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(IEC 695-2-4/2 : 1994)

**Fire hazard testing
Part 2 : Test methods—
Section 4/sheet 2 : 500 W nominal
test flames and guidance**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law:

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In the event of any doubts arising as to the contents,
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Contents

	Page
Introduction	1
1 Scope	2
2 Normative references	2
3 Definitions	3
4 Method A.....	3
4.1 Requirements.....	3
4.2 Apparatus and fuel.....	4
4.3 Production of test flame	5
4.4 Confirmation of the test flame.....	5
5 Method B.....	6
5.1 Requirements.....	6
5.2 Apparatus and fuel.....	6
5.3 Production of test flame	7
5.4 Confirmation of the test flame.....	7
6 Recommended arrangements for the use of the test flames	8
7 Classification and designation	8
 Annex A (informative) Test method A arrangement	 11
Annex B (informative) Test method B arrangement	15
Annex C (informative) Examples of test arrangements for tests on equipment	22
Annex D (informative) Examples of test arrangement for test on strips and sheets of material.....	23

Fire hazard testing

Part 2: Test methods

Section 4/sheet 2: 500 W nominal test flames and guidance

Introduction

This Japanese Industrial Standard has been prepared based on the 1st edition issued in 1994 of IEC 695-2-4/2 [Fire hazard testing, Part 2: Test methods - Section 4/sheet 2: 500 W nominal test flames and guidance] without changing the technical contents.

Furthermore, the matters that are indicated by underline (dotted line) do not appear in the original International Standard.

JIS C 0068-1995 [Fire hazard testing, Part 2: Test methods - Section 4/sheet 0: Diffusion type and premixed type flame test methods] gives:

- a) guidance on the design and use of flame test methods to assess the effect on the specimen of flames such as may arise from other ignited items in the vicinity, or from a fire in its early stages;
- b) a general description of the apparatus required to produce the test flame;
- c) a general description of the principle of a calibration procedure to check that the flame produced meets the requirements.

The detailed description of the apparatus needed to produce and verify the test flames is given in a series of sheets, of which this is one.

The status of the series, currently under study, is summarized in the following table:

Nominal power of the flame W	Type	Gas	Present status	Remarks Nominal height mm
1 000	Pre-mixed	Propane	JIS C 0069	ca 175
500 (A)	Pre-mixed	Methane	Method A of this document	ca 125
500 (B)	Pre-mixed	Propane	Method B of this document	ca 125
500 (C)	Pre-mixed	Methane/ propane	Under consideration	ca 125
50	Pre-mixed	Methane	Under consideration	ca 20

The aim of the work, which was initiated by ACOS, is to make available an appropriate (minimum) series of standardized test flames, covering a range of powers for the use of all committees needing test flames. Wherever possible these test flames have been based on existing types, but with improved specifications.

Two methods (A and B) of producing the 500 W flame have been developed and are described in this present report. A third method which uses non-adjustable hardware but which should be more versatile than the hardware used in method B is under evaluation in the working group. If successful, the third method will be published as an addendum to this report to enable an extensive evaluative comparison to be made.

The three test flames are as follows:

- flame A, based on methane, makes use of a more tightly specified version of a burner that has been used in some countries for many years;
- flame B, based on propane, makes use of the same hardware as **JIS C 0069-1995**
- flame C, which is under evaluation in a working group, will make use of a more highly developed version of the burner that is used in method A, and should be capable of being produced with both methane and propane.

1 Scope

This Standard gives the detailed requirements for the production of a nominal 500 W, pre-mixed type test flame. The approximate overall height is 125 mm.

Two methods (A and B) are given: flame A based on methane; flame B based on propane.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below.

JIS C 0063-1993 Fire hazard testing, Part 1: Guidance for preparation of requirements and test specifications for assessing fire hazard of electrotechnical products, General guidance

Note: IEC 695-1-1: 1982, Fire hazard testing – Part 1: Guidance for the preparation of requirements and test specifications for assessing fire hazard of electrotechnical products – General guidance is identical to JIS C 0063-1993.

JIS C 0064-1993 Fire hazard testing, Part 1: Guidance for preparation of requirements and test specifications for assessing fire hazard of electrotechnical products, General guidance for electronic components

Note: IEC 695-1-2: 1982, Fire hazard testing – Part 1: Guidance for the preparation of requirements and test specifications for assessing fire hazard of electrotechnical products – Guidance for electronic components is identical to JIS C 0064-1993.

