THIS DOCUMENT PROVIDED BY THE ABBOTT AEROSPACE
TECHNICAL LIBRARY
ABBOTTAEROSPACE.COM

METRIC

MIL-PRF-27407D
1 August 2014

SUPERSEDING
MIL-PRF-27407C
29 November 2006

PERFORMANCE SPECIFICATION

PROPELLANT PRESSURIZING AGENT, HELIUM

.

Comments, suggestions, or questions on this document should be addressed to AFPA/PTPS, 2430 C Street, Bldg 70, Area B, Wright-Patterson AFB OH 45433-7632 or e-mailed to 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

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

THIS DOCUMENT PROVIDED BY THE ABBOTT AEROSPACE
TECHNICAL LIBRARY
ABBOTTAEROSPACE.COM

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 helium.

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

1.2.1 Types. The types of helium are as follows:

Type I - Gaseous

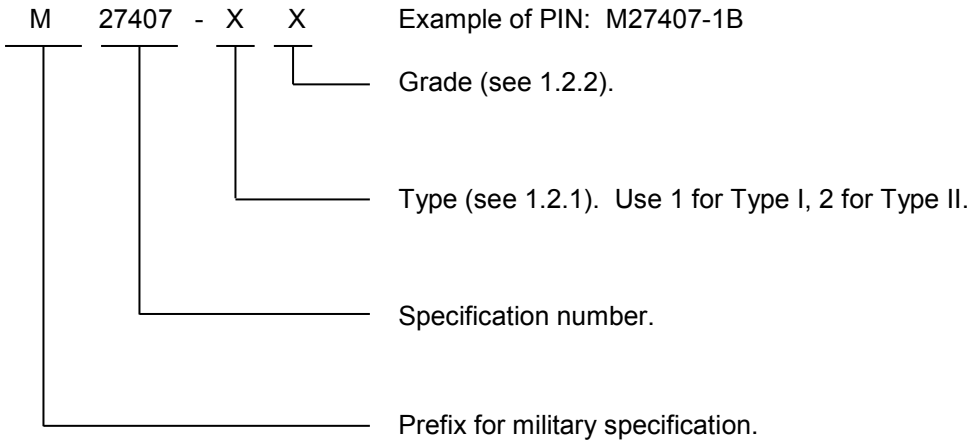
Type II - Liquid

1.2.2 Grades (Type I only). The grades of helium are as follows:

Grade A - Pressurizing

Grade B - Respirable

1.3 Part or identifying number (PIN). The PINs to be used for helium 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 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 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 STANDARDS

MIL-STD-101	Color Code for Pipelines and for Compressed Gas Cylinders
MIL-STD-1411	Inspection and Maintenance of Compressed Gas Cylinders

THIS DOCUMENT PROVIDED BY THE ABBOTT AEROSPACE
TECHNICAL LIBRARY
ABBOTTAEROSPACE.COM

COMMERCIAL ITEM DESCRIPTIONS

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

(Copies of these documents are available online at http://quicksearch.dla.mil.)

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.)

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-9.1	Commodity Specification for Helium
CGA P-15	Filling of Industrial and Medical Nonflammable Compressed Gas Cylinders

(Copies of these documents are available online at http://www.cganet.com.)

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 (except for related specification sheets), 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 Grade requirements.

3.1.1 Type I. The purity and impurity concentrations as applicable to each grade of helium shall conform to the limits of Table I when tested in accordance with the applicable test method also specified in Table I. Limits and tests may be added or deleted by the procuring activity (see 6.2).

3.1.2 Type II. The liquid shall pass the helium assurance test of 4.5. When using the vent gas analysis (see 4.5), the vent gas analysis shall conform to the limits of Table I. Limits and tests may be added or deleted 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. Unless otherwise specified (see 6.2), Types I and II need not be filtered.

3.4 Filled containers (Type I only).

3.4.1 Filling 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 4.6.1. In no case shall the

THIS DOCUMENT PROVIDED BY THE ABBOTT AEROSPACE
TECHNICAL LIBRARY
ABBOTTAEROSPACE.COM

filling pressure exceed the rated service pressure of the container. Pressure-Temperature Filling Charts in CGA P-15 may be used.

3.4.2 Leakage. Cylinders shall not leak when tested according to 4.6.2.

3.4.3 Inspection and maintenance. Compressed gas cylinders shall be inspected, maintained and charged according to 4.6.3.

4. VERIFICATION

4.1 Points of inspection (see 6.2). 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 4.6

a. Filling pressure 4.6.1

b. Leakage 4.6.2

TABLE I. Grade limits for helium (Type I, gaseous only) [1]

	Grade		Test Method
	A	B	
Purity, % by vol, min	99.995	99.997	4.4.1
Impurities, ppm by vol, max	50	--[2]	4.4.2
Water	9	9	4.4.2
Hydrocarbons (as methane)	5	1	4.4.2
Oxygen	3	3	4.4.2
Nitrogen + argon	14	5	4.4.2
Neon	23	23	4.4.2
Hydrogen	1	1	4.4.2
Carbon dioxide	1	--[2]	4.4.2
Carbon monoxide	1	--[2]	4.4.2

Notes:
1. For Type II requirements see 4.5. When using vent gas analysis, the analysis shall conform to Grade A or B requirements, as specified in the contract.
2. No limit for this grade; minimum purity shall be met.

