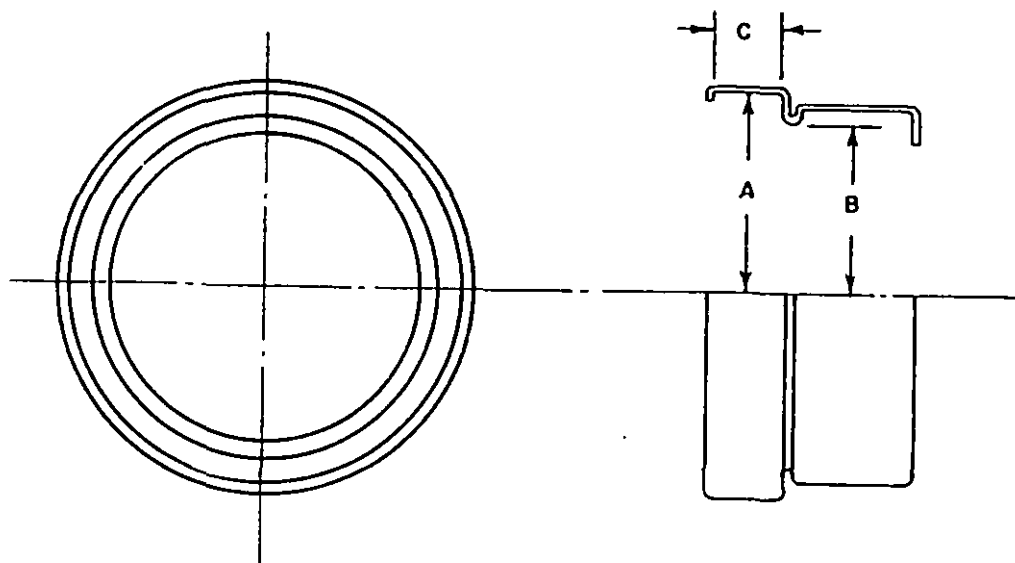
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| | A | B | C |
|--------------|-----------------|---------------|---------------|
| 59C 6671 - 3 | $4 \frac{3}{4}$ | $\frac{3}{8}$ | $\frac{1}{8}$ |
| 59C 6671 - 2 | $3 \frac{5}{8}$ | $\frac{3}{8}$ | $\frac{1}{8}$ |

FIGURE 1. Spiral Wire Guard.

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| | A | B | C |
|-------------|-------------------|------------------|---------------|
| 59C6671 - 3 | $2 \frac{3}{8}$ | $2 \frac{3}{16}$ | $\frac{3}{8}$ |
| 59C6671 - 2 | $1 \frac{13}{16}$ | $1 \frac{5}{8}$ | $\frac{3}{8}$ |

ASSEMBLED AS SHOWN ON
DRAWING 59C6671

DIMENSIONS IN INCHES

TOLERANCES $\pm \frac{1}{64}$

FIGURE 2. Split Guard Retainer.

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Burst pressure. The hose assembly shall withstand a hydraulic or pressure of at least 500 psig without bursting or otherwise breaking seam or junction.

3.4 Identification of product. The hose assembly shall be marked for identification in accordance with MIL-STD-130 as specified for parts. The marking shall be made in raised or stamped lettering on the retainer sleeve.

3.5 Workmanship. The hose assembly shall be assembled and finished in a thoroughly workmanlike manner. Particular attention shall be given to freedom from blemishes, defects, burrs, and sharp edges, and to thoroughness of soldering. Loose, spattered, or excess silver solder shall be removed from sub-assemblies prior to degreasing and final assembly.

3.5.1 Cleaning. All metal parts, plastic retainers, and subassemblies shall be degreased by use of an oxygen-safe solvent such as trichloroethylene. The hose shall be cleaned sufficiently to remove hydrocarbons and limit the particulate material contained in a flushing fluid to the following:

- a. No particle with any dimension greater than 1,000 microns.
- b. No fibrous particle (see 6.3.1) with a length greater than 6,000 microns.
- c. The total of solids collected by a 40-micron absolute filter, both fibrous and particulate, shall not exceed the weight specified in table II.

