

INCH-POUND
MIL-DTL-27516E
1 June 1999
SUPERSEDING
MIL-H-27516D
3 August 1977

DETAIL SPECIFICATION

HOSE AND HOSE ASSEMBLY, NONMETALLIC, SUCTION AND DISCHARGE

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

1. SCOPE

1.1 Scope. This specification contains the requirements for a non-collapsible, wired reinforced, synthetic rubber hose and hose assembly used with gasoline and jet-fuel.

1.2 Classification. Hose and hose assembly are classified as specified in table I.

TABLE I. Classification of hose and hose assembly.

Inside Diameter (in) ± 0.031	Outside Diameter (in) + 0.125 - 0.062	Maximum Weight (lb/ft)
1.00	1.50	0.90
1.25	1.75	1.00
1.50	2.00	1.15
2.00	2.50	1.50
2.50	3.13	2.15
3.00	3.63	2.50
4.00	4.66	3.60
6.00	6.81	7.00

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center, Columbus, Code DSCC-VAI, 3990 East Broad Street, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A
DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

FSC 4720

MIL-DTL-27516E

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

DEPARTMENT OF DEFENSE

- | | | |
|---------------|---|---|
| MIL-PRF-16173 | - | Corrosion Preventive Compound, Solvent Cutback,
Cold-Application |
| MIL-C-38404 | - | Couplings, Hose, Reattachable Screw-On |

STANDARD

FEDERAL

- | | | |
|-------------|---|------------------------------|
| FED-STD-601 | - | Rubber: Sampling and Testing |
|-------------|---|------------------------------|

(Unless otherwise indicated, copies of the above specifications and standards are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are Department of Defense (DoD) adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | | |
|------------------|---|--|
| ANSI/ASQC Z1.4 | - | Sampling Procedures and Tables for Inspection by Attributes
(DoD adopted) |
| ANSI/NCSL Z540-1 | - | Calibration Laboratories and Measuring and Test Equipment,
General Requirements (DoD adopted) |

(Application for copies should be addressed to the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.)

MIL-DTL-27516E

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D 156 - Saybolt Color of Petroleum Products, Standard Test Method for (DoD adopted)
- ASTM D 380 - Rubber Hose, Standard Test Methods for (DoD adopted)
- ASTM D 412 - Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension, Standard Test Methods for (DoD adopted)
- ASTM D 413 - Rubber Property - Adhesion to Flexible Substrate, Standard Test Methods for (DoD adopted)
- ASTM D 471 - Rubber Property - Effect of Liquids (DoD adopted)
- ASTM D 518 - Rubber Deterioration - Surface Cracking, Standard Test Method for (DoD adopted)
- ASTM D 1149 - Rubber Deterioration - Surface Ozone Cracking in a Chamber, Standard Test Method for (DoD adopted)

(Application for copies should be addressed to American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

- AS1933 - Age Controls for Hose Containing Age-Sensitive Elastomeric Material (DoD adopted)

(Application for copies should be addressed to Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications, specification sheets, or MS standards), 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 First article. When specified (see 6.2), samples shall be submitted for first article inspection in accordance with 4.3 and 6.3.

3.2 Material. Materials shall be as required in this specification and shall conform to all applicable Government specifications and drawings, except as otherwise specified herein. Materials which are not covered by specifications, or which are not specifically described herein, shall be of the quality appropriate for the purpose intended (see 6.1).

3.2.1 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 operational and maintenance requirements, and promotes economically advantageous life cycle costs.

MIL-DTL-27516E

3.3 Components. The hose assembly shall consist of the following:

- a. the basic hose (see 3.3.1)
- b. two reattachable couplings, if required, one at each end of the hose (see 3.3.2)
- c. reusable protective caps or plugs for each coupling (see 3.3.3)

3.3.1 Hose. The construction of the hose shall consist of the following:

- a. a compounded inner tube (see 3.3.1.1)
- b. stiffened wire reinforcement (see 3.3.1.2)
- c. a compounded cover (see 3.3.1.3)

The hose shall be no more than eight quarters old from the cure date to the date of delivery to the procuring activity or to the manufacturers of hose couplers and other accessory equipment. The hose assembly installed in equipment shall be no more than sixteen quarters old upon the date of delivery of that equipment to the procuring activity. Definitions for "cure date" and "quarter" can be found in AS1933. When couplings are not required (see 3.3.2), the cut hose ends shall be sealed with a sealant or cement to prevent the entrance of foreign contaminants.

