

BB-N-411C
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SUPERSEDING
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FEDERAL SPECIFICATION

NITROGEN, TECHNICAL

This specification was approved by the Commissioner, Federal Supply Services, General Services Administration, for use of all Federal Agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers gaseous and liquid nitrogen.

1.2 Classification.

1.2.1 Types, grades, and classes. The nitrogen shall be of the following types, grades, and classes, as specified (see 6.2):

Type I - Gaseous.

Type II - Liquid.

Grade A - 99.95 percent pure.

Grade B - 99.50 percent pure.

Grade C - 99.50 percent pure, moisture content not specified (type I only).

Class 1 - Oil free.

Class 2 - Oil tolerant (Type I only) (see 6.3).

2. APPLICABLE DOCUMENTS

2.1. Specifications and standards. The following specifications and standards 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 Specification

RR-C-901 - Cylinders, Compressed Gas: With Valve of Plug and Cap; ICC 3AA.

Federal Standard

FED. STD. No. 123 - Marking for Domestic Shipment (Civilian Agencies).

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(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly 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 and other Federal Specifications required by activities outside the Federal government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.)

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specifications.

MIL-V-2	- Valve; Cylinder, Gas.
MIL-T-704	- Treatment and Painting of Material

Military Standards.

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 and containerized Unite Loads 40" x 48" Pallets, Skids, Runners, or Pallet-Type Base.

(Copies of Military Specifications and Standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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

DEPARTMENT OF TRANSPORTATION

49 CFR 171-190 - Code of Federal Regulations.

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

NATIONAL BUREAU OF STANDARDS

Handbook H28 - Screw-Thread Standards for Federal Services

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

COMPRESSED GAS ASSOCIATION, INC.

- CGA Specification G-10.1 Commodity Specification for Nitrogen (first edition, dated 1969).
 CGA Pamphlet C-6 Standards for Visual Inspection of Compressed Gas Cylinders.
 CGA Pamphlet C-1 Methods for Hydrostatic Testing of Compressed Gas Cylinder.

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).

F310-70 Sampling Cryogenic Aerospace Fluids

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

3. REQUIREMENTS

3.1 Materials. The nitrogen shall conform to table I.

Table I.
Properties of Nitrogen, Technical.

Property	Requirement		
	Grade A	Grade B	Grade C
Purity, min. percent by volume	99.95	99.50	99.50
Oxygen, max. percent by volume	0.05	0.50	0.50
Moisture, max milgm H ₂ O/l of gas	0.02	0.02	*
Odor (see note 2)	None	None	None

* No limiting characteristics

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Notes:

1. Purity is the percent nitrogen and includes trace quantities of argon, neon, and helium.
2. All types and grades of nitrogen shall be free of oil contamination and shall have a total hydrocarbon level less than 50 ppm as methane by volume detectable by odor or by test when specified (see 4.4.2.5).
3. Nitrogen, type I and type II shall be produced in processes utilizing liquefaction of air and compressed by a cryogenic liquid converter or a water sealed or dry sealed compressor.
4. The type I nitrogen shall contain no solid particles whose maximum dimensions are greater than 50 microns. This shall be assumed to have been assured by the use of a 10 micron or better nominal filter at or close to the cylinder charging manifold (see 6.4.).

3.2 Containers and valves.

3.2.1 Type I, gaseous. Unless otherwise specified herein, the type I gaseous nitrogen shall be contained in Government-furnished cylinders (see 6.5) which are in accordance with 49 CFR 171-190 and equipped with valves having outlet connections in accordance with Handbook H28 or MIL-V-2 (see 6.3). When specified (see 6.2), new cylinders shall be furnished to the Government by the gas supplier. The cylinders shall be in accordance with RR-C-901 and shall be equipped with valves in accordance with MIL-V-2. When specified (see 6.2.), the gaseous nitrogen shall be contained in supplier owned, DOT approved containers.

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

3.3 Container maintenance. Unless Otherwise specified (see 6.2), containers that require maintenance shall be precessed by the supplier for serviceability to meet the requirements of this specification and 49 CFR 171-190 (see 6.6).

