

# INTERNATIONAL STANDARD

**ISO**  
**2685**

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## **Aircraft — Environmental conditions and test procedures for airborne equipment — Resistance to fire in designated fire zones**

*Aéronautique — Conditions et méthodes d'essai en environnement des  
équipements embarqués — Résistance au feu dans les zones désignées  
comme "zones de feu"*



Reference number  
ISO 2685:1992(E)

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

International Standard ISO 2685 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Sub-Committee SC 5, *Environmental and operational conditions for aircraft equipment*.

It cancels and replaces ISO Technical Report TR 2685:1984, of which it constitutes a technical revision.

Annexes A, B, C, D and E form an integral part of this International Standard. Annexes F and G are for information only.

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# Aircraft — Environmental conditions and test procedures for airborne equipment — Resistance to fire in designated fire zones

**WARNING** — Precautions shall be taken to safeguard the health of personnel conducting tests against the risk of fire, inhalation of smoke and/or toxic products of combustion.

## 1 Scope

This International Standard specifies requirements for all components, equipment and structure contained in designated fire zones and which are constructed to provide a level of resistance to fire not less than the specified minimum.

Two grades of resistance to fire applicable to components, equipment and structure are stated; annexes A to E give details of the types of standard burners and how they shall be used.

This International Standard does not relate to the resistance to fire outside designated fire zones, nor to flammability requirements, nor to those conditions which may exist when combustion chamber burn-through occurs.

**NOTE 1** The physical quantities and dimensions given in this International Standard are, wherever practicable, expressed in SI units but are based upon experience of tests conducted with equipment designed to alternative units.

## 2 Definitions

For the purposes of this International Standard, the following definitions apply.

**2.1 designated fire zone:** Region of an aircraft, for example compartments containing main engines and auxiliary power units, designated as such by the aircraft designer in accordance with the requirements of the approving authority.

**2.2 standard flame:** Flame having the following characteristics:

- temperature:  $1\,100\text{ °C} \pm 80\text{ °C}$
- heat flux density:  $116\text{ kW/m}^2 \pm 10\text{ kW/m}^2$

**2.3 fire resistant:** Grade designating components, equipment and structure capable of withstanding the application of heat by a standard flame for 5 min.

**2.4 fireproof:** Grade designating components, equipment and structure capable of withstanding the application of heat by a standard flame for 15 min.

## 3 Requirements

Components, equipment and structure installed in designated fire zones shall, where appropriate, conform to the requirements of one of the grades of resistance to fire (see 2.3 and 2.4). The relevant specification shall state the required grade. Test conditions and acceptance criteria shall be as specified in 5.1 and 5.2.

## 4 Test equipment

### 4.1 Large standard burner

The large standard burner shall produce a standard flame and a flame cross-sectional area of not less than  $0,018\text{ m}^2$ .

Details of acceptable burners (gas or liquid fuel) are given in annex A.

### 4.2 Small standard burner

The small standard burner shall produce a standard flame and a flame size of not less than 19 mm diameter.

Details of a small burner are given in annex A.

### 4.3 Alternative burners

Burners other than those shown in annex A are permitted provided it has been demonstrated that they meet the requirements of 4.1 or 4.2. A burner having a higher heat flux density than a standard burner may be used if agreed by the approving authority.

## 5 Test requirements

### 5.1 Test conditions

The following general conditions shall apply to fire tests. Particular conditions to be applied during the fire tests are given in annexes C to E. Any other particular conditions shall be detailed in the specification for the equipment under consideration.

#### 5.1.1 Mounting of specimen

The component, equipment or structure shall be installed on a test rig in a manner that is not less critical than in the aircraft installation, for example in the simulation of heat sink characteristics.

#### 5.1.2 Choice of burner

The type and number of burners shall be chosen so that, during the fire test, the critical parts of the components or items of equipment are enveloped in the test flame(s) from the appropriate direction(s). Generally, a large burner will be required but, for small components, one or more small burners may be used. The nominal axial distance between the burner nozzle(s) and the face of the item under test shall be as defined in annex A.

#### 5.1.3 Calibration of burner

The burner shall be calibrated in accordance with annex B.

#### 5.1.4 Specimen conditioning

For non-metallic components, unless evidence is shown that exposure to aircraft fluids will not adversely affect the resistance to fire characteristics, the specimen shall be conditioned prior to test. Conditioning can be accomplished by immersing the specimen in the fluid for 24 h at ambient temperature.

### 5.1.5 Test period

The component or item of equipment to be tested shall be subjected to the standard flame for a duration corresponding to the grade of resistance to fire, i.e.

- 5 min for a classification of fire resistant (see 2.3);
- 15 min for a classification of fireproof (see 2.4).

### 5.2 Test acceptance criteria

The criteria of acceptance shall be that the item is capable of withstanding the appropriate fire test in accordance with the applicable requirements and/or the detailed specification for the component or item of equipment.

Acceptance criteria appropriate to components of fluid systems, electrical systems and structures are given in annexes C to E respectively, or with the particular specification under consideration, where relevant.

## 6 Acceptance by analogy

If the applicable requirements permit acceptance by analogy, tests to demonstrate compliance with the standard grades of resistance to fire may not be necessary if similarity can be shown either

- a) on the evidence from previous testing of similar components, or
- b) on the basis of analysis of the design and construction of a component with respect to its inherent resistance to fire.

NOTE 2 The following materials (in the thicknesses given) are considered fireproof:

- stainless steel sheet, 0,38 mm thick;
- mild steel sheet protected against corrosion, 0,46 mm thick;
- titanium sheet, 0,46 mm thick;
- aluminium sheet, 1 mm thick, provided there is
  - a) an airflow of 41 m/s on the non-flame side of the sheet,
  - b) zero pressure difference across the sheet, and
  - c) no significant structural loading of the sheet.

## Annex A (normative)

### Examples of standard burners

#### A.1 Standard large gas burner

##### A.1.1 Equipment

###### A.1.1.1 Supply of propane gas with standard regulator valves

The calorific value of the gas shall normally be 93 000 kJ/m<sup>3</sup> (at room temperature and pressure).

**CAUTION** — The supply bottle(s) shall be kept well away from the burner and test specimen.

###### A.1.1.2 Supply of low-pressure compressed air

The actual pressure requirement will depend on the user's arrangement of equipment but a low-pressure (for example 35 kPa) supply with a free air flow of 25 m<sup>3</sup>/h is usually sufficient. Alternatively, a tapping from a higher pressure supply through a regulator is acceptable.

###### A.1.1.3 Ways of controlling and measuring gas and air supplies

Ways of controlling and measuring gas and air supplies include manual valves, flow measuring and pressure read-out for gas and air downstream of the valves, and may also feature valve upstream pressure monitoring. For flow measurement, suitable flow-meters may be used. Information on flow measurement using differential pressures across an orifice is also included in figure A.3.

**NOTE 3** AS401B and BS 3G 100 part 2, section 3, subsection 3.13:1983 show flow-measuring devices mounted with the burner head, but it has been established that they can be used satisfactorily at a console up to 4 m away if connected to the burner by pipes of minimum bore diameter 10 mm.

##### A.1.2 Details of the burner

The design of the burner is shown in figures A.1, A.2 and A.3 and a photograph of the burner is shown in figure A.4. Important features include:

- a) the means of mixing the gas and the air for combustion at the "mixing base";
- b) the design of the flame head;

- c) the means of introducing cooling air within the structure of the flame head.

###### A.1.2.1 Mixing base

Air and gas are introduced and mixed in a small chamber. From this chamber, the mixed gas and air enters a relatively large plenum chamber before reaching the flame head.

###### A.1.2.2 Flame head

The flame head has to act as a flame stabilizer and prevent flashback into the plenum chamber containing a combustible mixture. This is done by using 373 copper tubes cooled by air flowing around them. The cooling air is discharged through 332 holes onto the flame head; it is needed there to keep the burner temperature down at the level required for the test.

###### A.1.2.3 Cooling air

The cooling air shall be well distributed within the structure of the flame head for the purpose described in A.1.2.2. The top plate and tubing details given on figure A.1 are intended to produce the correct overall effect.

##### A.1.3 Setting up of the flame

###### A.1.3.1 Light-up

It is easier to light the burner at reduced gas flow but gas-rich. The following procedure is recommended.

Turn on the gas at a flow rate of about 0,5 m<sup>3</sup>/h (12 mm differential water pressure).

Ignite the gas.

If ignition does not occur within a few seconds, turn off the gas and purge the burner with mixing air and wait for low-lying gas near the burner to disperse.

When ignition occurs, introduce mixing and cooling air and then increase the gas flow rates and air flow rates to the intended level without delay.

In order that heating conditions may be stabilized, the apparatus shall be allowed to run for at least

5 min before calibrating the burner or starting the test.

**A.1.3.2 Establishing the gas and air flows**

Table A.1 gives typical flows of gas and air needed to achieve the characteristics of the standard flame.

**Table A.1 — Typical settings for fire integrity testing**

	Gas	Mixing air	Cooling air
<b>Flow rate</b>	1 m <sup>3</sup> /h	8,9 m <sup>3</sup> /h	12,7 m <sup>3</sup> /h
<b>Differential pressure</b>	45 mmH <sub>2</sub> O	435 mmH <sub>2</sub> O	300 mmH <sub>2</sub> O
NOTE — The above values may need adjusting to achieve the characteristics of the standard flame (see 2.2).			

**A.1.3.3 Calibration**

The burner shall be calibrated in accordance with annex B and shall meet the requirements for the standard flame (see 2.2).

**A.1.3.4 Distance between burner and test specimen**

The nominal axial distance between the burner nozzle and the face of the test specimen shall be 75 mm for vertical and horizontal applications.

**A.1.3.5 Shut-down**

After the test, the gas shall be turned off first. The air flow shall be turned off only when the burner has cooled sufficiently.

