

**INCH-POUND**

**O-N-350C**

November 13, 1991

**SUPERSEDING**

**O-N-350B**

September 25, 1985

**FEDERAL SPECIFICATION**

**NITRIC ACID, TECHNICAL**

*This specification is approved by the Commissioner of Federal Supply Service, General Services Administration, for use by all Federal agencies.*

**1. SCOPE**

**1.1 Scope.** This specification covers technical grade nitric acid.

**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:

**Federal Specifications:**

- L-P-390 - Plastic Molding and Extrusion Material Polyethylene and Copolymers (Low, Medium, and High Density)
- PPP-C-96 - Cans, Metal, 28 Gauge and Lighter
- PPP-C-186 - Containers, Packaging and Packing for Drugs, Chemicals, and Pharmaceuticals
- PPP-T-66 - Tape, Packaging, Vinyl Plastic Film

Comments or suggestions pertaining to this specification should be addressed to: Commander, U.S. Army Chemical Research, Development and Engineering Center, ATTN: SMCCR-PET-S, Aberdeen Proving Ground, MD 21010-5423.

AMSC N/A

FSC 6810

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

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**Federal Standards:**

- Fed. Std. No. 123 - Marking for Shipment (Civil Agencies)
- FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions as outlined under General Information in the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification, other Federal specifications, and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration Business Service Centers in Boston, MA; New York, NY; Washington, DC; Philadelphia, PA, Atlanta, GA; Chicago, IL; Kansas City, MO; Fort Worth, TX; Denver, CO; San Francisco, CA; Los Angeles, CA; and Auburn, WA.

(Federal Government activities may obtain copies of Federal standardization documents and the Index of Federal Specifications, Standards and Commercial Item Descriptions from established distribution points in their agencies.)

**Military Specifications:**

- MIL-P-15011 - Pallets, Material Handling, Wood Post Construction, 4-Way Entry

**Military Standards:**

- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-147 - Palletized Unit Loads

(Copies of military specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

**Code of Federal Regulations (CFR):**

- 29 CFR 1900.1200 - Hazard Communication
- 49 CFR 171 to 199 - Hazardous Materials Regulations

(The Code of Federal Regulations and Federal Register (FR) are for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office,

Washington, DC 20402. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for issuance thereof.)

**2.2 Other publications.** The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

**ASTM Standards:**

- |        |  |
|--------|--|
| C 516  | - Vermiculite Loose Fill Thermal Insulation  |
| D 1193 | - Reagent Water  |
| E 29   | - Using Significant Digits in Test Data to Determine Conformance with Specifications |

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

**International Civil Aviation Organization**

“Technical Instructions for the Safe Transport of Dangerous Goods by Air”

(Application for copies should be addressed to the International Civil Aviation Organization, 1000 Sherbrooke Street West, Suite 400, Montreal, Quebec, Canada H3A 2R2.)

**International Maritime Organization**

“International Maritime Dangerous Goods Code”

(Application for copies should be addressed to the International Maritime Organization, 101-104 Piccadilly, London, W1V 0AE, England.)

(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.)

**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 Appearance.** Nitric acid shall be free from sediment, suspended matter, and separated material when tested as specified in 4.2.4.1.

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**3.2 Chemical characteristics.** Nitric acid shall conform to the chemical characteristics of table I when tested as specified therein.

TABLE I. Chemical characteristics

Characteristic	Percent by weight		Test paragraph
	Minimum	Maximum	
Total acid content (as HNO <sub>3</sub> )	61.0	68.2	4.2.4.2
Residual acid (as H <sub>2</sub> SO <sub>4</sub> )	—	0.5	4.2.4.3
Chloride (Cl)	—	0.5	4.2.4.4

**3.3 Material Safety Data Sheets.** Material Safety Data Sheets for nitric acid shall be prepared and submitted by the contractor in accordance with FED-STD-313 (see 6.3).

#### 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 inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this 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 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.

**4.1.2 Contractor assurance of compliance.** The contractor's quality program or detailed inspection system shall provide assurance of compliance of all characteristics with the applicable specification requirements using, as a minimum, the conformance criteria specified herein.

