ANNEX 1

This table gives the TCi value for some mixtures of gases commonly used in detectors.

Tci-values from the 05/96

Inert gases			Flammable	gases				
	Hydrogen (H2)	Methane (CH4)	Ethane (C2H6)	Propane (C3H8)	Iso-Butane (i-C4H10)	n-Butane (n-C4H10)		DME
	(45)	(35)	(24)	(35)	(25)	(30)	(25)	()
N2 (45)		9.9%	4.94%	4.25%	4.1%	3.55%	3.26%	
CO2 (30)		22.45%	9.09%	7.95%	7.95%	6.52 %	6.45%	
He (46)		11.86%	5.45%	4.41%	4.15%	3.58%	3.55%	
Ne (40)		9.2%	4.37%	3.45%	3.26%	2.74%	2.70%	
Ar (46)		6.15%	3.05%	2.76%	2.4%	2.28%	2.16%	
SF6 (30)		50.4%	20.4%	20.4%	19.43%	16.97%	-	
CF4 (27)		33.4%	13.0%	11.76%	9.5%	9.28%	9.1%	
R134a (27)		11.98%	7.14%	6.7%	5.75%	5.8%	-	
LEL (%)	3.5%	4.4%	2.4%	1.8%	1.55%	1.45%	1.4%	
UEL (%)		16.9%	14.6%	10.4%	8.4%	9%	8.9%	

HEATS OF COMBUSTION OF COMMON GASES

GAS	HEAT OF COMBUSTION (H_2O & CO_2 Gas) Kcal/mole	Kcal/kg	K = ratio of Heat of Combustion to that of Hydrogen
HYDROGEN	57.7979	28900	1.0
METHANE	191.759	11988	0.42
ETHANE	341.261	11377	0.39
PROPANE	488.527	11002	0.38
iso-BUTANE	635.384	10955	0.38
n-BUTANE	635.384	10955	0.38
n-PENTANE	782.04	10861	0.38
DIMETHYL ETHER (DME)	359.33	7811	0.27

Although the heat of combustion of hydrogen is more than twice that of methane, ethane, etc., the latter gases have a greater heat of combustion per unit **volume** because of their higher density.

Physico-Chemical Properties of Flammable Gases and Vapours in Common Use at CERN

Gas	Mol. Wt.	LEL %v/v	UEL %v/v	Auto-Ignition Temp. °C	Minimum Ignition Energy mJ	Explo-sion Group (Ex)	Tempera-ture Class (Ex)	Relative Density Air=1	Physical State in Bottle	Boiling Pt. °C	Pressure in Bottle @15 °C Bars Abs
Acetylene (C2H2)	26	1.5	100	305	0.02	IIC	T2	0.91	Dissolved	-84	16-19
Hydrogen (H2)	2			560	0.019	IIC	T1	0.695	Gas	-253	180-200
Methane (CH4)	16	4.4	16.9	537	0.29	IIA	T1	0.55	Gas	-161.5	180-200
Ethane C2H6)	30	2.4	14.6	515	0.24	IIA	T1	1.05	Liquid	-89	33.8
Propane (C3H8)	44	1.8	10.4	493	0.25	IIA	T1	1.56	Liquid	-42	8,8
n-Butane C4H10)	58			372	0.25	IIA	T2	2.05	Liquid	-1	1.76
iso-Butane (CH3CH (CH3)CH3)	58	1.55	8.4	462	0.25	IIA	T1	2.05	Liquid	-11.7	2.56
n-Pentane (C5H12)	72	1.4	8.0	258	0.25	IIA	T3	2.48	Liquid	+36	
Dimethyl Ether (CH3-O-CH3)	46	3.0	27.0	350		IIB	T2	1.59	Liquid	-25	4,24

Physico-Chemical Properties of Non-Flammable Gases and Vapours in Common Use at CERN

Gas	Mol. Wt.	Relative Density Air=1	Physical State in Bottle	Boiling Pt. oC	Pressure in Bottle @15 oC Bars Abs
Helium (He)	4	0.14	Gas	-268.93	180-200
Neon (Ne)	20	0.7	Gas	-252.77	180-200
Argon (Ar)	40	1.38	Gas		180-200
Krypton (Kr)	83.8	2.91	Gas	-153.35	180-200
Xenon (Xe)	131.3	4.56	Gas (above 16.58C)	-108.1	8,8
Nitrogen (N2)	28	0.97	Gas	-195.8	180-200
Oxygen (O2)	32	1.1	Gas	-182.97	180-200
Carbon Dioxide (CO2)	44	1.53	Liquid	-78.5*	51
Carbon Tetrafluoride (CF4)	88	2.84	Gas	-127.94	180-200
Sulphur Hexafluoride (SF6)	146	5.11	Liquid	-63.8*	18.4
R 134a (CH2F - CF3)	102		Liquid	-26.5	4.9
Air	29	1	Gas	-194.35	180-200

*Sublimation Point @ 1 Bar Abs.