

<b>METRIC</b>
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**MIL-PRF-27415C**

**07 August 2013**

**SUPERSEDING**

**MIL-PRF-27415B**

**08 February 2007**

## **PERFORMANCE SPECIFICATION**

### **PROPELLANT PRESSURIZING AGENT, ARGON**



Comments, suggestions, or questions on this document should be addressed to AFPA/PTPT, 2430 C Street, Bldg 70, Area B, Wright-Patterson AFB, OH, 45433-7632 or e-mailed to [AFPA.PTPS@wpafb.af.mil](mailto:AFPA.PTPS@wpafb.af.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

AMSC N/A

FSC 9135

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

## 1. SCOPE

1.1 Scope. This specification covers the requirements for two grades and two types of argon.

1.2 Classification. The argon will be of the following types and grades as specified (see 6.2):

1.2.1 Types. The types of argon are as follows:

Type I - Gaseous

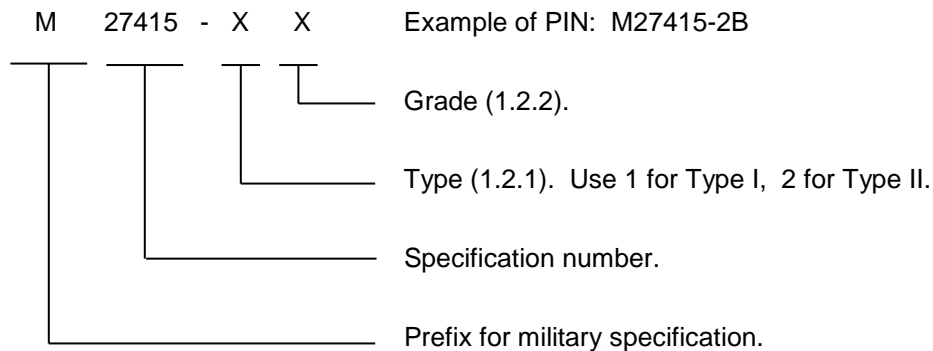
Type II - Liquid

1.2.2 Grades. The grades of argon are as follows:

Grade A - 99.998 percent purity

Grade B - 99.985 percent purity

1.3 Part or identifying number (PIN). The PINs to be used for argon acquired to this specification are created as follows:



## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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 of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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 cited in the solicitation or contract.

### DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-STD-101                      Color Code for Pipelines and for Compressed Gas Cylinders

MIL-STD-1411                  Inspection and Maintenance of Compressed Gas Cylinders

### COMMERCIAL ITEM DESCRIPTIONS

A-A-59860                      Valves, Cylinder, Gas (For Compressed or Liquefied Gases)

(Copies of these documents are available online at <https://assist.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094)

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2.2.2 Other Government documents, drawings, and publications. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issue of this document is the one cited in the solicitation or contract (see 6.2).

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) Formerly the National Bureau of Standards (NBS)

Technical Publication	Thermodynamic Properties of Argon from the Triple Point to 300K at Pressures to 1000 Atmospheres
NSRDS 27	

(Copies of this document are available online at <http://www.nist.gov> or the National Institute of Standards and Technology (NIST), 100 Bureau Drive, Stop 1070, Gaithersburg, MD 20899-1070.)

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 these documents are those cited in the solicitation or contract.

## ASTM INTERNATIONAL

ASTM E29	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications (DoD Adopted)
ASTM F307	Standard Practice for Sampling Pressurized Gas for Gas Analysis (DoD Adopted)
ASTM F310	Standard Practice for Sampling Cryogenic Aerospace Fluids (DoD Adopted)

(Copies of these documents are available online at <http://www.astm.org> or the ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken PA 19428-2959)

## COMPRESSED GAS ASSOCIATION (CGA)

CGA G-11.1	Commodity Specification for Argon
CGA P-15	Filling of Industrial and Medical Nonflammable Compressed Gas Cylinders

(Copies of these documents are available online at <http://www.cganet.com> or from the Compressed Gas Association, Inc., 14501 George Carter Way, Suite 103, Chantilly VA 20151)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document will take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 Composition. The purity and impurity concentrations shall conform to the limits of Table I when tested in accordance with the applicable test method also specified in Table I. Other limits and tests may be specified by the procuring activity (see 6.2).

3.2 Limiting values. The following applies to all specified limits in this specification: For purposes of determining conformance with these requirements, an observed value or a calculated value shall be rounded off in the last right-hand digit used in expressing the specification limit, using the Rounding Method of ASTM E29.

3.3 Filter. A filter with a rating of at least 10-micrometer nominal and 40-micrometer absolute or better shall be installed between the manufacturer's plant system and the manifold used to fill the gas or liquid containers for delivery.

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## 3.4 Filled containers (Type I only).

3.4.1 Pressure. The container filling pressure (see 6.2) shall not differ from that required by the contract by more than 1.0% at 21°C (70°F) when tested as specified in 4.5.1. In no case shall the filling pressure exceed the rated service pressure of the container.

