MATERIAL SAFETY DATA SHEET

NITROGEN

CHEMICAL PRODUCT

PRODUCT NAME: Nitrogen, compressed
CHEMICAL NAME: Nitrogen
CHEMICAL FAMILY: Nitrogen I**nert gas**
SYMBOL: N2
[USES]: Cryogenic Liquid N2， Liquid N2

INGREDIENT COMPOSITION INFORMATION

INGREDIENTS NAME	PERCENTAGE	OHSA PEL-TWA	ACGIH TLV
NITROGEN	>99%	None	Simple Asphyxiant

HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

CAUTION! High pressure gas.
Can cause rapid suffocation.
Do not breathe gas.
Self contained breathing apparatus may be required by rescue workers.

POTENTIAL HEALTH EFFECTS:

ROUTES OF EXPOSURE:

I**NHALATION:** Simple asphyxiant. Nitrogen is non-toxic, but may cause suffocation by displacing the oxygen in air. Exposure to oxygen-deficient atmosphere (<19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness and death. Exposure to atmospheres containing 8% to 10% or less oxygen will bring about unconsciousness without warning and so quickly that the individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death

EYE CONTACT: Not applicable
SKIN CONTACT: Not applicable
[SKIN ABSORPTION]: Not applicable
[INGESTION]: Not applicable
CHRONIC EFFECTS: Not established
MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None
OTHER EFFECTS OF OVEREXPOSURE: None
CARCINOGENICITY: Nitrogen is not listed

FIRST AID MEASURES

INHALATION: Persons suffering from lack of oxygen should be removed to fresh air. If victim is not breathing, administer artificial respiration. If breathing is difficult, administer oxygen. Obtain prompt medical attention.

EYE CONTACT: Not applicable.

SKIN CONTACT: Not applicable.

INGESTION: Not applicable.

NOTES TO PHYSICIAN: None.

FIRE FIGHTING MEASURES

FLASH POINT. Not applicable.

FLAMMABLE LIMITS IN AIR BY VOLUME: LOWER: Not applicable **UPPER:** Not applicable

EXTINGUISHING MEDIA: Nitrogen is nonflammable and does not support combustion. Use extinguishing media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING INSTRUCTIONS: Nitrogen is a simple asphyxiant. If possible, remove nitrogen cylinders from the fire area or cool with water. Self-contained breathing apparatus may be required for rescue workers.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Upon exposure to intense heat or flame, cylinder may vent rapidly and/or rupture violently. Most cylinders are designed to vent contents when exposed to elevated temperatures.

Pressure in a container can build up due to heat and it may rupture if pressure relief devices should fail to function.

HAZARDOUS COMBUSTION PRODUCTS: None known **[SENSITIVITY TO STATIC DISCHARGE]:** None

[SENSITIVITY TO MECHANICAL IMPACT]: None

ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Evacuate all personnel from the affected area. Shut off source of nitrogen, if without risk. Ventilate enclosed areas or remove cylinders to an outdoor location. If leaking from cylinder or its valve, contact your supplier.

HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling or being knocked over. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 125°F (52°C). Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time.

PRECAUTIONS TO BE TAKEN IN HANDLING: Use a suitable hand truck for cylinder movement. Never attempt to lift a cylinder by its valve protection cap. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Never insert an object (e.g., wrench, screwdriver, pry, bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. For additional precautions in using nitrogen see Other Information.

EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:

VENTILATION: Natural or mechanical to prevent oxygen-deficient atmospheres under 19.5% oxygen.

RESPIRATORY PROTECTION (SPECIFY TYPE):

General Use: None required.

Emergency Use: Self-contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmosphere. Air purifying respirators will not provide protection.

PROTECTIVE GLOVES: Work gloves are recommended when handling cylinders.

EYE PROTECTION: Safety glasses are recommended when handling cylinders.

OTHER PROTECTIVE EQUIPMENT: Safety shoes recommended when handling cylinders.

