

MIL-A-18455C  
23 December 1986  
SUPERSEDING  
MIL-A-18455B  
20 March 1962  
(See 6.9)

## MILITARY SPECIFICATION

### ARGON, TECHNICAL

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

#### 1. SCOPE

1.1 Scope. This specification covers two types of argon gas for use in inert gas shielded electric arc welding of aluminum, magnesium, corrosion-resisting steel and other alloys.

1.2 Classification. Argon shall be of the following types as specified (see 6.2).

Type I - Gaseous  
Type II - Liquid

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

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

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.

MIL-A-18455C

## SPECIFICATIONS

## FEDERAL

- RR-C-901 - Cylinder, Compressed Gas: High Pressure, Steel DOT 3AA, and Aluminum Applications, General Specification for.

## MILITARY

- MIL-V-2 - Valves, Cylinder, Gas (for Compressed or Liquefied Gases).  
 MIL-T-704 - Treatment and Painting of Materiel.  
 MIL-S-27626 - Sampler, Cryogenic Liquid.

## STANDARDS

## FEDERAL

- FED-STD-H28 - Screw-Thread Standards for Federal Services, Section 9, Gas Cylinder Valve Outlet and Inlet Threads.  
 FED-STD-313 - Material Safety Data Sheets, Preparation and the Submission of.

## MILITARY

- MIL-STD-101 - Color Code for Pipelines and for Compressed Gas Cylinders.  
 MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.  
 MIL-STD-129 - Marking for Shipment and Storage.  
 MIL-STD-147 - Palletized Unit Loads.  
 MIL-STD-1411 - Inspection and Maintenance of Compressed Gas Cylinders.

2.1.2 Other Government publications. The following other Government publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

## NATIONAL BUREAU OF STANDARDS (NBS)

Research paper No. 1865 - Measurement of Water in Gases by  
 Electrical Conduction in a Film of  
 Hygroscopic Material and the Use of  
 Pressure Changes in Calibration.

Research paper No. 1381 - Apparatus for Absorption of Gravimetric  
 Determination of Constituents for a  
 Gas Mixture.

(Application for copies should be addressed to the Superintendent of Documents, U.S. Printing Office, Washington, DC 20402.)

MIL-A-18455C

DEPARTMENT OF LABOR (OSHA)

Code of Federal Regulations (CFR)

29 CFR, Part 1910.1200 - Hazard Communication Standard.

DEPARTMENT OF TRANSPORTATION (DOT)

Code of Federal Regulations (CFR)

Title 49, Transportation.

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

(Copies of specifications, standards, publications and other Government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN CHEMICAL SOCIETY

Analytical Chemistry - Volume 26, No. 3

"Determination of Nitrogen Content of Noble Gases - Absorption in Titanium Metal", by H.S. Dombrowski

(Application for copies should be addressed to American Chemical Society, 1155 16th Street, NW, Washington, DC 20036.)

COMPRESSED GAS ASSOCIATION (CGA)

G-11.1 - Commodity Specification for Argon

(Application for copies should be addressed to the Compressed Gas Association, Inc., 500 Fifth Avenue, New York, NY 10036.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which 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 specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Composition. The argon shall not contain oil or odorous or toxic impurities, and shall be as specified in table I.

MIL-A-18455C

TABLE I. Composition of argon.

Composition	Percent by volume	
	Minimum	Maximum
Oxygen	-----	0.005
Hydrogen	-----	.005
Nitrogen	-----	.005
Argon	99.985	-----

3.2 Moisture content. When tested as specified in 4.4.1, the argon shall contain not more than 0.02 milligram of water vapor per liter of gas when measured at 21.1 degrees Celsius ( $^{\circ}\text{C}$ ) (70 degrees Fahrenheit ( $^{\circ}\text{F}$ )) and 101.3 kilopascals (kPa) (1 atmosphere) absolute or have a dew point of  $-53.8^{\circ}\text{C}$  ( $-65^{\circ}\text{F}$ ) or colder.