3.4.2 Leakage. Cylinders shall not leak when tested according to 4.5.2.

3.4.3 Inspection and maintenance. Compressed gas cylinders shall be inspected, maintained, and charged according to 4.5.3.

**TABLE I. Limits for argon**

Composition	Grade		Test Paragraph
	A	B	
Purity, % by volume, min	99.998	99.985	4.4.1
Impurities			
Water, ppm by volume, max	3.5	23	4.4.2
Dewpoint, °C (°F)	-68 (-90)	-54 (-65)	4.4.2
Oxygen, ppm by volume, max	2	50	4.4.2
Hydrogen, ppm by volume, max	2	50	4.4.2
Nitrogen, ppm by volume, max	10	50	4.4.2
Total hydrocarbons (as methane), ppm by volume, max	0.5	Not specified	4.4.2
Carbon dioxide, ppm by volume, max	0.5	Not specified	4.4.2

## 4. VERIFICATION

### 4.1 Points of inspection (see 6.2).

4.1.1 Containers. Unless otherwise specified, acceptance tests shall be conducted at the site of filling prior to shipment or departure.

### 4.2 Conformance inspection. Quality conformance tests shall consist of the following:

- a. Individual tests (Type I only) ..... 4.2.1
- b. Sampling tests ..... 4.2.2

4.2.1 Individual tests (Type I only). Each container shall be subjected to the following tests as described under 4.5:

- a. Filling pressure ..... 4.5.1
- b. Leakage ..... 4.5.2

4.2.2 Sampling test. The number of argon containers shall be selected in accordance with Table II and subjected to the tests required by Table I.

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**TABLE II. Sampling for test.**

Number of containers in lot	Number of containers to be sampled
1	1
2 – 40	2
41 – 70	3
71 – over	4

4.2.3 Lot definitions.

4.2.3.1 Type I. A lot is defined as all of the argon supplied in one or more container(s) filled from a single manifold at the same time.

4.2.3.2 Type II. Each filled container shall constitute a lot.

4.2.3.3 Container Assemblies. A shipping conveyance consisting of multiple cylinders or tubes that are interconnected by a single manifold that equalizes the pressure across all cylinders/tubes to form a single unit is considered a single container.

4.2.4 Sample. Each sample shall be of sufficient size to conduct all the quality conformance tests as specified herein. Unless otherwise specified, the quality conformance tests shall be performed on each required sample (see 6.2). When required, an equivalent sample shall be forwarded to a laboratory designated by the procuring activity for subjection to the quality conformance tests specified herein.

4.2.4.1 Sampling methods. Each sample taken for analysis shall be representative of the entire contents of the container being sampled. All equipment used shall be made of suitable materials. Unless otherwise specified in the acquisition requirements (see 6.2), sampling shall be accomplished by one of the following methods.

a. Type I, gaseous argon may be sampled in accordance with ASTM F307 and Type II, liquid argon may be sampled in accordance with ASTM F310. It is critical that the sampling port be clean and free of contaminants.

b. Connect the shipping container being sampled directly to the analytical equipment using suitable pressure regulation as required to prevent over-pressurization of the equipment.

4.2.5 Non-Bulk Containers. The number of containers filled with Type I (gaseous) argon selected for sampling from each lot shall be in accordance with Table II. The first and last containers to be filled within a given lot are typically sampled. Other samples may be selected at random. Every container filled with Type II (liquid) argon shall constitute a lot and will be sampled.

4.2.6 Bulk transports. For bulk shipments, each container filled with Type I (gaseous) or Type II (liquid) argon constitute a lot and shall be sampled.

4.3 Rejection. When any sample tested in accordance with 4.4 fails to conform to the requirements specified herein, the entire lot represented by the sample shall be rejected.

4.4 Analytical procedures. Unless otherwise specified (see 6.2), samples shall be analyzed according to the procedures described in 4.4.2. Calibration gas standards may be required to calibrate (zero and span) analytical instruments used to determine the purity and impurity contents of the argon. The accuracy of the calibration gas standards is to be traceable to the National Institute of Standards and Technology (NIST).

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4.4.1 Argon content. The argon content in percent shall be found by determining the aggregate impurities by the methods described in 4.4.2. The aggregate impurities shall include all the impurities listed in Table I, regardless of Grade. The percent argon is the value obtained when the aggregate impurities, expressed as volume percent, are subtracted from 100 percent.

4.4.2 Impurities. The analytical procedures described in CGA G-11.1 shall be used to determine the concentrations of those impurities listed in Table I.

## 4.5 Filled container tests (Type I only).

4.5.1 Filling pressure. Containers shall be stabilized to 21°C (70°F). Containers shall be tested for proper filling pressure by attaching a calibrated Bourdon-tube gauge or calibrated electronic equivalent gauge to the valve outlet. Then the valve shall be opened and the internal pressure observed on the gauge.

