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Identification of dangerous substances

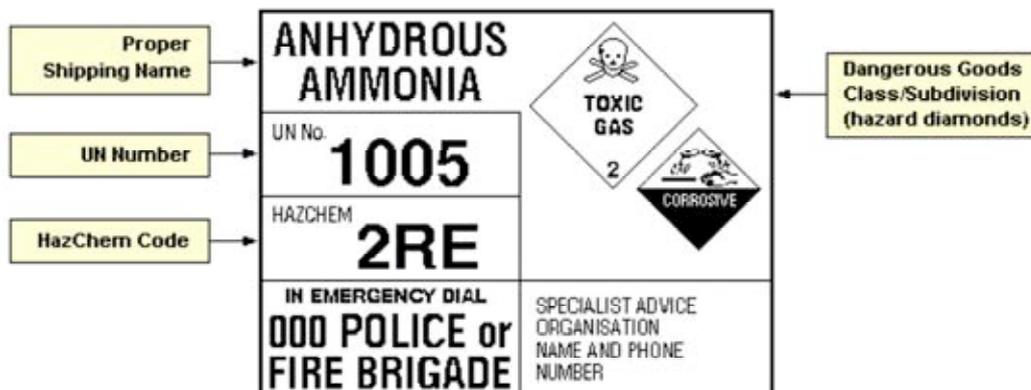
The identification of any substance is made by means of:

- **name** and/or **chemical formula**
- proper **shipping name** (it is assigned by the United Nations Committee of Experts for the Transport of Dangerous Goods and is used worldwide to describe the substance during transport to enable the quick identification of dangerous goods)
- **CAS number** is a unique numerical identifiers for chemical elements (CAS=Chemical Abstracts Service is a division of the American Chemical Society)
- **EC number** (European Commission number) is the seven-digit code that is assigned to chemical substances that are commercially available within the European Union
- **UN number** is a four digit number assigned by the United Nations to identify dangerous goods. UN numbers range from UN1001 to UN3500 and are published as part of their Recommendations on the Transport of Dangerous Goods (also known as the *Orange Book*) and have generally been adopted by member states.

The identification of the hazard is made by means of:

- **labelling** and relevant **pictograms**
- **cylinder colour code** (there is no universal colour coding system for cylinders around the world; many countries do have established systems as national standards. In Europe the colour coding system is defined in the EN 1089-3 standard)
- **Class + a number (1 – 9)***, assigned by the United Nations identifying the most significant hazard associated with a dangerous good. Classes may be further broken down into divisions and packaging groups (e.g. 2.1, 2.2, 2.3).
- **HazChem code**** is a 2 or 3 digit alpha/numeric code providing initial emergency response information about a dangerous good. The Hazchem Code is used and consistently applied in most parts of the world. In many countries display of the Hazchem Code for dangerous goods during shipment or storage is a legislative requirement.
- **Risk (R-) phrases***** (NB: new **hazard (H-) statements** will replace the former R- phrases according to the new GHS – Global Harmonized System of classification and labelling of chemicals - standard)

Example of an Emergency Information panel:



* Class number

All compressed gases have a primary risk of Class 2 and they may have subsidiary risk of another Class 2 category or another Class altogether. The general combinations of Classes are as follows: (references to ADR – the European Agreement concerning the International Carriage of Dangerous Goods by Road – and DOT – US Department Of Transportation – pictograms are shown as examples of Transport of Dangerous Goods labelling systems).

Class	Characteristic	Transport of Dangerous Goods - ADR (EU)	Transport of Dangerous Goods - DOT (US)	
1	<i>Explosives</i>			
2	<i>Gases</i>			
2.1	Flammable			
2.2	Non-Flammable, non-toxic			
2.3	Toxic / Poison			
3	<i>Flammable liquids</i>			

Class	Characteristic	Transport of Dangerous Goods - ADR (EU)	Transport of Dangerous Goods - DOT (US)
4	<i>Flammable solids</i>		
4.1	Flammable solids, self-reactive substances and solid desensitised explosives		
4.2	Substances liable to spontaneous combustion		
4.3	Substances which in contact with water emit flammable gases		
5	<i>Oxidizing substances and organic peroxides</i>		
5.1	Oxidising agent		
5.2	Organic peroxides		

Class	Characteristic	Transport of Dangerous Goods - ADR (EU)	Transport of Dangerous Goods - DOT (US)
6	Toxic and infectious substances		
7	Radioactive materials		
8	Corrosive		
9	Miscellaneous dangerous substances and articles		

Examples of some possible combinations:

Class	Characteristic	Transport of Dangerous Goods - ADR (EU)	Transport of Dangerous Goods - DOT (US)
2.3 & 2.1	Flammable & Toxic (e.g. CO, PH ₃)	 2	 TOXIC GAS 2
		 2	 FLAMMABLE GAS 2
2.2 & 5.1	Oxidising Gases (e.g. O ₂ , N ₂ O)	 2	 NON-FLAMMABLE GAS 2
		 5.1	 OXIDIZER 5.1
2.3 & 8	Poison & Corrosive (e.g. SO ₂ , HCl)	 2	 TOXIC GAS 2
		 8	 CORROSIVE 8
2.3 & 5.1	Poison & Oxidising (e.g. ClFO ₃)	 2	 TOXIC GAS 2
		 5.1	 OXIDIZER 5.1
2.3, 5.1 & 8	Poison, Oxidising & Corrosive (e.g. Cl ₂ , F ₂)	 2	 TOXIC GAS 2
		 5.1	 OXIDIZER 5.1
		 8	 CORROSIVE 8
2.3, 2.1 & 8	Poison, Flammable & Corrosive (e.g. SiH ₂ Cl ₂)	 2	 TOXIC GAS 2
		 2	 FLAMMABLE GAS 2
		 8	 CORROSIVE 8
4.3, 3 & 8	Substances which in contact with water emit flammable gases, Flammable & Corrosive (e.g. SiHCl ₃)	 4	 DANGEROUS "SI" 4
		 3	 FLAMMABLE LIQUID 3
		 8	 CORROSIVE 8

** HazChem code

The Hazchem Code describes the initial recommended emergency response for dangerous goods in emergency situations such as:

- leakage
- spillage
- fire

The HazChem Code defines:

- what sort of fire fighting or spillage control agent should be used
- whether the spilt material should be diluted or contained
- what type of Personal Protective Equipment (PPE) is required to deal with the material whether evacuation of people should be considered

The HazChem Code is composed of a number, followed by one or two letters, e.g. 2R and 3WE.

The second letter may be presented either in square brackets e.g. 2[S]E ; or graphic style - white lettering on a dark background, e.g. .

Note: The graphic style **must** be used in placards and panels. The square brackets are only to be used in documentation.

1) The first HazChem Code character indicates the equipment suitable for fire fighting and/or dispersing spills:

Code	Fire fighting agent
1	Water jet
2	Water fog (in the absence of fog a fine spray may be used)
3	Foam agent
4	Dry agent (water must not be allowed to come into contact with the substance).

Fire fighting agents with a higher number may be used, but never lower, i.e. for 2, foam (3) or dry agent (4) may also be used for fire fighting but not (1) water jets.

2) The second character defines the:

- reactivity - potential extent of the reaction during a fire, this could be benign, violently or explosively reactive
- PPE - recommended personal protective equipment; and
- Measures - the need to either dilute or contain the material

Letter	Reactivity	PPE	Measures
P	V	FULL	Dilute
R	-	FULL	Dilute
S	V	BA	Dilute
[S]	V	BA for FIRE only	Dilute
T	-	BA	Dilute
[T]	-	BA for FIRE only	Dilute
W	V	FULL	Contain
X	-	FULL	Contain
Y	V	BA	Contain
[Y]	V	BA for FIRE only	Contain
Z	-	BA	Contain
[Z]	-	BA for FIRE only	Contain

Abbreviations

V	The substance can be violently or even explosively reactive.
FULL	Full body protective clothing is a minimum of breathing apparatus, protective gloves, rubber boots and a chemical splash suit. In the case of some chemicals a fully sealed gas suit is required.
BA	Breathing apparatus, PLUS chemically impervious protective gloves.
DILUTE	May be washed away with large quantities of water. Wherever practicable, diluted substances should be contained and prevented from entering drains and water courses.
CONTAIN	Prevent, by any means available, spillage from entering drains or water course.

3) The final character is the letter 'E'. It is added as a third character to the Hazchem Code only when evacuation of people from the neighbourhood should be *considered*. Actual evacuation is not automatic and is a matter for decision after taking into account all relevant factors, including:

- the size and numbers of packages involved
- the size of the spill
- hazards relating to the various products
- proximity to population centres
- wind direction

The HazChem Code for the vast majority of Linde Gas products has been defined by authorities and recorded in various publications.

*** Risk (R-) phrases and Hazard (H-) statements

Some examples (NB: this is not a comprehensive list):

R- phrase	H- statement ¹
Flammable substances:	
R10 – Flammable	H220 – Extremely flammable gas
R11 – Highly flammable	H221 – Flammable gas
R12 – Extremely flammable	H222 – Extremely flammable aerosol
	H223 – Flammable aerosol
	H224 – Extremely flammable liquid and vapour
	H225 – Highly flammable liquid and vapour
	H226 – Flammable liquid and vapour
Toxic substances:	
R23 – Toxic by inhalation	H331 – Toxic if inhaled
R24 – Toxic in contact with skin	H311 – Toxic in contact with skin
R25 – Toxic if swallowed	H301 – Toxic if swallowed
R26 – Very toxic by inhalation	H330 – Fatal if inhaled
R27 – Very toxic in contact with skin	H320 – Fatal in contact with skin
R28 – Very toxic if swallowed	H300 – Fatal if swallowed
Corrosive substances:	
R34 – Causes burns	H314 – Causes severe skin burns and eye damage
R35 – Causes severe burns	
Toxicity to the environment:	
R51 – Toxic to aquatic organisms	H400 – Very toxic to aquatic life
R54 – Toxic to flora	H410 – Very toxic to aquatic life with long lasting effects
R55 – Toxic to fauna	H411 – Toxic to aquatic life with long lasting effects
R56 – Toxic to soil organisms	
R57 – Toxic to bees	

¹ According to the new GHS - Globally Harmonized System of classification and labelling of chemicals