

Specification for dedicated liquefied petroleum gas appliances — Mobile and portable non-domestic forced convection direct fired air heaters

The European Standard EN 1596:1998, with the incorporation of amendment A1:2004, has the status of a British Standard

ICS 91.140.20

National foreword

This British Standard is the official English language version of EN 1596:1998, including amendment A1:2004. It supersedes BS 4096:1967 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by **A1** **A1**.

The UK participation in its preparation was entrusted to Technical Committee GSE/24, Dedicated LPG appliances, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 December 1998

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 61 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments
14916	12 May 2004	See national foreword

© BS 12 May 2004

ISBN 0 580 30335 7

ICS 91.140.20

Descriptors: heaters, gas appliances, pressure equipment, liquefied petroleum gases, mobile equipment, portable equipment, definitions, classifications, safety, specifications, tests, marking, technical notices, name plates

English version

**Specification for dedicated liquefied petroleum gas
appliances — Mobile and portable non-domestic forced
convection direct fired air heaters**
(including amendment A1:2004)

Spécifications pour les appareils fonctionnant
exclusivement aux gaz de pétrole liquéfiés —
Générateurs d'air chaud à gaz, non domestiques,
à chauffage direct et convection forcée, mobiles et
portatifs
(inclut l'amendement A1:2004)

Festlegungen für Flüssiggasgeräte —
Ortsveränderliche und tragbare, nicht für den
Hausgebrauch bestimmte Warmluftzeuger ohne
Wärmeaustauscher mit erzwungener Konvektion
(enthält Änderung A1:2004)

This European Standard was approved by CEN on 23 May 1998, and amendment A1 was approved by CEN on 24 December 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



European Committee for
Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart, 36, B-1050 Brussels

© 1998 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. EN 1596:1998 + A1:2004 E



Documents

Document Sharing Hub

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 181, Dedicated liquefied petroleum gas appliances, the Secretariat of which is held by NSAI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 1998, and conflicting national standards shall be withdrawn at the latest by December 1998.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

Particular attention should be paid to the suitability of non-metallic materials used in the construction of these appliances. A European Standard for “Flexible hose, tubing and assemblies for use with propane and butane in the vapour phase” is being prepared by CEN/TC 218. These standards will be applicable to these types of appliances.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Foreword to amendment A1

This document (EN 1596:1998/A1:2004) has been prepared by Technical Committee CEN/TC 181, Dedicated liquefied petroleum gas appliances, the Secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2004, and conflicting national standards shall be withdrawn at the latest by September 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s)

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Contents	Page
Foreword	2
1 Scope	6
2 Normative references	7
3 Definitions	8
4 Classification	13
4.1 Classification of gases	13
4.2 Classification of low pressure appliances	14
4.3 Classification of medium pressure appliances	15
5 Safety and constructional requirements	15
5.1 General	15
5.2 Conversion to different gases	16
5.3 Materials	16
5.4 Cleaning and maintenance	16
5.5 Strength of assembly	16
5.6 Soundness of the gas circuit assembly	17
5.7 Connections	17
5.8 Appliance stability, transport and mobility devices	18
5.9 Taps and controls	18
5.10 Control handles	19
5.11 Injectors	20
5.12 Ignition devices	20
5.13 Safety devices	21
5.14 Facility for remote control	25
5.15 Thermostats and control of air temperature	25
5.16 Electrical equipment	26
5.17 Operational safety in the event of failure of auxiliary energy	26
5.18 Motors and fans	26
5.19 Heat inputs	26
5.20 Overheating of the LPG cylinder and, where applicable, its compartment	27
5.21 Temperature of various parts of the appliance	27
5.22 Floor temperatures	28
5.23 Temperature of taps and components	28
5.24 Air delivery temperatures	28
5.25 Ignition	28
5.26 Crosslighting	30
5.27 Flame stability	30
5.28 Flame length	31
5.29 Combustion	31
5.30 Operation safety	31