3.3 Type I, gaseous, cylinders and valves. Unless otherwise specified, the argon shall be contained in Government-owned and furnished cylinders conforming to DoT 3A or 3AA of CFR 49, parts 100-199 and RR-C-901. The cylinders shall be equipped with valves having outlet connection numbers 580, 677 and 680 in accordance with FED-STD-H28 and MIL-V-2. When specified (see 6.2) new cylinders shall be furnished by the argon contractor and shall be in accordance with RR-C-901 and equipped with valves in accordance with MIL-V-2. When specified (see 6.2) the argon shall be contained in contractor owned DoT approved cylinders.

3.3.1 Cylinder serviceability. Government or contractor owned and furnished cylinders shall be inspected, maintained and reconditioned in accordance with MIL-STD-1411 to meet the requirements of this specification and CFR Title 49, parts 100-199. The services to be performed shall be verified and deemed necessary by the applicable Government quality assurance representative or a qualified agent of the purchaser prior to their accomplishment.

3.3.2 Painting. Unless otherwise specified (see 6.2), Government owned and furnished cylinders for argon shall be cleaned, treated and painted in accordance with MIL-T-704. Unless otherwise specified (see 6.2), each DoD cylinder shall be coded and marked in accordance with MIL-STD-101.

3.3.3 Valves. Unless otherwise specified (see 6.2), replacements for defective valves in Government owned and furnished cylinders shall be contractor furnished from a qualified source listed on the QPL for MIL-V-2.

3.3.4 Filling pressures. Cylinders shall be charged to the pressure permitted (corrected to  $21.1^{\circ}\text{C}$ ) by the markings cold stamped into the shoulder of the cylinder in accordance with the CFR requirements. Cylinders except those owned by the U.S. Navy may be filled to a pressure of 10 percent in excess of the stamped service pressure if the cylinder meets or exceeds the minimum requirements of 173.302c, CFR Title 49.

3.4 Type II, liquid, containers. Type II, liquid argon, shall be contained in either contractor owned or Government owned insulated containers or tank trucks as specified (see 6.2). Containers shall be in accordance with 49 CFR, 171-190.

MIL-A-18455C

3.4.1 Container maintenance. Unless otherwise specified (see 6.2), containers that require maintenance shall be processed by the contractor for serviceability to meet the requirements of this specification and 49 CFR, 171-190.

3.5 Material safety data sheet (MSDS). The contracting activity shall be provided a material safety data sheet (MSDS) at the time of the contract award. The MSDS shall be provided in accordance with the requirements of FED-STD-313 and 29 CFR 1910.1200, Hazard Communication. When FED-STD-313 is at variance with the CFR, 29 CFR 1910.1200 shall take precedence, modify and supplement FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification.

#### 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 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must 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 assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

#### 4.2 Sampling.

##### 4.2.1 Inspection lot.

4.2.1.1 Type I argon. Every cylinder filled from the same source on the same day and offered for delivery at one time shall be considered a lot for purposes of quality conformance inspection.

4.2.1.2 Type II argon. The entire amount of type II argon supplied in one shipping container shall be a lot.

4.2.2 Sampling for examination of filled cylinders. A sample of filled cylinders shall be selected at random from each lot in accordance with MIL-STD-105 at inspection level I, and acceptable quality level (AQL) of 2.5 percent defective to verify conformance with all requirements of this specification regarding the closure, marking and other requirements not involving tests.

## MIL-A-18455C

4.2.3 Sampling for test. Sample cylinders shall be selected from each inspection lot in accordance with MIL-STD-105 at inspection level S-1 and AQL of 6.5 percent for the tests specified in 4.3.2. Type II liquid argon shall be sampled with a sampler, meeting the requirements of MIL-S-27626 or functional equivalent.