4.5.1.1 Service pressures lower than 25 MPa (3625 psi). The gauge shall have scale divisions not greater than 100 kPa (15 psi). If the internal pressure differs from the applicable filling pressure value by more than 100 kPa (15 psi), the container, and all other containers filled from the same manifold at the same time, shall be rejected.

4.5.1.2 Service pressures greater than 25 MPa gauge (3625 psig). The gauge shall have scale divisions not greater than 700 kPa (100 psi). If the internal pressure differs from the applicable filling pressure value by more than 700 kPa (100 psi), the container, and all other containers filled from the same manifold at the same time, shall be rejected.

4.5.2 Leakage. Each Type I argon container shall be tested for leaks at the neck threads, stem packing, and safety device of the valve with leak detection fluid. Valve seat leakage shall be tested after filling has been completed by connecting a hose to the valve outlet and placing the other end of the hose under the surface of a liquid. Methods of leak detection and/or the leak check guidance in CGA P-15 may also be used.

4.5.3 Inspection and Maintenance. Compressed gas cylinders shall be inspected, maintained, and charged according to MIL-STD-1411.

4.5.3.1 Valves. Valves shall conform to A-A-59860.

4.5.3.2 Color Coding. Government-owned cylinders shall be color coded according to MIL-STD-101.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. 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 argon is intended to be used as a welding, purging, pressurizing, atmospheric inerting agent or missile checkout gas in various military and space application systems.

- a. Title, number, and date of this specification.
- b. Type and grade of argon required (see 1.2).
- c. If required, the specific issue of individual documents referenced (see 2.2.1).
- d. When other limits or tests are required (see 3.1).
- e. When a variation in the points of inspection is required (see 4.1).
- f. When a variation of the quality conformance tests to be performed on a sample is required (see 4.2.4).
- g. When a variation to the sampling method is required (see 4.2.4.1).
- h. When a variation of the analytical procedures is required (see 4.4).
- i. Cylinder size, Capacity, and fill pressure (as determined by cylinder size and capacity)
- j. Packaging requirements (see 5.1).

a. RR-C-901	Cylinders, Compressed Gas: Seamless Shatterproof, High Pressure DOT 3AA Steel, and 3AL Aluminum
b. 49 CFR 171 – 199	Code of Federal Regulations

6.5 Particulate contamination. Long term storage of filled argon containers may allow particulate contaminants to accumulate. For this reason, the installation of in-line filters between the containers and system (if applicable) is recommended prior to use. Filters with a rating of five micrometer nominal and 25 micrometer absolute rating or better for Type I (gaseous) and with a 10 micrometer nominal and 40 micrometer absolute rating or better for Type II (liquid) are suggested.

Aerospace  
Cylinders  
Missile checkout  
Welding gas  
Inerting agent

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 extent of the changes.

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**TABLE III. Pressure temperature conversion chart  
container service pressure – 6000 psig. <sup>1</sup>**

TEMP °C (°F)	PSIG	TEMP °C (°F)	PSIG	TEMP °C (°F)	PSIG
-18 (0)	4567	7 (44)	5469	31 (88)	6366
-17 (2)	4608	8 (46)	5510	32 (90)	6407
-16 (4)	4649	9 (48)	5551	33 (92)	6448
-14 (6)	4690	10 (50)	5592	34 (94)	6488
-13 (8)	4731	11 (52)	5633	36 (96)	6529
-12 (10)	4772	12 (54)	5674	37 (98)	6570
-11 (12)	4813	13 (56)	5714	38 (100)	6610
-10 (14)	4854	14 (58)	5755	39 (102)	6651
-9 (16)	4895	16 (60)	5796	40 (104)	6691
-8 (18)	4936	17 (62)	5837	41 (106)	6732
-7 (20)	4978	18 (64)	5878	42 (108)	6772
-6 (22)	5019	19 (66)	5918	43 (110)	6813
-4 (24)	5060	20 (68)	5959	44 (112)	6853
-3 (26)	5101	21 (70)	6000	46 (114)	6894
-2 (28)	5142	22 (72)	6041	47 (116)	6935
-1 (30)	5183	23 (74)	6081	48 (118)	6975
0 (32)	5224	24 (76)	6122	49 (120)	7016
1 (34)	5265	25 (78)	6163	50 (122)	7056
2 (36)	5305	27 (80)	6204	51 (124)	7096
3 (38)	5346	28 (82)	6244	52 (126)	7137
4 (40)	5387	29 (84)	6285	53 (128)	7177
6 (42)	5428	30 (86)	6326	54 (130)	7218
Note 1: Calculated from the equation of state for argon of A. L. Gosman, et al. See NBS Technical Publication NSRDS 27 (Available through NIST).					

## CONCLUDING MATERIAL

## Custodians:

Army – MI

Navy – AS

Air Force – 68

DLA – PS

## Preparing activity:

Air Force – 68

(Project 9135-2011-006)

## Review activities:

Air Force – 19

## Civil Agency:

NASA – NA

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