**A.2 Standard large liquid fuel burner**

**A.2.1 General**

The details of the standard large liquid fuel burner specified in this annex are equivalent to those found in FAA Powerplant Engineering Report No. 3A. A typical liquid fuel burner complying with the requirements of this annex is shown in figure A.5.

**A.2.2 Details of the burner**

The liquid fuel burner shall

- a) be of a modified gun type;
- b) have an 80° spray angle nozzle, nominally rated at 8,5 l/h (assuming a typical fuel calorific value of 42,8 × 10<sup>3</sup> kJ/kg);
- c) have a 318 mm burner extension fixed at the end of the tube, with an opening 152 mm high and

280 mm wide, as shown in figures A.6 and A.7; and

- d) have a burner fuel pressure regulator that is capable of adjusting the fuel flow to achieve the characteristics of the standard flame (see 2.2).

**A.2.3 Setting up the flame**

The burner shall be lit and set up in accordance with the manufacturer's instructions. The flame shall be allowed to stabilize for at least 5 min before calibration or testing.

**A.2.4 Calibration**

The burner shall be calibrated for temperature and heat flux density in accordance with annex B and shall meet the requirements for the standard flame (see 2.2).

**A.2.5 Distance between burner and test specimen**

The nominal distance between the end of the burner extension and the component or item of equipment under test shall be 100 mm.

**A.3 Standard small gas burner**

**A.3.1 General**

Measurements have shown that the heat flux density of a standard small gas burner can exceed that specified for the standard flame. However, the use of this burner type is acceptable if agreed to by the approving authority.

**A.3.2 Details of the burner**

Figure A.8 shows only the essential details of the burner assembly. It comprises a gas injector complete with venturi and a jet, steel burner tube and gauze filter.

As received, the jet assembly in the body of the gas injector is normally fitted with fibre washers. These washers should be removed and new light alloy washers fitted in their place. These washers shall be bedded in carefully on both sides to form gas-tight joints. The jet shall be checked to ensure that it is clean and that it is firmly tightened in its holder, by means of the jet-key supplied with the jet.

The following items will be required for use in conjunction with the burner assembly:

- a) a cylinder of propane gas;
- b) a gas pressure regulator;

- c) a pressure gauge of suitable range;
- d) copper and flexible tubing, together with the necessary couplings.

### A.3.3 Setting up the flame

The gas pressure shall be set at 24 kPa (gauge) with the torch alight and with the air-adjusting nut set to give clearly defined blue cones in the flame, with the tips of the cones almost level with the end of the burner tubes. The best setting is usually that at which the conical bore in the rear end of the adjusting nut is in line with the tip of the jet (see figure A.8).

After the burner has been ignited, the flame stabilized and the torch adjusted, a blue inner cone will extend up 20 mm from the plane of the nozzle. The total length of the flame will then be of the order of 200 mm.

When the torch is satisfactorily adjusted, the flame shall be allowed to stabilize for at least 5 min before calibration or testing.

### A.3.4 Calibration

The burner shall be calibrated in accordance with annex B and shall meet the requirements for the standard flame (see 2.2). If the measured heat flux density exceeds the requirements for the standard flame, the actual value measured shall be noted.

### A.3.5 Distance between burner and test specimen

The nominal axial distance between the burner nozzle and the face of the specimen under test shall be that at which the standard flame conditions are achieved (approximately 50 mm).

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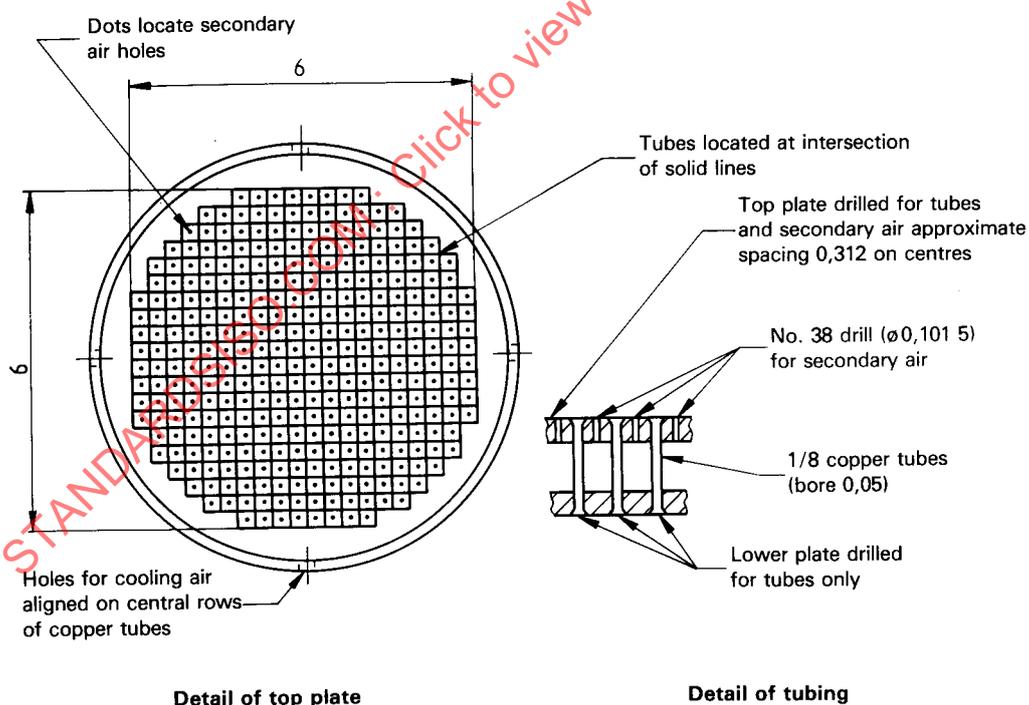
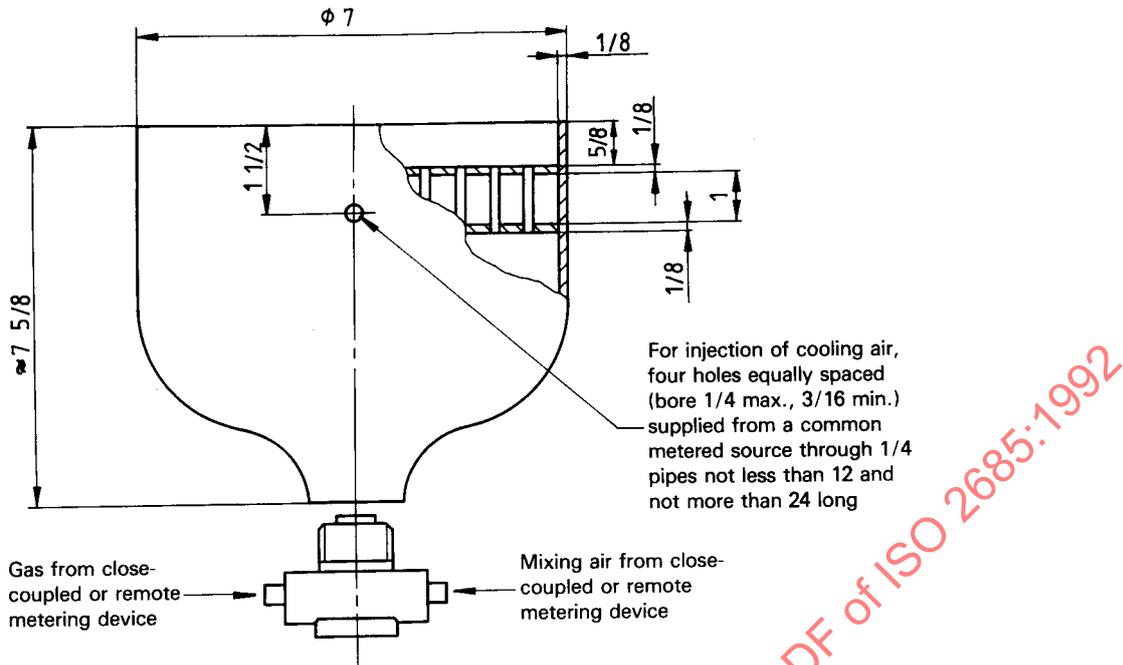
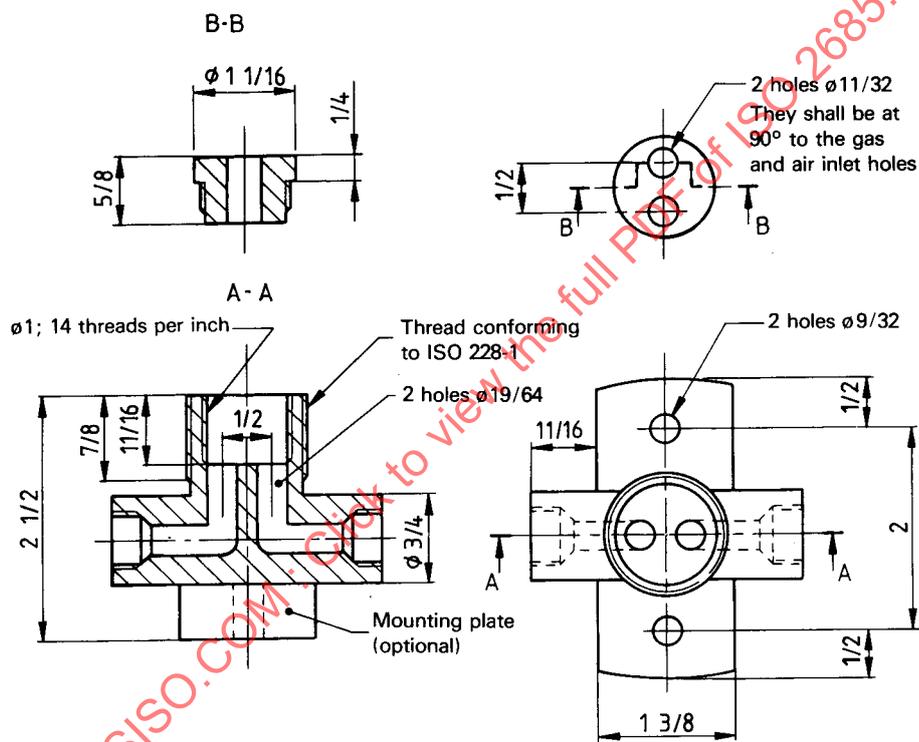