4.3 Quality conformance inspection. Quality conformance inspection shall be as follows:

4.3.1 Examination of filled cylinders. Each sample cylinder selected in accordance with 4.2.2 shall be examined for defects of the cylinder and the closure, for evidence of leakage and odor, and for unsatisfactory marking. The pressure of each type I sample filled cylinder shall also be measured as specified in 4.4.5. Any cylinder in the sample, having one or more defects, or under required fill shall not be offered for delivery. If the number of defective cylinders in any sample exceeds the acceptance number for the appropriate sampling plan in accordance with MIL-STD-105, this shall be cause for rejection of the lot represented by the sample.

4.3.2 Inspection. Argon gas taken from each of the sample cylinders selected in accordance with 4.2.3 shall be subjected to the tests as specified in 4.4.1 through 4.4.4.

4.4 Tests.

4.4.1 Moisture impurity. Argon gas from each sample filled cylinder shall be tested for moisture by one of the methods specified herein after the cylinder valve, regulator and test connections have been purged by withdrawing approximately 28 liters (L) (1 cubic foot (ft<sup>3</sup>)) of gas. In case of dispute, the accelerated gravimetric method, National Bureau of Standards research paper no. 1381, shall be the standard referee test when conducted as specified herein.

- (a) Accelerated gravimetric method. The accelerated gravimetric method shall be determined by measurement of the increase in weight of phosphorous pentoxide when subjected to a flow of a measured volume of argon as specified hereinafter. Invert the cylinder to be tested and place it in a suitable rack. Connect the cylinder to the test apparatus by the means of a length of bent, seamless, corrosion-resisting steel tubing and a high pressure union with needle valve and a glass-to-metal joint (no rubber shall be used; a sleeve joint secured with thermoplastic is acceptable). A mercury safety valve shall be connected between the low pressure outlet of the needle valve and the first absorber. The steel tubing shall be so fabricated that it will pass through two water baths at room temperature. The apparatus shall consist of three U-tube absorbers in series, each 10.2 centimeters (cm) (4-inches) high and 1.3 cm (1/2 inch) in diameter, containing phosphorous pentoxide on glass wool and connected through a water-saturator to a calibrated wet test meter of 1.4 L (1/20-ft<sup>3</sup>) size equipped with a 1 liter dial. The needle valve connecting the cylinder to the absorber shall be flushed with argon so that only gas discharged from the cylinder will pass through the absorber. The absorbers shall be brought to constant weight in a stream of dry argon

before they are weighed so they will be at all times filled with argon. Before each weighing of the absorbers they shall be opened momentarily to the air, closed, and cleaned. One hundred liters of gaseous argon shall be discharged through the apparatus at a rate not to exceed 0.4 liter per minute. The total volume of gas measured shall be corrected to conditions of 21.1°C and 101.3 kPa pressure. The moisture content shall then be calculated from the gain in weight of the absorbents and expressed in milligrams per liter of gas as measured at 21.1°C and 101.3 kPa. The moisture content shall be computed in terms of milligrams per liter at standard conditions.

- (b) Freeze-out volumetric method. Moisture content shall be measured by determining the amount of water collected in a trap subjected to liquid air or nitrogen temperature after a measured volume of argon has been passed.
- (c) Electrical conductivity-vapor pressure method. Moisture content of argon may be determined by the electrical conductivity-vapor pressure method as specified in the National Bureau of Standards research paper no. 1865.
- (d) Direct reading dew point method. Moisture content of argon may be measured by using direct reading dew point measurement equipment.
- (e) Moisture content may be determined by any method regularly used by the contractor and approved by the contracting activity.

4.4.2 Oxygen impurity. The argon gas from each sample filled cylinder shall be subjected to one of the following test procedures for determination of the oxygen impurity. If any cylinder sample of argon gas fails in any requirement, this shall be cause for rejection of the lot of filled cylinders.

