

# Übersetzungen von DIN-Normen

## Manuskriptübersetzungen

Die in Kopie beigefügte Rohübersetzung wurde vom DIN-Sprachendienst nicht auf ihre Richtigkeit geprüft. Deshalb schließt das Deutsche Institut für Normung e.V. (DIN) ausdrücklich jegliche Haftung für deren Richtigkeit bzw. Vollständigkeit aus.

# Translations of DIN-Standards

## Typescript translations

The attached typescript translation has not been checked by DIN-Sprachendienst for its accuracy. Deutsches Institut für Normung e.V. (DIN) cannot, therefore, assume responsibility for its correctness or completeness.

On no account shall the translation be considered authorized by DIN.

---

**Beuth Vet-lag GmbH** Berlin • Wien • Zürich

# Technical Help to Exporters

## T R A N S L A T I O N

DIN 18 891

*August 1984*

SOLID FUEL STOVES

*originallanguage version*

Kaminofen für feste Brennstoffe

---

**issued by** (DIN) DEUTSCHES INSTITUT FÜR NORMUNG EV  
Postfach 1107  
D-1000 Berlin 30  
WEST GERMANY

---

Technical Help to-Exporters has taken all reasonable measures to ensure the accuracy of this translation but regrets that no responsibility can be accepted for any error, omission or inaccuracy. In cases of doubt or dispute, the original language text only is valid.

© Technical Help to Exporters  
British Standards Institution  
Linford Wood, Milton Keynes, MK14 6LE  
Tel: Milton Keynes (0908) 320033 Telex: 825777

GERMAN STANDARD

D I N

18 891

August 1984

UDC 683.93/.94 : 697.243.3 : 001.4  
: 614.8 : 620.1 : 62-777

SOLID FUEL STOVES

Original language version:

Kaminöfen für feste Brennstoffe

Paragraphs 4.2, 5 and 6 of this standard contain safety requirements in the sense of the Gesetz über technische Arbeitsmittel (Gerätesicherheitsgesetz)' (the Equipment Safety Law).

Commencement of validity

This standard enters into effect from 01 August 1984.

The temperatures expressed in K relate to the test room temperature.

ALL dimensions in millimetres

General tolerances: see DIN 7168 - g

List of contents	page
<b>1</b>	<b>Field of application</b> ..... 3
<b>2</b>	<b>Definitions and design characteristics</b> ..... 5
2.1	Consumption
2.2	Waste gas
2.3	Damper arrangement
2.4	Pre-heater baffles
2.5	Steady condition
2.6	Thermal load
2.7	Thermal output
2.8	Rated thermal output
2.9	Basic embers..... 6
2.10	Fire box
2.11	Fire box opening
2.12	Ash compartment
2.13	Plane grate
2.14	Standing grate
2.15	Fire box floor
2.16	Fire-dog
2.17	Regulator
2.18	Efficiency
2.19	Heating gas..... 7
2.20	Re-kindling ability
2.21	Fuel selector of the stove
2.22	Models of stove
<b>3</b>	<b>Designation</b>
<b>4</b>	<b>Requirements</b>
4.1	General requirements
4.1.1	Rated thermal output
4.1.2	Grate arrangement*
4.1.3	Ash box..... 8
4.1.4	Efficiency
4.1.5	Re-kindling ability
4.2	Safety requirements
4.2.1	Materials and wall thicknesses
4.2.2	Regulators and controls
4.2.3	Fuel selector
4.2.4	Pre-heater baffles
4.2.5	Damper..... 9
4.2.6	Fire box
4.2.7	Fire box opening
4.2.8	Heating gas channels
4.2.9	Waste gas pipe stub
4.2.10	Operating handles
4.2.11	Temperatures at adjacent surfaces and in the wood store..... 10
4.2.12	Waste gas temperature
4.2.13	Escape of heating gas and falling out of embers
<b>5</b>	<b>Testing</b>
5.1	Points of measurement
5.2	Types of testing and test documents
5.2.1	Type testing
5.2.2	Component testing..... 11