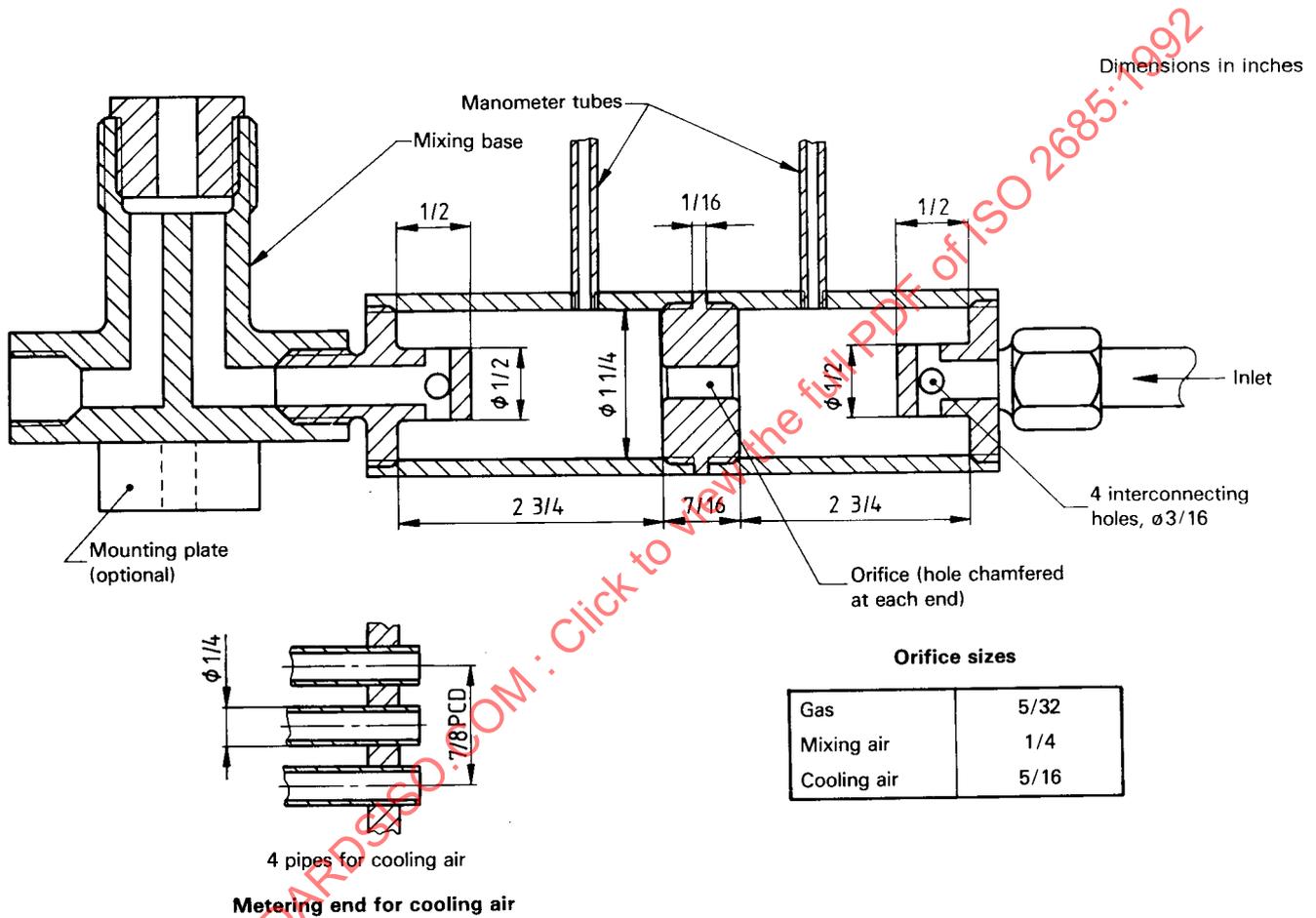
Figure A.1 — Large gas burner

Dimensions in inches



NOTE — AS401B gives additional constructional details.

Figure A.2 — Large gas burner — Mixing base



NOTES

- 1 Commercially available gas and air flow-meters may be used.
- 2 When differential values are stated for setting gas and air flows, these relate to a metering device. (See table A.1.)
- 3 The equipment may be close-coupled to the burner, or may be remote if a different end-fitting with an air manifold for the cooling air connections is used.

Figure A.3 — Large gas burner — Metering device

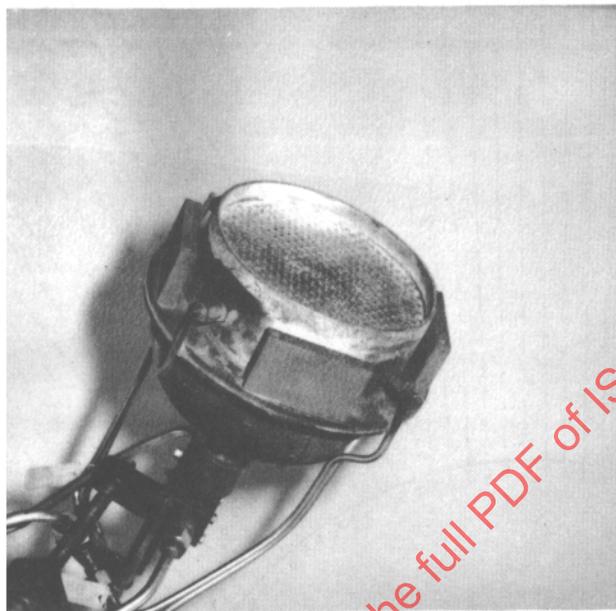


Figure A.4 — Large gas burner

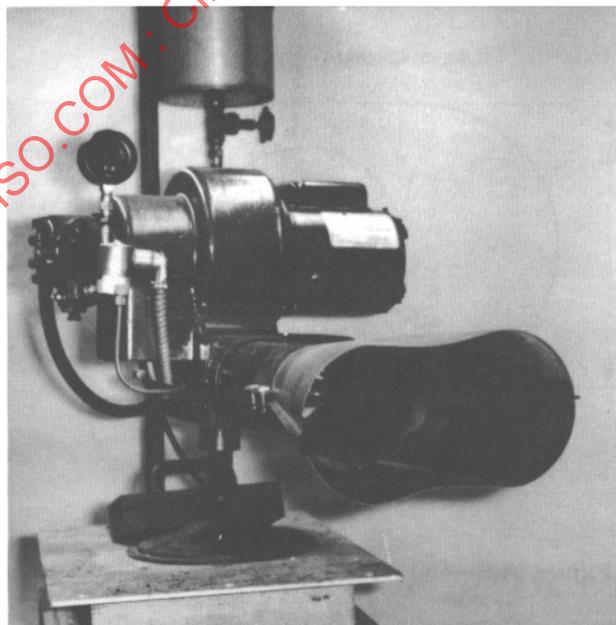
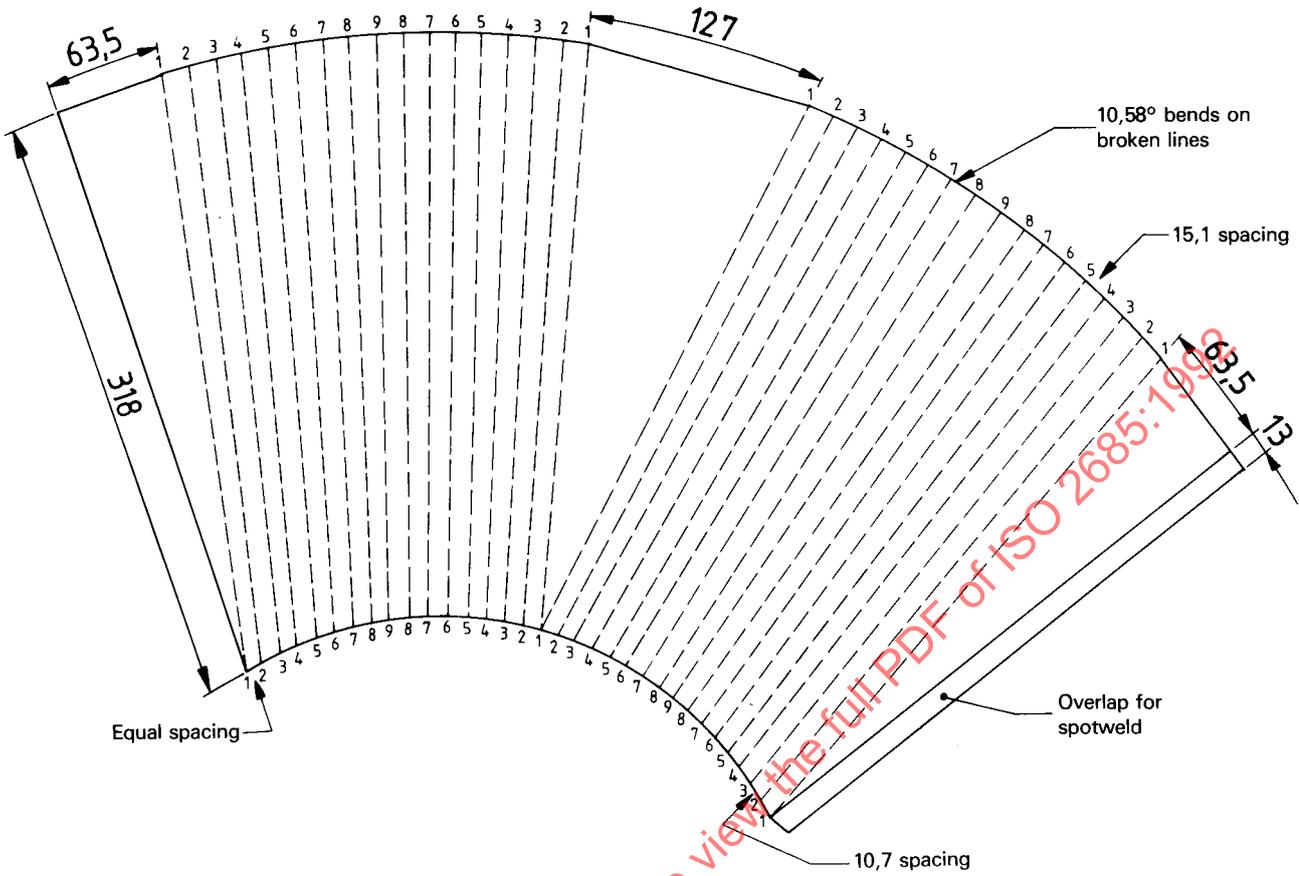