6	Test conditions and methods.....	31
6.1	General.....	31
6.2	Conversion to different gases.....	35
6.3	Materials	35
6.4	Cleaning and maintenance	36
6.5	Strength of assembly.....	36
6.6	Soundness of the gas circuit assembly	36
6.7	Connections.....	37
6.8	Appliance stability, transport and mobility devices	37
6.9	Taps and controls	37
6.10	Control handles	37
6.11	Injectors.....	37
6.12	Ignition devices	37
6.13	Safety devices	37
6.14	Facility for remote control	40
6.15	Thermostats and control of air temperatures.....	41
6.16	Electrical equipment	41
6.17	Operational safety in the event of failure of auxiliary energy.....	41
6.18	Motors and fans.....	41
6.19	Heat inputs	41
6.20	Overheating of the LPG cylinder, and where applicable, its compartment	44
6.21	Temperatures of various parts of the appliance	44
6.22	Floor temperatures	45
6.23	Temperatures of taps and components.....	45
6.24	Air delivery temperatures.....	45
6.25	Ignition.....	46
6.26	Crosslighting	47
6.27	Flame stability.....	48
6.28	Flame length.....	48
6.29	Combustion	48
6.30	Operational safety	49
7	Marking and instruction literature.....	49
7.1	General.....	49
7.2	Data plate	50
7.3	Other markings.....	50
7.4	Instructions for use and user maintenance	51
7.5	Servicing instructions.....	52
7.6	Packaging	53
	Figure 1 — Apparatus for the measurement of the increase of vapour pressure	54
	Figure 2 — Measurement of air delivery temperatures	55
	Figure 3 — Sample probe	56
	Figure B.1 — Nozzles.....	59
	Figure B 2 — Threaded union connector.....	62

Table 1 — Classification of gases.....	14
Table 2 — Maximum allowable pressure increase inside the LPG cylinder	27
Table 3 — Test gases corresponding to the categories of appliances.....	32
Table 4 — Characteristics of test gases	33
Table 5 — Test pressures (low pressure appliances)	34
Table 6 — Test pressures (medium pressure appliances).....	35
Table 7 — Test gases and pressures for ignition tests	46
Table 8 — Test gases and pressures for crosslighting tests	47
Table 9 — Carbon dioxide produced by test gases.....	49
Annex A (informative) Air supply and ventilation	57
Annex B (normative) Special national conditions	58
Annex ZA (informative) Correspondence between this standard and EC Directive 90/396/EEC	61

1 Scope

This standard defines, for the purpose of type examination, the construction, the safety characteristics, the test methods and the marking of mobile and portable non-domestic forced convection direct fired air heaters with a rated heat input not exceeding 180 kW (H_g) and burning third family gases, referred to in the body of the text as “appliances”.

This standard covers the following type of mobile and portable non-domestic forced convection direct fired air heaters of type A₃ (see CR 1749) fitted with an integral burner intended for use in other than residential dwellings:

- a) low gas pressure appliances operating at pressures up to and including 50 mbar burning commercial butane and/or commercial propane;
- b) medium gas pressure appliances operating at pressures above 50 mbar and up to A₁ 2 bar A₁ burning commercial butane and/or commercial propane.

It does not apply to appliances which are intended to be fixed or permanently installed, or to appliances which incorporate liquid feed burners.

Requirements for appliances given in this standard assume that the supply of gas from the gas cylinder will be governed by a pressure regulator. These appliances are not equipped with an appliance governor.

A₁ Text deleted. A₁

This standard does not cover cylinders for liquefied petroleum gases or their associated regulators.

There are no specific thermal efficiency requirements appropriate to these types of appliances as:

- a) all the heat produced by the combustion process is released into the space to be heated;
- b) the requirements with regard to the combustion performance, which is a safety matter, ensure the effective burning of the fuel gas.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 125, *Flame supervision devices for gas burning appliances — Thermo-electric flame supervision devices*.

EN 126, *Multifunctional controls for gas burning appliances*.

EN 161, *Automatic shut-off valves for gas burners and gas appliances*.