5.2.3	Supplementary testing	11
5.2.4	Design testing	
5.2.5	Type verification	12
5.3	Test equipment	
5.3.1	Measurement apparatus for fuel consumption	
5.3.2	Measured section	
5.3.3	Delivery pressure meter	
5.3.4	Waste gas analysis plotter	
5.3.5	Temperature measurement devices	14
5.3.6	Test floor and test walls	
5.4	Test fuels	
5.5	Preliminary testing	
5.6	Design testing	15
5.7	Technical testing from the point of view of heating	
5.7.1	Installation of the stove	
5.7.2	Dry heating	
5.7.3	Creation of steady condition and basic embers in a closed fire box	
5.7.4	Testing of safety	
5.7.5	Testing of rated thermal output with the fire box closed, determination of efficiency, and measurement of waste gas temperature and the temperature of the operating handles	17
5.7.6	Testing at reduced rated thermal output	18
5.7.7	Testing of re-kindling ability with the fire box closed	
5.8	Evaluation of measurements	
5.8.1	Efficiency	
5.8.2	Thermal output	19
5.8.3	Mass flow rate of waste gas, in g/s	
5.8.4	Meaning of symbols	20
5.9	Test report	21
6	Installation and operating instructions	21
7	Marking	23

Standards and other documents referred to in the text

Explanatory Notes

## 1 Field of application

1.1 This standard is applicable to solid fuel stoves with a rated thermal output of up to 11 kW.

Stoves are used for room heating with the solid fuels listed as low-smoke fuels in the first decree relating to the implementation of the Bundesimmissionsschutzgesetz (the Federal German Immission Control Act).

These stoves differ from the controlled-combustion stoves in accordance with DIN 18890 in respect of the flat grate, the associated reduced fuel charge and limited continuous combustion capacity, and the possibility, if required, of being used with an open fire box.

1.2 This standard is not applicable to stoves in which water is used as a heat transfer medium, or to open fires produced on-site or assembled from prefabricated components and attached to the building.

1.3 Designs which deviate in certain detailed respects from the provisions of this standard as a result of further technical developments may be approved as satisfying the standard by a Special Committee on receipt of a separate request. All such requests shall be addressed to the Normenausschuß Heiz-, Koch- und Wärmegerät (FNH) (the Heating and Cooking Appliances Standards Committee), Am Hauptbahnhof 10, D-6000 Frankfurt a.M. Federal Republic of Germany. The application shall be accompanied by the test report of an independent testing station approved by the Normenausschuß Heiz-, Koch- und Wärmegerät (FNH). The testing station shall apply the provisions of this standard as appropriate in the course of testing.

For the purposes of granting approval of compliance with the standard, the Special Committee shall arrive at its decision after examining the applicant before the following panel:

- a) Chairman of the FNH Section "Domestic fireplaces for solid fuels".
- b) Chairman of the FNH Working Committee on DIN 18891 and his deputy.
- c) Director of the testing station asked to carry out the testing.
- d) A representative of the group of manufacturers concerned.
- e) Chairman of the FNH.

The decision in respect of approval of compliance with the standard shall be arrived at on the basis of whether the requirements relating to safety, serviceability and testing to be imposed in accordance with this standard on stoves have been satisfied in a manner other than that stipulated in the standard.

Approval of compliance with the standard issued by the Special Committee shall become effective only after having been confirmed by the Working Committee responsible for DIN 18 891.

The request for approval of compliance with the standard shall be regarded as a request for standardization. Approval of compliance with the standard issued by the Special Committee shall be regarded as acceptance of the request for standardization. Details shall be published in the Standards Section of the ~~DIN-Mitteilungen~~, together with a statement to the effect that it is proposed to issue a corresponding subsequent edition of the

standard by the abridged procedure. Immediately on expiry of the four-week period for comments required under the abridged procedure, and provided that no objections have been received, confirmation of approval of Compliance with the standard by the Working Committee shall have the effect of adopting the subsequent edition.