**4.1.3 Alternative inspection provisions.** Alternative inspection procedures, methods, or equipment, such as statistical process control, tool control, and other types of sampling procedures may be used by the contractor when they provide, as a minimum, the level of quality assurance required by the inspection provisions specified herein. Prior to applying such alternative procedures, methods, or equipment, the contractor shall describe them in a written proposal submitted to the Government for evaluation and approval. (See 6.4.) When required, the contractor shall demonstrate that the effectiveness of each proposed alternative is equal to or better than the quality assurance provisions specified herein. In cases of dispute as to whether the contractor's proposed alternative provides equal quality assurance, the provisions of this specification shall apply. All approved alternative inspection provisions shall be specifically incorporated into the contractor's quality program or detailed inspection system, as applicable.

#### **4.2 Quality conformance inspection.**

**4.2.1 Lotting.** A lot shall consist of the nitric acid produced by one manufacturer, at one plant, from the same materials, and under essentially the same manufacturing conditions provided the operation is continuous. In the event the process is a batch operation, each batch shall constitute a lot (see 6.5).

#### **4.2.2 Sampling.**

**4.2.2.1 For examination of packaging.** Sampling shall be conducted in accordance with table II. The sample unit shall be one filled unit pack or packing container, as applicable, ready for shipment.

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**TABLE II. Sampling for packaging examination and test**

Number of containers in batch or lot	Number of sample containers
1 or 2	all
3 to 25	3
26 to 50	5
51 to 90	6
91 to 150	7
151 to 280	10
281 to 500	11
501 to 1,200	15
1,201 to 3,200	18
3,201 to 10,000	22
over 10,000	29

**4.2.2.2 For nitric acid test.** See 6.6 for sampling and testing precautions. Sampling shall be conducted in accordance with table III. A representative specimen of approximately 150 grams (g) shall be removed from each sample container and placed in a suitable clean, dry container labeled to identify the lot and container from which it was taken.

**TABLE III. Sampling for nitric acid test**

Number of containers in batch or lot	Number of sample containers
2 to 25	2
26 to 150	3
151 to 1,200	5
1,201 to 7,000	8
7,001 to 20,000	10
Over 20,000	20

**4.2.2.3 For container leakage test.** Sampling shall be conducted in accordance with table II. The sample unit shall be one container.

#### **4.2.3 Inspection procedure.**

**4.2.3.1 For examination of packaging.** Sample unit packs and packing containers shall be examined for the characteristics listed below. Failure of any sample unit pack or packing container to conform to all characteristics shall be cause for rejection of the lot represented.

- (a) Contents per container
- (b) Container
- (c) Container closure
- (d) Container free of damage and leaks
- (e) Fiberboard pads evident and correct (when required)
- (f) Marking evident, correct, and legible
- (g) Unitization

**4.2.3.2 For nitric acid test.** See 6.6 for sampling and testing precautions. Each sample specimen taken in 4.2.2.2 shall be tested as specified in 4.2.4. Failure of any test by any specimen shall be cause for rejection of the lot represented.

**4.2.3.3 For container leakage test.** The sample containers selected in 4.2.2.3 shall be tested as specified in 4.2.5. Failure of the leakage test by any container shall be cause for rejection of the lot represented.

**4.2.3.4 Significant places.** For the purpose of determining conformance with this specification, and observed or calculated value shall be rounded off "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value, in accordance with ASTM E 29.

**4.2.4 Nitric acid tests.** Water in accordance with ASTM D 1193 and reagent grade chemicals shall be used throughout the tests. Where applicable, blank determinations shall be run and corrections applied where significant. Tests shall be conducted as follows:

**4.2.4.1 Appearance.** Pour approximately 25 milliliters (mL) of the thoroughly mixed specimen into a clean, dry test tube, allow to stand for at least 10 minutes, and then examine visually for sediment, suspended matter, and separated material.

