Nitrogen

IDENTIFICATION

Nitrogen

ZVG No: 7070
CAS No: 7727-37-9
EC No: 231-783-9

CHARACTERISATION

SUBSTANCE GROUP CODE

139100 Inorganic gases

STATE OF AGGREGATION

The substance is gaseous.

PROPERTIES

colourless
odourless

CHEMICAL CHARACTERISATION

Non-combustible gas.
Only slightly soluble in water.
Nitrogen is commercially available in steel cylinders or in liquid form with a temperature of about -196 degree C.
Evaporation of very cold liquid or expansion of the gas causes formation of cold mist spreading on the ground.
Danger of suffocation at high concentrations.
(Concentrations above 88%, the nitrogen content in the air is 78% by volume)

FORMULA

N2

$N \equiv N$

Molar mass: 28,01 g/mol
Conversion factor (gaseous phase) at 1013 mbar and 20 °C:
1 ml/m³ = 1,16 mg/m³

PHYSICAL AND CHEMICAL PROPERTIES

TRIPLE POINT

Temperature: -210,0 °C
Pressure: 0,125 bar

MELTING POINT

Melting point: -209,86 °C

BOILING POINT

Boiling Point: -195,9 °C

CRITICAL DATA

Crit. temperature: -147,0 °C
Crit. pressure: 33,99 bar
Crit. density: 0,314 g/cm³

DENSITY

VAPOUR DENSITY
under standard conditions (0 °C, 1013 mbar)
Value: 1,2504 kg/m³

DENSITY OF LIQUID PHASE AT BOILING POINT
Value: 0,8085 kg/l

RELATIVE VAPOUR DENSITY
Ratio of the density to dry air at the same temperature and pressure
Value: 0,97

VAPOUR DENSITY
Value: 1,1694 kg/m³

Temperature:	15 °C
at 1 bar	

SOLUBILITY IN WATER

Concentration:	23,2 ml/l
Temperature:	0 °C

HAZARDOUS REACTIONS

Hazardous chemical reactions:
Risk of explosion in contact with:
ozone + metal
The substance can react dangerously with:
chromyl chloride; lithium aluminium hydride (rare); hydrogen (rare)
Formation of explosive nitrides with alkaline/ alkaline earth metals.

The following applies to the cryogenic liquefied gas:
Risk of explosion in contact with:
oxygen
The substance can react dangerously with:
lithium

FURTHER INFORMATION

inversion temperature : 850 Kelvin

SAFE HANDLING

TECHNICAL MEASURES - HANDLING

Workplace:
Provision of ventilation in the working area.

Equipment:
If dangerous pressure can arise from contact with heat, suitable safety measures and equipment should be provided.
If release of the substance cannot be prevented, then it should be suctioned off at the point of exit.
Label containers and pipelines clearly.
Suitable materials:
For cylinders and valves:
All usual materials.
For seals:
Polytetrafluoro ethylene PTFE (Teflon)
Polychloro trifluoro ethylene PCTFE
Polyvinylidene fluoride

Polyamide PA
Polypropylene PP
Butyl rubber IIR
Acrylonitrile butadiene rubber NBR
Polychloroprene rubber CR
Fluoro rubber FKM
Silicon rubber Q
Ethylene/Propylene-Diene-Terpolymers EPDM

Advice on safer handling:
Do not store cylinders at the working area.
Do not force open valve.
When changing bottles, always inspect the leak-proof closure of the filled and empty bottles.
Refilling or transfer in storage rooms is prohibited.
Prevent cylinders from falling over.
Suck back of water into the container must be prevented. Do not allow backfeed into the container.
Usually transport occurs in containers with high pressure. Use suitable equipment for the transport.
Tightly screw on the protective caps and blind nuts when transporting. Secure cylinders against falling over, do not throw.
When handling the liquefied gas:
Sufficient ventilation must be guaranteed for refilling, transfer, or open use.
Carefully dry containers and equipment before filling them.
Avoid splashing.
Avoid any contact when handling the substance.
Get damaged containers for cryogenic liquid to safety and evaporate contents outdoors without personal risk.

Cleaning and maintenance:
Regular inspection of leak test required!

TECHNICAL MEASURES - STORAGE

Storage:
Containers have to be labelled clearly and permanently.
Keep container in a well-ventilated place.
Keep upright, protect against falling over.
Protect from exposure to sunlight.
Do not store in escape routes, work rooms, or in direct proximity to them.
For transporting, storing, preparing, emptying, and maintaining pressurized gas bottles, the detailed rules in TRG 280 must be absolutely adhered to. For pressurised gas packaging, observe the applicable TRG 300.

Conditions of collocated storage:
Storage class 2 A (Gases)
Only substances of the same storage class should be stored together.
Collocated storage with the following substances is prohibited:

- Pharmaceuticals, foods, and animal feeds including additives.
- Infectious, radioactive und explosive materials.
- Flammable liquids of storage class 3.
- Other explosive substances of storage class 4.1A.
- Flammable solid substances or desensitized substances of storage class 4.1B.
- Pyrophoric substances.
- Substances liberating flammable gases in contact with water.
- Strongly oxidizing substances of storage class 5.1A.
- Oxidizing substances of storage class 5.1B.
- Organic peroxides and self reactive substances.
- Combustible and non combustible acutely toxic substances of stora-ge classes 6.1A and 6.1B.
- Combustible toxic or chronically acting substances of storage class 6.1C.
- Noncombustible toxic or chronically acting substances of storage class 6.1D.
- Combustible liquids of storage class 10.

Under certain conditions the collocated storage with the following sub-stances is permitted (For more details see TRGS 510):
- Aerosols (spray bottles).
- Ammonium nitrate and preparations containing ammonium nitrate.
- Combustible corrosive substances of storage class 8A.
- Combustible solids of storage class 11.

Consider the regulations of TRG 280 at collocated storage of different compressed gases.
The substance should not be stored with substances with which ha-zardous chemical reactions are possible.

TECHNICAL MEASURES - FIRE AND EXPLOSION PROTECTION

Technical, constructive measures:
Substance is non-combustible. Select fire and explosion prevention measures according to the other used substances.
Protect parts of the system from any warming; if necessary, provide cooling with sprayed water.

Precaution on handling:
Due to open use of the liquefied gas, oxygen from surrounding air is condensed. This leads to an enrichment with strongly oxidizing liquid oxygen and causes danger of a spontaneous combustion in contact with easily flammable materials.
Only freshly produced liquid nitrogen is particularly suitable for this purpose.

ORGANISATIONAL MEASURES

Instruction on the hazards and the protective measures using instruction manual (TRGS 555) are required with signature if just more than one minor hazard was detected.
Instruction must be provided before employment and then at a minimum of once per annum thereafter.
Instruction should include a hint regarding the danger of suffocation.

An escape and rescue plan must be prepared when the location, scale, and use of the work-site so demand.
Observe the restrictions on juvenile employment as defined in the "Jugendarbeitsschutzgesetz".

PERSONAL PROTECTION

Body protection:
Use protective boots while handling gas cylinders.

Respiratory protection:
In an emergency (e.g.: unintentional release of the substance) respiratory protection must be worn. Consider the maximum period for wear.
Wear self-contained breathing apparatus.
Do not use filter respirator.

Eye protection:
Sufficient eye protection should be worn.
When handling compressed gas, at least glasses with side protection should be worn.
When handling liquid gas, chemical safety goggles must be used as well as a protective shield.

Hand protection:
Wear leather gloves to prevent frostbite injuries from rapidly expanding gas when handling pressurised gas bottles.

Occupational hygiene:
Avoid skin contact with the liquid phase: risk of frostbite.
Avoid inhalation of gas.

DISPOSAL CONSIDERATIONS

Compressed gas cylinders can normally be returned to the supplier. Pressurised cans are non-returnable and must be disposed of.
Do not empty pressure vessels to the point of pressure compensation. Mark empty vessels to avoid confusion with full ones.

ACCIDENTAL RELEASE MEASURES

Provide adequate ventilation.
Wear respiratory protection (see chapter Personal Protection).
Attempt to stop the gas from escaping. Otherwise place leaky bottles under a suctioning device or put them outdoors.
Get damaged containers for cryogenic liquid into safety and evaporate content outdoors without personal risk.
Afterwards ventilate area.

Endangerment of watert:
No hazards to sources of water are to be feared if released into water, drainage, sewer, or the ground.

FIRE FIGHTING MEASURES

Instructions:
Substance is incombustible. Select fire fighting measures according to the surrounding conditions.
In the case of fire advise fire fighters on the presence of gas cylinders.
Cool surrounding containers with water spray.
If possible, take container out of dangerous zone.
Rise in pressure and risk of bursting when heating.
Be watchful for frostbite in case of contact with fluid.
Thoroughly avoid invasion of large quantities of the liquefied gas into lower or underground rooms.

Special protective equipment:
Wear self-contained breathing apparatus.

REGULATIONS

Classification:
Gases under pressure, compressed gas; H280

Signal Word: "Warning"

Hazard Statement - H-phrases:
H280: Contains gas under pressure; may explode if heated.

Precautionary Statement - P-phrases:
P403: Store in a well-ventilated place.