3.3.1 Processing type I nitrogen cylinder.

3.3.1.1 External inspection. Each cylinder and valve shall be examined for external corrosion or damage in accordance with CGA Pamphlet C-6, and for clarity of markings in accordance with 49 CFR 171-190. The area of the cylinder and valve shall be inspected for contamination. Cylinders having excessive corrosion, physical damage, evidence of exposure to fire or

evidence of a contaminate that cannot be removed by the supplier's standard handling procedures, or cylinders having a damaged or incorrect valve, or with unclear or incorrect marking shall not be refilled. When the contract or order does not provide for reconditioning of the Government-owned cylinder and valve, any defective cylinder shall be returned unfilled.

3.3.1.2. Hydrostatic testing. Each cylinder shall be inspected to determine the last date of hydrostatic testing. Unless otherwise specified herein, cylinders that have not been hydrostatically tested within 5 years prior to the intended fill date shall be hydrostatically tested and clearly marked in accordance with CGA Pamphlet C-1. Each cylinder subjected to the hydrostatic test shall be dried as specified in 3.3.1.3. When the contract or order does not specify hydrostatic testing, any cylinder requiring hydrostatic test shall be returned to the Government unfilled. When specified (see 6.2), hydrostatic retest period shall be 10 years.

3.3.1.3 Cylinder drying. When required, all cylinders shall be dried by either the hot-gas purging method specified in 3.3.1.3.1, or by the evacuation method specified in 3.3.1.3.2.

3.3.1.3.1 Hot-gas purging method. The cylinder shall be dried by the cylinder valve, inserting a tube extending approximately to the closed end of the cylinder, and passing clean, hot (300 deg. to 350 deg. F.) dry oil free air or nitrogen through the tube until the temperature of the open end reaches 180 deg. F., or the escaping gas reaches 215 deg. to 225 deg. F. The cylinder shall be inverted with the open end down for this hot purge so that the longitudinal axis of the cylinder is not more than 45 degrees from vertical. The supplier's standard drying process shall be acceptable, provided it can be demonstrated that the drying process has eliminated the moisture from the treated cylinder determined by the dewpoint of the escaping gas becoming constant with that of the dry purging gas.

3.3.1.3.2 Evacuation method. The cylinder shall be dried by attaching a vacuum pump to the cylinder valve outlet, opening the valve, and heating the cylinder to approximately 180 deg. F. in an oven or hot water bath while evacuating the cylinder to a pressure of 3 inches of mercury (Hg) or better.

3.3.1.4 Residual pressure and odor. The cylinders shall be inspected for residual pressure and sniff-tested for odor. Any cylinder having no residual pressure shall be pressurized to not less than 25 psi of nitrogen pressure and checked for odor and any condensed contaminants. Any cylinder

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having an odor or containing condensed contaminants which can not be removed by the supplier's standard handling procedure shall not be refilled. When the contract or order does not provide for reconditioning of the Government owned cylinders, the cylinders shall be returned unfilled.

3.3.1.5 Hammer test. During the inspection process, each cylinder shall be subjected to hammer testing for progressive corrosion or for the presence of contaminants which are not odor bearing. Cylinders that do not resound clearly shall not be refilled. When the contract or order does not provide for reconditioning of the Government-owned cylinders, the cylinders shall be returned unfilled.

3.3.1.6 Cylinder evacuation. Prior to filling, all cylinders shall be evacuated to a pressure of mercury (Hg) or better.

3.3.2 Painting. Government-furnished containers for nitrogen requiring repainting shall be cleaned, treated, and painted in accordance with MIL-T-704. The Government-furnished cylinders for type I gaseous nitrogen which are repainted shall be color coded and marked in accordance with MIL-STD-101.

3.3.3 Valves. Unless otherwise specified (see 6.2), replace valves for defective valves in Government-furnished cylinders for type I gaseous nitrogen shall be supplier furnished and installed and shall be in accordance with MIL-V-2.

3.4 Capacity. Containers of gaseous nitrogen shall be filled to the rated service pressure. The settled pressure in a filled container shall be within 25 pounds per square inch gage (psig) pressure of the pressure that corresponds to the settled container temperature as shown on Table II. Unless otherwise specified (see 6.2), containers of liquid nitrogen shall be filled to the rated capacity. Containers shall be filled in accordance with 49 CFR 171-190.