JIS C 0065-1993 Fire hazard testing, Part 1: Guidance for preparation of requirements and test specifications for assessing fire hazard of electrotechnical products, General for use of preselection procedures

Note: IEC 695-1-3: 1986, Fire hazard testing – Part 1: Guidance for the preparation of requirements and test specifications for assessing fire hazard of electrotechnical products – Guidance for use of preselection procedures is identical to JIS C 0065-1993.

JIS C 0068-1995 Fire hazard testing, Part 2: Test methods - Section 4/sheet 0: Diffusion type and premixed type flame test methods

Note: IEC 695-2-4/0: 1991, Fire hazard testing – Part 2: Test methods – Section 4/sheet 0: Diffusion type and pre-mixed type flame test methods is identical to JIS C 0068-1995.

JIS C 0069-1995 Fire hazard testing, Part 2: Test methods - Section 4/sheet 1: 1 kW nominal premixed type flame and guidance

Note: IEC 695-2-4/1: 1991, Fire hazard testing – Part 2: Test methods – Section 4/sheet 1: 1 kW nominal premixed test flame and guidance is identical to JIS C 0069-1995.

JIS C 0067-1993 Terminology concerning fire tests

Note: IEC 695-4: 1993, Fire hazard testing – Part 4: Terminology concerning fire tests is equivalent to JIS C 0067-1993.

Informative reference. JIS C 0067-1993 is a JIS version of IEC 695-4: 1989.

ISO 1337: 1980, Wrought coppers (having minimum copper contents of 99.85 %) – Chemical composition and forms of wrought products

3 Definitions

For the purpose of this Standard, the following definition applies:

standardized 500 W test flame: One that conforms with this technical report, meets all of the requirements given in either clause 4 for method A, or clause 5 for method B.

4 Method A

4.1 Requirements

A standardized 500 W nominal test flame, according to this method, is one that is produced:

- using hardware according to Figures A.1 and A.2 (see annex A);
- supplied with methane gas of purity not less than 99 % at a flow rate equivalent to 965 ml/min $\pm$ 30 ml/min at 23 °C, 0,1 MPa*, and at a back pressure of 125 mm $\pm$ 5 mm water, using the arrangements of figure A.2.

Corrected from the measurements taken under actual conditions of use.

The flame shall be symmetrical, stable and give a result of 54 s $\pm$ 2 s in the confirmatory test described in 4.4.

The confirmatory test arrangement shown in figure A.3 shall be used.

The blue cone shall have a height of $40 \text{ mm} \pm 2 \text{ mm}$, when measured using the jig described in figure 2, in subdued light against a dark background.

The overall height of the flame, when measured using the jig described in figure 2, in subdued light against a dark background, shall be approximately 125 mm.

4.2 Apparatus and fuel

4.2.1 Burner

The burner shall be in accordance with figure A.1.

NOTE – The burner tube, gas injector and needle valve are removable for cleaning purposes. Care should be taken on re-assembly that the needle valve tip is not damaged and that the needle valve and valve seat (gas injector) are correctly aligned.

4.2.2 Flowmeter

The flowmeter shall be appropriate for the measurement of the gas flow rate of 965 ml/min at 23°C , 0,1 MPa to an accuracy of $\pm 2\%$.

4.2.3 Manometer

The manometer shall be appropriate for the measurement of pressure in the range of 0 to 7,5 kPa. A water manometer may be used for this purpose. It should be adapted to read 0 to 7,5 kPa.

4.2.4 Control valve

A control valve is required to set the gas flow rate.

4.2.5 Copper block

A copper block of 9 mm diameter, of mass $10,00 \text{ g} \pm 0,05 \text{ g}$ in the fully machined but undrilled state (figure 1).

4.2.6 Thermocouple

Sheathed fine wire type K (NiCr/NiAl), outer sheath diameter 0,5 mm, suitable for long-term operation at $>1050^\circ\text{C}$.

The preferred method of fastening the thermocouple to the block is by compressing the copper around the thermocouple (see figure A.3).

4.2.7 Temperature/time indicating/recording and timing devices

The devices shall be appropriate for the measurement of the time for the block to heat up from $100^\circ\text{C} \pm 2^\circ\text{C}$ to $700^\circ\text{C} \pm 3^\circ\text{C}$ with a tolerance on the measured time of $\pm 0,5 \text{ s}$.