**4.2.4.2 Total acid content.** Weigh a small glass-stoppered Erlenmeyer flask containing approximately 15 mL of water to the nearest milligram. Rapidly add 2 to 3 mL of the thoroughly mixed specimen and reweigh. Titrate with approximately 1N sodium hydroxide solution which has been freshly standardized, using methyl red as the indicator. Calculate the percent weight total acid as nitric acid as follows:

$$\text{Percent nitric acid} = \frac{6.301 AB}{(C - D)}$$

where A = Milliliters of sodium hydroxide solution used  
 B = Normality of sodium hydroxide solution  
 C = Weight of stoppered flask, water, and nitric acid in grams  
 D = Weight of stoppered flask and water in grams.

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**4.2.4.3 Residual acid.** Evaporate approximately 50 g of the specimen weighed to the nearest milligram in an evaporating dish on a steam bath. Repeat the evaporation twice, adding 10 mL of water each time. Cautiously dilute the residue with 100 mL cold water and transfer quantitatively to a 250-mL beaker. Titrate with approximately 0.2N sodium hydroxide solution which has been standardized, using methyl red as the indicator. Calculate the percent by weight residual acid as sulfuric acid as follows:

$$\text{Percent residual acid} = \frac{4.904 AB}{W}$$

where A = Milliliters of sodium hydroxide solution used  
 B = Normality of sodium hydroxide solution  
 W = Weight of specimen in grams.

**4.2.4.4 Chloride.** Weigh to the nearest milligram approximately 20 g of the specimen and dilute with 300 mL of water. Heat to nearly boiling and add 10 mL of 0.5N silver nitrate solution. Stir thoroughly and allow to settle for at least 1 hour in a dark place. Filter through a tared filter crucible, wash thoroughly with water and alcohol and dry to constant weight at 105° to 110°C. Calculate the percent by weight chloride as follows:

$$\text{Percent chloride} = \frac{24.74 (A - B)}{W}$$

where A = Weight of crucible and precipitate in grams  
 B = Weight of crucible in grams  
 W = Weight of specimen in grams.

**4.2.5 Container leakage test.** Place the container in each of the following positions, and leave it in each for a period of 15 minutes.

- (a) Upright
- (b) Upside down
- (c) On one side (or one quadrant)
- (d) On one end (or second quadrant)
- (e) On other side (or fourth quadrant)

Examine the container after each period for any evidence of leakage.

## 5. PACKAGING

Note: The metric equivalents given for inch-pound quantities are nominal values provided for informational purposes and should not be considered as quantity requirements.

**5.1 Packaging.** Packaging shall be in accordance with the applicable requirements of 49 CFR 171 to 199 and the International Civil Aviation Organization – Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO–TDGA) or the International Maritime Organization – International Maritime Dangerous Goods Code (IMO–IMDGC), as applicable to the mode of transportation. The packaging shall meet the applicable packaging performance tests specified in ICAO–TDGA or IMO–IMDGC, as applicable.

## **5.2 Unit packing.**

**5.2.1 One-pint (0.5-liter) quantity.** A quantity of 1 pint (+1/8 or –0 fluid ounces) (0.5 liters) of nitric acid shall be unit packed in a nominal 1-pint (0.5-liter) screw-cap glass or polyethylene plastic bottle conforming to an IP.1 or IP.2 container of ICAO–TDGA or IMO–IMDGC, as applicable. The IP.1 container shall conform to the following: group A, class 1, type d, grade optional with closure A or R and outer seal A of PPP–C–186. The material used for the bottle shall conform to type I, class M or H, grade 1 or 2 of L–P–390. The thickness of the bottle shall be not less than 0.030 inch. The bottle shall be designed with a finish adapted to a screw-cap conforming to closure A or R of PPP–C–186. The closure of the bottle shall conform to closure A with a separate liner or closure R of PPP–C–186. The tightened screw-cap shall be secured to the neck of the bottle by a strip of tape applied circumferentially around, and centered over the juncture between the skirt of the cap and shoulder of the bottle neck. The tape shall have a nominal width of 2 inches and length of not less than one and one-third times the circumference of the screw-cap closure. The tape shall conform to type 1, class optional of PPP–T–66. There shall be no evidence of container leakage when the bottle is tested as specified in 4.2.5. Each bottle shall be placed upright and centered in a can with vermiculite cushioning. The can shall conform to type V, class 2, type VI tin or terneplate of PPP–C–96. The can shall be coated in accordance with plan B, with side seams striped, of PPP–C–96. Sufficient vermiculite conforming to type I, grade 3 of ASTM C 516 shall be used in each can to assure absorption of the entire contents of the bottle in the event of leakage or breakage. The seams of the slip-cover can shall be sealed with the same kind of tape used for the bottle. The IP.2 container shall be the same as specified above except that the bottle shall conform to group A, class 2, style 1, grade 2, closure A, seal A of PPP–C–186.