TABLE II. Pressure-Temperature Conversion Chart. Settled pressure (expressed in psig) which corresponds to the rated service pressure for a container filled to capacity.

Settled Temp of	Container service pressure--gaseous nitrogen					
	1800	2015	2200	2265	2400	3500
-50	1270	1207	1528	1574	1653	2385
-48	1279	1417	1540	1588	1667	2404
-46	1288	1427	1552	1601	1680	2423
-44	1297	1437	1564	1614	1693	2442
-42	1306	1447	1575	1627	1707	2460
-40	1315	1457	1585	1630	1720	2479
-38	1342	1468	1597	1643	1733	2497
-36	1338	1478	1609	1655	1746	2516
-34	1342	1488	1621	1667	1758	2534
-32	1351	1499	1632	1678	1771	2552
-30	1360	1509	1643	1689	1783	2571
-28	1369	1519	1654	1701	1795	2589
-26	1378	1529	1665	1713	1807	2608
-24	1387	1539	1676	1724	1819	2627
-22	1396	1550	1688	1735	1831	2645
-20	1405	1560	1699	1746	1843	2664
-18	1414	1570	1710	1757	1855	2683
-16	1423	1580	1722	1768	1868	2711
-14	1432	1590	1733	1780	1881	2730
-12	1441	1601	1744	1792	1893	2748
-10	1449	1611	1755	1804	1905	2757
- 8	1458	1621	1767	1815	1918	2776
- 6	1467	1631	1778	1827	1930	2795
- 4	1476	1641	1789	1839	1943	2813
- 2	1484	1651	1800	1850	1955	2832
0	1494	1661	1811	1861	1968	2851
+ 2	1503	1671	1823	1873	1980	2869
4	1511	1682	1833	1885	1993	2888
6	1520	1692	1845	1896	2005	2906
8	1528	1702	1856	1908	2017	2925
10	1538	1712	1867	1920	2030	2943
12	1546	1722	1878	1931	2042	2962
14	1555	1732	1889	1942	2055	2980
16	1563	1742	1901	1954	2067	2999
18	1573	1753	1912	1966	2079	3017
20	1582	1763	1923	1978	2092	3036
22	1590	1773	1934	1989	2104	3055
24	1599	1783	1945	2000	2116	3073
26	1608	1793	1956	2013	2129	3092
28	1616	1803	1967	2024	2141	3111
30	1625	1814	1978	2035	2154	3129

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TABLE II. Pressure-Temperature Conversion Chart. Settled pressure (expressed in psig) which corresponds to the rated service pressure for a container filled to capacity.

Settled Temp of	Container service pressure--gaseous nitrogen					
	1800	2015	2200	2265	2400	3500
32	1634	1824	1990	2046	2166	3148
34	1643	1834	2001	2058	2178	3167
36	1652	1844	2012	2070	2190	3185
38	1660	1854	2023	2082	2203	3204
40	1669	1864	2034	2093	2215	3222
42	1677	1874	2045	2105	2227	3241
44	1686	1884	2056	2116	2240	3260
46	1695	1894	2068	2128	2252	3278
48	1704	1904	2079	2139	2264	3297
50	1713	1914	2090	2150	2276	3316
52	1721	1924	2101	2162	2289	3334
54	1730	1934	2112	2173	2301	3353
56	1739	1944	2123	2185	2313	3371
58	1748	1954	2134	2196	2326	3389
60	1756	1964	2145	2208	2338	3408
62	1765	1975	2156	2219	2350	3426
64	1774	1985	2167	2230	2362	3445
66	1782	1995	2178	2242	2375	3463
68	1791	2005	2189	2253	2387	3482
70	1800	2015	2200	2265	2400	3500
72	1809	2025	2211	2279	2412	3519
74	1817	2035	2222	2288	2424	3537
76	1826	2045	2233	2300	2437	3556
78	1834	2055	2244	2310	2449	3574
80	1843	2065	2256	2322	2461	3598
82	1851	2075	2267	2333	2473	3601
84	1861	2085	2278	2345	2486	3620
86	1869	2095	2289	2357	2498	3639
88	1878	2105	2300	2368	2510	3658
90	1887	2115	2311	2379	2522	3686
92	1896	2225	2322	2390	2534	3705
94	1904	2135	2333	2402	2546	3723
96	1912	2145	2344	2414	2559	3741
98	1921	2154	2355	2425	2571	3760
100	1930	2164	2366	2436	2583	3778
102	1939	2174	2377	2448	2595	3796
104	1948	2184	2388	2459	2608	3814
106	1956	2194	2399	2470	2620	3832
108	1964	2204	2410	2482	2631	3850
110	1973	2214	2421	2494	2644	3868

TABLE II. Pressure-Temperature Conversion Chart. Settled pressure (expressed in psig) which correspond to the rated service pressure for a container filled to capacity.