- (a) Heat of reaction method. An excess of hydrogen (oxygen free) shall be mixed with the argon sample and passed over a palladium catalyst. The increase in temperature shall be measured and, by calculation, the oxygen determined for the metered flow rate of argon.
- (b) Combustion method. A small amount of oxygen-free hydrogen (previously dried) shall be mixed with the sample (previously dried). Then by combustion, the oxygen shall be combined with hydrogen to form water vapor. The water shall be determined by either one of the methods as specified in 4.4.1. The quantity of oxygen shall be calculated from the water vapor formed and the quantity of the sample used.
- (c) Bulb method. A clear glass electric light bulb shall be modified by fusing to it, inlet and outlet connections of short lengths of glass tubing. The argon to be tested shall be passed through the bulb until a representative sample is obtained and then the gas flow shall be stopped. An 18 volt (V) electrical current shall be applied to the tungsten filament for 1 minute. The current shall then be turned off and the filament flashed at 85 to 100 V. Emission of smoke at the instant of flashing indicates that the argon contains more than 8 parts per million oxygen. If this test indicates presence of oxygen it will be necessary to retest argon by methods (a) and (b) above.



MIL-A-18455C

- (d) Oxygen impurity may be determined by any other method regularly used by the contractor and approved by the contracting activity.

4.4.3 Hydrogen impurity. The argon gas from each of the sample filled cylinders shall be subjected to one of the following test methods for the determination of hydrogen impurity. If any cylinder sample of argon gas fails in any requirement, this shall be cause for rejection of the lot of filled cylinders.

- (a) Heat of reaction method. Test shall be conducted as specified in 4.4.2(a) for oxygen, except that an excess of hydrogen-free oxygen is mixed with the argon sample and passed over a palladium catalyst.
- (b) Combustion method. Test shall be conducted as specified in 4.4.2(b) for oxygen impurity, except that small amounts of hydrogen-free oxygen (dried) shall be "burned" with a metered amount of argon sample (previously dried) and the amount of water vapor formed shall be determined by one of the methods specified in 4.4.1. The quantity of hydrogen shall be calculated from the water vapor formed and the quantity of the sample used.
- (c) Hydrogen impurity may be determined by any other method regularly used by the contractor and approved by the contracting activity.

4.4.4 Nitrogen impurity. Argon gas from each of the sample filled cylinders shall be subjected to one of the following test methods for determination of nitrogen impurity. If any cylinder sample of argon gas fails in any requirement, this shall be cause for rejection of the lot of filled cylinders.

- (a) Nitrogen impurity may be determined by the method as specified in ACS Analytical Chemistry, volume 26, no. 3.
- (b) Argon gas from the sample cylinder shall be passed through a thermal conductivity cell of high sensitivity where the nitrogen content is determined by comparison with argon of known nitrogen content.
- (c) Nitrogen impurity may be determined by any alternate method regularly used by the contractor and approved by the contracting activity.

4.4.5 Filling pressure. The gauge pressure of each type I sample cylinder shall be measured in accordance with MIL-STD-1411. Pressure-temperature conversions of CGA G-11.1 shall be used.

4.5 Inspection of packaging. Sample packages and packs, and the inspection of the preservation-packaging, packing and marking for shipment 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.)



## MIL-A-18455C

5.1 Packing level A. When specified (see 6.2), each filled cylinder, whether Government-owned or contractor-furnished, shall be packed in accordance with the CFR 49.

5.1.1 Palletization. When specified (see 6.2), the cylinders shall be palletized in accordance with MIL-STD-147.

5.2 Marking. Cylinders and containers shall be marked in accordance with the CFR 49 and 29 CFR, Part 1910.1200. When specified (see 6.2), each cylinder shall also be marked with a complete description of the contents as specified in the contract or order under which the shipment is made. This information shall be marked on a suitable tag firmly wired to the cylinder cap.

5.2.1 Special marking. In addition to the marking specified in 5.2, each cylinder and palletized load shall be marked in accordance with MIL-STD-129 and DoT Regulations. The requirements of MIL-STD-101 shall apply for Government-owned cylinders.

