TECHNICAL REPORT

ISO TR 10353

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Plastics — Survey of ignition sources used for national and international fire tests

Plastiques — Étude des sources d'allumage utilisées pour les essais au feu nationaux et internationaux

Reference number
ISO/TR 10353:1992(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 10353, which is a Technical Report of type 3, was prepared jointly by Technical Committees ISO/TC 61, *Plastics,* Sub-Committee SC 4, *Burning behaviour,* and ISO/TC 92, *Fire tests on building materials, components and structures,* Sub-Committee SC 1, *Reaction to fire*

This survey of ignition sources used in plastics tests was initiated by ISO/TC 61/SC 4 in September 1984. Additional information on fire tests for building materials was provided by members of ISO/TC 92/SC 1 from May 1986.

This Technical Report was prepared in conjunction with ISO 10093, *Plastics — Fire tests — Standard ignition sources.*

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INTRODUCTION

Many organisations throughout the world have recognised that there are too many fire tests and that national standards organisations were proliferating more tests without sufficient attempts at harmonisation. There was in particular insufficient regard for the relevance of the ignition source to realistic fire scenarios. This survey was initiated to provide essential background information prior to recommending specific categories of ignition source for use in fire tests on plastics.

Plastics — Survey of ignition sources used for national and international fire tests

1. SCOPE

This technical report reviews parameters of ignition sources used in current national standards for the evaluation of plastics and building materials.

2. REFERENCE

ISO 10 093 Plastics - Fire Tests - Standard Ignition Sources.

3. BASIS OF SURVEY

3.1 All members of ISO/TC 61/SC 4 were requested to provide information on the ignition sources used in their national standard fire tests on plastics. The relevant details were entered on a common form to facilitate comparison between methods. Where no information on some parameters was available from the standard or elsewhere, blanks were left in the table.

3.2 The survey covers mainly flame sources used in reaction-to-fire tests where primary and secondary ignition sources are met. Furnaces used in fire resistance and non-combustibility tests have been omitted since these are believed to be more relevant to developed fires.

3.3 The ignition sources have been classified according to the scheme proposed in DIS 10093. In this scheme, primary ignition sources are designated with a prefix P and secondary ignition sources are designated with a prefix S. The type of ignition source is then classified according to the following description :

Class	Type
S	Smouldering
E	Electrical
DF	Diffusion flame
PF	Premixed flame
C	Crib
R	Non contacting radiant

4. CONCLUSIONS

4.1 A vast number of different types of ignition source are used in standard tests throughout the world. Many of these sources bear little relevance to ignition sources frequently found in real-life scenarios.

4.2 There is insufficient information provided in many standards to ensure reproducability between laboratories. In particular, there is a lack of harmonisation in the gases used and in the procedures for setting-up gas-burners.

5. RECOMMENDATIONS

5.1. Attempts should be made to reduce the number of ignition-sources used in ISO/TC 61 tests.

5.2. Future laboratory ignition sources should be relatable to sources which a statistical analysis of real fires shows are common hazards.

5.3. gas-burners should be operated to closely controlled gas-flow and line pressure limits. Measurements of flame height or flame temperature should only be used for approximate descriptions.

5.4. Application time and mode of impingement of ignition source should be standardised.

TABLE 1 - COUNTRY : AUSTRALIA

TEST NUMBER	AS2/22.1	AS2/22.2	ARAPAHOE SMOKE CHAMBER	EBS IGNITABILITY	NBS FRP	AS1530.2	AS1530.3	
IGNITION SOURCE	Flame	Hot wire	Flame	Flame	Flame	Flame	Flame	
BURNER TYPE	Bunsen	Electric coil	Mini Bunsen	Capillary	Commercial torch	Copper trough	Metal tube	
MODIFICATIONS	Air flow controlled	-	-	-	-	-	-	
INTERNAL DIAMETER (mm)	9	NA	5	0,9	9 (0,075 orifice)	11 x 20	4	
AIR INLET (open or closed)	Orifice manometer controlled	NA	Open	Luminous flame	Open	Ambient	None	
FUEL TYPE :	LPG	NA	LPG	LPG	LPG	Ethanol	Natural gas	
CALORIFIC VALUE (mJ/m3)	93	NA	93	93	93	-	4	
GAS PRESSURE (kN/m2)	125 mm H_2O (0,53 mm Orifice)	NA	-	-	-	NA	-	
GAS FLOW-RATE (cm3/min)	-	NA	90	-	-	NA	-	
FLAME HEIGHT (mm) TOTAL	40	NA	15	20	20	-	12 when vertically upwards operated	
INNER CONE	20	NA	12	-	(13)	-		
FLAME TEMPERATURE (°C)	-	950 coil temperature	-	-	-	-	-	
THERMAL ENERGY (kJ)	-	-	-	-	-	-	-	
IRRADIANCE (kW/m2)	-	-	-	-	-	-	-	
APPLICATION TIME OF IGNITION SOURCE (SECS)	2, 5, 10	Up to 30	30	Up to 600 (pilot for effluent gases)	600	Until fuel (0.1 ml) is used	Remote pilot for effluent gases	
TYPE OF TEST : MATERIALS	Cellular plastics	Cellular and solid plastics fabrics	PVC solid plastics	Flat building materials linings	Flooring materials	Plastics films fabrics	Building materials	
APPLICATION	Qual. contr.	Qual. contr.	Qual. contr.	Research being standardised	Regulations	Regulations	Regulations	
EQUIVALENTS TESTS	None	None	None	Early version of ISO/DIS 5657	ASTM E 648	None	None	
CLASSIFICATION : DIS 10093	P/PF	P/E	P/PF	P/DF	P/PF	S/DF	P/DF	