Addresses of testing stations are available on request from:

Normenausschuß Heiz-, Koch- und Wärmgerät im DIN (FNH), Am Hauptbahnhof 10,  
D-6000 Frankfurt a.M. Federal Republic of Germany.

## 2 Definitions and design characteristics

### 2.1 Consumption

The consumption is the rate at which the quantity of fuel is used up during combustion (see DIN 18 890/09.71).

### 2.2 Waste gas

Waste gas is the combustion gas which exits from the waste gas pipe stub of the fireplace.

### 2.3 Damper arrangement

Damper arrangements are arrangements for the purpose of increasing the flow resistance in the heating gas channel.

### 2.4 Pre-heater baffles

Pre-heater baffles (flaps or slides) are devices which, when opened, reduce the length of the path for the heating gases.

### 2.5 Steady condition

The steady condition is the operating state of the fireplace corresponding to a specific thermal load at which there is no longer a significant variation in the values which are to be measured over consecutive periods of identical length.

### 2.6 Thermal load

The thermal load is the quantity of heat supplied to the fireplace every hour, calculated on the basis of the calorific value of the fuel.

### 2.7 Thermal output

The thermal output is the **useable** quantity of heat emitted by the fireplace every hour.

### 2.8 Rated thermal output

The rated thermal output is the thermal output value declared by the manufacturer on the rating plate.

## 2.9 Basic embers

The basic embers consist of the mass of glowing, degassed fuel which must remain, after removal of the ashes, in order to ensure the ignition of the charge of fuel to be added.

## 2.10 Fire box

The fire box is the space formed by the fire box floor, the fire box walls and the fire box top, and the fire box opening, and, if appropriate, the fire box door.

## 2.11 Fire box opening

The fire box opening is the unobstructed opening in the fire box through which radiant heat emerges into the room in which the stove is installed. Depending on the design, some or all of the combustion air can flow in through the fire box opening.

## 2.12 Ash compartment

The ash compartment serves the purpose of accommodating the ash pan and, if appropriate, of guiding combustion air beneath the grate.

## 2.13 Plane grate

The plane grate is a device in the fire box floor through which the ash falls into the ash pan and through which combustion air is introduced.

## 2.14 Standing grate

The standing grate is a device which prevents fuel from falling from the fire box, and which may be a component part of the fire-dog.

## 2.15 Fire box floor

The fire box floor provides a surface on which to lay fuel for the purpose of combustion and a support for the fire-dog or the fire basket. The fire box floor is bounded by the side walls, the back wall, the fire box opening and the standing grate.

## 2.16 Fire-dog

The fire-dog is an arrangement situated above or in the fire box floor through which the ash falls and combustion air is introduced.

## 2.17 Regulator

Regulators are used for the purpose of adjusting the primary or secondary air cross-section.

## 2.18 Efficiency

The efficiency is the relationship between the thermal output and the associated thermal Load expressed as a percentage.



### 2.19 Heating gas

Heating gas is the combustion gas which flows inside the fireplace (see DIN 18890109.71).

### 2.20 Re-kindling ability

The re-kindling ability is the property exhibited by fireplaces of being able to ignite a charge of fuel which is added after a specific period of burning.

### 2.21 Fuel selector of the stove

The fuel selector of the stove is an arrangement for the pre-setting of the maximum primary or secondary air cross-section to suit the nature of the particular fuel which has been selected.

### 2.22 Models of stove

#### a) Model 1

Stoves of Model 1 have an enclosed fire box, the door of which is opened only for servicing purposes. Compliance with this shall be ensured through the requirements set out in Paragraph 4.2.6.

#### b) Model 2

Stoves of Model 2 have a lockable fire box opening and can be operated with the fire box door closed or open.