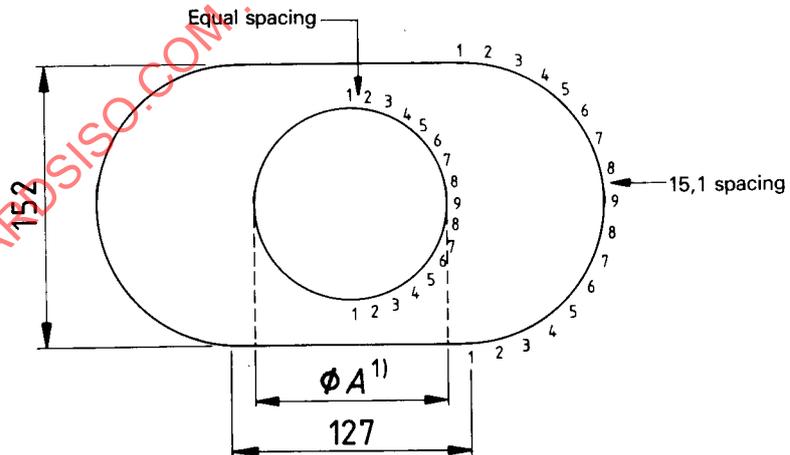
Figure A.5 — Large liquid fuel burner

Dimensions in millimetres



Development of extension cone

Material: 0,8 Inconel



1) See figure A.7.

Figure A.6 — Liquid fuel burner extension cone

Dimensions in millimetres

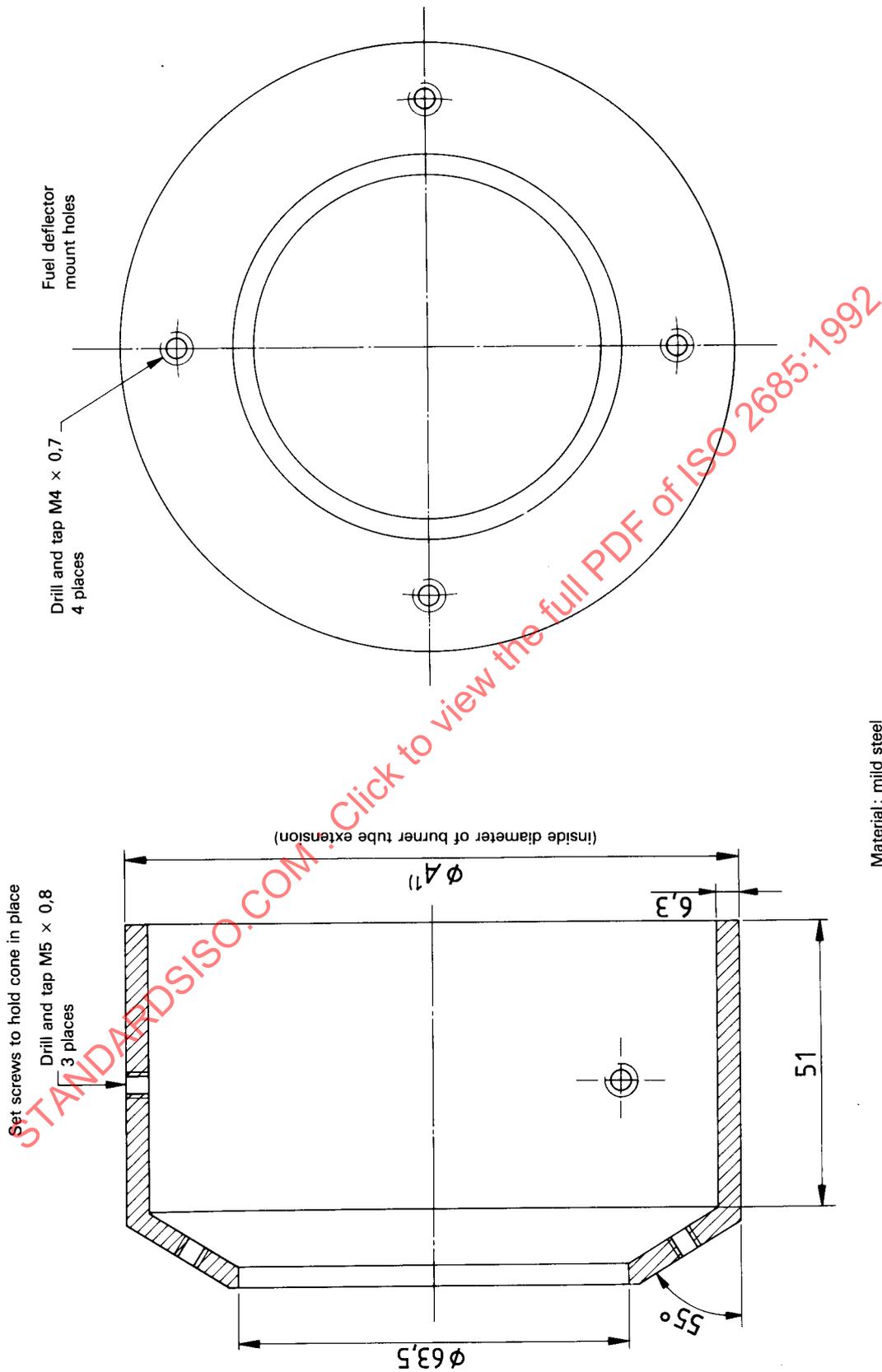


Figure A.7 — Liquid fuel burner air tube reducing cone

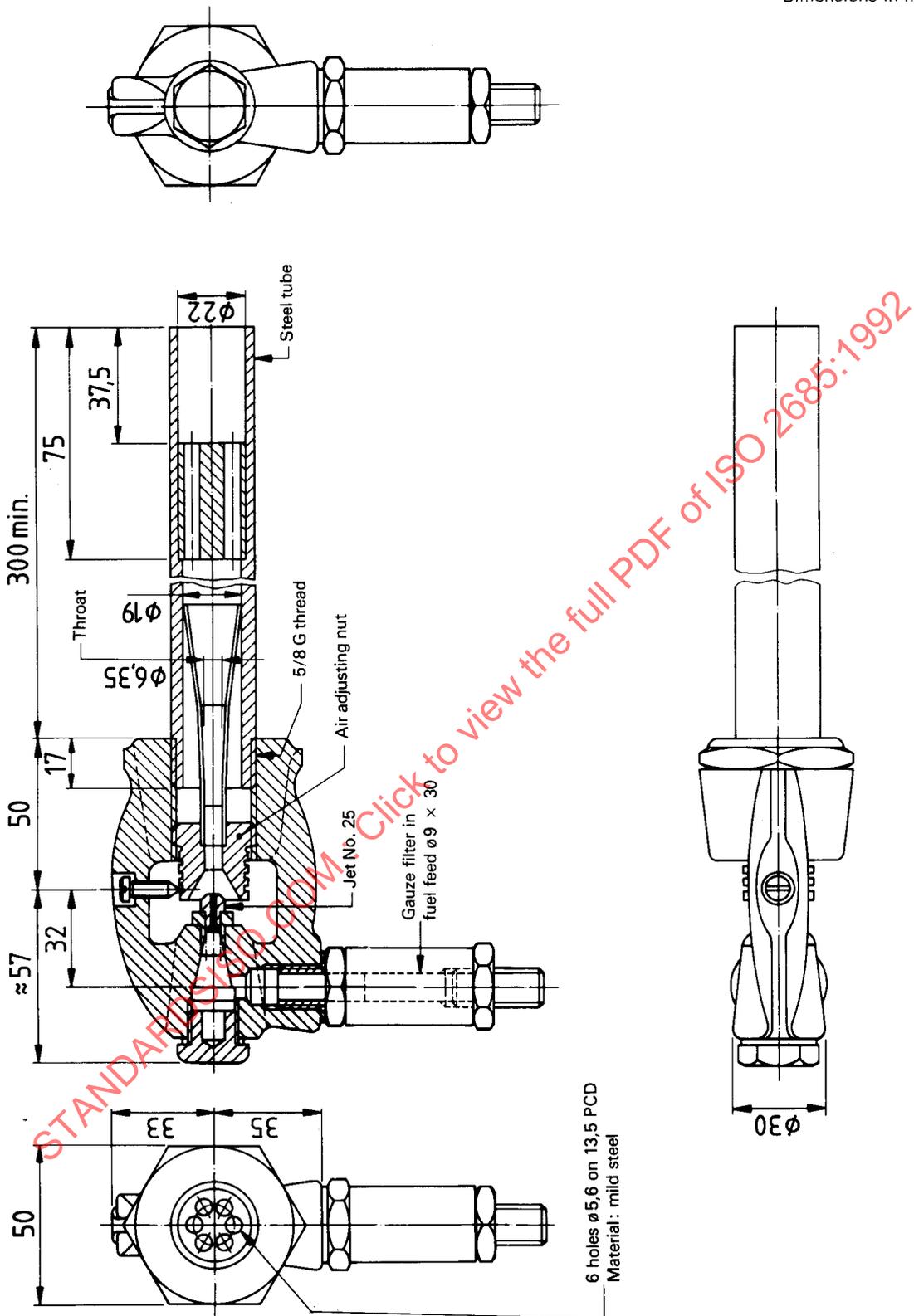


Figure A.8 — Small gas burner

## Annex B (normative)

### Calibration procedure for standard burners

#### B.1 Calibration of burners

##### B.1.1 General

Before carrying out the calibration procedure, the burner shall be ignited and adjusted in accordance with the relevant procedures. The burner shall then be run for the prescribed warm-up period to allow the flame to stabilize.