NA : non available

TABLE 2 – COUNTRY : CANADA

TEST NUMBER	ASTM D 1230	CPS	CPAT-84E	CAN 4 5102 M 63	CAN 4 5102.2M83	CNA 4 5109 M 1980	CAN 4 5127 M 1982	CAN 2-4.2 M 77 27
IGNITION SOURCE	Flame	Flame	Flame	Flame	Flame	Flame	Flame	Flame
BURNER TYPE	Needle	Angled burner	Bunsen	Steiner tunnel	Steiner tunnel	Bunsen	Cylindrical tray	Bunsen or Tirrill
MODIFICATIONS	–	–	–	–	Angled Downwards	–	Sand ceramic beads	–
INTERNAL DIAMETER (mm)	26 gauge	11	9,4	–	19.1 orifice	9.5	48 holes of 02 in pipe	10
AIR INLET (open or closed)	Closed	Closed	Closed	Closed	Closed	Closed/Open	Open	Closed
FUEL TYPE :	N° 4 Butane	97 % Methane	Manufactured gas type B	Natural or Methane gas	Natural or Methane gas	Any gas	Natural gas	–
CALORIFIC VALUE (mJ/m3)	125	37.2	20.1	37.2	37.2	30 – 38	37.2	–
GAS PRESSURE (kN/m2)	17.2	17.2	–	–	–	–	–	–
GAS FLOW-RATE (cm3/min)	–	–	–	1.42×10^5	1.42×10^5	–	5.3×10^4	–
FLAME HEIGHT (mm) TOTAL	15.6	38	38	1372	1372	40/280	–	40
INNER CONE	NA	NA	NA	NA	NA	NA	NA	NA
FLAME TEMPERATURE (°C)	–	–	–	–	–	–	–	–
THERMAL ENERGY (kJ)	–	–	–	–	–	–	–	–
IRRADIANCE (kW/m2)	–	–	–	–	–	–	–	–
APPLICATION TIME OF IGNITION SOURCE (SECS)	A	3	12	600	600	12/120	300	12
TYPE OF TEST : MATERIALS	Clothing textiles	Children sleepwear	Tent material	Building material	Floors coverings	Fabrics and films	Non melting building materials	Textile fabrics
APPLICATION	Flame spread	Char length	Flame spread	Flame spread	Flame spread	–	Corner wall test	Flame spread
TESTS EQUIVALENTS								
CLASSIFICATION : DIS 10093	P/DF	P/DF	P/DF	S/DF	S/DF	P/PF	S/PF	P/DF

TABLE 2 (continued) – COUNTRY : CANADA

TEST NUMBER	CAN2.4.2 M77 27.7	CAN2 51-GP-1cm	CAN2C22.2 No.0.6 m1982					
IGNITION SOURCE	Cigarette	Flame	Flame					
BURNER TYPE	NA	NA	Tirrill					
MODIFICATIONS	–	–	–					
INTERNAL DIAMETER (mm)	NA	NA	10					
AIR INLET (open or closed)	NA	NA	Open					
FUEL TYPE :	Natural tobacco 85 mm long 1.1 g	Natural tobacco 84 mm 1.1. g	Natural or methane gas					
CALORIFIC VALUE (mJ/m3)	–	–	37					
GAS PRESSURE (kN/m2)	NA	NA	74					
GAS FLOW-RATE (cm3/min)	NA	NA	–					
FLAME HEIGHT (mm) TOTAL	NA	NA	127					
INNER CONE	NA	NA	38					
FLAME TEMPERATURE (°C)	–	–	950					
THERMAL ENERGY (kJ)	–	–	–					
IRRADIANCE (kW/m2)	–	–	–					
APPLICATION TIME OF IGNITION SOURCE (SECS)	< 500	< 500	5 x 54					
TYPE OF TEST : MATERIALS	Matresses	Cellulose insulation	Polymers in electrical equipment					
APPLICATION	Flame spread	Flame spread	Flammability properties					
TESTS EQUIVALENTS								
CLASSIFICATION : DIS 10093	P/S	P/S	S/PF					

TABLE 3 – COUNTRY : CZECHOSLOVAKIA

TEST NUMBER	64 0149	64 0752	64 0755	64 0756	64 0757	64 5464	64 0853	2437
IGNITION SOURCE	Flame	Incandescent bar	Flame	Flame	Flame	Flame	Flame	Flame
BURNER TYPE	–	NA	Bunsen	–	Bunsen	Bunsen	Landman	
MODIFICATIONS	–	–	–			Wing top 48 x 3 mm	–	–
INTERNAL DIAMETER (mm)	0.8-1.6	8 (S.C. rod)	9.5	2-3	9.5	–	–	–
AIR INLET (open or closed)	–	NA	–	–	–	–	Open	–
FUEL TYPE :	–	NA	–	–	–	–	Coal gas	
CALORIFIC VALUE (mJ/m3)	–	NA	–	–	–	–	–	–
GAS PRESSURE (kN/m2)	–	NA	–	–	–	–	–	–
GAS FLOW-RATE (cm3/min)	–	NA	–	–	–	–	2000	–
FLAME HEIGHT (mm) TOTAL	20	NA	100	6-12	100	38	100	–
INNER CONE		NA	–	–	–	–	–	–
FLAME TEMPERATURE (°C)	–	955	–	–		–	1000-1100	
THERMAL ENERGY	–	–	–	–		–	4000 Kcal/m3	
IRRADIANCE (kW/m2)	–	–	–	–	–	–	–	–
APPLICATION TIME OF IGNITION SOURCE (SECS)	–	–	–	–		–	600	
TYPE OF TEST : MATERIALS	Plastics	Plastics	Plastics	Plastics	Plastics	Cellular plastics and rubber	Building materials	Building materials
APPLICATION	Ignition temperature	–	Bars	Oxygen index	Films	–	–	–
TESTS EQUIVALENTS	–	–	–	–	–	–	–	DIN 4102 brandschascht
CLASSIFICATION : DIS 10093	P/DF	P/E	S/PF	P/DF	S/PF	P/PF	S/PF	S/PF

