

INCH-POUND

MIL-I-22344D
15 August 1991
SUPERSEDING
MIL-I-22344C
26 May 1981
(See 6.9)

MILITARY SPECIFICATION
INSULATION, PIPE, THERMAL, FIBROUS GLASS

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

1. SCOPE

1.1 Scope. This specification establishes the requirements for fibrous glass pipe insulation for use as thermal control on pipes, valves, and fittings for temperatures up to and including 370 degrees Fahrenheit (^oF) (see 3.2 and 3.5).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifications, standards, and handbooks 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).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 5640

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

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SPECIFICATIONS

FEDERAL

PPP-F-320 - Fiberboard; Corrugated and Solid, Sheet Stock (Container grade), and Cut Shapes.

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MIL-L-19140 - Lumber and Plywood, Fire-Retardant Treated

STANDARDS

FEDERAL

FED-STD-313 - Material Safety Data, Transportation Data for Hazardous Materials Furnished to Government Activities.

MILITARY

MIL-STD-1623 - Fire Performance requirements and Approved Specification for Interior Finish Materials and Furnishings (Naval Shipboard Use)

MIL-STD-2073-1 - DOD Materiel Procedures for Development and Application of Packaging Requirements.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, BLDG. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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 the documents which are 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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

C 302 - Standard Test Method for Density of Preformed Pipe-Covering-Type Thermal Insulation.

C 335 - Standard Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

C 411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

D 578 - Standard Specification for Glass Fiber Yarns.

D 3951 - Standard Practice for Commercial Packaging. (DOD adopted)

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

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

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2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, 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.), a sample shall be subjected to first article inspection (see 6.4) in accordance with 4.3.

3.2 Material. The basic material shall be glass, processed from a molten state into fibrous form, shot-free, impregnated with a binder, and compressed or otherwise formed into pipe insulation (see 6.5). The insulation may be split or slit lengthwise.

3.2.1 Fiber diameter. The average fiber diameter shall be no greater than 0.0004 inch (see 4.6.2).

3.2.2 Prohibited fibers. Neither asbestos nor ceramic (refractory) fibers nor materials containing any of these fibers shall be used in the insulation.

3.2.3 Material safety data sheet (MSDS). The contracting activity shall be provided a material safety data sheet at the time of contract award. The MSDS shall be provided in accordance with the requirements of FED-STD-313. The MSDS shall be included with each shipment of the material covered by this document (see 6.6).

3.3 Dimensions. Pipe insulation shall be furnished in the dimensions specified in 3.3.1 through 3.3.4.

3.3.1 Length. Pipe insulation shall be furnished in lengths of 3 to 6 feet with tolerance of plus or minus 3/16 inch (see 6.2).

3.3.2 Size. Insulation shall be furnished to fit standard pipe and tube sizes (see 6.2), from 1/4 to 36 inches. The longitudinal seam shall close to within 1/8 inch along the entire length of the section. The inside diameter of the insulation shall not exceed the outside diameter of the pipe by 1/4 inch for nominal pipe sizes (nps) up to 4-1/2 inch or by 5 percent on sizes over 4-1/2 inches nps.

3.3.3 Thickness. Insulation shall be furnished either single or double layer in nominal thicknesses of 1/2 to 4 inches in increments of 1/2 inch, according to simplified standard sizes (see 6.2) with tolerance of plus or minus 3/32 inch in thickness.

3.3.4 Density. Insulation shall have a nominal density of 5.0 pounds per cubic foot (lb/ft³) with a tolerance of plus or minus 2.0 lb/ft³.

3.4 Alkalinity and pH. Alkalinity of the pipe insulation expressed as equivalent sodium oxide (Na₂O) shall be not greater than 0.60 percent and the pH shall be not less than 7.5 nor more than 12.0 (see 4.6.3 and 4.6.4).

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3.5 Hot surface performance. Pipe insulation shall be suitable for use at temperatures up to and including 370°F, and thicknesses less than 4 inches. Pipe insulation shall show neither evidence of flaming, glowing, smoldering, nor smoking. There shall be no degradation which will seriously affect performance. Minor loss of binder or slight discoloration of the binder shall be acceptable. There shall be neither cracking nor delamination of the insulation. The insulation thickness along the top of the pipe shall decrease by not more than 10 percent (see 4.6.5).