It is recommended that provision be made for the burner to be set up away from either the test specimen or calibration equipment but it should be possible to move it quickly to the correct position for fire testing or calibration. All such work should be carried out under essentially still conditions.

##### B.1.2 Temperature measurements

The flame temperature shall be measured at the appropriate axial distance from the burner (see annex A) to confirm that the conditions of the standard flame are achieved (see 2.2). The equipment required and the procedures to be used are described in B.3.

##### B.1.3 Measurements of heat flux density

Heat flux density shall be measured at the appropriate axial distance from the burner (see annex A) to confirm that the conditions of the standard flame are achieved (see 2.2). The equipment required and the procedures to be used are described in B.4.

#### B.2 Calibration period

Once a burner has been calibrated in accordance with B.1, a temperature check in accordance with B.1.2 shall be made before each test. The burner shall be recalibrated for heat flux density within periods acceptable to the approving authority, but they shall be no longer than 6 months.

#### B.3 Temperature calibration method

The thermocouple shall comply with the specifications given in figure B.1. The measured flame temperature shall be within the required tolerance over at least 25 % of the burner area. For liquid fuel

burners, the temperature measurement is acceptable if each of the seven thermocouple measuring points shown in figure B.2 measures a temperature of  $1\ 100\ ^\circ\text{C} \pm 80\ ^\circ\text{C}$ . A similar approach is acceptable for other large burners. An alternative type of thermocouple or temperature-measuring device may be used provided it is calibrated against that shown in figure B.1.

#### B.4 Heat flux density calibration method

##### B.4.1 General

The burners may be calibrated by either of the methods described in B.4.2 or B.4.3. Note however that the apparatus described in B.4.2 is unsuitable for small standard burners. Where no alternative method of calibrating small burners for heat flux density is available, the burner shall be calibrated by temperature alone.

##### B.4.2 Heat flux density measuring apparatus

###### B.4.2.1 Details of apparatus

Large burners may be calibrated using the continuous flow calorimeter apparatus shown in figure B.3. A constant head of water above the heat-transfer tube ensures consistent flow conditions. A valve on the outlet pipe enables the water flow rate to be adjusted. Provision is required for measuring the flow rate during the test. Figure B.4 specifies the materials and dimensions of the heat-transfer tube and its associated mixing tubes and temperature sampling points.

Since the temperature rise across the heat-transfer tube is small, mercury thermometers capable of reading to within  $0,1\ ^\circ\text{C}$  or immersion thermocouples shall be used.

###### B.4.2.2 Procedure

The following procedures shall be carried out.

- a) The external surface of the copper tubing shall be cleaned with fine steel wool before each test.
- b) The water supplied shall have a temperature between  $10\ ^\circ\text{C}$  and  $21\ ^\circ\text{C}$ .

- c) The water flow rate shall be adjusted to 225 l/h (i.e.  $62,5 \times 10^{-6} \text{ m}^3/\text{s}$ ).
  - d) The burner shall then be lit and set to give  $1\,100 \text{ }^\circ\text{C} \pm 80 \text{ }^\circ\text{C}$  at the appropriate axial distance from the burner (see annex A).
  - e) With the water flowing through the device, position the burner so that the heat-transfer tube is in the appropriate location (see annex A). A 3 min warm-up period shall be allowed in order to obtain stable conditions before temperature measurements are recorded.
- NOTE 4 When warming up the flame (as opposed to warming the apparatus), do not expose the heat-transfer tube to the flame; this minimizes carbon build-up on the tube.
- f) During the test, the temperatures recorded by the inlet and outlet thermometers shall be recorded every 30 s over a 3 min period.

**B.4.2.3 Calculation of heat flux density**

The heat flux density  $q$ , in kilowatts per square metre, is given by

$$q = \frac{q_v \rho c (T_2 - T_1)}{A}$$

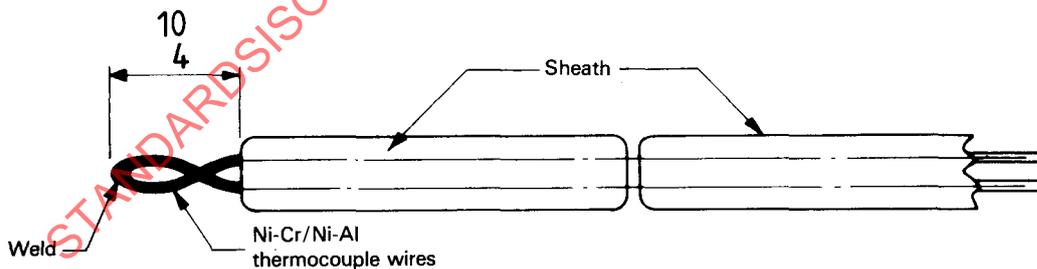
where

- $q_v$  is the water volume flow rate, in cubic metres per second;
- $\rho$  is the density of water, in kilograms per cubic metre, at the mean temperature  $(T_1 + T_2)/2$ , i.e. approx.  $1\,000 \text{ kg/m}^3$ ;
- $c$  is the specific heat of water, in kilojoules per kilogram kelvin, at the mean temperature  $(T_1 + T_2)/2$ , i.e. approx.  $4,185 \text{ kJ}/(\text{kg}\cdot\text{K})$ ;
- $T_1$  is the time-averaged water temperature, in degrees Celsius, at the entry to the heat transfer tube;
- $T_2$  is the time-averaged water temperature, in degrees Celsius, at the exit from the heat-transfer tube;
- $A$  is the total surface area, in square metres, of the heat-transfer tube exposed to the flame (i.e.  $\pi \times$  external diameter of tube  $\times$  length of tube exposed).

**B.4.3 Calorimeter**

An alternative calorimeter may be used, providing the approving authority agrees to that method of measuring the heat flux density.

Dimensions in millimetres



**NOTES**

- 1 The thermocouple wire shall have a diameter of between 0,6 mm and 1 mm.
- 2 If a metal sheath is used, the maximum diameter shall not exceed 3 mm.
- 3 The thermocouple shall be unshielded and non-aspirated.