TABLE 4 – COUNTRY : FINLAND

TEST NUMBER	SFS 4190	SFS 4192	SFS 4194	SFS 4195				
IGNITION SOURCE	Gas burner	Gas burner	Wood crib	Wood crib				
BURNER TYPE	Teclu	Ring burner Ø 45 mm	NA	NA				
MODIFICATIONS	–	–	NA	NA				
INTERNAL DIAMETER (mm)	–	–	NA	NA				
AIR INLET (open or closed)	Open	–	NA	NA				
FUEL TYPE :	Propane (min. 95 %)	Propane (min. 95 %)	Pine 40 g	Pine 40 g				
CALORIFIC VALUE (mJ/m3)	–	–	–	–				
GAS PRESSURE (kN/m2)	–	–	NA	NA				
GAS FLOW-RATE	90 g/h	380 g/h	NA	NA				
FLAME HEIGHT (mm) TOTAL	–	–	–	–				
INNER CONE		–	–	–				
FLAME TEMPERATURE (°C)	–	–	–	–				
THERMAL ENERGY (kJ)	–	–	–	–				
IRRADIANCE (kW/m2)	–	–	–	–				
APPLICATION TIME OF IGNITION SOURCE (SECS)	max. 1800	max. 600	–	–				
TYPE OF TEST : MATERIALS	Building products	Building products	Roofing materials	Flooring materials				
APPLICATION	Primarily flat products	Primarily flat products	Roofing materials	Flooring materials				
TESTS EQUIVALENTS	Nordtest NT fire 002	Nordtest NT fire 004	Nordtest NT fire 006	Nordtest NT fire 007				
CLASSIFICATION : DIS 10093	S/PF	S/PF	S/C	S/C				

TABLE 5 – COUNTRY : FRANCE

TEST NUMBER NF	S 51-203	/	C 32-070	C 68-093	L 17-106	P 92-501	P 92-503	P 92-504
IGNITION SOURCE	Flame	-	Flame	Flame	Flame	Electric radiator	Electric radiator	Flame
BURNER TYPE	Bunsen	-	Bunsen	Bunsen	Bunsen	-	-	Bunsen
MODIFICATIONS	-	-	NA	NA	-	Pilot flame	Pilot flame	-
INTERNAL DIAMETER (mm)	-	-	9-12	10	9-5	-	-	9-5
AIR INLET (open or closed)	-	-	-	-	-	-	-	-
FUEL TYPE :	Propane or Butane	-	Propane	Propane	Town gas	Butane	Butane	Town
CALORIFIC VALUE (mJ/m3)	-	-	-	-	-	-	-	-
GAS PRESSURE (kN/m2)	-	-	-	-	-	-	-	-
GAS FLOW-RATE (cm3/min)	-	-	-	-	-	-	-	-
FLAME HEIGHT (mm) TOTAL	20	-	125	15	38	-	-	25
INNER CONE	-	-	40	-	-	-	-	-
FLAME TEMPERATURE (°C)	-	-	M. pt. of copper wire	-	> 840			
THERMAL ENERGY (kJ)	-	-	-			500 W	500 W	-
IRRADIANCE (kW/m2)	-	-	-	-	-	30	-	-
APPLICATION TIME OF IGNITION SOURCE (SECS)	20	-	-	-	-	1200	300	30
TYPE OF TEST : MATERIALS	-	-	-	-	-	Building materials	Flexible materials	
APPLICATION	Toys	-	-	-	-	-	-	Spread of flame
TESTS EQUIVALENTS	-	-	-	-	-	-	-	-
CLASSIFICATION : DIS 10093	P/PF	P/PF	S/PF	P/PF	P/PF	S/R	S/R	P/PF

TABLE 5 (continued) – COUNTRY : FRANCE

TEST NUMBER NF	P 92-505	P 92-506	T 51-072	T 56-125	C 20-455	C 20-456	T 51-071	T 47-108
IGNITION SOURCE	Electric radiator	Radiant panel	Flame	Flame	Glow-wire	Flame	Flame	Flame
BURNER TYPE	NA	NA	Bunsen	Bunsen	NA	Needle	–	Alcohol
MODIFICATIONS	NA	Pilot flame	–	Wingtop	–	–	–	–
INTERNAL DIAMETER (mm)	NA	–	9.5	9.5	NA	0.5	3	20
AIR INLET (open or closed)	NA	–	–	–	–	Closed	–	–
FUEL TYPE :	NA	Propane	Natural gas	Propane or butane	–	Butane	Propane or butane	Alcohol
CALORIFIC VALUE (mJ/m3)	NA	–	–	–	–	–	–	–
GAS PRESSURE (kN/m2)	NA	–	–	–	–	–	–	–
GAS FLOW-RATE (cm3/min)	NA	–	–	–	–	–	–	–
FLAME HEIGHT (mm) TOTAL	NA	–	HB = 25 V = 19	38	–	12	–	150
INNER CONE	NA	–	0	6	–	–	–	–
FLAME TEMPERATURE (°C)	NA	850	–	–	550, 650, 750, 850, 960	–	–	M. pt. of copper wire
THERMAL ENERGY (kJ)	500 W	–	–	–	–	–	–	–
IRRADIANCE (kW/m2)	30	–	–	–	–	–	–	–
APPLICATION TIME OF IGNITION SOURCE (SECS)	600 max	600	–	300	60	50-120	180	–
TYPE OF TEST : MATERIALS	Plastics	Floor coverings	Plastics	Foams	Electrical materials	Electrical materials	Plastics	Conveyor belts
APPLICATION	Drip test	–	–	–	–	Spread of flame	Oxygen index	–
TESTS EQUIVALENTS	–	–	–	–	IEC 695-2-1	IEC 695-2-2	–	ISO 340
CLASSIFICATION : DIS 10093	S/R	S/R	P/DF	P/PF	P/E	P/DF	P/DF	S/DF