4.2.8 There shall be a means of measuring the ambient air temperature and pressure.

4.2.9 The fuel gas shall be methane with a purity of not less than 99 %.

4.3 *Production of test flame*

The gas supply arrangements for the burner, given in figure A.2, shall be used. Care shall be taken to ensure leak-free connections.

The gas shall be ignited, and the gas flow and back pressure adjusted to the required values. The air inlet shall be adjusted until the blue cone height is $40 \text{ mm} \pm 2 \text{ mm}$, when measured using the jig described in figure 2 in subdued light against a dark background, and then locked in position with the lock nut.

The flame shall appear stable and symmetrical on examination.

4.4 *Confirmation of the test flame*

4.4.1 *Principle*

The time taken for the temperature of the copper block, described in figure 1, to increase from 100°C to 700°C shall be $54 \text{ s} \pm 2 \text{ s}$, when the flame confirmatory test arrangement of figure A.3 is used.

4.4.2 *Procedure*

- Set up the arrangement according to figure A.3 in a draught-free environment, ensuring leak-free gas connections.
- Temporarily remove the burner away from the block to ensure no influence of the flame on the block during the preliminary adjustment of the gas flow, gas back pressure and air inlet.
- Ignite the gas, and adjust the gas flow and back pressure to the prescribed conditions. Adjust the air inlet until the blue cone height is $40 \text{ mm} \pm 2 \text{ mm}$, when measured using the jig described in figure 2, and viewed in subdued light against a dark background. Lock the air inlet in position with the lock nut.
- Ensure that the overall height of the flame, measured using the jig described in figure 2, in subdued light against a dark background is approximately 125 mm and that the flame is symmetrical.
- Wait for a period of at least 5 min to allow the burner conditions to reach equilibrium. Check that the gas flow and back pressure and the blue cone height are within the prescribed limits.
- With the temperature/time indicating/recording devices operational, re-position the burner under the block.
- Make three determinations of the time for the temperature of the block to increase from $100^\circ\text{C} \pm 2^\circ\text{C}$ to $700^\circ\text{C} \pm 3^\circ\text{C}$. Allow the block to cool naturally in air to below 50°C between determinations.
- If the copper block has not been used before, make a preliminary run to condition the block surface. Discard the result.
- Calculate the mean time in seconds as the result.

4.4.3 The flame is confirmed and may be used for test purposes if the result is within the range $54 \text{ s} \pm 2 \text{ s}$.

5 Method B

5.1 Requirements

A standardized 500 W nominal test flame, according to this method, is one that is produced:

- using hardware according to figures B.1 to B.5 (see annex B);
 - supplied with propane gas of purity not less than 98 % at a flow rate equivalent to 360 ml/min $\pm$ 15 ml/min at 23 °C, 0,1 MPa*, and
 - supplied with air at a flow rate equivalent to 6,0 l/min $\pm$ 0,3 l/min at 23 °C, 0,1 MPa*.
- Corrected from the measurements taken under actual conditions of use.

The flame shall be symmetrical, stable and give a result of 54 s $\pm$ 2 s in the confirmatory test described in clause 5.4.

The confirmatory test arrangement shown in figure B.7 shall be used.

The approximate dimensions of the flame, measured using the jig described in figure 2, in subdued light, against a dark background, shall be:

blue cone height:	35 mm to 45 mm
overall height:	115 mm to 135 mm

5.2 Apparatus and fuel

5.2.1 Burner

The burner shall be in accordance with figures B.1 to B.5 inclusive.

NOTE – The burner tube, gas injector and flame stabilizer are removable for cleaning purposes.

5.2.2 Flowmeters

Flowmeters shall be appropriate:

- for the measurement of the gas flow rate of 360 ml/min at 23 °C, 0,1 MPa to an accuracy of $\pm$ 2 %, and
- for the measurement of the air flow rate of 6,0 l/min at 23 °C, 0,1 MPa to an accuracy of $\pm$ 2 %.

5.2.3 Manometers

Two manometers are required, appropriate for the measurement of pressures in the range 0 to 7,5 kPa. Water manometers may be used for this purpose. They should be adapted to read 0 to 7,5 kPa.

5.2.4 Control valves

Two control valves are required to set the flow of gas and air to within the required tolerances.