**Figure B.1 — Details of thermocouple**

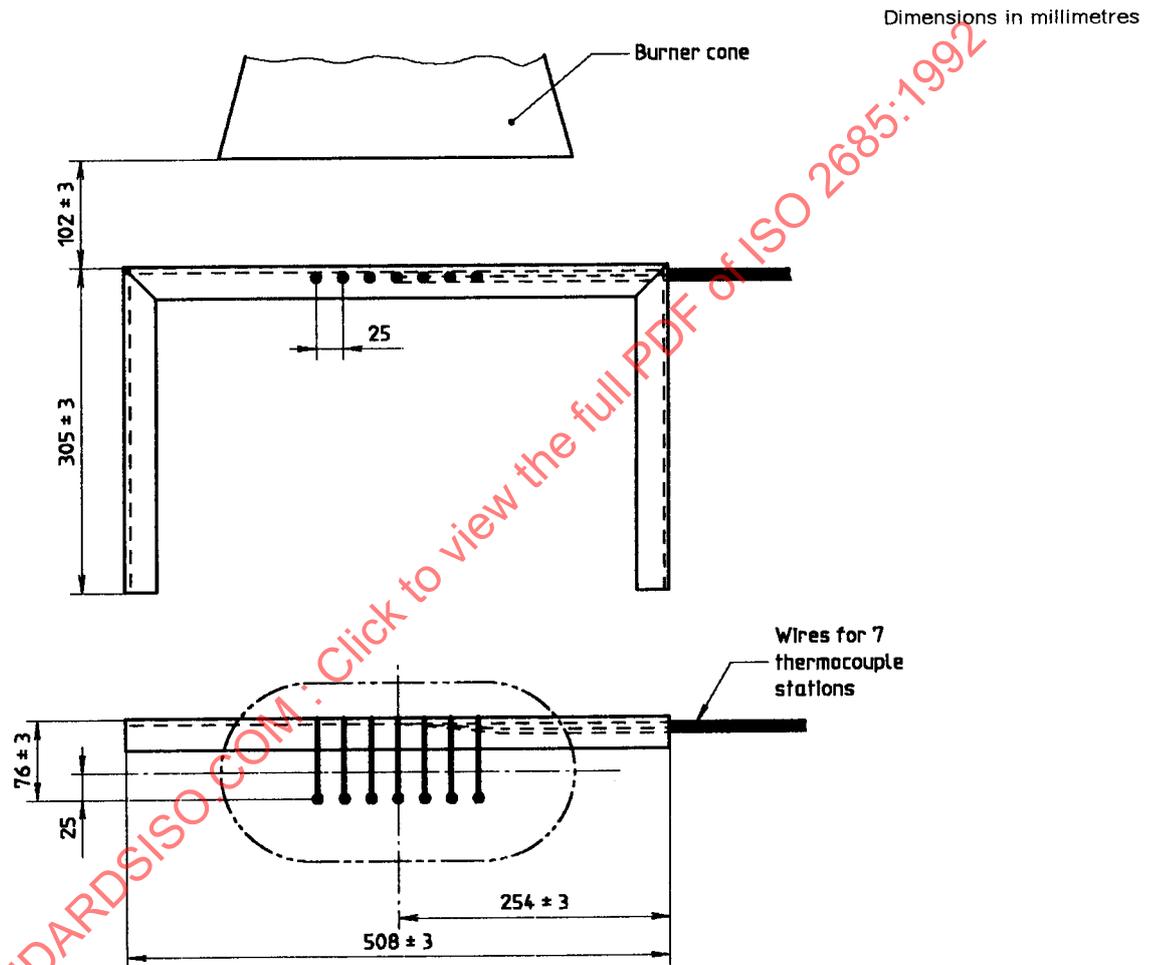


Figure B.2 — Large liquid fuel burner — Thermocouple positions

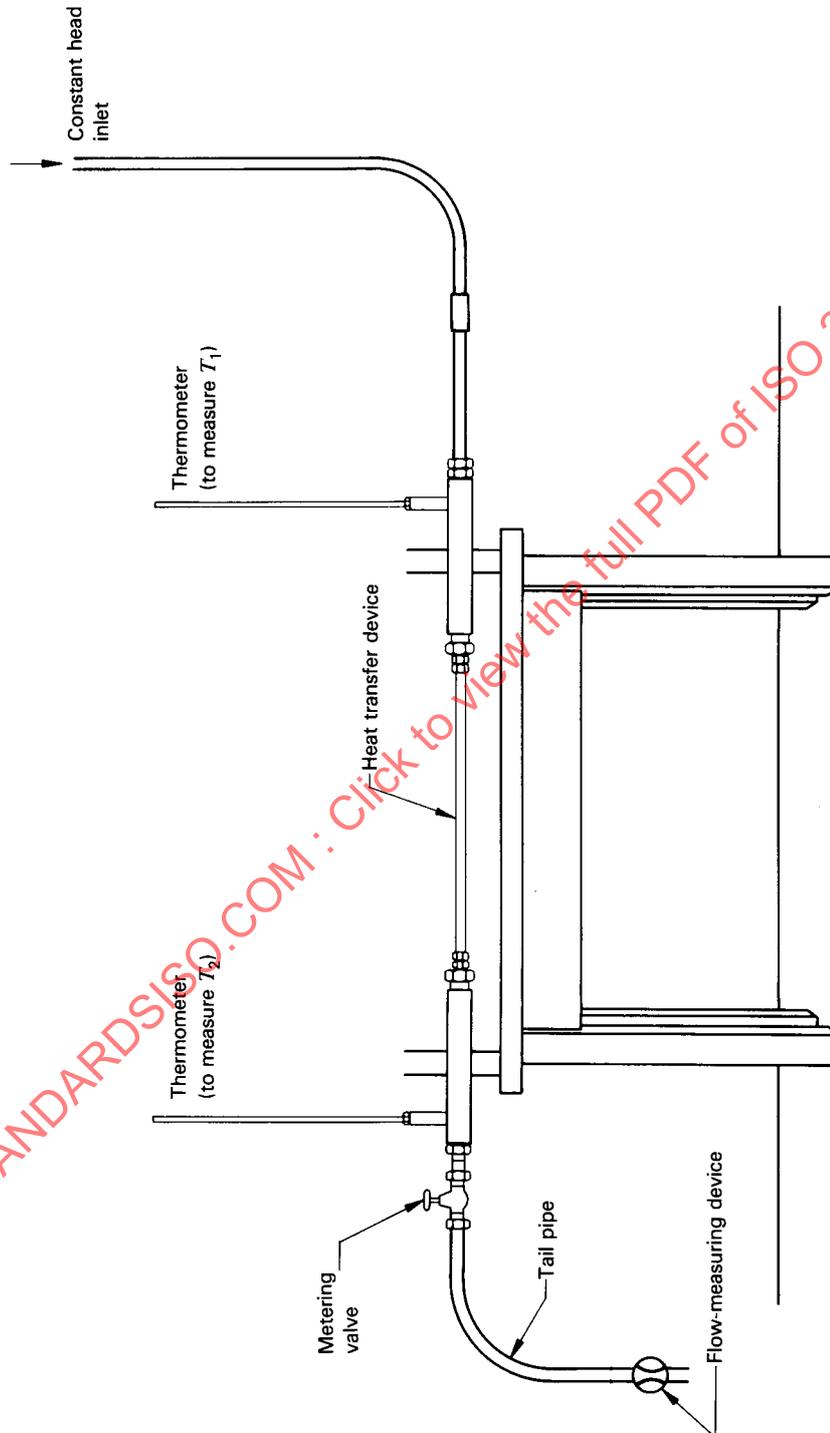
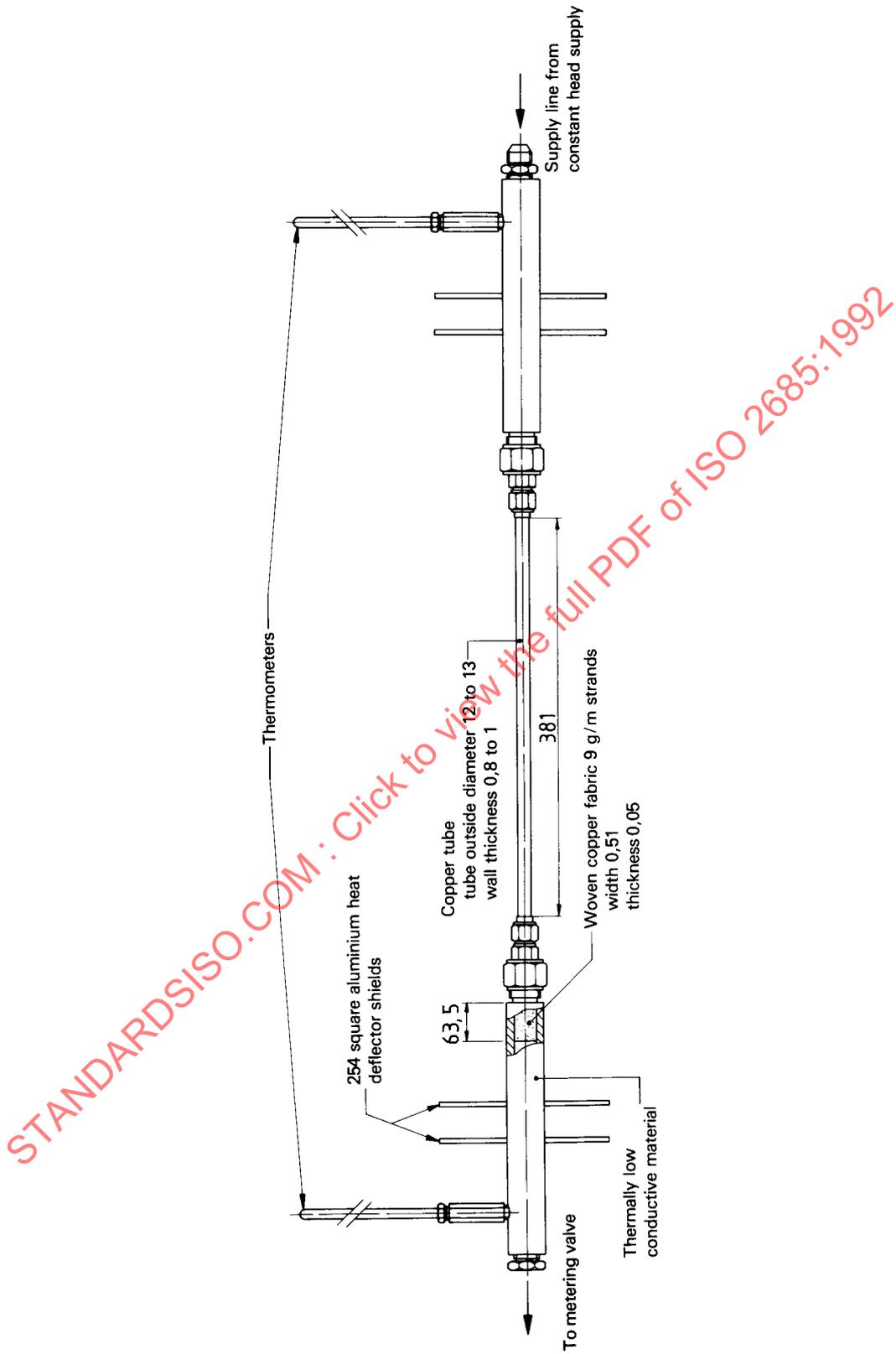


Figure B.3 — Lay-out of apparatus for measuring heat flux density

Dimensions in millimetres



NOTE — The copper fabric enables thermal uniformity of the water to be achieved.

Figure B.4 — Tube for measuring heat flux density

## Annex C (normative)

### Test conditions for fluid systems components

#### C.1 General

This annex specifies the particular test conditions for flammable fluid systems and pneumatic systems components.

#### C.2 Standard flame

The component under test shall be subjected to a standard flame (see 2.2).

#### C.3 Vibration

Flexible hose assemblies and components shall be vibrated where appropriate along or perpendicular to the axis of the component at a frequency of 33 Hz and with a minimum amplitude of 1,6 mm.

#### C.4 Particular conditions

##### C.4.1 Pressure

The pressure shall be the working pressure of the component or, where specified, the system pressure may be substituted during the test.

##### C.4.2 Flow rates

Unless more critical flow rates are specified for the particular installation, the flow rates for the full period of test shall be as given in C.4.2.1 to C.4.2.3.

##### C.4.2.1 Fuel and lubricating systems

- Pipes and flexible hose assemblies: flow rate, in litres per minute, shall be equal to

$$0,03d^2$$

where  $d$  is the internal diameter, expressed in millimetres.

- Other components: the flow rate shall be determined in the same way using the internal diameter of the inlet coupling.

The fluid shall be the system fluid or equivalent.