3.6 Fire performance. Insulation shall conform to the requirements of MIL-STD-1623 (see 4.6.6).

3.7 Thermal conductivity. Thermal conductivity shall be not greater than the following values (see 4.6.7):

<u>Mean temperature, °F</u>	<u>Thermal Conductivity, (Btu-in/hr-ft²-°F)(1 inch thickness)</u>
25	0.23
50	0.24
75	0.25
100	0.26
200	0.31

3.8 Recovered materials. Unless otherwise specified herein, all material incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used products is allowed under this specification unless otherwise specifically specified.

3.9 Toxicity. The material shall have no adverse effect on the health of personnel when used for its intended purpose (see 6.1 and 6.6). Questions pertinent to this effect shall be referred by the contracting activity to the Navy Medical Command (NAVMEDCOM) who will act as an advisor to the contracting activity.

3.10 Workmanship. Insulation shall be free of defects in appearance and dimensions (see 4.5.1).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract, or purchase order, the contractor may use his own or any other facilities suitable for the performance of the

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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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

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

4.3 First article inspection. First article inspection shall consist of the examination of 4.5.1 and tests specified in 4.6.

4.3.1 First article unit. The first article unit shall consist of one segment of each thickness acquired at any one time.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the examination of 4.5.1, and the tests of 4.6.1 and 4.6.2 (see 6.3).

4.4.1 Lot. A lot shall consist of units representative in material and manufacturing process of all items offered under this document, except that samples for testing for conformance to 3.3 and 3.8 shall be taken from the actual lots to be shipped. Units of different size and thickness may be considered in one lot, provided there is no variation in material or process across the range. Where material and process varies across the range of size and thickness offered, additional samples shall be tested to characterize these variations. A unit is defined as a single length of pipe insulation of either the split or slit form.

4.4.2 Samples. Samples shall be selected randomly from the lot. The number of samples subjected to the examination of 4.5.1 and tests of 4.6.1 and 4.6.2 shall be in accordance with table I.

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TABLE I. Sampling for quality conformance inspection.

Lot Size	Sample Size	Accept	Reject <u>1/2/3/</u>
2 - 15	2	0	1
16 - 25	3	0	1
26 - 90	5	0	1
91 - 150	6	0	1
151 - 280	7	0	1
281 - 500	9	0	1
501 - 1200	11	0	1
1201 - 3200	13	0	1
3201 - over	15	0	1

- 1/ All defective items shall be replaced with acceptable items prior to lot acceptance.
- 2/ Inspect sample size until reject criteria is reached.
- 3/ Rejected lots may be screened and resubmitted for inspection and retest.

4.5 Inspection.4.5.1 Examination of the end item for defects in appearance and dimensions.

Each of the samples selected shall be examined, weighed, and measured, as applicable, to determine conformance to the requirements of 3.3 and 3.8. These tests shall be conducted on the actual lots to be shipped. Any unit containing one or more visual or dimensional defects as shown in table II shall be cause for rejection of the unit.

TABLE II. Visual and dimensional defects.

Appearance:	Binder spots or foreign inclusions larger than 1 inch in any two perpendicular dimensions. Delamination larger than 4 square inches. Sections not slit or split as ordered. Dents, depressions, or voids affecting more than 10 percent of the surface face and 20 percent of the thickness.
Dimensions:	Not within limits or tolerances specified in 3.3.

4.6 Tests.

4.6.1 Density. Density of the pipe insulation shall be determined in accordance with the method specified in ASTM C 302. On the jacketed product (see 6.5), density shall be determined by individual piece weight, using nominal facing and adhesive weight.

4.6.2 Fiber diameter. Diameter of the fiber shall be determined by either of the following methods:

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(a) Microscopic: Diameter of fibers shall be determined microscopically on the basis of measuring 50 fibers from samples selected in accordance with 4.4.2. The average diameter for determining conformance shall be the arithmetic means of all measurements.

(b) The method specified in ASTM D 578.

In case of dispute, the microscopic test method shall be the referee test method.