TABLE 5 (continued) – COUNTRY : FRANCE

TEST NUMBER NF	D 60-011	D 60-012	T 51-015					
IGNITION SOURCE	Cigarette	Flame	Glow-wire					
BURNER TYPE	NA	Tube	NA					
MODIFICATIONS	Length 68 mm Diameter 8 mm	–	–					
INTERNAL DIAMETER (mm)	Masse 1 g	–	NA					
AIR INLET (open or closed)	NA	Closed	NA					
FUEL TYPE :	Tobacco	Propane or butane	NA					
CALORIFIC VALUE (mJ/m3)	–	–	NA					
GAS PRESSURE (kN/m2)	NA	2.55	NA					
GAS FLOW-RATE (cm3/min)	NA	45	NA					
FLAME HEIGHT (mm) TOTAL	NA	–	NA					
INNER CONE	NA	–	NA					
FLAME TEMPERATURE (°C)	–	–	960					
THERMAL ENERGY (kJ)	–	–	–					
IRRADIANCE (kW/m2)	–	–	–					
APPLICATION TIME OF IGNITION SOURCE (SECS)	–	–	180					
TYPE OF TEST : MATERIALS	–	–	thermo-sets					
APPLICATION	–	–	–					
TESTS EQUIVALENTS	BS 5852 Part 1	BS 5852 Part 1 and 2	ISO 181					

CLASSIFICATION : P/S P/DF P/E
DIS 10093

TABLE 6 – COUNTRY : GERMANY

TEST NUMBER DIN	57 472 Part 804A	57 472 Part 804B	57 472 Part 804C	57 472 Part 814	VDE 0471 Part 2-2 (3.84)	VDE 0471 Part 2-1 (3.84)		
IGNITION SOURCE	Flame	Flame	Flame	Flame	Flame	Glow-wire (electrically heated)		
BURNER TYPE	Bunsen	Bunsen	Ribbon type burner	Long tube burner		–		
MODIFICATIONS	Without igniting flame	–	–	–		–		
INTERNAL DIAMETER (mm)	8	8	–	–	0,5 ± 0,1	–		
AIR INLET (open or closed)	Closed	Open	Open	Open		–		
FUEL TYPE :	Propane	Propane	Propane (Propane/air mixture)	Propane (Propane/air mixture)	Butane (purity-95 %)	–		
CALORIFIC VALUE (mJ/m3)	93,87	93,87	93,87	93,87		–		
GAS PRESSURE (kN/m2)	–	300 (abs.)	–	–		–		
GAS FLOW-RATE (cm3/min)	–	–	1483,3 ± 100	–		–		
FLAME HEIGHT (mm) TOTAL	125	175	–	–		–		
INNER CONE	–	55	–	–		–		
FLAME TEMPERATURE (°C)	–	Copper wire test	–	800 ± 50 in a distance of 75 mm from the burner	800 ± 50 in a distance of 75 mm from the burner	550 – 650 – 750 850 – 960		
THERMAL ENERGY (kJ)	–	–	$(25 \pm 1.67) \times 10^3$	–		–		
IRRADIANCE (kW/m2)	–	–	–	–		–		
APPLICATION TIME OF IGNITION SOURCE (SECS)	Variable t_{max} : 20	$t = 60 + \frac{m}{25}$ m = sample mass(g) t = time of application of the flame	1200	Until the failure of the 2-A fuse	5 – 10 – 20 – 30 – 60 – 120	30 ± 1		
TYPE OF TEST : MATERIALS	Flame propagation characteristics	Flame propagation characteristics	Flame propagation characteristics	Testing of the insulation effect under fire conditions	Fire hazard testing	Fire hazard testing		
APPLICATION	Testing of cable, wires and flexible cords	Testing of cable, wires and flexible cords	–	Testing of cable, wires and flexible cords		Specification for fire risk testing of electrotechnical prod.		
TESTS EQUIVALENTS	VDE 0472 Part 804A (8.83)	VDE 0472 Part 804B (8.83)	Similar to IEC-Report 332-3 VDE 0472 Part 804C (8.83)	Similar to IEC Publication 331	IEC 695-2-2 1980	IEC 695-2-1 8.1980		
CLASSIFICATION : DIS 10093	S/DF	S/PF	S/PF	S/PF	P/DF	P/E		

TABLE 6 (continued) – COUNTRY : GERMANY

TEST NUMBER DIN	4102 Part 1, B1	4102 Part 1, B2	75200	53438	54332	54336	22103	22118
IGNITION SOURCE	Flame	Flame	Flame	Flame	Flame	Flame	Flame	Flame
BURNER TYPE	Ring burner	Klein-brenner	Bunsch	Klein-brenner	Klein-brenner	Klein-brenner	Bunsen or Barthel	Franke III
MODIFICATIONS	Pilot-Flame	–	–	–	–	–	–	–
INTERNAL DIAMETER (mm)	Nozzle 3,5	Nozzle 0,17	9,5	Nozzle 0,17	–	–	10	–
AIR INLET (open or closed)	–	–	Closed	Open	–	–	–	–
FUEL TYPE :	Methane 99,5 %	Propane	–	Propane	Propane	Propane	Propane or alcohol	Propane
CALORIFIC VALUE (mJ/m3)	–	–	38 mJ/m3	–	–	–	–	–
GAS PRESSURE (kN/m2)	–	–	–	50 – 500 mbar	–	–	–	–
GAS FLOW-RATE	35 l/min ± 0,5 l/min	–	–	–	–	–	–	–
FLAME HEIGHT (mm) TOTAL	–	20	38	20	20	40 ± 3	150-180	–
INNER CONE	–	–	–	–	–	–	–	–
FLAME TEMPERATURE (°C)	–	–	–	–	–	–	–	–
THERMAL ENERGY (kJ)	–	–	–	–	–	–	–	–
IRRADIANCE (kW/m2)	–	–	–	–	–	–	–	–
APPLICATION TIME OF IGNITION SOURCE (SECS)	600	15	15	15	15,5	15	45	900
TYPE OF TEST : MATERIALS	Building materials	Building materials	Road vehicles	–	Textiles	Textiles	–	–
APPLICATION	Brandschacht	–	–	–	Floor materials	–	Conveyor belts	Conveyor belts
TESTS EQUIVALENTS	–	–	ISO 3795	DIN 4102 B2	–	–	–	–
CLASSIFICATION : DIS 10093	S/PF	P/PF	P/DF	P/PF	P/PF	P/PF	S/PF	S/PF