EN 257, *Mechanical thermostats for gas-burning appliance.*

EN 298, *Automatic gas burner control systems for gas burners and gas burning appliances with or without fans.*

EN 437, *Test gases — Test pressures — Appliance categories.*

prEN 1106, *Manually operated taps for gas burning appliances.*

EN 50165, *Electrical equipment of non-electric appliances for household and similar purposes — Safety requirements.*

EN 60529, *Degrees of protection provided by enclosures (IP Code).*
(IEC 60529:1989)

EN 60335-1, *Safety of household and similar electrical appliances — Part 1: General requirements.*
(IEC 60335-1:1991, modified)

EN 60730-2-1, *Automatic electrical controls for household and similar use — Part 2: Particular requirements for electrical controls for electrical household appliances.*
(IEC 60730-2-1:1989, modified)

EN 60730-2-9, *Automatic electrical controls for household and similar use — Part 2: Particular requirements for temperature sensing controls.*
(IEC 60730-2-9:1992, modified)

IEC 34-5, *Rotating machines — Part 5: Classification of degrees of protection provided by enclosures of rotating electrical machines.*

CR 1749, *European scheme for the classification of gas appliances according to the method of evacuation of the products of combustion (types).*

3 Definitions

For the purpose of this standard the following definitions apply.

3.1

air proving device

device which monitors and proves the existence of an adequate flow of air for combustion and, where appropriate, for dilution

3.2

automatic burner control system

system that comprises a programming unit and all the elements of a flame detector. All the functions of an automatic burner control system may be assembled in one or more housings

3.3

auxiliary equipment

auxiliary equipment includes timers, thermostats etc.

3.4

air delivery temperature

maximum temperature of outlet air measured in an arc of 1,5 m from the appliance outlet

3.4.1

space heating appliance

appliance whose air delivery temperature does not exceed the ambient by more than 80 K

3.4.2

commercial drying appliance

appliance whose air delivery temperature may exceed the ambient by more than 80 K. These appliances are intended for purposes other than space heating

3.5

automatic appliance

appliance which incorporates a programmed and controlled ignition, start-up and protection system which is initiated by a single signal e.g. the operation of a switch

3.6

automatic valve

device that automatically opens, closes or varies a rate on a signal from the control circuit and/or the safety circuit

3.7

manual appliance

appliance in which the necessary steps to achieve ignition and operation are controlled separately by the operator

3.8

burner

component that allows the gas to burn

3.8.1

main burner

burner that is intended to assure the thermal function of the appliance and is generally called the burner

3.8.2

ignition burner

burner whose flame is intended to ignite another burner

3.9

gross calorific value (H_s)

quantity of heat produced by the combustion, at constant pressure, of unit volume or mass of the considered gas, the water produced by the combustion being condensed. It is expressed in megajoules either per 1 m³ of dry gas measured at 15 °C at a pressure of 1 013,25 mbar or to 1 kg of dry gas

3.10

cold condition

condition of the appliance required for some tests and obtained by allowing the unlit appliance to attain equilibrium at room temperature

3.11

competent person

person who is qualified by training or experience to carry out a specified task

3.12

conversion

operation carried out by a competent person at the time of a change of gas

3.13

direct fired air heater

air heater in which the products of combustion mix with the heated air being supplied to the space

3.14

extinction delay time

for a thermoelectric flame supervision device, the time that elapses between disappearance of the supervised flame and the interruption of the gas supply

3.15

extinction safety time

for automatic burner control units, the time that elapses between extinction of the supervised flame and the signal to shut-off the gas supply to the burner

3.16

flame lift

phenomenon characterized by the partial or total lifting of the base of the flame away from the burner port, or the flame holding zone provided by the design

3.17

flame supervision device

device including a sensing element which causes the gas supply to a burner to be opened or closed according to the presence or absence of the flame which activates the sensing element

3.18

gas circuit

assembly of parts of the appliance that carry or contain the combustion gas between the appliance gas inlet connection and the burner

3.19

gas inlet connection

part of the appliance intended to be connected to the gas supply

3.20

gas pressure

all the pressures are static pressures of the moving gas, relative to the atmospheric pressure, measured at right angles to the directions of the flow of the gas

Unit: millibars (mbar)

3.21

gas rate adjuster

device allowing the gas rate to a burner to be set at a predetermined value according to the supply conditions. It often consists of a screw, termed a “throttle screw” or an “adjustment screw”. The operation of changing the setting of this device is termed the “adjustment of the gas rate”. The adjustment screw of a variable regulator is regarded as a gas rate adjuster.