PHYSICAL AND CHEMICAL PROPERTIES

MOLECULAR WEIGHT: 28.0134

BOILING POINT (1 ATM): -350.4 °F (-195.8 °C)

SPECIFIC GRAVITY (Air=1) At 70°F (21.1 °C) and atm: 0.967

RELATIVE DENSITY, gas @ 101.325 kpa C@25°C=0.967 (Air=1): 0.967

TRIPLE POINT TEMPERATURE= - 210.0"C

VAPOR PRESSURE (at 20°C): Not applicable

ABSOLUTE DENSITY, gas @ at 101.325kpa @ 25`C, =1.145 5 kg/m 3

EVAPORATION RATE (Butyl Acetate=l): Gas, not applicable.
SOLUBILITY IN WATER: at 101.325 kpa (Partial pressure of N2) @ 25°C = 1.485 $cm^3/100cm^3$ water.
EXPANSION RATIO: Not applicable.
[pH]: Not applicable.
APPEARANCE, ODOR AND STATE: Colorless, odorless and tasteless gas at normal temperature and pressure.
[COEFFICIENT OF WATER/OIL DISTRIBUTION]: Not available.
[**ODOR THRESHOLD]:** Not applicable.

STABILITY AND REACTIVITY

STABILITY: Stable
CONDITIONS TO AVOID: None
INCOMPATIBILITY (Materials to avoid): None
REACTIVITY: **A) HAZARDOUS DECOMPOSITION PRODUCTS:** None
B) HAZARDOUS POLYMERIZATION: Will not occur

TOXICOLOGICAL INFORMATION

Nitrogen is a simple asphyxiant.
(IRRITANCY OF MATERIAL): None **(SENSITIZATION TO MATERIAL):** None
(REPRODUCTIVE EFFECTS): None
(TERATOGENICITY): None **(MUTAGENICITY):** None
(SYNERGISTIC MATERIALS): None

ECOLOGICAL INFORMATION

The atmosphere contains approximately 78% nitrogen. No adverse ecological effects are expected. Nitrogen does not contain any Class I or Class II ozone-depleting chemicals.

DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.
For emergency disposal, secure the cylinder and slowly discharge gas to the atmosphere in a well-ventilated area or outdoors.

TRANSPORT INFORMATION

DOT/IMO SHIPPING NAME: Nitrogen, compressed.
HAZARD CLASS: 2.2 (Nonflammable Gas).
PRODUCT RQ: Not applicable.
SHIPPING LABEL(s) : Nonflammable gas.
PLACARD (When required): Nonflammable gas.
SPECIAL SHIPPING INFORMATION : Cylinders should be transported in a secure position, in a well ventilated truck. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards and should be discouraged.

OTHER INFORMATION

SPECIAL PRECAUTIONS: Use piping and equipment adequately designed to withstand pressures to be encountered. Use a check valve or other protective apparatus in any line or piping from the cylinder to prevent reverse flow.
MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist, or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have their properties that can cause serious injury or death.

OTHER INFORMATION:

NFPA RATINGS:		**HMIS RATINGS:**	
HEALTH:	=0	HEALTH:	=0
FLAMMABILITY:	=0	FLAMMABILITY:	=0
INSTABILITY:	=0	REACTIVITY:	=0
SPECIAL:	=SA (CGA Recommends this to designate simple asphyxiant.)		

NITROGEN, REFRIGERATED LIQUID

CHEMICAL PRODUCT

PRODUCT NAME: Nitrogen, refrigerated liquid
CHEMICAL NAME: Nitrogen
CHEMICAL FAMILY: Inert Gas
SYMBOL: N2
SYNONYMS: Nitrogen NF, LIN, Cryogenic Liquid Nitrogen, Liquid Nitrogen
[USES]: Various chemical and industrial uses such as pH control, industrial water and sewage treatment, stabilization and agricultural.

INGREDIENT COMPOSITION INFORMATION

INGREDIENTS NAME	PERCENTAGE	OHSA PEL-TWA	ACGIH TLV
NITROGEN	>99.99%	None	Simple Asphyxiant

HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

WARNING! Extremely cold liquid and gas under pressure.
Can cause rapid suffocation.
Can cause severe frostbite.