TABLE 6 (continued) – COUNTRY : GERMANY

TEST NUMBER MSZ	54333	54334	54341	54324/1	54324/1			
IGNITION SOURCE	Flame	Flame	Flame	Cigarette	Flame			
BURNER TYPE	Klein-brenner	Klein-brenner	Paper-pillow		Tube			
MODIFICATIONS								
INTERNAL DIAMETER (mm)	Nozzle 0,17	Nozzle 0,17			6,5 ± 0,1			
AIR INLET (open or closed)	Open	Open						
FUEL TYPE :	Propane	Propane	Paper	Mass (1 ± 0,1)9	Propane			
CALORIFIC VALUE (mJ/m3)			80-90 g					
GAS PRESSURE (kN/m2)	50-500 mbar	50-500 mbar						
GAS FLOW-RATE (cm3/min)					45 ± 2			
FLAME HEIGHT (mm) TOTAL	40	40						
INNER CONE								
FLAME TEMPERATURE (°C)								
THERMAL ENERGY (kJ)								
IRRADIANCE (kW/m2)								
APPLICATION TIME OF IGNITION SOURCE (SECS)	Until ignition	15						
TYPE OF TEST : MATERIALS			Uphalstered furniture	Uphalstered furniture	Uphalstered furniture			
APPLICATION			Railway seats					
TESTS EQUIVALENTS								
CLASSIFICATION : DIS 10093	P/PF	P/PF	S/DF	P/S	P/DF			

TABLE 7 – COUNTRY : HUNGARY

TEST NUMBER MSZ	14800/3-69	14800/4-74	04 103-77					
IGNITION SOURCE	Flame	Flame	Flame					
BURNER TYPE	Quadratic with 32 jets	Quadratic with 32 jets	wood crib					
MODIFICATIONS	–	–	–					
INTERNAL DIAMETER (mm)	–	–	–					
AIR INLET (open or closed)	–	–	–					
FUEL TYPE :	–	–	Wool + 10 kg fuel oil					
CALORIFIC VALUE (mJ/m3)	–	–	–					
GAS PRESSURE (kN/m2)	–	–	–					
GAS FLOW-RATE (cm3/min)	72,000	85,000	–					
FLAME HEIGHT (mm) TOTAL	–	–	–					
INNER CONE	–	–	–					
FLAME TEMPERATURE (°C)	–	–	300 (at 10 mm) 600 (at 15 mm)					
THERMAL ENERGY	5000 Kcal/Nm^3	4200 Kcal/Nm^3	–					
IRRADIANCE (kW/m2)	–	–	–					
APPLICATION TIME OF IGNITION SOURCE (SECS)	600	120	1200 max					
TYPE OF TEST : MATERIALS	Building materials	Building materials	Wall facades					
APPLICATION	Low combustibility	Moderate combustibility	–					
TESTS EQUIVALENTS	DIN 4102 Part 1 Brandschacht	DIN 4102 Part 1 Brandschacht	–					

CLASSIFICATION : S/PF S/PF S/C
DIS 10093

TABLE 8 – COUNTRY : ITALY

TEST NUMBER CSE	RF1/75/A	RF2/75/A	RF3/77					
IGNITION SOURCE	Flame	Flame	Radiant panel + flame					
BURNER TYPE	Kleinbrenner	Kleinbrenner	–					
MODIFICATIONS	–	–	–					
INTERNAL DIAMETER (mm)	6	6	–					
AIR INLET (open or closed)	Open	–	–					
FUEL TYPE :	Propane	Propane	–					
CALORIFIC VALUE (mJ/m3)	–	–	–					
GAS PRESSURE (kN/m2)	–	–	–					
GAS FLOW-RATE (cm3/min)	–	–	–					
FLAME HEIGHT (mm) TOTAL	40	20	50					
INNER CONE	35	15	–					
FLAME TEMPERATURE (°C)	–	–	–					
THERMAL ENERGY (kJ)	–	–	–					
IRRADIANCE (kW/m2)	–	–	2-30					
APPLICATION TIME OF IGNITION SOURCE (SECS)	12	30	–					
TYPE OF TEST : MATERIALS	curtains, linings	linings, floors, walls, ceilings	Building materials					
APPLICATION	–	–	spread of flame					
TESTS EQUIVALENTS	DIN 50051	DIN 50051	–					
CLASSIFICATION : DIS 10093	P/PF	P/PF	S/R					

TABLE 9 – COUNTRY : JAPAN

TEST NUMBER	JIS A 1321	JIS A 1322	JIS D 1201	JIS K 6911	JIS K 6911	JIS K 7201	JIS C 0061	
IGNITION SOURCE	Electric furnace	Flame	Flame	Flame	Flame	Flame	Flame	
BURNER TYPE	–	Mekeer	Bunsen	Bunsen	Bunsen	–	Needle	
MODIFICATIONS	–	–	–	–	–	–	–	
INTERNAL DIAMETER (mm)	–	20	9	9,5	9,5	3	0,5 ± 0,1	
AIR INLET (open or closed)	Open	Open	Open	Open	Open	Closed	Closed	
FUEL TYPE :	–	LPG	Natural gas	Natural gas	Natural gas	LPG	Butane (propane)	
CALORIFIC VALUE (mJ/m3)	–	128,5	37	37	37	100,5	–	
GAS PRESSURE (kN/m2)	–	–	–	–	–	–	–	
GAS FLOW-RATE (cm3/min)	–	–	–	–	–	11400	–	
FLAME HEIGHT (mm) TOTAL	–	65	38	19	25,4	15-20	12 ± 1	
INNER CONE	–	–	–	–	–	–	–	
FLAME TEMPERATURE (°C)	–	–	–	–	–	–	–	
THERMAL ENERGY (kJ)	–	–	–	–	–	–	–	
IRRADIANCE (kW/m2)	–	–	–	–	–	–	–	
APPLICATION TIME OF IGNITION SOURCE (SECS)	–	10, 20, 30, 60, 120, 180	15	10	30	–	5, 10, 20 30, 60, 120	
TYPE OF TEST : MATERIALS	Internal finish material	Thin material	Organic material	Thermo-setting plastics	Thermo-setting plastics	Rubber plastics fibres	Plastics	
APPLICATION	Building	Building	Automobile	Method B	Method C	–	Electrical components	
TESTS EQUIVALENTS	–	–	FMVSS 302	UL 94	UL 94	ASTM D 2863	IEC 695-2-2	
CLASSIFICATION : DIS 10093	S/R	P/PF	P/PF	P/PF	P/PF	P/DF	P/DF	