Settled Temp of	Container service pressure--gaseous nitrogen					
	1800	2015	2200	2265	2400	3500
112	1982	2224	2432	3505	2656	3887
114	1991	2234	2443	2516	2669	3905
116	2000	2244	2454	2528	2680	3924
118	2008	2254	2465	2539	2693	3942
120	2017	2263	2476	2550	2705	3961
122	2025	2273	2486	2561	2718	3979
124	2034	2283	2498	2573	2729	3996
126	2043	2293	2509	2584	2741	4014
128	2051	2303	2520	2595	2754	4032
130	2060	2313	2530	2607	2766	4049
132	2069	2323	2541	2618	2778	4067
134	2078	2333	2553	2630	2790	4085
136	2086	2342	2564	2641	2803	4101
138	2094	2352	2574	2652	2814	4119
140	2103	2362	2585	2663	2826	4136
142	2111	2372	2596	2675	2839	4154
144	2120	2381	2608	2686	2851	4172
146	2129	2391	2619	2697	2863	4189
148	2138	2401	2630	2709	2875	4207
150	2147	2411	2641	2720	2887	4224

3.5 Leakage. Containers and valve shall not leak after being filled.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance at all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 on the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of inspection. Inspection shall be classified as follows:

- (a) Quality conformance inspection (see 4.3).
- (b) Inspection of preparation for delivery (see 4.5).

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4.3 Quality conformance inspection.

4.3.1 Inspection lot.

4.3.1.1 Type I, gaseous. A lot shall consist of all cylinders filled from the same source during a consecutive 24 hour period. A source is considered to be either an individual nitrogen producing process, or an individual storage container to which no nitrogen is added after the initial filling. Once nitrogen is added to a storage container from which cylinders are being filled, that storage container is prescribed as being a different source.

4.3.1.1.1 Sampling, Type 1. Sampling shall be from filled cylinders which shall be selected in accordance with MIL-STD-105, inspection level S-4.

4.3.1.2 Type II liquid. Each filled container shall be considered a lot.

4.3.1.2.1 Sampling, type II. Sampling of type II liquid oxygen shall be in accordance with ASTM F310-70 Standard Method of Sampling Cryogenic Aerospace Fluids.

4.3.1.3 Sampling, small containers. Type II nitrogen shall be drawn from each container. When specified (see 6.2), bulk liquid nitrogen used exclusively for filling an entire order of small liquid containers may be sampled and tested immediately prior to the actual transfer in lieu of testing samples from the small liquid containers.

4.3.2 Examination. Each container shall be examined as specified in 4.4.1. Presence of one or more defects shall be cause for rejection.

4.3.3 Tests.

4.3.3.1 Individual. Each container shall be tested as specified in 4.4.2.4 for leakage. Failure of the test shall be cause for rejection.

4.3.3.2 Samples. Samples selected in accordance with 4.3.1.1.1 and 4.3.1.2.1 shall be tested in accordance with 4.4.2. AQL shall be 2.5 percent defective. The nitrogen sample for testing shall be representative of the type I nitrogen supplied in the cylinders.

4.4 Inspection procedure.

4.4.1 Examination. Each container of nitrogen shall be examined as specified herein for the following defects:

101. Container or valve not as specified.
102. Container maintenance not as specified.
103. Capacity not as specified.

4.4.2 Tests. Before any test, sufficient nitrogen shall be permitted to flow to displace any other gas present in the test equipment lines. Liquid nitrogen shall be in vapor form for the tests.