##### C.4.2.2 Hydraulic systems

- Pipes and flexible hose assemblies: flow rate, in litres per minute, shall be equal to

$$0,006d^2$$

where  $d$  is the internal diameter, expressed in millimetres.

- Other components: the flow rate shall be determined in the same way, using the internal diameter of the inlet coupling.

The fluid shall be the system fluid or equivalent.

##### C.4.2.3 Pneumatic systems

The flow rate in pneumatic pipes, hoses and components shall be zero unless otherwise specified.

#### C.5 Test procedure for hoses

The hose to be tested shall be not less than 60 cm long. Hoses shall be mounted horizontally and shall include one 90° bend. One end fitting and at least 12 cm of hose shall be enveloped by the test flame.

#### C.6 Fluid temperature

##### C.6.1 Liquid

The temperature of the fuel, lubricant or hydraulic fluid inside hoses shall be at least 93 °C to 110 °C. The fluid temperature for other components shall be the same unless otherwise specified.

##### C.6.2 Pneumatic

The temperature of the air or gas inside the component shall be not less than the maximum normal design temperature.

## **C.7 Test acceptance criteria**

### **C.7.1 Fuel, lubricating and hydraulic systems**

In addition to complying with 5.2, system components shall show no evidence of leakage over the test period specified in 5.1.5.

### **C.7.2 Pneumatic systems**

In addition to complying with 5.2, system components shall show no evidence of significant leakage over the test period specified in 5.1.5.

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## Annex D (normative)

### Test conditions for electrical cables and connectors

#### D.1 General

This annex specifies the particular test conditions for electrical cables and connectors.

#### D.2 Vibration

The cable or connector specimen shall be vibrated across the axis of the component at a frequency of between 30 Hz and 60 Hz and with a minimum acceleration of 4g.

#### D.3 Particular conditions for electrical cables

##### D.3.1 Standard flame

The cable specimen shall be subjected to a standard flame (see 2.2 and annex A).

##### D.3.2 Single core cables

Three test specimens 0,75 m long shall be selected at random from a quantity of cable and prepared for test in the following manner.

Each length of cable shall have the middle half-metre immersed in one of the listed fluids at ambient temperature for 24 h. A separate typical specimen shall be used for each fluid:

- a) aviation fuel;
- b) engine lubricating oil;
- c) hydraulic oil.

After removal of surplus fluid from the cables, each length in turn shall be mounted onto a frame as shown in figure D.1. Each of the the two nickel-chrome ribbons shall be wrapped once around the sample with their inner edges spaced 25 mm  $\pm$  5 mm apart. The sample and test ribbons shall be weighted, as shown in figure D.1 and the test assembly adjusted so that the area wrapped by the ribbons is located at the appropriate distance above the burner where the temperature is 1 100 °C. After tensioning with weights, the samples and test ribbons shall be locked at the pulley position to avoid the weights giving high loading under vibration/resonant conditions.

ition to avoid the weights giving high loading under vibration/resonant conditions.

The test sample shall be connected to a circuit as shown in figure D.2. Sample continuity is shown when a current flow of 2 A is registered with the electrical supply switched on. The insulation degradation detection circuit shall be checked by depressing the test switch; an indication of 25 mA flow should be registered.

##### D.3.3 Multi-core cables

Three test specimens shall be prepared for test as described in D.3.2.

Each test specimen shall be mounted onto the test frame over the burner in a manner similar to that shown in figure D.1, using the appropriate weight.

The test samples shall in turn be connected to a circuit as shown in figure D.3, test 1. Pre-test checks shall be carried out as described in D.3.2. Vibration on the mounting frame shall be as described in D.2.

##### D.3.4 Multi-core screened cables

Multi-core screened cables feature an overall screen (metal braid) in close contact with the individual cores.

Three test specimens shall be prepared for test as described in D.3.2.

Each test specimen shall be mounted onto the test frame over the burner in a manner similar to that shown in figure D.1, using the appropriate weight.

The test samples shall in turn be connected to a circuit as shown in figure D.3, test 2. Pre-test checks shall be carried out as described in D.3.2. Vibration on the mounting frame shall be as described in D.2.

##### D.3.5 Acceptance criteria

The cables shall be declared fire resistant if there is continuity through the test specimen for 5 min of flame impingement, and the resistance of the insulation during the same period is not less than 10 000  $\Omega$ . If the cable is to be declared fireproof, the test period shall be extended to 15 min.

## D.4 Particular conditions for electrical connectors

### D.4.1 Standard flame

The connector shall be subjected to a standard flame (see 2.2 and annex A).

### D.4.2 Wiring of specimen connector

The connector shall be wired as shown in figure D.4, using fire resistant wiring. Each contact shall be connected in series. The load shall be set to give a constant current equal to the nominal value specified for the connector.

### D.4.3 Mounting of connector specimen

The mated connector pair, together with the required accessories, shall be mounted as shown in figure D.5.

### D.4.4 Acceptance criteria

Connectors with a requirement for electrical functioning shall be declared fire resistant if no electrical failure occurs over a period of 5 min. During the 5 min application of the flame, switch 1 shall be closed and switch 2 open. After 5 min, open switch 1 and close switch 2.

Electrical failure will be assumed if, during the first 5 min, there is any electrical discontinuity or if, during a further 1 min, there is any leakage in excess of the value specified for the connector.

In the case of connectors intended for use in firewall applications, no flame shall pass from one side of the mounting plate to the other, nor shall there be any spontaneous ignition on the side of the plate away from the flame, over a period of 15 min.

The above tests may be carried out simultaneously.