TABLE 10 – COUNTRY : NETHERLANDS

TEST NUMBER	NEN 3883	NEN 3883 flashover	NEN 3882	NEN 3881	NEN 1775	NEN 1775 Propagation	NEN 1722	
IGNITION SOURCE	Radiant panel	12 electric filaments + pipe burner	0,6 kg wood wool in basket	Electric oven	Flame	Radiant panel + Gasburner	Flame	
BURNER TYPE	–	Gas jets	NA	NA	Kleinbrenner	–	Kleinbrenner	
MODIFICATIONS	Natural gas Pilot flame	–	NA	NA	–	Propane-mix igniter	–	
INTERNAL DIAMETER (mm)	–	–	NA	NA	–	Igniter-nozzle 0,17	–	
AIR INLET (open or closed)	–	–	NA	NA	–	mix : gas-air by venturi	–	
FUEL TYPE :	Natural gas	Hydrogen 70 % Nat. gas 30 %	Wood	NA	Propane	Propane	Propane	
CALORIFIC VALUE (mJ/m3)								
GAS PRESSURE (kN/m2)	–	–	NA	NA	–	–	–	
GAS FLOW-RATE (cm3/min)								
FLAME HEIGHT (mm) TOTAL	180	20	–	NA	20	–	–	
INNER CONE	NA	–	–	NA	–	–	–	
FLAME TEMPERATURE (°C)	900	–	–	750	–		Panel : 500 Chamber :180±3	
THERMAL ENERGY (kJ)	–	HFR : 0,19-2,25	–	–	–	–	–	
IRRADIANCE (kW/m2)	–	–	–	–	–	–	–	
APPLICATION TIME OF IGNITION SOURCE (SECS)	600	1800 max	–	–	–	600	–	
TYPE OF TEST : MATERIALS	Surface spread of flame	Ignitability flashover smoke	Roof resistance test	non-combustibility test for building materials	Ignitability floors + coverings or coat	Fire propagation floors + coverings or finishing coat	Burning behaviour textiles ignitability flame speed of vertically used textiles	
APPLICATION								
TESTS EQUIVALENTS	BS 476 Part 7	formerly : NEN 1076 pt B+C	DIN 4102	DIS-ISO 1182 BS 476 Part 4	DIN 4102	ASTM E648-78		
CLASSIFICATION : DIS 10093	S/R	S/R	S/C	S/R	P/PF	S/R	P/PF	

TABLE 11 - COUNTRY : SWEDEN

TEST NUMBER	SIS 650082	SIS 650083	SS 024831	SS 024825	SS 832527	SS 923512	SEMK 0101	SEMK 0101
IGNITION SOURCE	Flame	Flame	Flame	Radiation + flames	Flame	Cigarette	Flame	Flame
BURNER TYPE	Bunsen	Needle	Bunsen	-	-	-	Needle	Bunsen
MODIFICATIONS	-	-	-	-	-	-	-	-
INTERNAL DIAMETER (mm)	9	0.25	9	Size of source 100 x 100	-	Size 8 x 70	0.5	10
AIR INLET (open or closed)	Closed	Closed	Open	-	-	NA	Closed	Open
FUEL TYPE :	Propane	Butane	Propane	Wood (40 g)	Methenamine pill	Tobacco	Butane	Methane
CALORIFIC VALUE (mJ/m3)	-	-	-	-	-	NA	-	-
GAS PRESSURE (kV/m2)	-	-	2	-	-	NA	-	-
GAS FLOW-RATE (cm3/min)	-	-	750	-	-	NA	-	-
FLAME HEIGHT (mm) TOTAL	38	16	220	-	-	NA	12	25
INNER CONE	-	-	-	-	-	NA	-	-
FLAME TEMPERATURE (°C)	-	-	-	-	-	-	-	-
THERMAL ENERGY (kJ)	-	-	-	-	-	-	-	-
IRRADIANCE (kW/m2)	-	-	-	-	-	-	-	-
APPLICATION TIME OF IGNITION SOURCE (SECS)	12	-	900	900 max	-	-	10,60 or 120	30
TYPE OF TEST : MATERIALS	Fabrics	Fabrics	Building materials	Flooring	Flooring	Flooring	Electrical equipment	Electrical equipment
APPLICATION	-	-	-	-	-	-	-	-
TESTS EQUIVALENTS	-	-	-	-	-	-	-	-
CLASSIFICATION : DIS 10093	P/DF	P/DF	S/PF	S/C	P/DF	P/S	P/DF	P/PF

TABLE 12 – COUNTRY : SWITZERLAND

TEST NUMBER	SIA 183/2 Part 2	SNV 198891						
IGNITION SOURCE	Flame	Flame						
BURNER TYPE	M Luscher	Kleinbrenner						
MODIFICATIONS	–							
INTERNAL DIAMETER (mm)	0.18 / 3.5							
AIR INLET (open or closed)	1/2 open							
FUEL TYPE :	–							
CALORIFIC VALUE (mJ/m3)	–							
GAS PRESSURE (kN/m2)	28-500							
GAS FLOW-RATE (cm3/min)	–							
FLAME HEIGHT (mm) TOTAL	20	20						
INNER CONE	17							
FLAME TEMPERATURE (°C)	1050							
THERMAL ENERGY (kJ)	–							
IRRADIANCE (kW/m2)	–							
APPLICATION TIME OF IGNITION SOURCE (SECS)	Edge 15 Face 45	30						
TYPE OF TEST : MATERIALS	Building materials	Flooring						
APPLICATION	–							
TESTS EQUIVALENTS	–							
CLASSIFICATION : DIS 10093	P/PF	P/PF						

