Technical Product Information

Performance Chemicals
Hydrazine

Ultra Pure™ Hydrazine

Hydrazine (N_2H_4) is a clear, colorless, hygroscopic liquid with a distinct ammonia-like odor. It is a highly polar solvent, miscible with other polar solvents, but immiscible with nonpolar solvents.

The purity of *Ultra Pure*™ hydrazine exceeds the requirements for both the Monopropellant Grade and the High Purity Grade as specified in the latest revision of Military Specification MIL-PRF-26536D. *Ultra Pure* hydrazine is a replacement for the former Viking Grade hydrazine produced by Martin Marieta. *Ultra Pure* hydrazine is aniline free, with none detectable at the detection limit of specified analysis procedures.

Specifications and Properties

Specifications for *Ultra Pure* hydrazine are given in Table 1.

Physical properties of *Ultra Pure* hydrazine are given in Table 2.

Hydrazine is a strong reducing agent. Mixtures of hydrazine and very strong oxidizers are hypergolic (i.e., they autoignite on contact). Hydrazine and hydrazine blends are used as fuels in hypergolic bipropellant combinations. They also have other properties, such as high specific impulse. *Ultra Pure* hydrazine in contact with platinum group metal catalysts will decompose in a controlled reaction and can be used as a monopropellant.

Table 1
Specifications

Component	(% by weight)
Hydrazine (min)	99.5
Water (max)	0.5
Particulate (max)	1.0[a]
Ammonia (max)	0.3
Aniline (max)	Free[b]
Carbon dioxide (max)	0.003
Chloride (max)	0.0005
Iron (max)	0.0004
Nonvolatile residue (max)	0.001
Other volatile carbonaceous material[c] (max)	.005

[a] mg/l

[b] Not detectable at detection limits of all specified methods.

[c] Total as unsymmetrical dimethyl hydrazine (UDMH), monomethyl hydrazine (MMH), and alcohol.

Table 2

Physical Properties

pH (1% solution)		10.0-10.7
Density @ 25°C	(g/ml)	1.004
	(lb/gal)	8.379
Viscosity @ 25°C (cp)		0.90
Vapor Pressure (mm Hg @ 30.7°C)		10
Freezing Point	(°C)	2.0
	(°F)	35.6
Flash Point, TCC	(°C)	37.8
	(°F)	100.0
Boiling Point @ 760 mm Hg	(°C)	113.5
	(°F)	236.3
Flammable Limits in Air (% by vol)		4.7-100

Ultra Pure hydrazine is very hygroscopic. It also readily absorbs carbon dioxide from the air. These two properties are of special concern during handling (see "Sampling," below).

Applications

The major use for *Ultra Pure* hydrazine is as a rocket propellant in monopropellant thrusters and gas generators. Most satellites in earth orbit and most space probes use hydrazine for attitude control and orbit maintenance. Other applications may be in the electronics industry.

Sampling Procedures

Since the carbon level in *Ultra Pure* hydrazine is essentially zero, even a brief exposure to air (and hence to carbon dioxide) can cause a significant increase in the apparent contamination level of the relatively small sample quantity of *Ultra Pure* hydrazine. The following techniques for cleaning equipment and taking samples have proven satisfactory.

Cleaning Sample Bottles: It is recommended that the bottles used for sampling *Ultra Pure* hydrazine be new, unused Wheaton type or equivalent, made of borosilicate glass, equipped with lined phenolic resin black caps modified to have *Teflon*[d] inserts and liners.

[d] Teflon® is a registered trademark of E. I. duPont de Nemours & Co., Inc.

Sample bottles require special cleaning because of the distortion of results caused by even minute amounts of contaminants. The recommended cleaning procedure is as follows:

1 Soak bottles and lids for 30 minutes in a hot solution of Liquinox or Alconox or similar industrial strength detergents.
2 Rinse the bottles four times by completely filling them with demineralized water.
3 Invert the bottle and observe for any "water break". Any "water break" indicates that the bottle is not thoroughly cleaned and should be rewashed.
4 Dry the bottles for 4-6 hours in a laboratory oven at 100-110°C. Caps should be dried for 1 hour maximum as they will become brittle and liners will distort with excessive heating.
5 Cool the dried bottles to room temperature by purging with nitrogen gas.
6 Once cool, cap the purged bottles with the cleaned and dried caps.