3.3.1.1 Tube. The inner tube shall be fabricated of synthetic rubber compounded with a copolymer of butadiene and acrylonitrile to provide resistance against aromatic gasoline and jet fuels. The bore of the tube shall be smooth, free from pitting, cuttings, borings, or cements. The tube shall have a uniform thickness of not less than 0.078 inch.

3.3.1.2 Reinforcement. A helix or helices of round steel wire shall be reinforced by being interwoven with yarns, cotton or synthetic, or by being sandwiched in between two layers of braided or woven yarns. The steel wire shall have physical and dimensional characteristics necessary to meet the requirement specified in 3.5.9.

3.3.1.3 Cover. The cover shall be constructed of compounded polymerized chloroprene and shall be smooth, free from pitting. It shall have a uniform thickness of not less than 0.047 inch.

3.3.2 Couplings. If required (see 6.2), couplings shall conform to class 1 of MIL-C-38404, type I or II.

3.3.3 Caps and plugs.

3.3.3.1 Caps. Male couplings conforming to MIL-C-38404 shall be provided with protective, closed end, reusable threaded metal or plastic caps. The cap shall have a thickness of 0.022 to 0.031 inch and shall not be chemically affected by corrosion-preventive compound conforming to class I of MIL-PRF-16173.

3.3.3.2 Plugs. Female couplings conforming in MIL-C-38404 shall be provided with protective, closed end, reusable threaded metal or plastic plugs. The metal plug shall not be chemically affected by corrosion-preventive compound conforming to class I of MIL-PRF-16173.

3.4 Physical characteristics.

3.4.1 Diameter. Hose and hose assemblies shall be furnished in the sizes specified in 1.2.

MIL-DTL-27516E

3.4.2 Length. Hose length shall be as specified by the procuring activity (see 6.2) with a tolerance of ± 2 percent. Length of the hose assembly shall be measured from the interface ends of the couplings while the hose assembly is subjected to 10 ± 1 psig.

3.4.3 Weight. Weight of the hose shall be not greater than the values listed in 1.2.

3.5 Performance.

3.5.1 Adhesion between component parts. When tested in accordance with 4.5.3, adhesion between component parts shall be not less than the values specified in table II.

TABLE II. Adhesion requirements.

Inside Diameter of Hose (in)	Unaged Adhesion (lb/in)	Aged Adhesion (lb/in)
up to and including 3	12	9
4 and 6	10	5

3.5.2 Volume increase. When tested in accordance with 4.5.4, the volume increase of the tube and cover shall be not greater than 50 and 100 percent, respectively.

3.5.3 Tensile strength. When tested in accordance with 4.5.5, the tensile strength of the tube and cover shall be not less than 600 and 400 psi, respectively.

3.5.4 Ultimate elongation. When tested in accordance with 4.5.5, the ultimate elongation of the tube and cover before immersion shall be not less than 200 percent. After immersion, the ultimate elongation of the tube and cover shall be not less than 100 percent.

3.5.5 Pull resistance. When tested in accordance 4.5.6, the hose assembly shall not break and the couplings shall not disconnect from the hose.

3.5.6 Proof pressure. When tested in accordance with 4.5.7 and subjected to the proof pressure specified in table III, leakage shall not occur in the hose or at the couplings.

3.5.7 Length change. The length of the hose shall not change more than 7 percent when tested in accordance with 4.5.8.

3.5.8 Burst resistance. When tested in accordance with 4.5.9 and subjected to the burst pressure specified in table III, the hose shall not leak, disconnect from the couplings, burst, or develop a permanent blister.

TABLE III. Proof pressure and burst resistance requirements.

Hose Inside Diameter (in)	1.00	1.25	1.50	2.00	2.50	3.00	4.00	6.00
Proof Pressure (psi)	175	175	175	175	175	175	100	100
Burst Pressure (psi)	500	500	500	400	400	400	300	300

MIL-DTL-27516E

3.5.9 Crush resistance. Testing shall be performed in accordance with 4.5.10. During the test, the outside diameter shall be not less than 85 percent of the original outside diameter of the hose. After the load has been released, the outside diameter shall be not less than 95 percent of the original outside diameter of the hose.

3.5.10 Low temperature bend. Specimens of the tube and cover shall not crack when tested in accordance with 4.5.11.

3.5.11 Environmental vacuum. The hose assembly shall maintain a vacuum after being tested in accordance with 4.5.12.

3.5.12 Ozone resistance. When tested in accordance with 4.5.13 and then examined with 2X magnification, the cover shall not show any evidence of cracking.