THIS DOCUMENT PROVIDED BY THE ABBOTT AEROSPACE
TECHNICAL LIBRARY
ABBOTTAEROSPACE.COM

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

4.2.2 Sampling tests. Type I helium shall be selected according to 4.2.2.1 and tested for the requirements of Table I as specified in 4.4. Type II helium shall be selected according to 4.2.2.2 and tested for the requirements of 3.1.2 as specified in 4.5.

4.2.2.1 Sampling plan (Type I). The number of helium containers sampled from each lot, as defined in 4.2.3, shall be selected in accordance with Table II.

4.2.2.2 Sampling plan (Type II). One sample shall be taken from each lot, as defined in 4.2.3.

4.2.3 Lot. A lot shall consist of one of the following:

a. Type I. For gas cylinders, a lot is defined as all of the helium supplied in one or more container(s) filled from a single manifold at the same time. This includes gas containers that are interconnected by a single manifold that equalizes the pressure across all the containers. The first and last cylinders filled within a given lot are typically sampled. Other samples may be selected at random as required (see 6.2).

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

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 testing. Each sample taken for analysis shall be representative of the entire contents of the container being sampled.

4.2.5 Sampling Methods. Unless otherwise specified in the acquisition requirements, sampling shall be accomplished by one of the following methods.

a. Type I, gaseous helium may be sampled in accordance with ASTM F307 and Type II, liquid helium 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.

4.3 Rejection. When any sample tested in accordance with 4.4 or 4.5 fails to conform to the requirements specified herein, the entire lot represented by the sample shall be rejected.

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

THIS DOCUMENT PROVIDED BY THE ABBOTT AEROSPACE
TECHNICAL LIBRARY
ABBOTTAEROSPACE.COM

4.4.1 Purity. The helium percent shall be found by determining the aggregate impurities by the methods of CGA G-9.1. The aggregate impurities shall include all of the impurities listed in Table I, regardless of the Grade analyzed. The percent helium is the value obtained when this amount, expressed as volume percent, is subtracted from 100 percent.

4.4.2 Impurities. The analytical procedures described in CGA G-9.1 shall be used to determine the concentration of each impurity listed in Table I.

4.5 Helium assurance test (Type II). Liquid helium is generally assumed to be extremely pure because contaminants have been removed during the early stages of the liquefaction process which occurs at -269°C. It follows that assuring that the fluid is helium is sufficient to verify a contaminant free product. The requirement for ensuring that the loaded fluid is liquid helium can be satisfied by one of the following methods:

a. Analyzing the vent gas and verifying the purity for the grade from one of the shipping containers by:

1. A thermal conductivity detector (TCD) measuring the aggregate impurities that have different thermal conductivities than helium. The analyzer shall be calibrated at appropriate intervals by using gas calibration standards (see 4.4).

2. Determining the aggregate impurities using the methods in 4.4.

3. Determining the aggregate of all impurities by mass spectrometer. The percent helium is the value obtained when the aggregate expressed as percent (v/v) is subtracted from 100%.

b. Demonstrating that fluid in one of the shipping containers or the storage tank from which the shipping containers are filled is below the hydrogen triple point (-259°C).

4.6 Containers of Type I helium.

4.6.1 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. The gauge shall have scale divisions not greater than 100 kPa (15 psi). Then the valve shall be opened and the internal pressure observed on the gauge. 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.

4.6.2 Leakage. Each Type I helium 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.

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

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

4.6.3.2 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.

THIS DOCUMENT PROVIDED BY THE ABBOTT AEROSPACE
TECHNICAL LIBRARY
ABBOTTAEROSPACE.COM

6. NOTES

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

6.1 Intended use. Type I, Grade A, helium is intended for pressurization of military rocket engine propellant systems, space vehicles and associated ground support equipment, welding and other shielding gas operations. Type I, Grade B, helium is intended for use (when blended with oxygen) as a respirable breathing gas for divers during deep excursions into the oceans. Type II helium is intended for use as a cryogenic coolant in specialized test and measurement equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Type and grade required, if applicable (see 1.2). Grades only apply to Type I.
c. Method of shipment, type and capacity of containers.
d. When limits or tests are to be added or deleted (see 3.1.1).
e. When filtration is required (see 3.3).
f. When variation in points of inspection is granted (see 4.1).
g. When conformance tests on each sample are not required (see 4.2.4).
h. When other analytical procedures are to be used (see 4.4).
i. Cylinder size, capacity and fill pressure (as determined by cylinder size and capacity).

6.3 Packaging requirements. Guidance for cylinders may be found in the following documents:

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
c. CGA C-6	Standards for Visual Inspection of Steel Compressed Gas Cylinders

6.4 Subject term (key word) listing.

Aerospace
Breathing
Coolant
Cryogenic
Cylinders
Divers
Respiration
Shielding
Space vehicle
Welding

6.5 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.

THIS DOCUMENT PROVIDED BY THE ABBOTT AEROSPACE
TECHNICAL LIBRARY
ABBOTTAEROSPACE.COM

CONCLUDING MATERIAL

Custodians:
Navy – AS
Air Force – 68
DLA – PS

Review activities:
Air Force – 19

Civil Agency:
NASA – NA

Preparing activity:
Air Force – 68
(Project 9135-2011-004)

Note: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil.