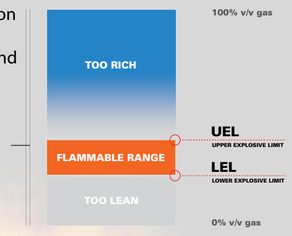
DMS
DETECTION & MEASUREMENT SYSTEMS

HAZARDOUS GAS DETECTION Reference Guide

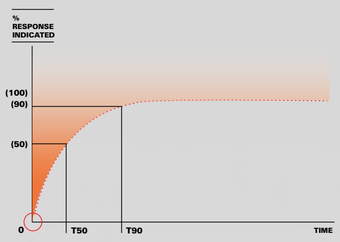
COMBUSTIBLE MIXTURE LEVEL

There is only a limited band of gas/air concentration which will produce a combustible mixture. This band is specific for each gas and vapor and is bound by an upper level, known as the Upper Explosive Limit (or the UEL) and a lower level, called the Lower Explosive Limit (LEL).



GAS DETECTOR RESPONSE

Response times are typically measured as T50 and T90. Most diffusion based gas sensors will provide a rapid initial response to the presence of the target gas. The indicated concentration will increase at a slower rate as the indicated concentration stabilizes. The time it takes for the detector to reach 50% of that stable indicated concentration is referred to as a T50 time. The time it takes for the detector to reach 90% of that stable indicated concentration is referred to as the T90 time.



FLASH POINT (FP °F)

The flash point of a flammable liquid is the lowest temperature at which surface of the liquid emits sufficient vapor to be ignited by a small flame. Don't confuse with Ignition Temperature as the two can be very different.

GAS / VAPOR	FLASH POINT °F	IGNITION TEMP. °F
Methane	-306	935
Kerosene	100	410

VAPOR DENSITY / SPECIFIC GRAVITY

Helps determine sensor placement.
The density of a gas / vapor is compared with air when air = 1.0
Vapor Density < 1.0 will rise
Vapor Density > 1.0 will fall

GAS / VAPOR	VAPOR DENSITY
Methane	0.55
Carbon Monoxide	0.97
Hydrogen Sulfide	1.19
Butane	2.08

COMBUSTIBLE GAS

GAS	LOWER EXPLOSIVE LIMIT (LEL/LFL) (%)	UPPER EXPLOSIVE LIMIT (UEL/UFL) (%)	SPECIFIC GRAVITY AIR =1	FLASH POINT FAHRENHEIT (°F)
Acetone	2.6	12.8	0.79	0
Acetylene	2.5	100	0.9	-0.7
Acrolein	2.8	31	0.83	-15
Acrylonitrile	3	17	0.8	32
Benzene	1.4	8	2.7	12
1,3-Butadiene	2	12	0.62	-12
n-Butane	1.9	8.5	2.07	-76
iso-Butane	1.8	8.4	2.07	-12
Carbonyl Sulfide	12	28	2.1	N/A
Cyclobutane	1.8	11.1	1.9	N/A
Cyclohexane	1.3	8	2.9	-4
Cyclopropane	2.4	10.4	1.45	N/A
Diethylamine	1.8	10.1	2.53	-20
Diethyl ether	1.9	36	2.6	-49
Ethane	3	12.4	1.04	-211
Ethylene	2.75	28.6	0.97	-213
Ethanol	3.3	19	1.59	55
Ethylbenzene	1	7.1	3.66	59
Ethylene oxide	3	100	1.49	0
Heptane	1	7	3.46	25
Hexane	1.1	7.5	2.97	-9.4
Hydrogen	4	75	0.07	N/A
Isobutane	1.8	8.4	2.01	-117
Isobutyl alcohol	1.2	10.9	2.55	82
Isopropanol	2	12	2.07	53
Methane	5	15	0.55	N/A
MEK	1.8	10	2.42	26
n-Heptane	1	7	3.5	25
n-Hexane	1.2	7.5	2.97	-9
n-Pentane	1.5	7.8	2.48	-57
Nitromethane	7.3	n/A	2.11	95
n-Octane	1	6.5	3.9	56
Propane	2	9	1.55	-156
Propylene	2	11.1	1.45	-162
Propylene oxide	2.8	37	2	-35
Styrene	1.1	6.1	0.91	88
Toluene	1.3	7.1	0.87	40
Vinyl chloride	3.6	33	2.15	-110
p-Xylene	1.1	7	3.66	81

AREA CLASSIFICATION

Process plants are divided into Zones (European and IEC method or Divisions (North American method) according to the likelihood of a potentially explosive atmosphere being present.

Note: *North American legislation now allows Zones to be used to classify areas, where this practice is used it follows the IEC ZONE method.*

EUROPEAN & IEC CLASSIFICATION	DEFINITION OF ZONE OR DIVISION	NORTH AMERICAN CLASSIFICATION
Zone 0 (gases) Zone 20 (dusts)	An area in which an explosive mixture is continuously present or present for long periods	Class I Division 1 (gases) Class II Division 1 (dusts)
Zone 1 (gases) Zone 21 (dusts)	An area in which an explosive mixture is likely to occur in normal operation	Class I Division 1 (gases) Class II Division 1 (dusts)
Zone 2 (gases) Zone 22 (dusts)	An area in which an explosive mixture is not likely to occur in normal operation and if it occurs it will exist only for a short time	Class I Division 2 (gases) Class II Division 2 (Dusts)

GAS GROUPS

Both European/IEC standards and North American Standards group gasses according to their volatility. An electrical device that is certified for one gas group will automatically be certified for the less volatile gasses below it according to the chart.
GROUP I is concerned only with underground mining where methane and coal dust are present.
GROUP II gases occuring in surface industries, are sub-grouped according to their volatility. This enables electrical equipment to be designed to less onerous tolerances if it is to be used with the least volatile gas.

TYPICAL GAS / MATERIAL	EUROPEAN / IEC GAS GROUP	NORTH AMERICAN GAS GROUP
Acetylene	IIC	A
Hydrogen	IIC	B
Ethylene	IIB	C
Propane	IIA	D

TOXIC GAS

GAS	SPECIFIC GRAVITY AIR=1	EXPOSURE LIMITS BASED ON ACGIH TLV
AMMONIA	0.662	25 PPM
ARSINE	2.69	50 PPB
BORON TRIFLUORIDE	2.99	1 PPM (CEILING)
BROMIDE	3.12	100 PPB
CARBON MONOXIDE	0.97	25 PPM
CHLORINE	2.49	500 PPB
CHLORINE DIOXIDE	1.64	100 PPB
DIBORANE	0.21	100 PPB
DICHLOROSILANE (DCS)	3.48	N/A
DIMETHYLAMINE (DMA)	0.68	5 PPM
DIMETHYL HYDRAZINE (UDMH)	0.78	10 PPB
ETHYLENE OXIDE	0.88	1 PPM
FLUORINE	1.11	1 PPM
GERMANE	1.162	200 PPB
HYDRAZINE	0.797	10 PPB
HYDROGEN BROMIDE	2.77	2 PPM (CEILING)
HYDROGEN CHLORIDE	2.97	2 PPM (CEILING)
HYDROGEN CYANIDE	0.7	4.7 PPM (CEILING)
HYDROGEN FLUORIDE	0.7	3PPM (CEILING)
HYDROGEN PEROXIDE	1.46	1 PPM
HYDROGEN SULFIDE	1.19	10 PPM
METHYL FLUORIDE	1.19	N/A
NITRIC ACID	2.1	2 PPM
NITRIC OXIDE	1.04	25 PPM
NITROGEN DIOXIDE	1.59	3 PPM
NITROGEN TRIFLUORIDE	2.46	10 PPM
OZONE	1.66	100 PPB
PHOSGENE	1.39	100 PPB
PHOSPHINE	1.214	300 PPB
PROPYLENE OXIDE	0.83	2 PPM
SILANE	1.11	N/A
SULFUR DIOXIDE	2.26	2 PPM
SULFURIC ACID	3.4	N/A
TRIETHYL AMINE (TEA)	0.73	1 PPM

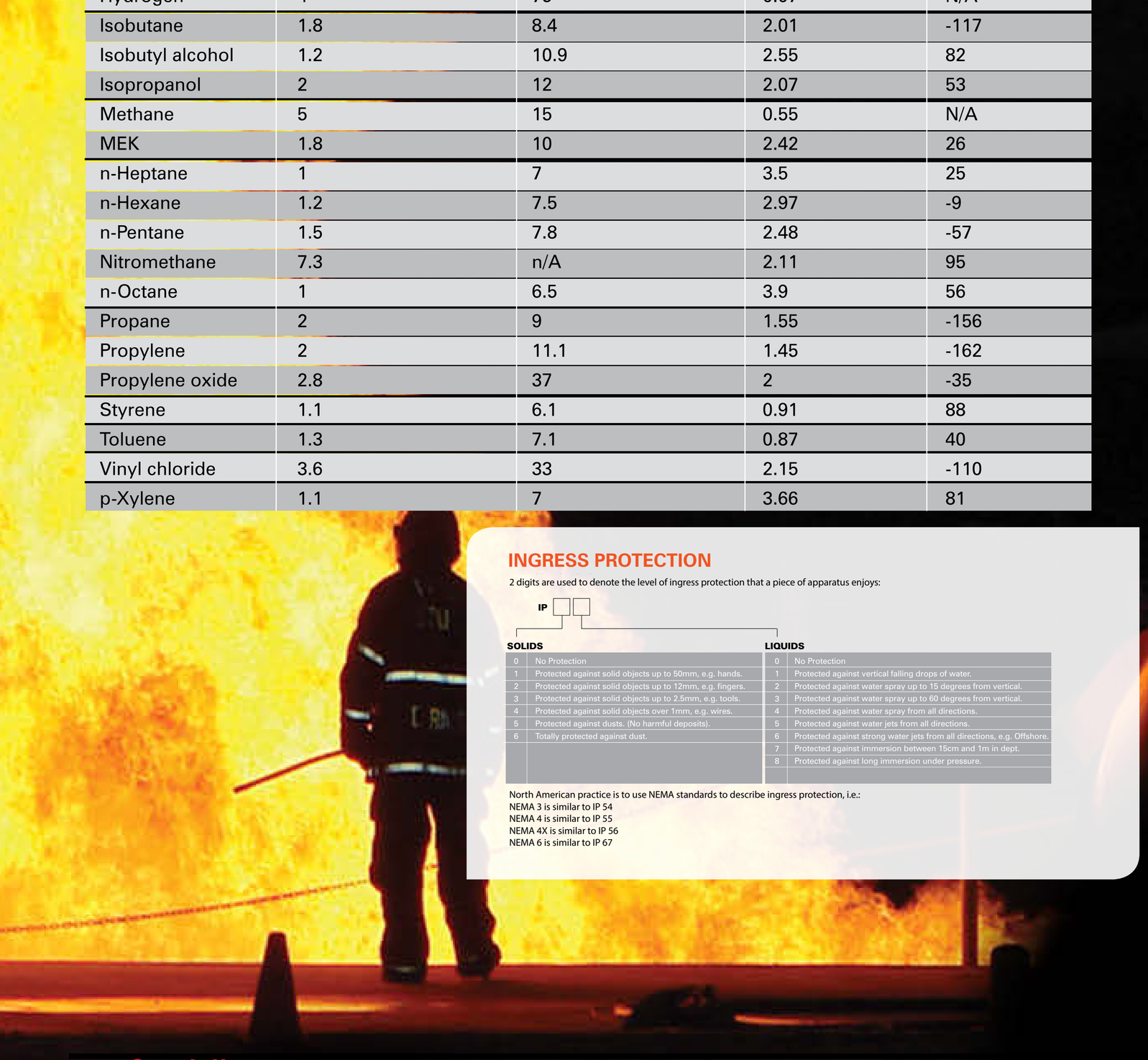
INGRESS PROTECTION

2 digits are used to denote the level of ingress protection that a piece of apparatus enjoys:

IP □□

SOLIDS		LIQUIDS	
0	No Protection	0	No Protection
1	Protected against solid objects up to 50mm, e.g. hands.	1	Protected against vertical falling drops of water.
2	Protected against solid objects up to 12mm, e.g. fingers.	2	Protected against water spray up to 15 degrees from vertical.
3	Protected against solid objects up to 2.5mm, e.g. tools.	3	Protected against water spray up to 60 degrees from vertical.
4	Protected against solid objects over 1mm, e.g. wires.	4	Protected against water spray from all directions.
5	Protected against dusts. (No harmful deposits).	5	Protected against water jets from all directions.
6	Totally protected against dust.	6	Protected against strong water jets from all directions, e.g. Offshore.
		7	Protected against immersion between 15cm and 1m in dept.
		8	Protected against long immersion under pressure.

North American practice is to use NEMA standards to describe ingress protection, i.e.:
NEMA 3 is similar to IP 54
NEMA 4 is similar to IP 55
NEMA 4X is similar to IP 56
NEMA 6 is similar to IP 67



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