Manufacturer's specification by Air Liquide

Reference: 01401

COLOUR CODING OF GAS CYLINDERS

Shoulder colour: Black
(Nitrogen)

Shoulder colour: Black
Cylinder colour: Green
(Nitrogen, alternative)

Shoulder colour: Black
Cylinder colour: Black
(Nitrogen, alternative)

WORKPLACE LABELLING ACCORDING TO GERMAN ASR A1.3

Warning label:

Caution - gas cylinder

Precept label:

Use safety goggles

Wear safety shoes

GERMAN WATER HAZARD CLASS

Substance No: 1351

non-hazardous to waters
Classification according to the Administrative Regulation of Substances Hazardous to Water (VwVwS)

TRANSPORT REGULATIONS

UN Number: 1066
Shipping name: Nitrogen, compressed
Hazard Identification Number: 20
Class: 2.2 (Non-flammable, non-toxic gases)
Packing Group: -
Danger Label: 2.2

Tunnel restrictions:
Passage forbidden through tunnels of category E.

UN Number: 1977
Shipping name: Nitrogen, refrigerated, liquid
Hazard Identification Number: 22
Class: 2.2 (Non-flammable, non-toxic gases)
Packing Group: -
Danger Label: 2.2

Tunnel restrictions:
Transports in tanks: passage forbidden through tunnels of category C, D and E.
Other transports: passage forbidden through tunnels of category E.

RESTRICTIONS OF USE / BANS OF USE

Directives on Safety in School (BGR/GUV-SR 2003)
Pupil and teacher experiments with this substance are authorised without restrictions.
Substance list to GUV-SR 2004 (as of 11.2010)

FURTHER REGULATIONS

TRGS 407
Tätigkeiten mit Gasen - Gefährdungsbeurteilung; Ausgabe Juni 2013, berichtigt

Dezember 2013

TRGS 725/TRBS 3145
Ortsbewegliche Druckgasbehälter - Füllen, Bereithalten, innerbetriebliche Beförderung, Entleeren; Ausgabe Juni 2013

TRGS 726/TRBS 3146
Ortsfeste Druckanlagen für Gase; Ausgabe April 2014

TRGS 510
Lagerung von Gefahrstoffen in ortsbeweglichen Behältern; Ausgabe Januar 2013, geändert und ergänzt November 2014

TRGS 500
Schutzmaßnahmen; Ausgabe Januar 2008, ergänzt Mai 2008

LINKS

Oxygen depletion – Hazard of asphyxia (in german only)
Oxygen depletion (in german only)
Safety instructions - handling of cryogenic liquefied nitrogen in movable cryogenic vessel (in german only)
Publications of the IGV (Industriegaseverband e.V.) (in german only)
Hazards of inert gases and oxygen depletion(Doc 44/09)
Publications of EIGA (European Industrial Gases Association) Documents Download

REFERENCES

Reference: 00001
IFA: Erfassungs- und Pflegehandbuch der GESTIS-Stoffdatenbank (nicht öffentlich)
Data acquisition and maintenance manual of the GESTIS substance database (not publicly)

Reference: 00240
E. Brandes, W. Möller "Sicherheitstechnische Kenngrößen" Band 1 "Brennbare Flüssigkeiten und Gase" ("Safety-related characteristics" Vol. 1 "Combustible liquids and gases"), Wirtschaftsverlag NW, Verlag für neue Wissenschaft GmbH, Bremerhaven, 2003

Reference: 00260
1x1 der Gase. Physikalische Daten für Wissenschaft und Praxis. Herausgeber: AIR LIQUIDE Deutschland GmbH, Düsseldorf, 1. Auflage 2005

Reference: 00440
Datenbank CHEMSAFE, Version 2.10 (2014), DECHEMA-PTB-BAM

Reference: 00500

RÖMPP Online ab 2003

Reference: 01401
GHS-Sicherheitsdatenblatt (GHS Material Safety Data Sheet), Air Liquide

Reference: 05000
Kühn-Birett-Gruppenmerkblätter

Reference: 05097
Kühn-Birett-Merkblätter: 97. Ergänzungslieferung; 03/97

Reference: 05109
Kühn-Birett-Merkblätter: 109. Ergänzungslieferung; 08/98

Reference: 05300
TRGS 510 "Lagerung von Gefahrstoffen in ortsbeweglichen Behältern" Ausgabe Januar 2013, geändert und ergänzt November 2014

Reference: 06002
L. Roth, U. Weller "Gefährliche Chemische Reaktionen" Loseblattsammlung mit Ergänzungslieferungen ("Dangerous chemical reactions" loose-leaf collection with supplement deliveries), ecomed-Verlag

Reference: 07584
Allgemeine Verwaltungsvorschrift zur Änderung der Verwaltungsvorschrift wassergefährdende Stoffe - VwVwS vom 27. Juli 2005; Bundesanzeiger Jahrgang 57, Nr. 142a, vom 30. Juli 2005

Reference: 07635
AUERDATA 98 und BGR/GUV-R 190 "Einsatz von Atemschutzgeräten" Ausgabe 11/2009

Reference: 07902
ADR 2015 - Europäisches Übereinkommen über die internationale Beförderung gefährlicher Güter auf der Straße (ADR)

Reference: 99999
Angabe des Bearbeiters (Indication of the editor)