5.2.2 Commodity tag. Each liquified container shall have a commodity tag attached to the fill valve. The commodity tag shall identify fill plant, product, date filled, container number, and name of filler.

5.3 Material safety data sheet. A copy of the material safety data sheet shall be attached to the shipping document for each destination (see 3.5).

## 6. NOTES

6.1 Intended use. The argon covered in this specification is intended for use in inert gas shielded electric arc welding of aluminum, magnesium, corrosion-resisting steel and other alloys.

6.2 Ordering data. Acquisition documents should specify the following:

- (a) Title, number and date of this specification
- (b) Quantity and type of argon required.
- (c) When gas contractor is to furnish new gas cylinders (see 3.3).
- (d) When gas is to be furnished in contractor owned cylinders (see 3.3).
- (e) When cylinders shall be cleaned, treated and painted in accordance with MIL-T-704 (see 3.3.2).
- (f) When cylinder is to be color coded other than in accordance with MIL-STD-101 (see 3.3.2).
- (g) When replacement valve is other than a QPL valve in accordance with MIL-V-2 (see 3.3.3).
- (h) When liquid is to be furnished in contractor owned containers (see 3.4).
- (i) Maintenance required for liquid containers (see 3.4.1).
- (j) Applicable level of packing required (see 5.1).
- (k) Whether cylinders should be palletized (see 5.1.1).
- (l) Whether cylinders should be marked with description of contents (see 5.2).

MIL-A-18455C

6.3 Purchase basis. The basis of purchase should be the cubic foot of argon measured at atmosphere (14.7 lb/in<sup>2</sup>) pressure and 70°F.

6.4 Cylinder contents. The contents of a full cylinder should be based on charts from the National Bureau of Standards miscellaneous publication no. 71 on the compressibility of gases, corrected for the actual volume of the cylinder filled.

6.5 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 and 29 CFR 1910.1200. The pertinent Government mailing addresses for submission of data are listed in appendix B of FED-STD-313.

6.6 Container services. The gas contractor should furnish at no additional cost, all services which are required at each and every filling of a container to comply with applicable regulations and normal good practice. Such services would include, but not be limited to, all inspection, testing, evacuation, and handling services required for the gas supplied.

6.7 Schedule of fees. A schedule of allowable fees should be specified by the purchaser for the gas contractor's performance of service such as the replacement of valves, valve parts, and cylinder caps, hydrostatic testing, cleaning, painting, color/coding, marking, and handling of unserviceable containers as required. All materials and components for these services should be furnished by the gas contractor.

6.8 Subject term (key word) listing.

Argon gas  
Containers  
Cylinders  
Gaseous  
Liquid

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

Custodians:

Army - MI  
Navy - SH  
Air Force - 68

Preparing activity:

Navy - SH  
(Project 6830-0144)

Review activities:

DLA - GS  
Navy - MC

User activities:

Army - ME  
Navy - AS, YD

**INSTRUCTIONS:** In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

**NOTE:** This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification 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.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY

COMMANDER  
NAVAL SEA SYSTEMS COMMAND (SEA 5523)  
DEPARTMENT OF THE NAVY  
WASHINGTON, DC 20362-5101

OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE \$300

**BUSINESS REPLY MAIL**

FIRST CLASS PERMIT NO. 12503 WASHINGTON D. C.

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

COMMANDER  
NAVAL SEA SYSTEMS COMMAND (SEA 5523)  
DEPARTMENT OF THE NAVY  
WASHINGTON, DC 20362-5101

NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER

MIL-A-18455C

2. DOCUMENT TITLE

ARGON, TECHNICAL

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

☐ VENDOR☐ USER☐ MANUFACTURER☐ OTHER (Specify): \_\_\_\_\_

b. ADDRESS (Street, City, State, ZIP Code)

## 5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

## 6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

b. WORK TELEPHONE NUMBER (Include Area Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

8. DATE OF SUBMISSION (YYMMDD)

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)