3.5.13 Fuel color change. When tested in accordance with 4.5.14, change in the fuel color shall be not greater than 40.

3.6 Product identification. The hose shall be legibly marked along its longitudinal axis with a fuel-resistant yellow stripe. The stripe shall be broken at intervals of approximately 2 inches.

3.6.1 Labeling. A label, vulcanized and inlaid approximately in the center on each length of hose, shall contain the following information:

- a. Part or identifying number (PIN) as described in 6.4
- b. Date of manufacture (quarter and year)
- c. Contract or order no.
- d. Manufacturer's name or trademark

3.7 Workmanship. The hose shall be uniform in quality and shall be free from defects, irregularities, or foreign matter that may adversely affect its service performance.

4. VERIFICATION

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

- a. First article inspection (see 4.3)
- b. Conformance inspection (see 4.4).

4.2 Inspection facilities. The contractor shall establish and maintain or identify quality facilities that have sufficient quantity of test and measuring equipment necessary to accurately perform all the required inspection specified herein. ANSI/NCSL Z540-1 or equivalent shall be used to establish and maintain a calibration system that controls the accuracy of test and measuring equipment.

4.3 First article inspection. When specified in the contract or purchase order (see 6.2), samples that are representative of the production item shall be subjected to first article inspection after the Government has awarded the contract. First article inspection shall be performed to determine whether the production items meet the requirements of this specification.

MIL-DTL-27516E

4.3.1 Samples. Unless otherwise specified (see 6.2), samples shall be subjected for first article inspection as specified in 4.3.2. The samples shall be representative of the construction, workmanship, components and materials to be used during production. Each sample shall be a section of hose of the specified diameter with sufficient length for all inspections and tests specified in 4.3.2. Couplings conforming to MIL-C-38404 shall be provided as part of the sample.

4.3.2 Testing of first article samples. First article inspection shall consist of all tests and examination specified in 4.5.

4.4 Conformance inspection. Conformance inspection shall be performed to determine whether the products conform to the requirements set forth in this specification.

4.4.1 Inspection lot. All hoses or hose assemblies of the same type and size offered to the Government at one time shall be considered as a lot for the purpose of inspection.

4.4.2 Sampling.

4.4.2.1 Sampling for nondestructive examination. Samples shall be selected in accordance with ANSI/ASQC-Z1.4, inspection level S-2, and subjected to examination in accordance with 4.5.1.

4.4.2.2 Sampling for destructive testing. One hose length shall be randomly selected from each lot and submitted for inspection. After examining the length of hose in accordance with 4.5.1, the hose shall be cut approximately 3 feet from one end and 15 inches from the other end. These will provide lengths for the pull test (see 4.5.6) and the burst test (see 4.5.7). Additional lengths of hose shall be cut from the original length for the remaining tests required. When hose is ordered in short lengths and is insufficient for tests, the manufacturer shall furnish extra lengths for test purposes. Samples subjected to destructive testing shall not be part of the contract or order.

4.4.3 Conformance inspection tests. Testing shall include all the tests specified in 4.5, except for the environmental vacuum test (see 4.5.12) which may be waived if performed every 36 months.

4.4.4 Rejection and retest. If one or more items fail to meet the requirements specified herein, the entire lot shall be rejected. Samples may be submitted for retesting only after the manufacturer has furnished details concerning the previous rejection and the action taken to correct the defects in the lot.

4.5 Tests.

4.5.1 Examination of products. The hose or hose assembly shall be examined for the following:

- a. Dimensions, length and weight not as specified (see 3.4)
- b. Materials not as specified (see 3.2)
- c. Hose construction not as specified (see 3.3.1)
- d. Couplings not as specified (see 3.3.2)
- e. Identification marking missing, illegible, or not as specified (see 3.6)
- f. Workmanship not as specified (see 3.7)

4.5.2 Test methods and conditions. Testing shall be performed in accordance with Table IV under the conditions specified for each particular test.

MIL-DTL-27516E

TABLE IV. Test methods.

Requirement	Requirement Paragraph	Test Method Paragraph
Adhesion between component parts	3.5.1	4.5.3
Volume increase	3.5.2	4.5.4
Tensile strength	3.5.3	4.5.5
Ultimate elongation	3.5.4	4.5.5
Pull resistance	3.5.5	4.5.6
Burst resistance	3.5.6	4.5.7
Proof pressure	3.5.7	4.5.8
Length change	3.5.8	4.5.9
Crush resistance	3.5.9	4.5.10
Low temperature bend	3.5.10	4.5.11
Environmental vacuum	3.5.11	4.5.12
Ozone resistance	3.5.12	4.5.13
Fuel color change	3.5.13	4.5.14

4.5.3 Adhesion between component parts. A 12-inch length of hose shall be stoppered with leakproof plugs and filled with fluid conforming to ASTM D 471, reference fuel B. The filled specimen shall be held at $75 \pm 5^\circ\text{F}$ for 48 hrs. Within 15 minutes after removal of the fluid, ring specimens shall be obtained from the center of the hose length and tested in accordance with ASTM D 413. Conformance shall be as specified in 3.5.1.