## 3 Designation

Designation of the requirements relating to a Model 1 (1) stove:

Kaminofen DIN 18 891 - 1  
(Stove DIN 18 891 - 1)

## 4 Requirements

### 4.1 General requirements

#### 4.1.1 Rated thermal output

The rated thermal output in kW shall be determined on the basis of the test results and shall be rounded-off to the nearest whole kW.

#### 4.1.2 Grate arrangement

If fitted, a grate arrangement shall be easily serviced and permit the convenient removal of ashes. It shall be suitable for the fuels recommended by the manufacturer.

#### 4.1.3 Ash box

Wherever a plane **grate** is fitted, an ash box with a volume of at least 0.5 dm<sup>3</sup> per kW of rated thermal output is required. When in its fully-inserted position, no ash shall fall below it. It shall be capable of being removed, transported and emptied in a convenient manner.

#### 4.1.4 Efficiency

The efficiency, established under test conditions in accordance with Paragraph 5.7.5 and with the fire box closed, shall be at least 70%. In the case of stoves having a scavenged sight-window glass larger than 0.2 m<sup>2</sup>, the efficiency shall be at least 60%.

#### 4.1.5 Re-kindling ability

A ~~10~~-hour re-kindling ability shall be possible for a single charge of fuel, using coal as the test fuel under the test conditions in accordance with Paragraph 5.7.7.

### 4.2 Safety requirements

#### 4.2.1 Materials and wall thicknesses

The quality of the materials and the form and dimension of the components shall ensure that the stoves, when operated in accordance with the instructions, and in the presence of the associated mechanical, chemical and thermal stresses remain reliable at all times and capable of being operated for the appropriate period.

Only non-combustible materials shall be used; the operating handles are exempted from this requirement.

#### 4.2.2 Regulators and controls

The regulators and controls shall be clearly visible and shall bear permanent markings. Their position in the open or closed function shall be clearly visible.

#### 4.2.3 Fuel selector

The fuel selector shall exhibit clearly and durably marked positions for the fuels specified in the operating instructions.

#### 4.2.4 Pre-heater baffles

The pre-heater baffles shall be capable of easy operation and shall close tightly. Their open and closed positions shall be clearly visible and permanently marked.

#### 4.2.5 Dampers

Dampers, if fitted, shall be easy to operate. They shall have openings, the combined surface area of which shall be not less than 3% of the cross-sectional area in the form of a sector or a segment of a circle, but with a minimum size of 20 cm<sup>2</sup>. It shall be possible to readily identify the position of the damper and to lock it in place.

#### 4.2.6 Fire box

In the case of stoves of Model 1, the design shall ensure that the fire box remains closed at all times, except during servicing, including when the stove is not in use. Loading doors which do not close automatically shall not uncover an opening larger than 0.05 m<sup>2</sup>.

#### 4.2.7 Fire box opening

The fire box opening of Model 2 stoves shall not be larger than 0.2 m<sup>2</sup>.

#### 4.2.8 Heating gas channels

The heating gas channels shall be capable of being cleaned. The minimum unobstructed width of the heating gas channels and the cleaning opening shall be at least 40 mm if these cannot be exposed for cleaning purposes.

The cleaning openings shall be easily accessible.

#### 4.2.9 Waste gas pipe stub

The waste gas pipe stub shall have a sleeve length of at least 40 mm. The external diameter of the waste gas pipe stub shall fit a waste gas pipe with a nominal diameter in accordance with DIN 1298, although a dimension of 180 mm shall not be exceeded.

Note: It is recommended that the diameter of the waste gas pipe stub be reduced to 130 mm for Model 1 stoves.

Replaceable waste gas pipe stubs shall be securely fitted and shall match every stove connection point. The use of adapters to change the diameter of the waste gas pipe stub shall be permissible if these are a part of the stove.