TABLE II. Allowable Weight, Total Solids Per Ft.
Hose Length

| Hose ID | Weight Per Linear Foot |
|---------|------------------------|
| 1 Inch | 0.2 Milligram |
| 2 Inch | 0.5 Milligram |

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, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 tests. The inspection and testing of the hose assembly shall be classified as follows:

- a. Preproduction testing-----See 4.4
- b. Acceptance tests-----See 4.5

4.3 Test condition.

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4.3.1 Tolerances on pressures. Tolerances on pressure data shall be within 2 percent of actual values based on units of pounds per square inch gage.

4.4. Preproduction testing (see 6.2).

4.4.1 Test samples. One of each size hose being procured shall be subjected to the preproduction tests specified in 4.4.3.

4.4.2 Test report. Upon completion of the preproduction tests, a preproduction test report in accordance with MIL-STD-831 shall be prepared.

4.4.3 Preproduction tests. The preproduction tests shall consist of all the tests described under 4.6.

4.5 Acceptance tests. The acceptance tests shall consist of the individual tests described under 4.5.1.

4.5.1 Individual tests. Each hose assembly shall be subjected to the following tests as described under 4.6:

- a. Examination of product-----See 4.6.1
- b. Bend radius test-----See 4.6.2
- c. Proof pressure tests-----See 4.6.3.1 and 4.6.3.2

4.6 Test methods.

4.6.1 Examination of product. The hose assembly shall be inspected to determine compliance with the requirements specified herein with respect to the drawings, materials, workmanship, and marking. The hose overall length shall be checked against nominal length as specified by the procuring activity (see 6.2).

4.6.1.1 The specific parameters delineated in table III shall be determined and recorded for the preproduction article. The tabulation shall be included in the preproduction test report.

4.6.2 Bend radius test. The hose assembly shall be subjected to a bend radius test as shown on figure 3. The bend radius shall be measured and shall not exceed that specified in table I for the hose ID being tested on a mandrel of at least the size specified. The hose shall be subjected to no force other than its own weight. The hose shall then be rotated 180° as shown on figure 3. The bend radius shall be measured and shall not exceed that specified. Failure to comply with the specified bend radius shall be cause for rejection of the hose.

4.6.3 Proof pressure tests.

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TABLE III
TABULATION OF HOSE EXAMINATION

| PARAMETER | RESULT |
|--|---|
| 1. Dimensions of 59C6671 A. B. C. D. E. F. G. H. J. K. L. M. N. P. R. | <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> |
| 2. Inspect inner and outer braids where affixed to end fittings to determine whether joint is smooth and continuous. | <hr/> |
| 3. Two layers 1-1/2-pound density 1-inch-thick fiberglass mat | <hr/> |
| 4. Polyken No. 320, or equal, wrapped over the entire length to hold insulation | <hr/> |
| 5. Spacing between each spiral shall not exceed 1-inch | <hr/> |
| 6. Spiral wire guard material | <hr/> |
| 7. Connector sleeve and nut material | <hr/> |
| 8. Retainer ring material | <hr/> |
| 9. Corrugated hose material | <hr/> |
| 10. Seal material used between connector and retaining ring, and retaining ring and sleeve | <hr/> |
| 11. Type and class of solder used | <hr/> |
| 12. Spiral wire guard dimensions of figure 1: A. B. C. | <hr/> <hr/> <hr/> <hr/> |
| 13. Split guard retainer dimensions of figure 2: A. B. C. | <hr/> <hr/> <hr/> <hr/> |