A1 In this case the data plate and the instructions should state the limits of the range rate **A1**

3.22

gas supply pressure

difference between the static pressure measured at the inlet connection of the appliance and the atmospheric pressure

3.23

heat input

product of the volume or mass rate and the calorific value of the gas (brought to the same reference conditions)

Unit: kilowatt

3.24

hot condition

condition of the appliance required for some tests and obtained by heating to thermal equilibrium at the nominal heat input specified by the manufacturer, any thermostat remaining fully open

3.25

ignition device

any means (flame, electrical ignition device or other device) used to ignite the gas at the ignition burner or at the main burner. This device can operate intermittently or permanently

3.26

ignition opening time

for thermoelectric flame supervision devices, the time that elapses between ignition of the supervised flame and the moment when the closure element is held open by the flame signal

A1 3.27

ignition rate

average heat input of the pilot burner (if any) during the ignition safety time, expressed as a percentage of the nominal total heat input **A1**

3.28

ignition safety time

for automatic burner control units, the time that elapses between the signal to open and the order to close the gas supply in the burner in the event of ignition not taking place

3.29

injector

component that admits the gas into an aerated burner

3.30

light back

phenomenon characterized by the return of the flame inside the body of the burner

3.31

limit gas

test gases representative of the extreme variations in the characteristics of the gases for which the appliance has been designed

3.32

multifunctional control

device having at least two functions, one of which is a shut-off function, integrated in one housing, whereby the functional parts cannot operate if separated

3.33

mobile heater

self-contained heater for connection to a gas supply by means of flexible tubing and designed to be moved without lifting

3.34

nominal heat input of burner

value of the heat input of the burner, as declared by the manufacturer at the nominal operating pressure

Unit: kilowatt

3.35

overheat cut-off device

device that causes safety shutdown and non-volatile lockout so as to prevent the air temperature exceeding a preset limit

3.36

portable heater

self-contained heater for connection to a gas supply by means of flexible tubing and designed to be easily carried

3.37

pressure couple

two related pressures which will give the same heat input on the same injector on butane and propane at their respective pressures

3.38

pressure regulator

device which is not part of the appliance, but which maintains an outlet pressure within preset limits whatever the upstream pressure, the rate and the temperature

3.39

primary air adjuster

device allowing the aeration of a burner to be set at a predetermined value according to the supply conditions. The operation of changing the setting of this device is termed the “adjustment of primary air”

3.40

putting a control out of service

action whereby a control (of temperature, pressure, etc.) is put out of action and then sealed in this position. The appliance then functions as if this device had been removed

3.41

purge

mechanical introduction of air into the combustion circuit in order to displace any gas/air mixture which could remain there

3.42

reference conditions

dry gas at a temperature of 15 °C and at an absolute pressure of 1 013,25 mbar

3.43

reference gas

test gas on which appliances operate under nominal conditions when they are supplied at the corresponding normal pressure

3.44

relative density

ratio of the mass of a volume of dry gas to an equal volume of dry air under the same temperature and pressure conditions

3.45

restrictor

device with a calibrated orifice which is placed in the gas circuit to create a pressure loss and thus reduce the gas pressure at the burner to a predetermined value, for a given supply pressure and rate

3.46

safety shutdown

process which is initiated immediately in response to the signal of a limiting device or sensor and which causes the burner to shut down; the appliance returns to its start position

3.46.1

non-volatile lockout

shutdown condition such that a restart can only be accomplished by a manual reset

3.46.2

volatile lockout

shutdown condition such that a restart can only be accomplished by restoration of the electrical supply after its loss

3.47

sealing an adjuster

action whereby the locking of an adjuster is achieved by a means such that any attempt to change the adjustment makes the interference with the adjuster apparent (e.g. breaking of a sealing material)

3.48

setting and locking an adjuster

action whereby an adjuster, after having been set by the manufacturer is immobilized in this position by an effective means (screw, plug etc.)

3.49

setting pressure

gas pressure measured at the inlet of the appliance that is required to obtain the rated heat input using the reference test gas

3.50

soft solder

solder for which the lowest temperature of the melting range, after application, is less than 450 °C

3.51

sound mechanical joint

connection device assuring gas soundness in an assembly made up of several parts, generally of metal

It may be:

- a conical joint;
- an O-ring joint;
- a flat-faced joint;
- a nut and olive joint;
- a cone seated union;
- a flat-faced washered union.

