

TECHNICAL REPORT

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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*



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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 Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.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 :

<u>Class</u>	<u>Type</u>
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 reproducibility 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	ARAPAOE 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 ₂ O (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-BAE	CAN 4 5102 M 63	CAN 4 5102.2MB3	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	-
INTERVAL DIAMETER (mm)	26 gauge	11	9,4	-	19.1 orifice	9.5	48 holes of Ø2 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)	>	3	12	600	600	12/120	300	12
TYPE OF TEST :	Clothing	Children	Tent	Building	Floors	Fabrics	Non melting	Textile
MATERIALS	textiles	sleepwear	material	material	coverings	and films	building materials	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 ml982					
IGNITION SOURCE	Cigarette	Flame	Flame					
BURNER TYPE	NA	NA	Tin-111					
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 : P/DF P/E S/PF P/DF S/PF P/PF S/PF S/PF

DIS 10093

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	Tecflu	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/m ³)	-	-	-	-				
GAS PRESSURE (kN/m ²)	-	-	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/m ²)	-	-	-	-				
APPLICATION TIME OF IGNITION SOURCE (SECS)	max. 1800	max. 600	-	-				
TYPE OF TEST :	Building products	Building products	Roofing materials	Flooring materials				
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 : S/PF S/PF S/C S/C
DIS 10093