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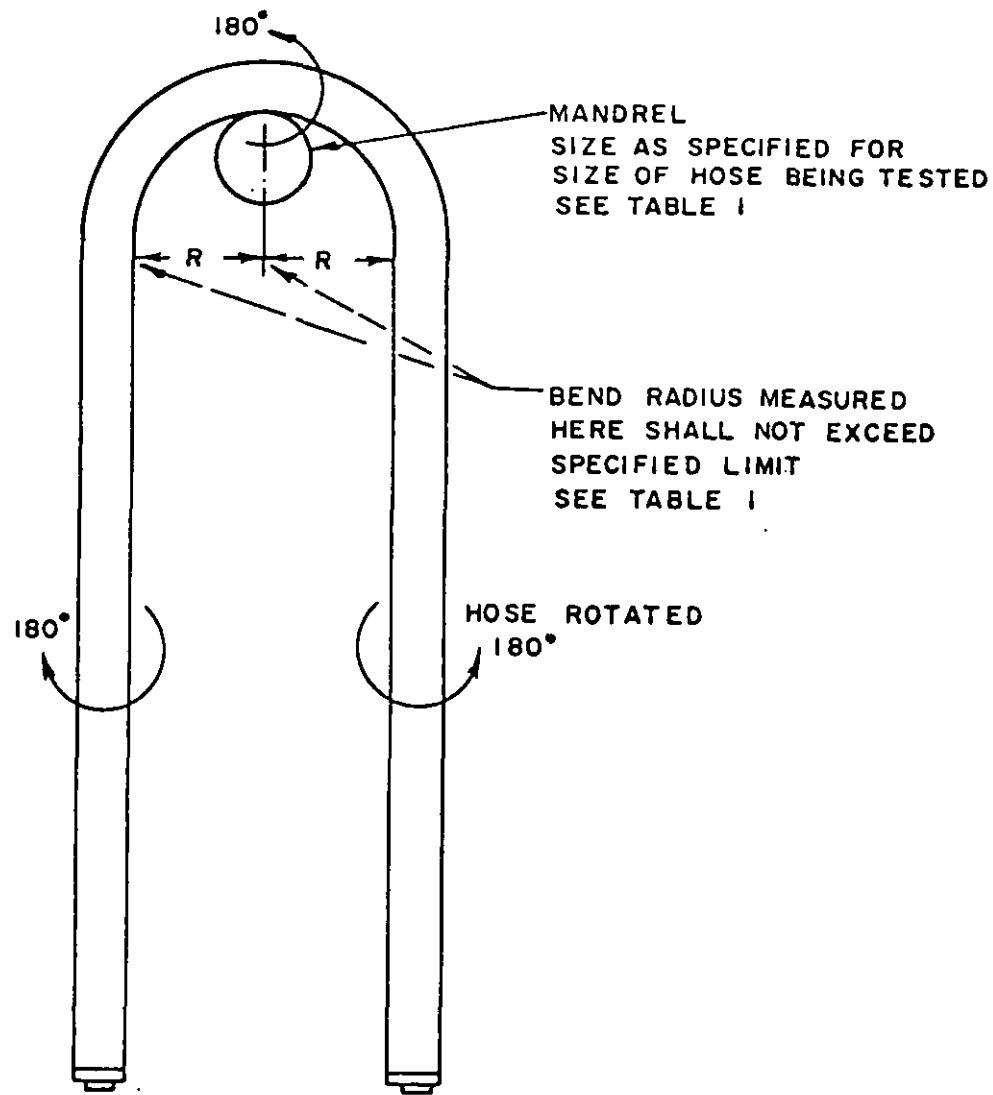


FIGURE 3 BEND RADIUS

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4.6.3.1 Outer corrugated hose. Before final assembly and after being permanently affixed to the sleeve, the outer corrugated hose shall be subjected to an internal air pressure of at least 75 psi. One end of the hose shall be provided with a leaktight stopper. The other end shall be attached, airtightly, to the pressurizing device. The hose shall be submerged in water during this test. Any leakage during this test shall be recorded in detail on the test data sheet and shall be cause for rejection.