Sample Taking: When it is necessary to take a sample of *Ultra Pure* hydrazine, follow the steps listed below:

1 Verify that the sample bottle, cap and liner have been cleaned by the recommended method.
2 Verify that the sample line has been flushed with *Ultra Pure* hydrazine to assure pure hydrazine for the sample.
3 Purge the glass sample bottle with gaseous nitrogen for one to two minutes.
4 Place the sample bottle under the sample line outlet with a continuous nitrogen purge.
5 Open the sample line valve and fill the sample bottle with hydrazine under a nitrogen hood purge.
6 When the bottle is filled, close the sample line valve and cap the glass sample bottle.

The precautions taken during these cleaning and sampling procedures, should also be adhered to during the analysis operation in order to avoid recontamination.

Storage and Handling

The experience accumulated by the chemical and aerospace industries indicates that with rigid adherence to proper precautions *Ultra Pure* hydrazine can be handled safely. Because hydrazine vapors have an upper explosive limit of 100% and, because hydrazine liquid is very reactive with many materials, the safety precautions outlined below are necessary to avoid fire or explosions. In addition, prolonged exposure to hydrazine vapor, contact with skin, or ingestion may produce harmful or fatal effects.

Storage: Outside or detached storage is preferred. If kept inside, use a well-ventilated standard flammable liquid storage room or cabinet. Tanks should be located in a diked area. Store away from heat, sparks, open flame and oxidants. Do not contaminate.

Ultra Pure hydrazine may be stored in the DOT-approved container in which it is shipped. (See *Shipping Information*, below.) Because hydrazine is hygroscopic, a nitrogen purge must be maintained on open containers to prevent exposure to atmospheric moisture and carbon dioxide.

Since *Ultra Pure* hydrazine is stable, it can be stored without loss of purity. Keep the container securely closed. Carefully vent the container when opening.

Safety Precautions: *Ultra Pure* hydrazine is insensitive to shock or friction. But both hydrazine and its vapor can be flammable or explosive in the presence of heat, flame, sparks, contaminants, and oxidizers, including air. All hydrazine containers and handling equipment should be electrically grounded. An inert atmosphere (pad) is necessary over *Ultra Pure* hydrazine at all times because of the rapid rate of oxidation, which may lead to a fire or explosion. (NOTE: Hydrazine is not pyrophoric in air. Other contaminants must be present to cause a fire or explosion.)

Nitrogen, which is inert and readily available, has been adopted as the padding material for hydrazine storage and transfer. The lower explosive limit of hydrazine vapor in air is 4.7%. This value increases significantly when a nitrogen atmosphere is used.

Prevent contact between *Ultra Pure* hydrazine and strong oxidizers such as hydrogen peroxide, dinitrogen tetroxide, fluorine, halogen fluorides, and fuming nitric acid. Such contact will result in immediate ignition or explosion.

Prevent contact with metal oxides, such as those of iron, copper, lead, manganese, and molybdenum. Contact with metallic oxide surfaces may lead to flaming decomposition.

Prevent contact with organic materials having large surface areas or porous surfaces. Absorption of hydrazine by rags, cotton waste, sawdust, or similar organic materials will eventually result in spontaneous ignition.

For additional details on handling and storage of *Ultra Pure* hydrazine, contact the Arch Chemicals Sales Office.

For More Information Technical Service

Technical service is available to facilitate further use of *Ultra Pure* hydrazine. If you have a specific question, or need further information, please call Hydrazine Technical

Service, Arch Chemicals, Inc. (337) 430-4023.

Shipping Information

Ultra Pure hydrazine is available in 55-gallon (420 lbs net) nonreturnable steel drums. Drums meet DOT Specifica-tion 1A1/X and are constructed of 304 stainless steel containing less than 0.5% molybdenum. *Ultra Pure* hydrazine can be supplied in customer-provided pressure cylinders.

How to Order

To place orders for delivery in the U.S. or Canada to get fast answers on order status or product availabilities, call our toll free number: 1-800-654-6018.

For written inquiries about orders, and to place confirmations, we have set up a special box number for you. Just address your envelope to: Arch Chemicals, Inc., 960 I-10 Service Rd., Westlake, LA 70669 .

Please refer to the Material Safety Data Sheet (MSDS) for complete information on Storage and Handling, Toxicological Properties, Personal Protection, First Aid, Spill and Leak Procedures, and Waste Disposal. To order an MSDS, call the Arch Chemicals sales office listed below or the MSDS Control Group at (800) 511-MSDS. Before using or handling this product, the MSDS should be thoroughly reviewed.

Sales Office Arch Chemicals, Inc.
960 I-10 Service Rd., Westlake,
LA 70669

Phone: (337) 430-4023

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