#### 4.2.10 Operating handles

The operating handles shall be capable of easy operation. They shall be designed and fitted in such a way that their surface temperature does not exceed room temperature by more than the following amounts under the test conditions in accordance with Paragraph 5.7.5:

35 K for metal;  
 45 K for ceramics;  
 60 K for plastics.

These temperatures may be exceeded only if the manufacturer supplies devices with the stove which permit it to be operated in safety.

#### 4.2.11 Temperatures at adjacent surfaces and in the wood store

The surface temperatures on the floor in front of and beneath the stove and at the adjacent walls at a distance of 200 mm below and next to the stove, as well as in the wood store, shall not rise more than 60 K above room temperature under the test conditions in accordance with Paragraphs 5.7.4 and 5.7.5. If smaller distances are specified by the manufacturer in his operating instructions, then the requirements shall be satisfied at these distances.

#### 4.2.12 Waste gas temperature

The waste gas temperature in the waste gas pipe shall not exceed a value of 400°C under test conditions in accordance with Paragraph 5.7.5.

#### 4.2.13 Escape of heating gas and falling out of embers

No heating gas shall escape into the room in which the stove is installed, and no embers shall fall from the fire box under all operating conditions encountered during testing.

## 5 Testing

### 5.1 Points of measurement

The points of measurement accepted by the FNH shall apply to the testing of stoves.

### 5.2 Types of testing and test documents

#### 5.2.1 Type testing

Type testing shall be commissioned by the manufacturer in order to establish whether a stove is in compliance with the standard. Testing shall extend to all parts of the stove. For this purpose the manufacturer shall make available to the testing station one example of each output category of the type of stove in question. The following documents shall be submitted and examined in conjunction with type testing:

- a. Durable drawing,  
for example blueprints (sheet size in accordance with DIN 823 and folding in accordance with DIN 8241, executed in such a way as to provide a clear picture of the model of stove and all its component parts. Sectional drawings of all parts which are essential to operation, to a scale of not less than 1:5. The drawings shall contain all functionally important dimensions.
- b. Photograph of the stove, 13 cm x 18 cm.
- c. Printed Leaflets relating to the stoves, in particular installation and operating instructions; promotional folders.
- d. Specification of the stove:
  - mode l;
  - rated thermal output, in kW;
  - dimensions, in mm;
  - diameter of waste gas pipe stub, in mm;
  - size of fire box floor or size of fire basket, in m<sup>2</sup>;
  - size of fire box opening, in m<sup>2</sup>;
  - grate construction;
  - connection facilities;
  - details of materials;
  - surface finish, replacement parts and accessories;
  - position and means of attachment of rating plate with relevant details.

#### 5.2.2 Component testing

Component testing shall extend to one or more component parts of a type-tested stove. Paragraphs 5.6 and 5.7 shall apply as appropriate to its performance.

#### 5.2.3 Supplementary testing

The purpose of supplementary testing is to determine the influence of supplementary devices on the compliance with the standard of a type-tested stove. The testing of any parts on which the supplementary devices have no influence is not required in this context.

#### 5.2.4 Design testing

The purpose of design testing is to determine whether the stove which is the subject of the request for design testing differs from the type-tested reference stove in respect of the execution and arrangement of any functionally significant component parts.

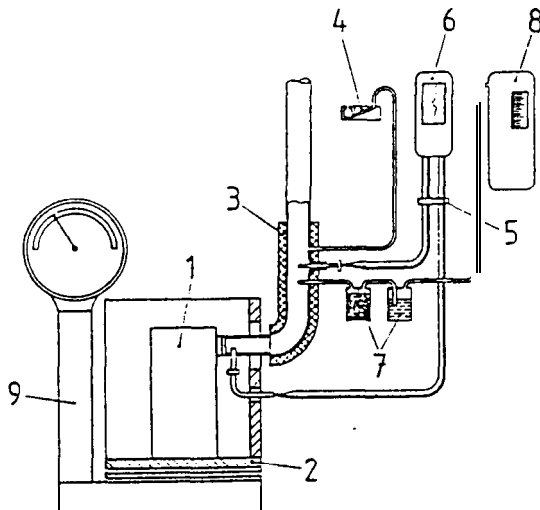
### 5.2.5 Type verification

Type verification may be requested by anyone in the event of there being any doubt as to the compliance with the standard of a stove bearing the DIN Test and Control Mark.