TABLE 13 – COUNTRY : UNITED KINGDOM

TEST NUMBER BS	415	476 Part 3	476 Part 5	476 Part 6	2011 2 = 1 P2	2495	2782 Part 1 = 140D	2782 Part 1 = 140A
IGNITION SOURCE	Flame	Flame	Flame	Flame + 2 electric bars	Flame	Flame	Flame	Flame
BURNER TYPE	Tube	Tube	Tube	Tube with 14 holes	Tube	Bunsen	Cup	Bunsen
MODIFICATIONS	–	–	–	–	–	–	–	–
INTERNAL DIAMETER (mm)	0.5	9	1.5	Holes 1.5	14–15	10	NA	–
AIR INLET (open or closed)	Closed	Closed	Closed	Open	–	Open	NA	–
FUEL TYPE :	Butane	Town gas * or natural gas	Town gas *	Town gas *	Propane	Propane	Industrial methylated spirit (99 %)	–
CALORIFIC VALUE (mJ/m3)	–	–	27	16.3	–	–	–	–
GAS PRESSURE (kN/m2)	–	–	–	100	–	3.4	NA	–
GAS FLOW-RATE (cm3/min)	–	TG = 3730 NG = 1550	–	1940	–	–	NA	–
FLAME HEIGHT (mm) TOTAL	12 ± 2	200–250	10	–	–	–	–	13–19
INNER CONE	–	0	0	–	12–13	15	–	0
FLAME TEMPERATURE (°C)	800	–	–	–	Copper wire > 1000°C for < 6 s	–	–	–
THERMAL ENERGY (kJ)	–	–	–	–	–	–	–	–
IRRADIANCE (kW/m2)	–	–	–	2 kW heaters + 14.6 kW/m2 Gas burner	–	–	–	–
APPLICATION TIME OF IGNITION SOURCE (SECS)	15	60	10	1200	15	–	–	10
TYPE OF TEST : MATERIALS	Plastics	Plastics, bitumen felt	Building materials	Building materials	Plastics	GRP	Plastics	Plastics
APPLICATION	Printed circuit boards	Roofing	Ignitability	Heat release	Electrical	Protective helmets	QC	QC
TESTS EQUIVALENTS	–	–	–	–	–	–	–	–
CLASSIFICATION :	P/DF	S/DF	P/DF	S/R + PF	S/PF	S/PF	S/DF	P/PF

* Methane 27.4 %
Nitrogen 17.4 %
Hydrogen 55.2 %
DIS 10093

TABLE 13 (continued) – COUNTRY : UNITED KINGDOM

TEST NUMBER BS	2782 Part 1 = 140E	3119	3212	3869	4066		4569	4584 Part 1	4607 Part 3
IGNITION SOURCE	Flame	Flame	Flame	Flame	Flame		Flame	Flame	Flame
BURNER TYPE	Cup	Bunsen	Bunsen	Bunsen	Bunsen		Tube	Bunsen	Bunsen
MODIFICATIONS	–	–	–	–	–		–	–	–
INTERNAL DIAMETER (mm)	NA	9	–	–	9 ± 1		3	–	9
AIR INLET (open or closed)	NA	Closed	Open	Open	–		–	Open	Open
FUEL TYPE :	Industrial methylated spirits (99 %)	–	–	–	Propane or natural gas		Butane	Methane or natural gas	Propane or butane
CALORIFIC VALUE (mJ/m3)	–	–	–	–	–		–	37	–
GAS PRESSURE (kN/m2)	NA	–	–	–	–		–	–	–
GAS FLOW-RATE (cm3/min)	NA	–	–	–	–		–	–	–
FLAME HEIGHT (mm) TOTAL	–	38	Diameter = 25	19	125	175	50	25	100
INNER CONE	–	–	–	–	40	55	–	–	50
FLAME TEMPERATURE (°C)	713	–	–	–	M. pt. of copper wire		–	–	Cooper wire melts<6s
THERMAL ENERGY (kJ)	–	–	Heat flow rate = 0.5 kW	–	–		–	–	–
IRRADIANCE (kW/m2)	–	–	–	–	–		–	–	–
APPLICATION TIME OF IGNITION SOURCE (SECS)	45	12	–	–	60 (min)		2	30	–
TYPE OF TEST : MATERIALS	Plastics	Textiles	Rubber	U-PVC	Plastics		Textiles	Plastics	Plastics
APPLICATION	QC	Flameproof industrial clothing	Tubing	Building	Cables		Pile fabrics	Electronic enclosures	Electronic conduits
TESTS EQUIVALENTS	–	–	–	–	–		–	–	–
CLASSIFICATION : DIS 10093	S/DF	S/DF	S/PF	P/PF	S/PF		P/DF	P/PF	S/PF

TABLE 13 (continued) – COUNTRY : UNITED KINGDOM

TEST NUMBER BS	4735	5438	5852 Part 1	5852 Part 1	5852 Part 2	5852 Part 2	5852 Part 2	5852 Part 2
IGNITION SOURCE	Flame		Cigarette	Flame 1	Flame 2	Flame 3	Crib 4	Crib 5
BURNER TYPE	Bunsen		Length 68 mm Diameter 8 mm Mass 4 g	Tube Simulated match flame	Tube	Tube	NA	NA
MODIFICATIONS	Wing-top Jet = 0.3 mm			–	–	–	NA	NA
INTERNAL DIAMETER (mm)	9.5 ± 0.5		NA	6.5	6.5	6.5	NA	NA
AIR INLET (open or closed)	–		NA	Closed	Closed	Closed	NA	NA
FUEL TYPE :	Propane		Tobacco	Butane	Butane	Butane	Wood (pinus silvestris) 8,5 g ± 0,5 g	Wood (pinus silvestris) 17 g ± 1g
CALORIFIC VALUE (mJ/m3)	–		–	–	–	–		
GAS PRESSURE (kN/m2)	< 7		NA	2.8	2.8	2.8	NA	NA
GAS FLOW-RATE (cm3/min)	–		NA	45 ± 2	160 ± 5	350 ± 10	NA	NA
FLAME HEIGHT (mm) TOTAL	38		Smouldering rate = 12 ± 3 mins/50 mm	35	145	240	150–245	250–335
INNER CONE	6		NA	0	0	0	–	–
FLAME TEMPERATURE (°C)	–		NA	880	890	850	710	725
THERMAL ENERGY (kJ)	–		–	2	12	46	142	285
IRRADIANCE (kW/m2)	–		–	30–40	0–40	20–40	15	17.5
APPLICATION TIME OF IGNITION SOURCE (SECS)	60		–	20	40	70	200	180
TYPE OF TEST : MATERIALS	Foams		Foams + fabrics	Foams + fabrics	Foams + fabrics	Foams + fabrics	Foams + fabrics	Foams + fabrics
APPLICATION	QC		Upholstered Furniture	Upholstered Furniture	Upholstered Furniture	Upholstered Furniture	Upholstered Furniture	Upholstered Furniture
TESTS EQUIVALENTS	ISO 3582	–	ISO 8191 Part 1	–	ISO 8191 Part 2	ISO 8191 Part 2	–	–
CLASSIFICATION : DIS 10093	S/PF		P/S	P/DF	P/DF	S/DF	S/C	S/C