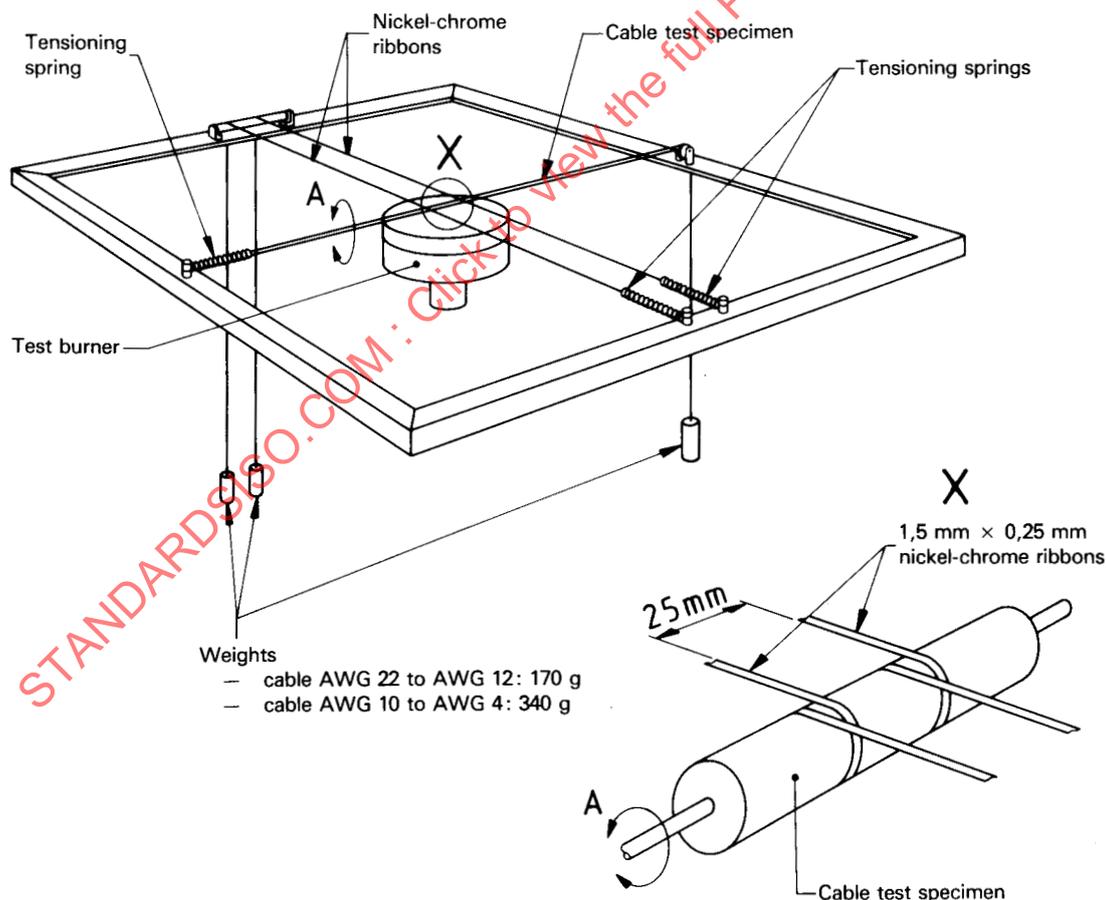


Figure D.1 — Electrical cable test rig

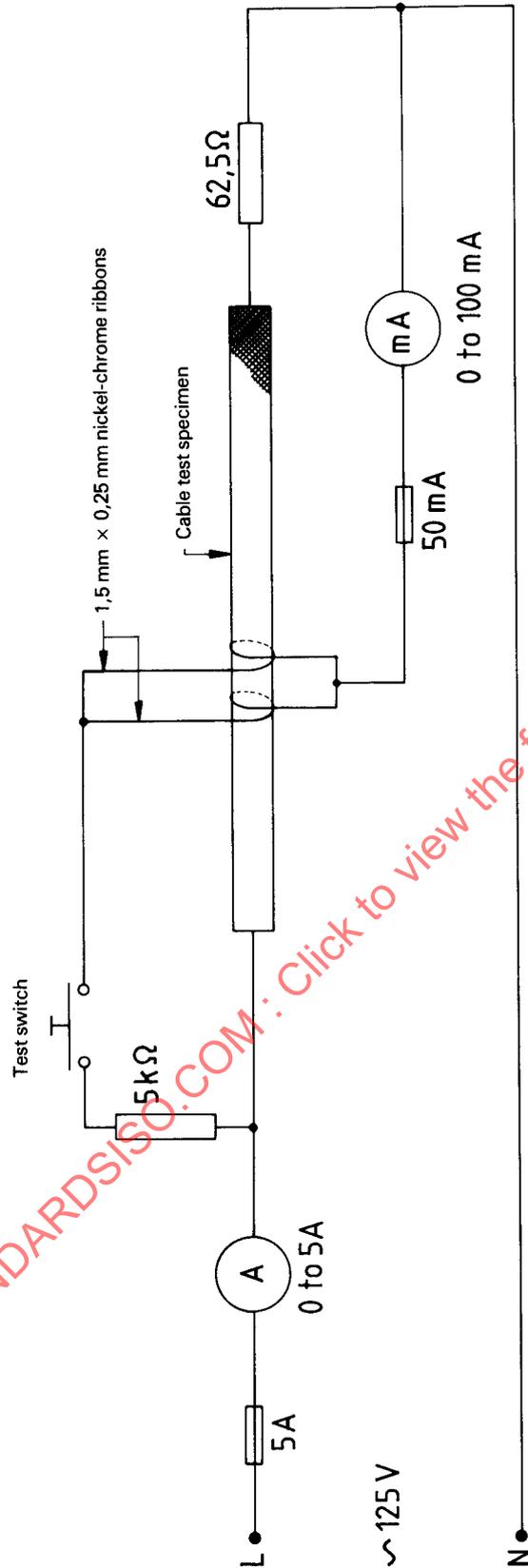


Figure D.2 — Circuit diagram for single-core cables

Procedure:

- Note the line current (approximately 2 A).
- Operate the switch and observe a 25 mA reading.
- Leakage current flow shall not exceed 12,5 mA during the test period.

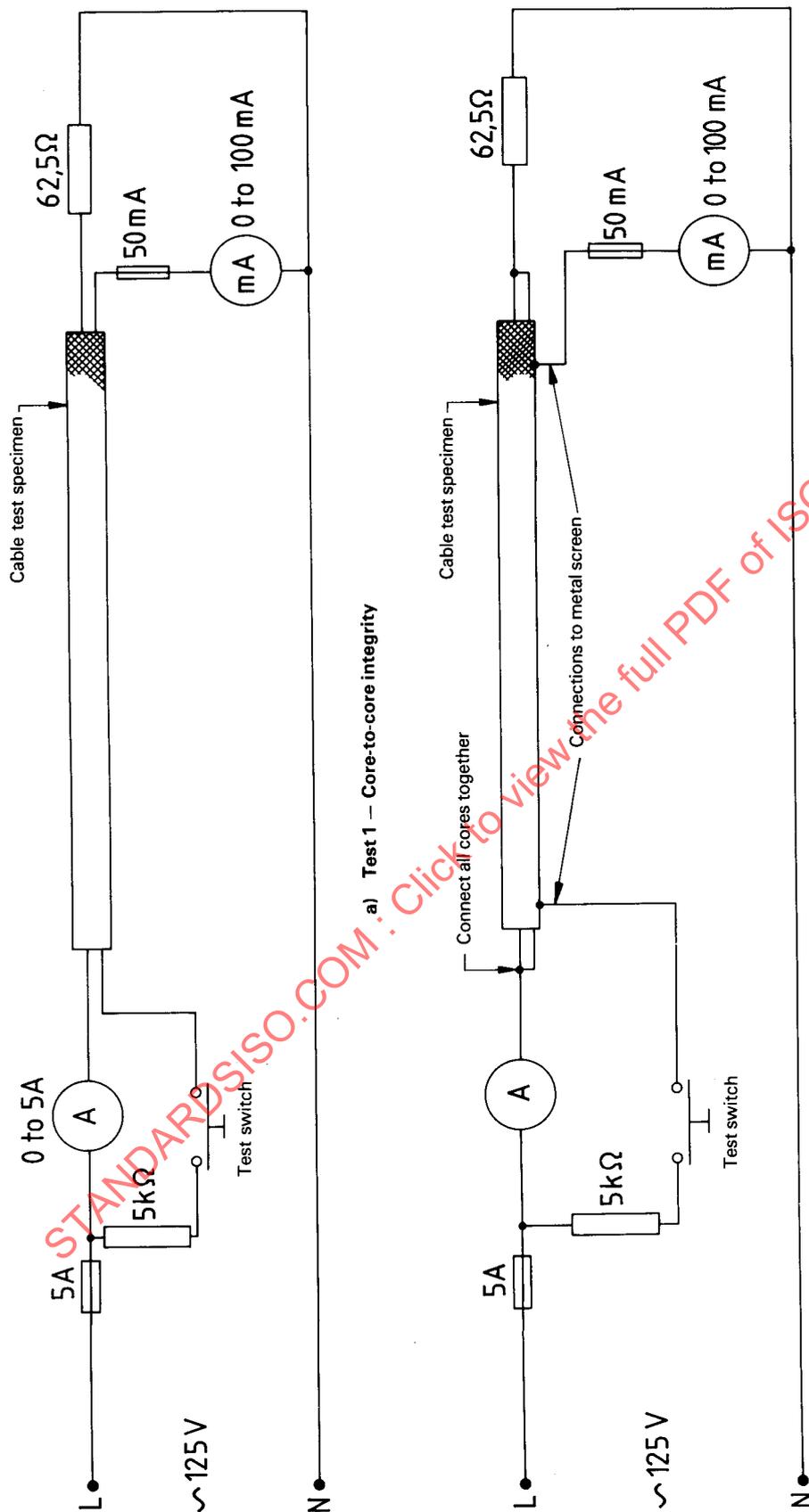


Figure D.3 — Circuit diagram for multicore cables

Procedure:

- a) Note the line current (approximately 2 A).
- b) Operate the switch and observe a 25 mA reading.
- c) Leakage current flow shall not exceed 12,5 mA during the period of tests 1 and 2.

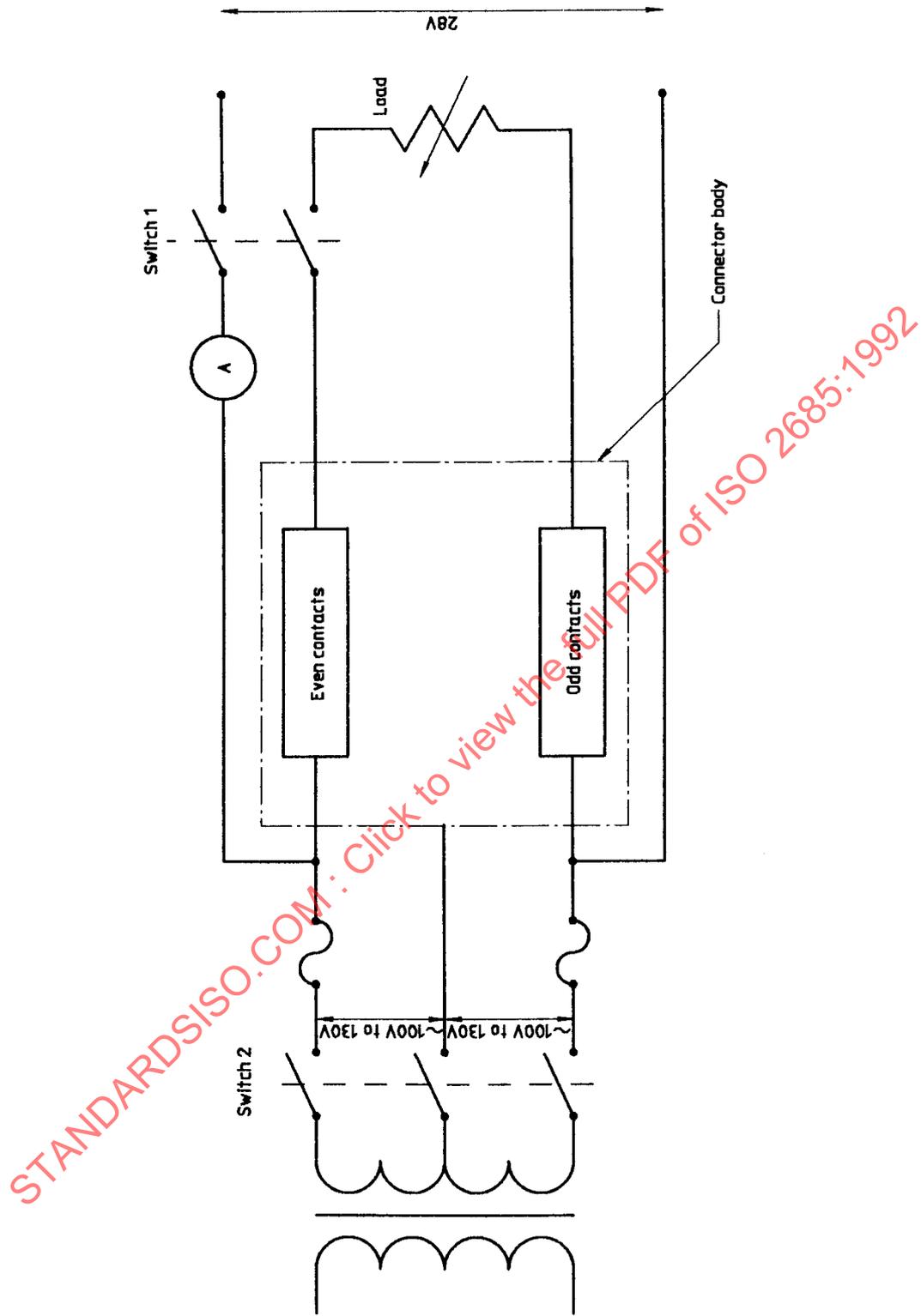


Figure D.4 — Typical circuit diagram for connectors