It shall be performed by a recognized independent testing station, which shall arrange for the test item to be selected from a sufficient number in a factory or commercial store by an organization (e.g. the FNH) instructed to do this on behalf of the testing station.

Type verification shall be performed fundamentally as type testing. If the objection relates only to a limited part of the standard, type verification may be performed as component testing, supplementary testing or design testing, at the discretion of the testing station.

### 5.3 Test equipment (see Figures 1 to 3)



- 1 Stove
- 2 Test floor and test walls
- 3 Measured section
- 4 Delivery pressure meter
- 5 Reference point
- 6 Temperature measurement equipment
- 7 Cleaning filter and waste gas washer
- 8 Waste gas analysis plotter
- 9' Consumption scale balance

Figure 1. Test device for technical testing from the point of view of heating

5.3.1 Measurement apparatus for fuel consumption

5.3.1.1 Fuel scale balance for the purpose of determining the quantity of test fuel to be added and the weight of the removed ashes, with a maximum error of 10 g and a scale graduation of 2 g.

5.3.1.2 Consumption scale balance for the purpose of determining fuel consumption with a maximum error of 100 g and a scale graduation of 20 g.

5.3.2 Measured section

An arrangement as shown in Figure 2 for the purpose of determining the delivery pressure, the waste gas temperature and the waste gas composition.

5.3.3 Delivery pressure meter

An indicating or printing device for determining the delivery pressure, with a zero-point control facility during operation and limits of error of not more than 0.005 mbar.

5.3.4 Waste gas analysis plotter

5.3.4.1 A device for determining the CO<sub>2</sub> and (CO + H<sub>2</sub>) content for at least 20 analyses per hour, with limits of error of not more than 0.2% by volume.