3.52

flame stability

condition of the flame at the burner port when the phenomenon of flame lift or light back does not occur

3.53

tap

type of valve on an appliance that controls the flow of gas to the various burners and adjusts their rate during use

3.54

thermostat

device to maintain automatically a selected constant temperature

3.55

volume or mass rate

3.55.1

volume rate

volume of gas passed in unit time. This is expressed in cubic metres per hour or in cubic decimetres per hour

3.55.2

mass rate

mass of gas passed in unit time. This is expressed in kilograms per hour or grams per hour

3.56

Wobbe number

given by the formula:

$$W_s = \frac{H_s}{\sqrt{d}}$$

where H_s is the gross calorific value of a gas expressed in megajoules per cubic metre, and d is its relative density

3.57

yellow tipping

phenomenon characterized by the appearance of yellow colouring at the top of the blue cone of an aerated flame

3.58

country of destination

3.58.1

direct country of destination

country for which the appliance has been certified and which is specified by the manufacturer as the intended country of destination. At the time of putting the appliance on the market and/or installation, the appliance shall be capable of operating, without adjustment or modification, with one of the gases distributed in the country concerned, at the appropriate supply pressure. More than one country can be specified if the appliance, in its current state of adjustment, can be used in each of these countries

3.58.2

indirect country of destination

country for which the appliance has been certified, but for which, in its present state of adjustment, is not suitable. Subsequent modifications or adjustments are essential in order that it can be utilized safely and correctly in that country

3.59

normal pressure

pressure under which the appliances operate in nominal conditions when they are supplied with corresponding reference gas

3.60

transportable heater

self-contained heater for connection to a gas supply by means of flexible tubing and designed to be moved by using special equipment

4 Classification

4.1 Classification of gases

Gases are classified in families according to the value of their Wobbe number, in accordance with EN 437, as shown in Table 1.

Table 1 — Classification of gases

Gas families and groups	Wobbe number $\text{MJ/m}^3 (H_s)$
Group B/P	Between 72,9 and 87,3
Group P	Between 72,9 and 76,8

4.2 Classification of low pressure appliances

Low pressure appliances are classified into categories according to the gases that they are designed to use, in accordance with EN 437. However, for each country, only some of the categories defined hereafter are applicable, on account of local gas distribution conditions (types of gas and supply pressures). For these categories, requirements different from those defined in this standard shall not be specified.

NOTE Table B.1, Table B.2 and Table B.3 identify the gas distribution conditions and types of connection applicable to each country.

This specification only covers appliances of the following categories.

a) Category $I_{3B/P(30)}$

An appliance capable of using third family gases (propane, butane or their mixtures), without adjustment at normal supply pressures from 28 mbar to 30 mbar.

b) Category $I_{3B/P(50)}$

An appliance capable of using third family gases (propane, butane or their mixtures), without adjustment at normal supply pressures of 50 mbar.

c) Category $I_{3+(28-30/37)}$

An appliance capable of burning third family gases (butane and propane), and operating without adjustment on the appliance using a pressure couple. For butane, appliances in this category may be used without adjustment at normal supply pressures from 28 mbar to 30 mbar, for propane they are used at a normal supply pressure of 37 mbar.

d) Category $I_{3P(30)}$

An appliance capable of using third family gases in group P (propane), without adjustment, at a normal supply pressure of 30 mbar.

e) Category $I_{3P(37)}$

An appliance capable of using third family gases in group P (propane), without adjustment at a normal supply pressure of 37 mbar.

f) Category I_{3P(50)}

An appliance capable of using third family gases in group P (propane), without adjustment at a normal supply pressure of 50 mbar.

4.3 Classification of medium pressure appliances

Medium pressure appliances are classified into categories according to the gases that they are designed to use i.e. I_{3B/P}, I_{3P}.

NOTE For the purposes of this standard, a similar method of classification as used in 4.2 has been applied to medium pressure appliances.

5 Safety and constructional requirements

5.1 General

Except where otherwise stated the construction requirements shall be verified by the inspection of the appliance and its instruction literature. The safety requirements shall be checked in accordance with Clause 6.

There shall be no provision for adjustment of parts of the appliance which have been set by the manufacturer.

Primary air and gas rate adjusters shall be preset by the manufacturer and shall not be capable of being changed.

5.2 Conversion to different gases

The appliance shall be supplied for a single gas category and for a single operating pressure or pressure couple or pressure range. Conversion to another category or pressure or pressure couple shall not be possible.

5.3 Materials

The quality and thickness of material used in the construction of an appliance shall be such that the constructional and safety characteristics are not altered in use.