POTENTIAL HEALTH EFFECTS:

ROUTES OF EXPOSURE:

INHALATION: Simple asphyxiant. Nitrogen is non-toxic, but may cause suffocation by displacing the oxygen in air. Exposure to oxygen deficient atmosphere (<19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness and death. Exposure to atmospheres containing 8% to 10% or less oxygen will bring about unconsciousness without warning and so quickly that the individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death

EYE CONTACT. Tissue freezing and severe cryogenic burns of eyes.

SKIN CONTACT. Tissue freezing and severe cryogenic burns of skin.

[SKIN ABSORPTION]: Not applicable

[INGESTION]: Not applicable

CHRONIC EFFECTS: None established

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None

OTHER EFFECTS OF OVEREXPOSURE: None

CARCINOGENICITY: Nitrogen is not listed.

FIRST AID MEASURES

INHALATION: Persons suffering from lack of oxygen should be removed to fresh air. If victim is not breathing, administer artificial respiration. If breathing is difficult, administer oxygen. Obtain prompt medical attention.

EYE CONTACT. In case of splash contamination, immediately flush eyes with water for at least 15 minutes. See a physician, preferably an ophthalmologist immediately.

SKIN CONTACT. Remove any clothing that may restrict circulation to frozen area. Do not rub frozen parts as tissue damage may result. As soon as practical place the affected area in a warm water bath that has a temperature not to exceed 105°F (40°C). Never use dry heat. In case of massive exposure, remove clothing while showering with warm water. Call a physician as soon as possible. Frozen tissue is painless and appears waxy with a possible yellow color. It will become swollen, painful and prone to infection when thawed. If the frozen part of the body has been thawed by the time medical attention has been obtained, cover the area with dry sterile dressing with a large bulky protective covering.

INGESTION: Not applicable

NOTES TO PHYSICIAN: Not applicable.

FIRE FIGHTING MEASURES

FLASH POINT. Not applicable **AUTOIGNITION: Nonflammable**

FLAMMABLE LIMITS IN AIR BY VOLUME: **LOWER:** Not applicable **UPPER:** Not applicable

EXTINGUISHING MEDIA: Nitrogen is nonflammable and does not support combustion. Use extinguishing media appropriate for the surrounding fire.

SPECIAL FIRE FIGHTING INSTRUCTIONS: Nitrogen is a simple asphyxiant. If possible, remove nitrogen cylinders from the fire area or cool with water. Do not direct spray at the container vent. Self-contained breathing apparatus may be required for rescue workers. Evacuate this area.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Liquid nitrogen when spilled will vaporize rapidly forming an oxygen deficient vapor cloud. Evacuate this vapor cloud area. Visibility may be obscured in its vapor cloud. Pressure in a container can build up due to heat and it may rupture if pressure relief devices should fail to function. Contact with cold liquid or gaseous nitrogen may cause frostbite.

HAZARDOUS COMBUSTION PRODUCTS: None known

[SENSITIVITY TO STATIC DISCHARGE]: Non applicable **[SENSITIVITY TO MECHANICAL IMPACT]:** None

ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Evacuate all personnel from the affected area. Shut off source of nitrogen, if possible without risk. Ventilate enclosed areas or remove leaking containers to a well-ventilated location. To increase rate of vaporization, spray large amounts of water on to the spill from an upwind position. If leaking from container or its valve, contact your supplier.

HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Do not store in a confined space. Cryogenic containers are equipped with pressure relief devices to control internal pressure. Under normal conditions these containers will periodically vent product. Some metals such as carbon steel may become brittle at low temperatures and will easily fracture. Prevent entrapment of liquid in closed systems or piping without pressure relief devices.

PRECAUTIONS TO BE TAKEN IN HANDLING: Never allow any unprotected part of the body to touch non-insulated pipes or vessels that contain cryogenic fluids. The extremely cold metal will cause the flesh to stick fast and tear when one attempts to withdraw from it. Use a suitable four-wheel hand truck for container movement. Containers shall be handled and stored in an upright position. Do not drop or roll containers on their sides. If the user experiences any difficulty operating container valve discontinue use, and contact supplier. For additional precautions in using liquid nitrogen see Other Information.

EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: **VENTILATION:** Natural or mechanical to prevent oxygen-deficient atmospheres under 19.5% oxygen

RESPIRATORY PROTECTION (SPECIFY TYPE):

General Use: None required

Emergency Use: Self-contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmosphere. Air purifying respirators will not function.

PROTECTIVE GLOVES: Loose fitting thermal insulated or leather gloves **EYE PROTECTION:** Full face shield and safety glasses are recommended.

OTHER PROTECTIVE EQUIPMENT: Safety shoes when handling containers. Long-sleeved shirts and trousers without cuffs.

PHYSICAL AND CHEMICAL PROPERTIES

MOLECULAR WEIGHT: 28.0134

BOILING POINT (1 ATM): -350.4'F (-195.8 °C)

SPECIFIC GRAVITY (Air=1) At 70`F (21.1'C) and atm: 0.967

RELATIVE DENSITY, gas @ 101.325 kpa @25°C=0.967 (Air=1): 0.967

TRIPLE POINT TEMPERATURE = - 210.0°C

VAPOR PRESSURE (at 20°C): Not applicable

ABSOLUTE DENSITY, gas @ at 101.325kpa @ 25°C, =1.145 5 kg/m3

EVAPORATION RATE (Butyl Acetate=l): Gas, not applicable

SOLUBILITY IN WATER: at 101.325 kpa (Partial pressure of N2) @ 25°C = 1.485 cm 3/100cm3 water

EXPANSION RATIO: Not applicable

[pH]: Not applicable

APPEARANCE, ODOR AND STATE: Colorless, odorless and tasteless gas at normal temperature and pressure.

[COEFFICIENT OF WATER/OIL DISTRIBUTION]: Not available

[ODOR THRESHOLD]: Not applicable

STABILITY AND REACTIVITY

STABILITY: Stable **CONDITIONS TO AVOID:** None **INCOMPATIBILITY (Materials to avoid):** None

REACTIVITY: A) **HAZARDOUS DECOMPOSITION PRODUCTS:** None **B) HAZARDOUS POLYMERIZATION:** Will not occur

TOXICOLOGICAL INFORMATION

Nitrogen is a simple asphyxiant.

(IRRITANCY OF MATERIAL): None **(SENSITIZATION TO MATERIAL):** None

(REPRODUCTIVE EFFECTS): None

(TERATOGENICITY): None **(MUTAGENICITY):** None

(SYNERGISTIC MATERIALS): None

ECOLOGICAL INFORMATION

The atmosphere contains approximately 78% nitrogen. No adverse ecological effects are expected. Nitrogen does not contain any Class I or Class II ozone-depleting chemicals. Nitrogen is not listed as a marine pollutant.

DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. For emergency disposal, discharge slowly to the atmosphere in a well-ventilated area or outdoors.

TRANSPORT INFORMATION

DOT/IMO SHIPPING NAME: Nitrogen, Refrigerated liquid **HAZARD CLASS:** 2.2 (Nonflammable Gas)

PRODUCT RQ: Not applicable **SHIPPING LABEL(s) :** Nonflammable gas

PLACARD (When required): Nonflammable gas

SPECIAL SHIPPING INFORMATION : Containers should be transported in a secure position, in a well- ventilated truck. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards and should be discouraged. For air shipments, the "Cryogenic Liquid" handling label must be used in addition to the nonflammable gas hazard label on packages and over packs containing cryogenic liquids.

OTHER INFORMATION

SPECIAL PRECAUTIONS: Use piping and equipment adequately designed to withstand pressures to be encountered. Use a check valve or other protective apparatus in any line or piping from the cylinder to prevent reverse flow. To prevent cryogenic liquids or cold gas from being trapped in piping between valves the piping shall be equipped with pressure relief devices. Only transfer lines designed for cryogenic liquids shall be used. It is recommended that all vents be piped to the exterior of the building.

OTHER INFORMATION:

NFPA RATINGS:		**HMIS RATINGS:**	
HEALTH:	=3	HEALTH:	=3
FLAMMABILITY:	=0	FLAMMABILITY:	=0
INSTABILITY:	=0	REACTIVITY:	=0
SPECIAL:	=SA (CGA Recommends this to designate simple asphyxiant.)		