4.6.3.2 Inner hose subassembly. The inner hose subassembly consisting of the inner corrugated hose (diamond or basket braid) and connector shall be subjected to an internal air pressure of at least 150 psig. One end of the hose shall be provided with a leaktight stopper. The other end shall be attached to the pressurizing device in an airtight manner. During this test, the hose shall be submerged in water. Any evidence of leakage during this test shall be cause for rejection.

4.6.4 Servicing test. The hose assembly shall be connected to a source of liquid oxygen or liquid nitrogen. The hose shall then be subjected to the following tests:

4.6.4.1 The hose assembly shall be subjected to a servicing cycle (see 6.3.2) and the following operations performed in the order listed:

- a. Connect the discharge end of the hose to a container suitable for use with liquid oxygen or nitrogen.
- b. Pressurize the liquid container to at least 50 psig.
- c. Rapidly open the discharge valve of the liquid vessel and transfer not less than the following quantity of the cryogenic liquid into the receiving container through the servicing hose:
 - (1) 1 Inch ID--2 liters
 - (2) 2 Inch ID--5 liters
- d. Close the discharge valve of the liquid vessel.
- e. Permit the tank to set with the vent valve fully open until all ice and frost are gone from the servicing hose assembly. The application of external heat to expedite warmup is permissible.

4.6.4.2 The servicing cycle specified in 4.6.4.1 shall be repeated until the hose has been subjected to not less than fifty such cycles. The liquid container shall be filled with additional liquid as necessary for completing the testing. The hose assembly shall complete the fifty servicing cycles without leakage or damage, or it shall be considered to have failed the test.

4.6.5 Burst pressure test. Following the servicing test specified in 4.6.4, the hose assembly shall be hydraulically or pneumatically pressurized from 0 to at least 500 psig in approximately 2 minutes. If any component of the hose assembly bursts or cracks at any junction at less than 500 psig, it shall be cause for rejection. After reaching 500 psig, the pressure shall be gradually increased until failure occurs, and the results shall be recorded.

4.6.6 Cleanliness tests. Prior to delivery, one hose out of each lot of ten or less, cleaned and ready for delivery, shall be tested as follows to verify compliance with the cleanliness requirements of 3.5.1.

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4.6.6.1 The hose shall be suspended vertically. The discharge from the bottom of the hose shall be through a multilayer, stainless-steel wire wound, or stainless-steel wire mesh, cloth-type filter in which the wires have been fused under controlled conditions and are capable of retaining all particles whose smallest dimension is 40 microns. The top of the hose shall be connected to a container of trichloroethylene or other oxygen-safe hydrocarbon solvent with a volume at least 10 times that of the interior of the hose. The liquid shall be pressurized to 50 psig and then flowed at the maximum flow rate through the hose and filter. The liquid shall then be transferred to the container at the top of the hose. This procedure shall be repeated 10 times. The filter shall be thoroughly cleaned and dried following the completion of the 10 cycles. The particulate matter remaining shall be inspected and shall not exceed the following:

- a. No particle with any dimension greater than 1,000 microns.
- b. No fibrous particle with a length greater than 6,000 microns.
- c. The total of solids collected, both fibrous and particulate, shall not exceed the weight listed in table II for the hose size tested.

4.6.6.1.1 Failure of the hose to meet the cleanliness test specified in 4.6.6.1 shall require recleaning of the lot until a random-selected hose fulfills the test.

4.7 Inspection of the preservation, packaging, packing, and marking for shipment and storage. The inspection of the preservation, packaging, packing, and marking for shipment and storage shall be in accordance with the requirements of section 5, or the documents specified therein.