4.5.4 Volume increase. Specimens of the tube and cover shall be tested in accordance with method 6211 of FED-STD-601, except that the immersion fluid used shall conform to ASTM D 471, reference fuel B. Conformance shall be as specified in 3.5.2.

4.5.5 Tensile strength and ultimate elongation. Testing shall be conducted in accordance with ASTM D 412. The tube and cover test specimens shall be obtained using die C. Immersion shall be for 48 hours at $75 \pm 5^\circ\text{F}$ in fluid conforming to ASTM D 471, reference fuel B. Testing shall be conducted within 5 minutes after removal from the fluid. Conformance shall be as specified in 3.5.3 and 3.5.4.

4.5.6 Pull resistance. One coupling of a 15-inch hose assembly shall be held securely while a pull is applied to the other coupling by any convenient means. The separation rate between the couplings shall not be less than 1 in/min until a load of 1000 lb has been reached. Couplings used for testing shall conform to MIL-C-38404. Conformance shall be as specified in 3.5.5.

4.5.7 Proof pressure. The hose assembly, with attached couplings conforming to MIL-C-38404, shall be subjected to the proof pressure specified in table III and then tested in accordance ASTM D 380. Conformance shall be as specified in 3.5.6.

MIL-DTL-27516E

4.5.8 Length change. Length change shall be determined while the hose is subjected to the proof pressure test (see 4.5.7). Conformance shall be as specified 3.5.7.

4.5.9 Burst resistance. A hose assembly, approximately 3 ft in length, shall be tested in accordance with ASTM D 380. Couplings conforming to MIL-C-38404 shall be used for testing all hose sizes except the 6-inch ID hose. When testing the 6-inch ID hose, any coupling that will remain on the hose at the pressure tested may be used. Conformance shall be as specified in 3.5.8.

4.5.10 Crush resistance. A 12-inch length of hose shall be centered between 3-inch wide parallel metal plates so that only a 3-inch length of the hose shall be crushed. The plates shall be brought together at a rate no greater than 2 in/min until a load of 250 pounds has been applied. The distance between the plates shall be measured and expressed as a percentage of the original outside diameter of the hose. When the load is released, the smallest outside diameter of the hose at the center of the compressed area shall be measured. The results shall be recorded as a percentage of the original outside diameter of the hose. Conformance shall be as specified 3.5.9.

4.5.11 Low temperature bend. Buffed specimens of the tube and cover, 4.500 inches long, shall be clamped in a concave shape between 2-inch wide plates held at 2.500 inches apart. No more than 0.250 inch of each end shall be used for clamping. The specimen shall be held in this position and exposed to $-42 \pm 2^\circ\text{F}$ for 72 hours. After 72 hours and while maintaining the same temperature, the plates shall be moved together in 5 ± 2 seconds until the ends of the specimens are not more than 1 inch apart. Conformance shall be as specified in 3.5.10.

4.5.12 Environmental vacuum. One hose assembly of each size being procured shall be completely filled with fluid conforming to ASTM D 471, reference fuel B, and then held at atmospheric pressure and temperature for 7 days. At the end of this period, the hose assembly shall then be subjected to the following vacuum cycling. Conformance shall be as specified in 3.5.11.

- a. Apply 15 inches mercury (Hg) vacuum to the hose assembly and hold for not less than 5 minutes.
- b. Release the vacuum to approximately zero gage.
- c. Repeat "a" and "b" every 7 minutes until 500 cycles have been completed. The number of cycles recorded shall be cumulative. The test may be run continuously or intermittently.

4.5.13 Ozone resistance. Specimens from the cover shall be prepared as described in procedure B of ASTM D 518 and then subjected to testing in accordance with ASTM D 1149. After conditioning for 24 hours in an ozone free atmosphere, the specimens shall then be exposed for 72 hours at $104 \pm 2^\circ\text{F}$ in an atmosphere containing 50 parts per hundred million of ozone. Conformance shall be as specified in 3.5.12.