**5.2.2 Five-pint (2.5-liter) quantity.** A quantity of 5 pints (+5/8 or –0 fluid ounces) (2.5 liters) of nitric acid shall be unit packed as specified in 5.2.1, except the container shall be a nominal 5-pint (2.5-liter) bottle.

**5.3 Packing.** Packing shall be level A or B as specified (see 6.2).

### **5.3.1 Level A.**

**5.3.1.1 Six and one-half-gallon (25-liter) quantity.** A quantity of 6-1/2 gallons (+7 or –0 fluid ounces) (25 liters) of nitric acid shall be packed in a nominal 6-1/2-gallon

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(25-liter) composite container or carboy conforming to the requirements of a 6HA2 or 6HD2 container of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.3.1.2 Thirteen-gallon (50-liter) quantity.** A quantity of 13 gallons (+13 or -0 fluid ounces) (50 liters) of nitric acid shall be packed as specified in 5.3.1.1, except the container shall be a nominal 13-gallon (50-liter) composite container.

**5.3.2 Level B.**

**5.3.2.1 One-pint (0.5-liter) quantity.** Twelve 1-pint (0.5-liter) bottles of nitric acid unit packed as specified in 5.2.1 shall be packed upright in a close-fitting weather-resistant fiberboard box conforming to the requirements of a 4G container of ICAO-TDGA or IMO-IMDGC, as applicable. Each box shall be closed and reinforced as specified in accordance with the general packing requirements of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.3.2.2 Five-pint (2.5-liter) quantity.** Six 5-pint (2.5-liter) bottles, unit packed as specified in 5.2.2, shall be packed upright in a close-fitting weather-resistant fiberboard box conforming to the requirements of a 4G container of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.3.2.3 Six and one-half-gallon (25-liter) quantity.** A quantity of 6-1/2 gallons (+7 or -0 fluid ounces) (25 liters) of nitric acid shall be packed in a nominal 6-1/2-gallon (25-liter) polyethylene plastic container conforming to the requirements of a 1H1 of ICAO-TDGA or IMO-IMDGC, as applicable. In addition, the drum shall have a handle to provide safe handling.

**5.3.2.4 Thirteen-gallon (50-liter) quantity.** A quantity of 13 gallons (+13 or -0 fluid ounces) (50 liters) of nitric acid shall be packed as specified in 5.3.2.3, except that the container shall be a nominal 13-gallon (50-liter) polyethylene plastic container.

**5.4 Overpacking.** Overpacking shall be level A or B as specified (see 6.2).

**5.4.1 Level A.**

**5.4.1.1 One-pint (0.5-liter) quantity.** Two packs of 1-pint (0.5-liter) bottles shall be overpacked in a close-fitting water-repellent treated wooden or plywood box. The wooden box shall conform to the requirements of a 4C1 container of ICAO-TDGA or IMO-IMDGC, as applicable. The plywood shall conform to the requirements of a 4D container of ICAO-TDGA or IMO-IMDGC, as applicable. In addition, the plywood shall be not less than 3/8 inch thick and the cleats not less than 3/4 inch thick by 1-3/4 inch wide. Each box shall be closed and reinforced as specified in accordance with the general packing requirements of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.4.1.2 Five-pint (2.5-liter) quantity.** Two packs of 5-pint (2.5-liter) bottles shall be overpacked in a close-fitting water-repellent treated wooden or plywood box. The wooden box shall conform to the requirements of a 4C1 container of ICAO-TDGA or IMO-IMDGC, as applicable. The plywood shall conform to the requirements of a 4D container of ICAO-TDGA or IMO-IMDGC, as applicable. In addition, the plywood shall be not less than 3/8 inch thick and the cleats not less than 3/4 inch thick by 1-3/4 inch wide. Each box shall be closed and reinforced as specified in accordance with the general packing requirements of ICAO-TDGA or IMO-IMDGC, as applicable.