5. PREPARATION FOR DELIVERY

5.1 Cleaning. Prior to packaging, hose assemblies shall complete the cleanliness tests specified in 4.6.6.

5.1.1 Preservation and packaging. Preservation and packaging shall be level A or C (see 6.2).

5.1.2 Levels A and C. Each hose assembly shall be encased in a sealed plastic bag fabricated from type II, grade C material conforming to L-P-378 having a minimum thickness of 6 mils (0.006 inch). Each bagged hose assembly shall be packaged one each in a type I, class 2 fiberboard unit container conforming to PPP-B-636. Closure and sealing of the container shall be in accordance with PPP-B-636. Hose assemblies under 10 feet in length shall be packaged straight (uncoiled). Hose assemblies exceeding 10 feet in length shall be packaged coiled. Radii of the coils shall be not less than as specified in table I.

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

5.2.1 Level A. Hose assemblies exceeding 10 feet in length, packaged as specified in 5.1.2 shall not be overboxed for shipment. Such hose assemblies shall be shipped in the unit container. Hose assemblies under 10 feet in length, packaged as specified in 5.1.2, shall be overboxed in a type I, class 2 container conforming to PPP-B-636. Closure and sealing shall meet PPP-B-636.

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5.2.2 Level B. Hose assemblies exceeding 10 feet in length, packaged as specified in 5.1.2, shall not be overboxed for shipment. Such hose assemblies shall be shipped in the unit container. Hose assemblies under 10 feet in length shall be overboxed in a type I, class 1 container conforming to PP-B-636. Closure and sealing shall conform to PPP-B-636.

5.2.3 Level C. Packages that require overpacking for acceptance by the carrier shall be packed in a manner that will insure safe transportation, at the lowest rate, to the point of delivery. Containers shall meet applicable carrier rules and regulations.

5.3 Physical protection. Blocking, bracing, and cushioning shall be as specified in MIL-STD-1186.

5.4 Marking. In addition to markings required by the contract or order (see 6.2), unit and shipping containers shall be marked in accordance with MIL-STD-129. The nomenclature shall be as follows:

HOSE ASSEMBLY, METAL, CRYOGENIC LIQUID, TRANSFER.

5.4.1 Precautionary markings. The following marking shall be included:

DO NOT ALLOW OIL OF ANY KIND TO BE USED ON OR ABOUT HOSE.

6. NOTES

6.1 Intended use. The hose assembly covered by this specification is intended for use as an insulated flexible transfer line on cryogenic fluid servicing equipment.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number, and date of this specification.
- b. In the event it becomes necessary to change the drawing(s) to achieve the performance requirements of the specification, the contractor shall immediately notify the contracting officer, with recommendations for drawing changes to obtain the required performance. To the extent approved, such changes shall be processed in accordance with the provisions of the changes clause of this contract (See 3.2).
- c. Nominal lengths and part number of hose assemblies required (See Drawing 59C6671).
- d. Location and conditions for preproduction testing (see 4.4).
- e. Required level of preservation and packaging, and packing (see section 5).
- f. Special shipment markings (see 5.4).

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

6.3.1 Fibrous particle. A fibrous particle is defined as a long, slender particle whose maximum cross-sectional dimension is 40 microns.

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6.3.2 Servicing Cycle. A servicing cycle shall be defined as transferring cryogenic liquid under pressure from one vessel to another.

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Project No. 3655-F053

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POSTAGE AND FEES PAID

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| SPECIFICATION ANALYSIS SHEET | | Form Approved Budget Bureau No. 119-R004 |
|--|----------------------------|---|
| INSTRUCTIONS | | |
| This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof). | | |
| SPECIFICATION | | |
| ORGANIZATION (of submitter) | | CITY AND STATE |
| CONTRACT NO. | QUANTITY OF ITEMS PROCURED | DOLLAR AMOUNT \$ |
| MATERIAL PROCURED UNDER A | | |
| <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT | | |
| 1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? | | |
| A. GIVE PARAGRAPH NUMBER AND WORDING. | | |
| B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES. | | |
| 2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID | | |
| 3. IS THE SPECIFICATION RESTRICTIVE? | | |
| <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY? | | |
| 4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity) | | |
| SUBMITTED BY (Printed or typed name and activity) | | DATE |