4.5.14 Fuel color change. A hose, of sufficient length to contain at least one gallon of fluid, shall be filled with fuel conforming to ASTM D 471, reference fuel B, capped or plugged and then permitted to stand for 72 hours with agitation at 24 and 48 hours. After the 72-hour period, fuel drawn from the center section of the hose length shall be tested in accordance with ASTM D 156. A sample of the original fuel shall also be tested for comparison. Conformance shall be as specified in 3.5.13.

MIL-DTL-27516E

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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 and hose assembly required by this specification are used in dispensing hydrocarbon fuels. It is military unique due to its usage on both fuel servicing trucks and air transportable hydrant refueling systems.

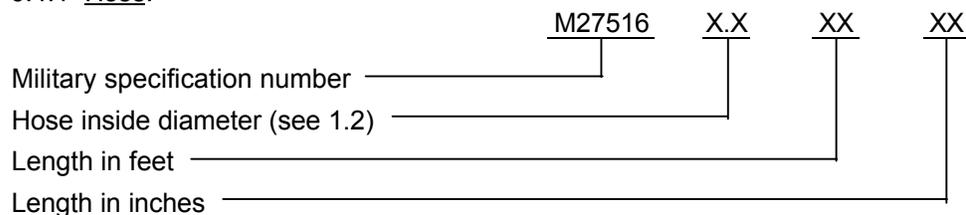
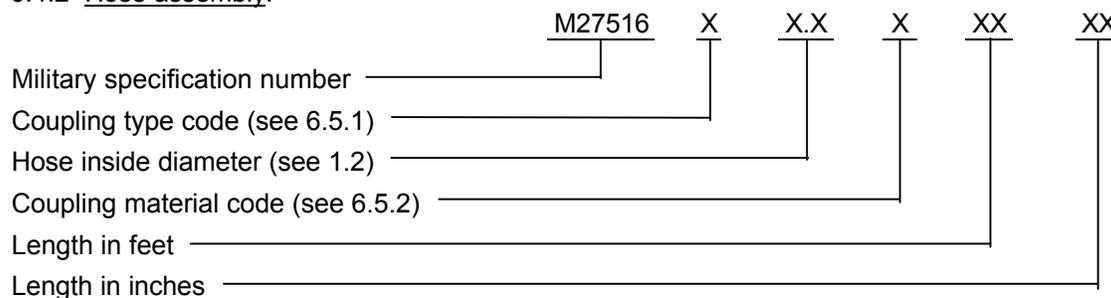
6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification, including any amendments.
- b. Issue of DoDISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.2 and 2.3).
- c. Required hose inside diameter (see 1.2).
- d. Male or female couplings, if required (see 3.3.2).
- e. Required length of hose or hose assembly (see 3.4.2).
- f. Name and address of Government facility where the first article inspection samples are to be submitted, if required (see 3.1, 4.3 and 6.3).
- g. Packaging requirements (see 5.1).
- h. Required PIN (see 3.6.1 and 6.4).

6.3 First article inspection requirements. When first article inspection is required, testing should be performed under the appropriate provisions of 7-104.55 of the Armed Services Procurement Regulation. First article samples should be selected from the initial procurement items. The contracting officer should provide specific instructions, in all procurement instruments, regarding the arrangements for examinations, test and approval of the first article samples. First article inspection may be waived if the contractor has previously passed first article inspection for the same size (inside diameter) under previous contracts with the government.

6.4 Part or identifying number (PIN). The following examples should be used for guidance in designating part number for hose or hose assembly covered by this specification:

MIL-DTL-27516E

6.4.1 Hose.6.4.2 Hose assembly.6.5 Coupling codes.

6.5.1 Type code. The coupling type code used in part number designation should be as specified in table V.

TABLE V. Coupling type code.

Coupling Type Code	MIL-C-38404 Coupling Type For Hose End			
	1st End		2nd End	
	Type I (male)	Type II (female)	Type I (male)	Type II (female)
A	X		X	
B		X		X
C	X			X

6.5.2 Material code. The following letters should be used as the coupling material code in the part number designation:

- "R" for MIL-C-38404, class 1 (brass)
- "S" for MIL-C-38404, class 2 (stainless steel or aluminum)

6.6 Subject term (key word) listing.

Hydrocarbon fuels, dispensing
 Refueling systems
 Trucks, fuel servicing

MIL-DTL-27516E

6.7 Changes from previous issue. Marginal notations are not used to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:

Army – CR4
Air Force - 99
DLA - CC

Preparing activity:
DLA - CC

(Project 4720-0184)

Review activities:

Army - AV
Air Force - 82
DLA - GS