4.4.2.1 Purity and oxygen. The purity and the oxygen content, percentages by volume, shall be determined by Gas Chromatograph as outlined in 4.4.2.1.1 or by one of the oxygen analysis methods specified in section 5.5 of CGA Specification G-10.1, with the following provisions:

- (a) The comparison tube apparatus described in 5.5.7 of MA G-10.1 shall not be applicable.
- (b) Analytical instruments shall be appropriately calibrated and operated within the maximum range as specified in CGA G-10.1.
- (c) Orsat apparatus, if used, shall be such that accuracy shall be at least plus or minus 0.01 percent by volume for grade A nitrogen and at least plus or minus 0.1 percent by volume for grades B or C nitrogen.
- (d) In case of dispute the gas, chromatograph method shall be the reference standard.

Purity and oxygen content not as specified in 3.1 shall constitute failure of this test.

4.4.2.1.1 Gas chromatograph apparatus method. The purity of nitrogen shall be determined in accordance with the following gas chromatographic procedures:

- (a) Apparatus - A gas chromatograph having the following minimum capabilities is required:
 - (1) Temperature control systems capable of maintaining the chromatographic column and detector at the prescribed temperature +/- 1 deg. C.
 - (2) Gas sampling valve.
 - (3) Not wire or thermistor type thermal conductivity detector.
 - (4) Recorder or other readout.
- (b) Materials - The following materials are required:
 - (1) Chromatographic column - A tubular column constructed of aluminum, copper or stainless steel, 6 feet long by 1/4 inch outside diameter. (Optimum column size will vary between instruments). The column is to be packed with activated Molecular Sieve 5A or 13X.

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- (2) Carrier Gas - dry helium of a minimum of 99-95 volume percent purity.
- (3) Standards - Appropriate standards containing 0.05% by volume oxygen (Grade A) and 0.50% by volume oxygen (Grade B) may be obtained from Gas Supply Facilities or prepared in the laboratory.
- (c) Analysis Parameters - The following general analysis conditions are recommended. The parameters will between instruments.
- (1) Column temperature - 60 deg. C isothermal
 - (2) Detector temperature (when separate from column) - 150 deg. C
 - (3) Sample size - 0.5cc or as appropriate for instrument
 - (4) Carrier gas flow - 20 ml per minute (will vary with instrument)
 - (5) Detector current - sufficient to easily detect the oxygen requirement of Grade A or B.
- (d) Constituent identification - Employing the operating conditions specified, oxygen followed by nitrogen will elute from the column within 5 minutes.
- (e) Quantitative measurement - Quantitative measurement of a component concentration depends upon a determination of the peak height or peak area of the component's chromatograph peak. For the determination of oxygen, the peak is sufficiently sharp to recommend the use of peak height in lieu of peak area. To obtain the percent concentration of the oxygen component, a direct comparison is made between the peak height of the oxygen and that of a standard containing a known concentration of oxygen. Both the sample and the standard must be analyzed under identical operating conditions. The volume percent of the oxygen component may be calculated by using the following equation:

$$\% \text{ (Vol) } O_2 - \frac{\text{Peak Height } O_2 \text{ in Sample}}{\text{Peak Height } O_2 \text{ in Std}} \times \% \text{ (vol) } O_2 \text{ in Std}$$

4.4.2.2 Moisture content. The moisture content shall be determined by either the accelerated gravimetric method as specified in 4.4.2.2.1. or one of the moisture content analysis methods specified in section 5.3 of CGA G-10.1 with the following provisions:

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- (a) The condensed water measurement Method described in section 5.3.1 of CGA C-10.1 is not applicable.
- (b) Analytical instruments shall be appropriately calibrated and operated within the maximum range as specified in CGA G-10.1. Analytical apparatus shall be such that measurement can be made with a precision of at least plus or 0.002 milligram water per liter of gas.
- (c) The 0.02 milligram water per liter of gas is equivalent to 26.3 parts per million water vapor by volume, and also to a dewpoint of minus 63.5 deg. F.

Moisture content not as specified in 3.1 shall constitute failure of this test.