TABLE 13 (continued) – COUNTRY : UNITED KINGDOM

TEST NUMBER BS	5852 Part 2	5852 Part 2	5865	6307	6334 Method FH	6334 Method FV	6334 Method BH	
IGNITION SOURCE	Crib 6	Crib 7	Flame	Flame	Flame	Flame	Incandescent bar	
BURNER TYPE	NA	NA	Spirit	–	Bunsen	Bunsen	–	
MODIFICATIONS	NA	NA	NA	NA	L = 100 mm	L = 100 mm	L = 100 mm	
INTERNAL DIAMETER (mm)	NA	NA	19	NA	9.5	9.5	8	
AIR INLET (open or closed)	NA	NA	–	NA	Open	Open	NA	
FUEL TYPE :	Wood (pinus silvestris) 60 g ± 2	Wood (pinus silvestris) 126 g ± 4 g	Industrial methylated spirit 660 P)	Hexamethylene tetramine 150 mg	Methane or natural gas	Methane or natural gas	NA	
CALORIFIC VALUE (mJ/m3)			–		37	37	–	
GAS PRESSURE (kN/m2)	NA	NA	NA	NA	–	–	NA	
GAS FLOW-RATE (cm3/min)	NA	NA	2.55 ± 0.15 ml/min	NA	–	–	NA	
FLAME HEIGHT (mm) TOTAL	250–350	345–490		–	25 ± 2	20 ± 2	–	
INNER CONE	–	–	–	–	–	–	–	
FLAME TEMPERATURE (°C)	790	795	–	–	–	–	955 ± 15	
THERMAL ENERGY (kJ)	1040	2110	–	–	–	–	350 W	
IRRADIANCE (kW/m2)	22,5	25	–	–	–	–	–	
APPLICATION TIME OF IGNITION SOURCE (SECS)	360	390	–	–	30	10	180	
TYPE OF TEST : MATERIALS	Foams and fabrics	Foams and fabrics	Small-scale flame tests (cf. coal)	Textile floor coverings	Electrical insulating materials	Electrical insulating materials	Electrical insulating materials	
APPLICATION	Upholstered furniture	Upholstered furniture	–	–	Flame tests	Flame tests	Flame tests	
TESTS EQUIVALENTS	–	–	–	–	–	–	–	
CLASSIFICATION : DIS 10093	S/C	S/C	S/DF	P/DF	P/PF	P/PF	P/E	

TABLE 14 – COUNTRY : USA

TEST NUMBER UL	214	214	263	746C	1410	44	44	62
IGNITION SOURCE	Small flame	Large flame	Furnace	Flame	Flame	Flame	Flame	Flame
BURNER TYPE	Bunsen	Bunsen	–	Bunsen	Match	Tirrill Bunsen	Tirrill Bunsen	Tirrill Bunsen
MODIFICATIONS	length 80–100	length 80–100	–	–	–	Tilted 20° Length 80–100 mm	Tilted 20° 80–100	80–100
INTERNAL DIAMETER (mm)	9.5	9.5	–	9.5	–	9.5	9.5	9.5
AIR INLET (open or closed)	Closed	Open	–	Open	–	Open	Open	Open
FUEL TYPE :	Methane or natural gas	Methane or natural gas	–	Methane or natural gas	Hexamethylene tetramine pill	Methane or natural gas	Methane or natural gas	Methane or natural gas
CALORIFIC VALUE (mJ/m3)	29–37	29–37	–	37	–	37	37	37
GAS PRESSURE (kN/m2)	–	108 mm of water	–	–	–	–	–	–
GAS FLOW-RATE (cm3/min)	–	–	–	–	–	–	–	–
FLAME HEIGHT (mm) TOTAL	38	279	–	19	–	100–125	100–125	5
INNER CONE	0	0	–	0	–	38	38	1/3 of overall
FLAME TEMPERATURE (°C)	–	–	5 m = 538 10 m = 704	–	–	816	816	816
THERMAL ENERGY (kJ)	–	–	30 m = 843 60 m = 927 80 m = 1260	–	–	–	–	–
IRRADIANCE (kW/m2)	–	–	–	–	–	–	–	–
APPLICATION TIME OF IGNITION SOURCE (SECS)	12	120	Not more than one hour	2 x 30	105	30	5 x 15	30
TYPE OF TEST : MATERIALS	Fabrics and films	Fabrics and films	Struct. building materials, wall	Electrical equipment plastics	Carpets Cabinets	Rubber insulation wire	Plastic insulation 14 or 12 AWG wire	Xmas tree wire 24–18 AWG
APPLICATION	Vertical or 25° from vertical	Vertical or 25° from vertical	–	–	Surface burning	Horizontal	Vertical	Horizontal
TESTS EQUIVALENTS	–	–	–	–	–	Similar to UL 62, 83, 224, 493, 510, 719, 854, 1063, 1441, 1581, PARA 1100.1, 1100.6	Similar to UL 83, 1569, 1581, PARA 1080.1, 1080.9	UL 1581
CLASSIFICATION : DIS 10093	P/DF	S/DF	S/R	P/PF	P/DF	S/PF	S/PF	S/PF