4.6.3 Alkalinity. The alkalinity test shall be performed as follows: Weigh a 5 +/- 0.01 gram representative sample (a representative sample may be conveniently prepared by taking borings with a large cork borer through the cross-section of the pipe insulation) of pipe insulation and introduce into a 500-milliliter (mL) Pyrex Erlenmeyer flask or equal. Wet with 5 mL of 96 percent ethyl alcohol, and add 400 mL of distilled water. Reflux for 4 hours +/- 5 minutes. At the end of this period, disconnect the condenser and filter immediately through a number 42 Whatman paper, or its equivalent, supported in a Buechner funnel or equal, and connected to a suction source. Wash the flask and residual material three times with 25 mL portions of hot distilled water. Titrate the combined filtrate and wash solution immediately with 0.02N H₂SO₄, using six to eight drops of a 1-percent solution of phenol-red indicators, to the disappearance of the pink color. Run a blank determination of the total amount of distilled water and alcohol, and substitute the titrate value in the formula below:

$$\text{Percent alkalinity as Na}_2\text{O} = \frac{(A-B)N \times 0.031 \times 100}{W}$$

Where:

- A = mL H₂SO₄ required to titrate sample
- B = mL H₂SO₄ required to titrate the blank
- N = Normality of the H₂SO₄
- W = Weight of sample in grams

4.6.4. Hydrogen-ion concentration (pH). The pH test shall be performed as follows: A 25-gram sample shall be taken (a representative sample may be conveniently prepared by taking borings with a large cork borer through the cross-section of the pipe insulation). A representative 1 gram specimen weighed to the nearest 0.001 gram shall be placed in a 500 mL Pyrex Erlenmeyer flask or equal, and 100 mL of distilled water added. The distilled water shall be made by the Rohm and Haas Amberlite Ion Exchange Resin HB-1 method. Macerate the glass insulation with the flattened end of a polyethylene stirring rod until the specimen is thoroughly wetted. Afflix a 9 millimeter (mm) by 200-centimeter (cm) Pyrex glass air condenser or equal, and set the flask on a hot plate. The hot plate shall be adjusted so that it will maintain the contents of the flask at 194°F to 212°F, without boiling the water. The flask and contents shall be heated for 1 hour after which time the flask shall be cooled to 68°F to 86°F. Transfer 50 mL of the extract to a 100 mL Pyrex glass beaker or equal, and measure the pH with a glass electrode and a saturated KCl-calomel electrode half-cell with precision to within 0.1 pH.

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4.6.5 Hot surface performance. Hot surface performance of one sample of pipe insulation shall be determined in accordance with ASTM C 411. Insulation for 1-inch pipe shall be tested at a temperature of 370°F, and a thickness of 1 inch.

4.6.6 Fire performance. Three flat samples of pipe insulation shall be tested in accordance with MIL-STD-1623.

4.6.7 Thermal conductivity. One sample of pipe insulation shall be tested in accordance with ASTM C 335. Determinations shall be made at three mean temperatures, 100°F, 150°F, and 200°F. Results of these tests shall be extended, through reasonable curve fit or numerical techniques, to establish the thermal conductivity at the levels specified in 3.7.

4.7 Toxicological product formulations. The contractor shall have the toxicological product formulations and associated information available for review by the contracting activity to evaluate the safety of the material for the proposed use.

4.8 Inspection of packaging. Sample packs and the inspection of packing and marking for shipment, stowage and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition.)

5.1 Packing. Packing shall be level A, B, C, or commercial as specified (see 6.2).

5.1.1 General.

5.1.1.1 Navy fire-retardant requirements.

- (a) Treated lumber and plywood. Unless otherwise specified (see 6.2), all lumber and plywood including laminated veneer materials used in shipping container and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Levels A and B - Type II - weather resistant.
Category 1 - general use.

Level C - Type I - non-weather resistant.
Category 1 - general use.

- (b) Fiberboard. Unless otherwise specified (see 6.2), fiberboard used in the construction of class-domestic, non-weather resistant fiberboard and cleated fiberboard boxes including interior packing forms shall meet the flamespread index and the specific optic density requirements of PPP-F-320.

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5.1.2 General requirements for levels A, B, and C. Containers selected (see 5.1.2.1) shall be of minimum weight and cube consistent with the protection required, and of uniform size.

5.1.2.1 Levels A, B, and C containers. Insulation shall be packed in exterior shipping containers for the level of packing specified (see 5.1), in accordance with exterior shipping container requirements of MIL-STD-2073-1, and herein. Unless otherwise specified (see 6.2), container selection and options shall be at the contractor's option.