4.4.2.2.1 Accelerated gravimetric method. The moisture content shall be determined by measurement of increase in weight of phosphorus pentoxide (P_2O_5) when subjected to a flow of a measured volume of nitrogen in the following procedure:

- (a) The container to be tested shall be inverted in a suitable rack. The container shall be connected to the test apparatus by means of a length of bent, seamless, corrosion-resisting steel tubing, and a high-pressure union needle valves and a glass-to-metal joint. (No rubber connections shall be used; a sleeve Joint secured with "tygon" or equivalent is acceptable). The apparatus shall consist of three U-tube absorbers-in series, each 4 inches high and 1/2 inch in diameter, containing phosphorous pentoxide on glass wool and connected through a water-saturator to a calibrated wet-test meter of 1/20-cubic-foot size equipped with a 1-liter dial.
- (b) A mercury safety valve shall be connected between the lower-pressure outlet of the needle valve and the first absorber. The steel tube shall be so fabricated that it will first pass through a water bath at room temperature and then into a second bath also at room temperature. The needle valve connecting cylinder to the absorber shall be flushed with nitrogen 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 nitrogen before they are weighed so they will be at all times filled with nitrogen. Before each weighing of the opened absorbers, they shall be opened momentarily to the air, closed, and cleaned. One-hundred liters of gaseous nitrogen shall be discharged through the apparatus at a rate not to exceed 0.4 liter per minute.

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- (c) The gas volume corresponding to the gain in weight shall be calculated to 760 mm. of mercury and 70 deg. F. The moisture content shall be computed in term of milligrams per liter.

4.4.2.3 Odor. Filled containers of nitrogen shall be sniff-tested. A sniff-test is made by wafting a low level of effluent vapor from a liquid nitrogen container or escaping gas from a nitrogen cylinder past the tester's nostrils with a hand or a card. The detection of any odor in the effluent gas from any container shall constitute failure of this test.

4.4.2.4 Leakage. All containers after filling shall be tested for leakage by applying a soap solution to all portions of the valve and the junction of the valve and cylinder. Care shall be taken to ensure that the solution utilized does not contaminate the valve outlet. Any leakage as evidenced by bubbling of the soap solution shall constitute failure of this test.

4.4.2.5 Total hydrocarbon content. When specified (see 6.2), a total hydrocarbon content shall be determined by means of one of the total hydrocarbon methods specified in section 5.5 of CGA specification G-10.1.

4.5 Inspection of preparation for delivery. Each container of nitrogen shall be examined for compliance with the requirements of 5.1 and the marking shall be examined to determine whether any marking is missing, illegible, incorrect, or incomplete. Any one defect shall be cause for rejection.

5. PREPARATION FOR DELIVERY

5.1 Packing. Shipment of the containers of nitrogen shall conform to 49 CFR 171-190.

5.1.1 Palletization. When specified (see nitrogen contained in cylinders shall be pelletized in accordance with MIL-STD-147.

5.2 Marking. The containers shall be marking in accordance with 49 CFR 171-190. Each container shall be stenciled or tagged with the type, grade, and class of nitrogen it contains.

5.2.1 Civil agencies. In addition to the marking specified in 5.2, the containers shall be marked in accordance with FED. STD. No. 123.

5.2.2 Military agencies. In addition to the marking specified in 5.2, the containers shall be marked in accordance with MM-STD-129.

6. NOTES

6.1 Intended use. Gaseous nitrogen is used for pressurizing fuel tanks and hydraulic system accumulators, superpressurizing carbon dioxide and

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fluorocarbon cylinders (e.g., fire extinguishers), purging equipment calibrating instruments, and providing inert atmospheres. Oxygen systems may be purged with class 1 nitrogen. The grade A nitrogen in a gaseous state is specifically intended for purging missile systems equipment. Grade A and grade B, class nitrogen are suitable for purging aircraft oxygen converters, pressurize aircraft struts, and purging and pressurizing rocket engine propellant systems. Liquid nitrogen is used as a cooling agent in low temperature processes, as an agent to shield against heat effects on temperature-critical apparatus, and as a source of gaseous nitrogen.