#### **5.4.2 Level B.**

**5.4.2.1 One-pint (0.5-liter) quantity.** Two packs of 1-pint (0.5-liter) bottles shall be overpacked in a close-fitting fiberboard box conforming to the requirements of a 4G container of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.4.2.2 Five-pint (2.5-liter) quantity.** Two packs of 5-pint (2.5-liter) bottles shall be overpacked in a close-fitting fiberboard box conforming to the requirements of a 4G container of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.5 Marking.** Shipments for civil agencies shall be marked in accordance with Fed. Std No. 123. Shipments for military activities shall be marked in accordance with MIL-STD-129.

**5.5.1 Container compliance markings.** Each shipping container shall be marked in accordance with 49 CFR 171 to 179 and either ICAO-TDGA or IMO-IMDGC, as applicable.

**5.5.2 Hazard class label.** Each shipping container and pallet load shall be labeled in accordance with 49 CFR 171 to 179 and either ICAO-TDGA or IMO-IMDGC, as applicable.

**5.5.3 Proper shipping name.** Each shipping container and pallet load shall be marked with proper shipping name in accordance with 49 CFR 171 to 179 and either ICAO-TDGA or IMO-IMDGC, as applicable.

**5.5.4 Precautionary markings.** Each unit and shipping container shall be marked or labeled, as applicable, in accordance with 29 CFR 1900.1200(f) to show the required precautionary information. Each outer container shall be marked to show the top of the container by use of an arrow and the word "UP".

**5.5.5 Overpack markings.** Each overpack shall be marked "Inner packages comply with prescribed specification \_\_\_\_\_." (Enter either 4C1, 4D, or 4G, as applicable.)

**5.6 Palletization.** All shipments of containers of 5 gallons or less shall conform to load type VI in accordance with MIL-STD-147 and the pallet shall conform to type IV or V of MIL-P-15011. When specified, all other shipments of nitric acid shall be palletized in accordance with the applicable requirements of MIL-STD-147.

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## 6. NOTES

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

**6.1 Intended use.** Nitric acid is intended for use in the manufacture of metals, chemicals, and fertilizers, in the cleaning of a variety of materials, and in the nitrating of agents.

**6.2 Acquisition requirements.** Acquisition documents must specify the following:

- (a) Title, number, and date of this specification
- (b) Unit quantity required
- (c) Level of packing required (see 5.3)
- (d) Level of overpacking required (see 5.4)
- (e) If palletization is required for shipments of containers over 5 gallons (see 5.6).

**6.3 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 mailing addresses for submissions of data are listed in FED-STD-313.

**6.4 Submission of alternative inspection provisions.** Proposed alternative inspection provisions should be submitted by the contractor to the procuring contracting officer for evaluation and approval by the technical activity responsible for preparation of this specification.

**6.5 Batch.** A batch is defined as that quantity of material which has been manufactured by some unit chemical process or subjected to some physical mixing operation intended to make the final product substantially uniform.

**6.6 Sampling and testing precautions.** This specification requires inspection of chemical material which is potentially hazardous to personnel. This specification does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this specification to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

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

**6.8 Subject term (key word) listing.**

chemical  
fertilizer  
metal  
nitrating

**MILITARY INTERESTS:**

**Custodians:**

Army - EA  
Navy - SH  
Air Force - 68

**Review activities:**

Army - AR, MD, MI  
Navy - OS  
DLA - GS

**CIVIL AGENCY COORDINATING ACTIVITIES:**

GSA-FSS (9FTE-10)  
VA-OSS

**Preparing activity:**

Army - EA  
Project No. 6810-1237