5.1.2.1.1 Container closure and gross weight.

5.1.2.1.1.1 Closure. Container closure, reinforcing, and banding shall be in accordance with the applicable container specification or appendix thereto except that weather-resistant fiberboard boxes shall be closed in accordance with method V and reinforced with nonmetallic or tape banding and domestic or fire-retardant fiberboard boxes shall be closed in accordance with method I using pressure sensitive tape.

5.1.2.1.1.2 Weight. Wood, plywood, and cleated type containers exceeding 200 pounds gross weight shall be modified by the addition of skids in accordance with MIL-STD-2073-1 and the applicable container specification or appendix thereto.

5.1.2.2 Commercial. Insulation shall be packed for shipment in accordance with ASTM D 3951 and herein.

5.1.2.2.1 Container modification. Shipping containers exceeding 200 pounds gross weight shall be provided with a minimum of two, 3- by 4-inch nominal wood skids laid flat, or a skid or sill type base which will support the material and facilitate handling by mechanical handling equipment during shipment, stowage and storage.

5.1.3 Marking, levels A, B, C, and commercial. In addition to any special marking required (see 6.2 and herein), shipping containers shall be marked including bar coding for shipment, stowage and storage in accordance with MIL-STD-2073-1, appendix F.

5.2 Material safety data sheet. A copy of the material safety data sheet shall be attached to the shipping document for each destination (see 3.2.3).

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This specification covers material intended for use on pipes as an antisweat insulation for temperatures of 32°F to 100°F, and as a heat insulation for surface temperatures of 100°F to 370°F (see 3.2 and 3.5).

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6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of this specification.
- (b) ~~Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2)~~
- (c) When a first article inspection is required (see 3.1).
- (d) Length of insulation required (see 3.3.1).
- (e) Nominal pipe and tube sizes required (see 3.3.2).
- (f) Thickness of insulation required (see 3.3.3).
- (g) Levels of packing required (see 5.1).
- (h) When fire-retardant material is not required (see 5.1.1.1 (a) and (b)).
- (i) Container selection, if other than contractor's option (see 5.1.2.1).
- (j) Special marking, if required (see 5.1.3).

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Reference paragraph</u>	<u>DID number</u>	<u>DID title</u>	<u>Suggested tailoring</u>
4.4	DI-T-2072	Reports, Test	----

The above DID's were those cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.3. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government

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approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.5 Jackets and layers. Pipe insulation is also furnished with factory-applied jackets. The jacketed insulation must meet all of the requirements of this specification. Preformed fibrous glass fittings are also available. If multi-layer combinations of single standard layers are required, the layers should be specified as "factory-tested".

6.6 Material safety data sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6.7 Toxicity. To determine conformance to requirements of 3.10, the manufacturer of the material should disclose the formulation of his product to the Bureau of Medicine and Surgery (BUMED), MED-242, Washington, DC 20372. The disclosure of proprietary information, which will be held in confidence by BUMED, should include: the name, formula, and approximate percentage by weight and volume of each ingredient in the product; the results of any toxicological testing of the product; identification of its pyrolysis products; and any such other information as may be needed to permit an accurate appraisal of any toxicity problem associated with the handling, storage, application, use, disposal, or combustion of the material. Information submitted should be clearly marked or identified as to its being provided in connection with qualification under MIL-I-2781.

6.8 Subject term (key word) listing.

Antisweat
Conductivity
Control

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

Custodians:
Navy - SH
Air Force - 99

Preparing activity:
Navy - SH
(Project 5640-0483)

Review activity:
Navy - MS

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:		1. DOCUMENT NUMBER MIL-I-22344D	2. DOCUMENT DATE (YYMMDD) 15 AUGUST 1991
3. DOCUMENT TITLE INSULATION, PIPE, THERMAL, FIBROUS GLASS			
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)			
5. REASON FOR RECOMMENDATION			
6. SUBMITTER			
a. NAME (Last, First, Middle Initial)		b. ORGANIZATION	
c. ADDRESS (Include Zip Code)		d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY			
a. NAME Technical Point of Contact (TPOC): . Linda Lovell (SEA 5143) PLEASE ADDRESS ALL CORRESPONDENCE AS FOLLOWS:		b. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON	
c. ADDRESS (Include Zip Code) COMMANDER, NAVAL SEA SYSTEMS COMMAND SEA 5523, DEPARTMENT OF THE NAVY WASHINGTON, DC 20362-5101		TPOC: 703-602-0146 8-332-0146	
		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	