6.2 Ordering data. Purchasers should exercise any desired options offered herein, and procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type, grade and class of nitrogen required (see 1.2).
- (c) When new cylinders are to be furnished to the Government by the gas supplier or when the gaseous nitrogen is to be contained in supplier-owned containers (see 3.2.1).
- (d) Whether liquid nitrogen is to be delivery in supplier-owned or Government-furnished containers or tank trucks (see 3.2.2).
- (e) Extent of maintenance required on Government-furnished containers (see 3.3 and 6.6).
- (f) When hydrostatic testing is required every 10 years in lieu of 5 years, (see 3.3.1.2).
- (g) When replacement valves for Government-furnished cylinders are not to be furnished by the supplier (see 3.3.3).
- (h) Quantity of liquid nitrogen required in a container, if less than rated capacity (see 3.4).
- (i) When bulk liquid nitrogen may be tested in lieu of sample small liquid containers filled from bulk source (see 4.3.1.3).
- (j) When total hydrocarbon content test is required (see 4.4.2.5).
- (k) When cylinders are to be palletized (see 5.1.1).

6.3 Class 1 and class 2 nitrogen. Gaseous nitrogen is considered oil free, if the gas is compressed with a water-lubricated or dry-seal compressor or a cryogenic converter and if the gas is produced from a liquid nitrogen source. Liquid nitrogen is oil free by nature of the production process. Contamination would be caused by contact with contaminated equipment or by improper container handling methods. Cylinders for nitrogen are considered oil free if the cylinder meet the maintenance criteria specified in 3.3, or if the cylinders are internally cleaned to meet the oil-free criteria specified in RR-C-901. The container maintenance and nitrogen production requirements of BB-N-411 insure that both class 1 and class 2 nitrogen are handled identically. The only remaining difference between

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classes is the valve-outlet application. Class I nitrogen cylinders utilize either connection 580 or 000, whereas class 2 nitrogen cylinders use connection 590. Connection 590 is obsolete for nitrogen service and is to be phased out of the Government system. Users should replace valves having connections 590 with valves having connection 580 in normal cylinder maintenance. The 000 connection is a non-standard outlet used to service artillery. Users should consider replacing the connection 000 with connection 580.

6.4 Particulate matter control. For some purposes, such as aircraft oxygen converter purging, pressurization of aircraft struts, and purging and pressurization of rocket engine propellant systems, it is important to control the nitrogen particulate matter content as specified in 3.1. Control of particulate matter in the user's dispensing equipment can be assured by the installation of a 10 micron or better nominal filter in the service line.

6.5 Government-furnished containers. The contracting officer should arrange to furnish the cylinders specified in 3.2.1.

6.6 Maintenance of Government-furnished containers. Purchasers should specify the extent to which Government-furnish containers that require maintenance should be processed by the gas supplier.

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

6.6.2 A schedule of allowable fees should be specified by the purchaser for the gas supplier's performance of services 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 supplier.

6.7 Grade comparison. The limiting characteristics of the nitrogen grades specified herein are considered identical to those of grades presented in Compressed Gas Association (CGA) Specification for Nitrogen, G-10.1 as follows:

	GRADES		
	A	B	C
BB-N-411	A	B	C
G-10.1 (ed. 1969)	G	D	C

6.8 Basis of purchase.

6.8.1 Type I (gaseous) nitrogen should be purchased by the cubic foot, based upon normal atmospheric conditions. Gaseous nitrogen is available in several cylinder sizes ranging from 180 through 340 cubic feet capacity at the rated service pressure.

6.8.2 Type II (liquid) nitrogen should be purchased by the pound or by the short ton. The following-conversion factors for liquid nitrogen should be used:

Pound (mass)	Liquid Gallons	Liquid Liters	Cubic feet of gaseous nitrogen at 70 deg. F. and 1 atmosphere pressure.
1.0000	0.1484	0.5618	13.8000
6.7380	1.0000	3.7850	93.0100
1.7800	0.2642	1.0000	24.5700
0.0724	0.0108	0.0407	1.0000

6.9 International standardization. Certain provisions (see 3.1) of this specification are the subject of international standardization agreement ASCC Air Standard 14/6 and 14/10, and NATO STANAG'S 3443GGS 3546GGS and 3624GGS. When amendment, revision, or cancellation of this specification is proposed which will effect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

MILITARY INTEREST

Custodians:

Army - ME
Navy - SH
Air Force - 68

Review activities:

Army - MD

User activities:

Army - GL
Navy - YD, AS, NC

Preparing activity:

Army - ME

CIVIL AGENCIES

MD - GSA - AGR
HEW - COM

Project No. 683-0059

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