In particular, all parts of the appliance shall withstand the mechanical, chemical and thermal conditions to which they may be submitted during their use. In normal conditions of use, of cleaning or of adjustment, the materials shall not be liable to any alterations which might impair their performance. Sheet metal parts not made of corrosion-resistant material shall be effectively protected against corrosion.

Materials containing asbestos shall not be used.

Copper tubing shall not be used where it would be exposed to temperatures in excess of 100 C.

Any thermal or acoustic insulation shall be securely located and shall be protected against mechanical damage and shall be non-combustible.

5.4 Cleaning and maintenance

Any part of the appliance requiring cleaning by the user shall be easily accessible without having to move the appliance or use a tool for dismantling. It shall be possible to replace such parts correctly and without difficulty, and shall be difficult to reassemble such parts incorrectly.

Sharp borders and edges which could give rise to injury, for example during cleaning and maintenance, shall be avoided.

Any control placed in the gas circuit shall be arranged so that any adjustment or maintenance by a competent person is easy and so that its exchange by him is possible.

5.5 Strength of assembly

The construction of an appliance shall be such that, during normal conditions of use, maintenance or movement, any displacement, distortion or deterioration of parts likely to impair its safety will not occur.

5.6 Soundness of the gas circuit assembly

5.6.1 General

Holes for screws, pins, etc. intended for the assembly of components shall not open into the gas ways. The wall thickness between drillings and gas ways shall be at least 1 mm. This does not apply to orifices for measurement purposes.

The soundness of assemblies connected to the gas circuit shall be assured, by means of metal-to-metal joints or joints with seals (e.g. washers, O-rings or gaskets).

For parts that do not require to be dismantled during normal maintenance, for example taps and injectors, the use of thread sealing compounds is permitted.

Soft solder shall not be used to ensure the soundness of the connections of the gas circuit.

Removable components or the threaded parts of the pipe work which may be dismantled during normal maintenance are considered to be sound if they stay sound after five disconnections, if necessary after changing a gasket, where such exists.

5.6.2 Soundness test

5.6.2.1 Low pressure appliances

Under the test condition specified in 6.6.2.1, the leak detected shall not exceed $0,10 \text{ dm}^3/\text{h}$.

5.6.2.2 Medium pressure appliances

Under the test condition specified in 6.6.2.2 the leak detected shall not exceed $0,10 \text{ dm}^3/\text{h}$.

These requirements shall also be satisfied after all the appliance tests have been carried out but before any of the components used in the soundness tests have been removed.

5.7 Connections

A1 The end of the gas inlet connection shall be positioned to allow the free movement of a hose assembly; the gas input shall be one of the following types: **A1**

- a) with a nozzle for the secure attachment of a flexible tube using clips or a similar method;
- b) with a cone seated union, or a flat-faced washered union, or threaded union, attached to a flexible tube.

The special “national conditions” for connections are given in Table B.3

5.8 Appliance stability, transport and mobility devices

5.8.1 *Transportable appliances*

The appliance shall be so constructed as to allow for safe transportation. To ensure this transport handles, hooks or rings shall be part of the appliance. Any transport rings shall have a minimum inner diameter of at least 60 mm.

5.8.2 *Mobile and portable appliances*

When tested in accordance with **6.8.2** the appliance shall not tip over when inclined in all directions at an angle of 15° to the horizontal.

When the appliance incorporates a gas cylinder the test shall be carried out in turn with all of the manufacturer's recommended sizes of gas cylinder fitted. The test is carried out with the gas cylinder both empty and full.

5.8.3 *Mobility devices*

Appliances incorporating wheels or castors shall have means to prevent accidental movement when in use. Wheels, castors and their mountings shall be sufficiently robust to support the mass of the appliance and a full gas cylinder if incorporated.

5.9 Taps and controls

5.9.1 *General*

The appliance shall be fitted with such taps and controls as are essential for the normal operation of the appliance by the user and shall be in an easily accessible position.

Taps and controls shall be placed in such a way that their strength, operation, manipulation and accessibility undergo no damage from actions to which they are subjected in normal use, and they shall be protected against external clogging.

Taps shall be mounted in such a way that no accidental movement relative to the gas supply connection is possible. Taps shall be individually replaceable.

It shall be possible to dismantle the parts of a tap as far as necessary for its maintenance.