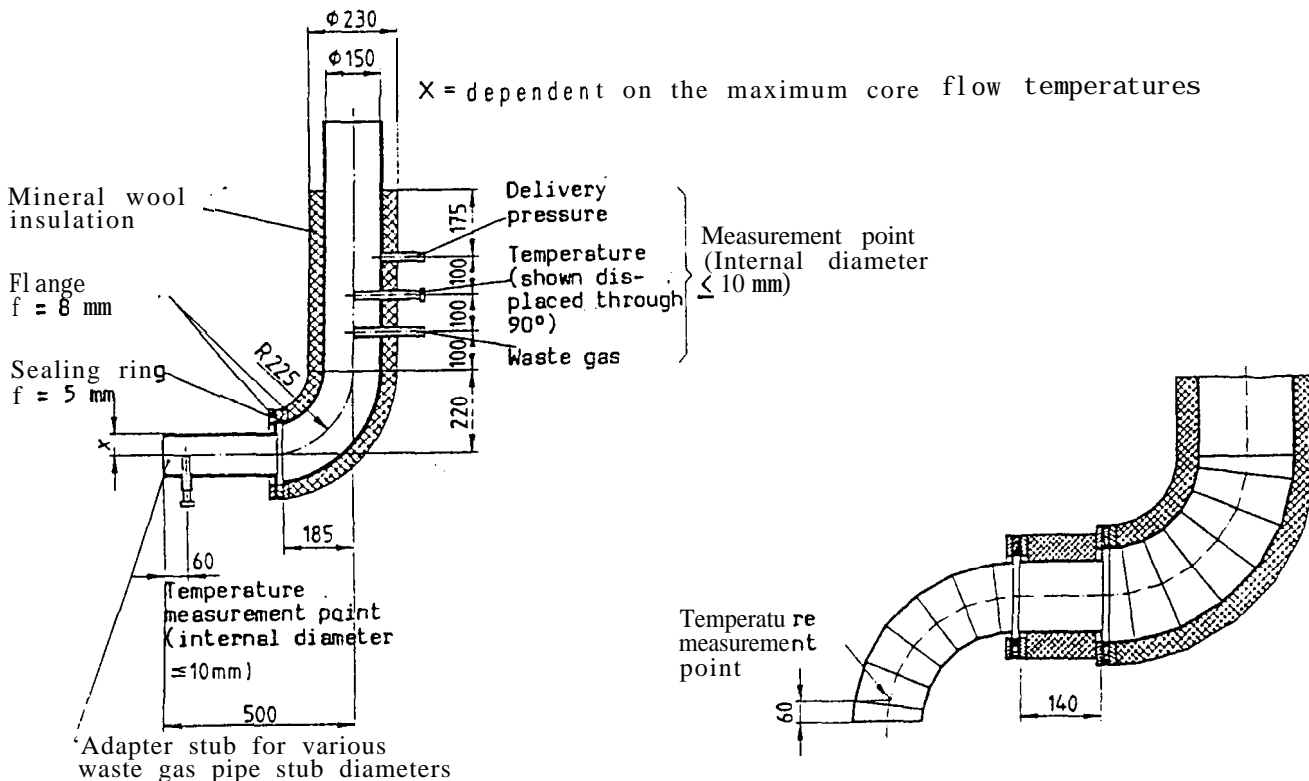


Fig. 2. Measured section.

Fig. 3. Vertical connection.

5.3.4.2 A continuous plotting device for determining the CO content with limits of error of not more than  $\pm 0.2\%$  by volume.

#### 5.3.5 Temperature measurement devices

5.3.5.1 A device for determining the waste gas temperature with limits of error of not more than  $5^{\circ}\text{C}$ .

5.3.5.2 A device for determining the surface temperatures with limits of error of not more than  $\pm 2^{\circ}\text{C}$ .

5.3.5.3 A device for determining the ambient temperature with limits of error of not more than  $1^{\circ}\text{C}$ .

#### 5.3.6 Test floor and test walls

Equipment as shown in Figure 3 for determining the surface temperature of the test floor and the test walls.

#### 5.4 Test fuels

##### 5.4.1 Test fuels for rated thermal output and, if appropriate, re-kindling ability

Test fuels are the fuels specified as being suitable by the manufacturer in the operating instructions.

If wood is used as a test fuel, Logs with a maximum water content of 20% by mass, of  $(330 \pm 30)$  mm in length, and with a circumference of 300 to 355 mm shall be used. Brown coal briquettes and various types and grades of mineral coal may be specified only if the stove has a suitable grate (e.g. size 180 mm x 200 mm, with a slot width of 8 mm) and an ash box.

In order to ensure adequate coverage of the grate, logs of smaller and greater length may be used.

##### 5.4.2 Test fuels for safety testing

Safety testing shall be performed using a piece of wood with an edge length of 50 mm x 50 mm or 40 mm x 60 mm, with a maximum water content of 15%, and with a length to suit the fire box.

#### 5.5 Preliminary testing

Before starting the test, the documents submitted in accordance with Paragraph 5.2 shall be inspected for completeness and correctness.

Checks shall then be made to establish whether the marking Crating plate) corresponds to the requirements in accordance with Paragraph 7, and whether the stove to be tested exhibits any obvious transport damage which could influence its function.



### 5.6 Design testing

A check shall be made to establish whether the requirements in accordance with Paragraphs 4.2.1 to 4.2.9 have been met.

### 5.7 Technical testing from the point of view of heating

The damper arrangement shall be kept open, and the fuel selector shall be set to the appropriate test fuel during all the tests.

#### 5.7.1 Installation of the stove

The stove shall be installed on the test floor of the test equipment in accordance with Figure 4, using the appropriate floor protection specified by the manufacturer.

#### 5.7.2 Dry heating

The stove shall be dry heated or pre-heated.

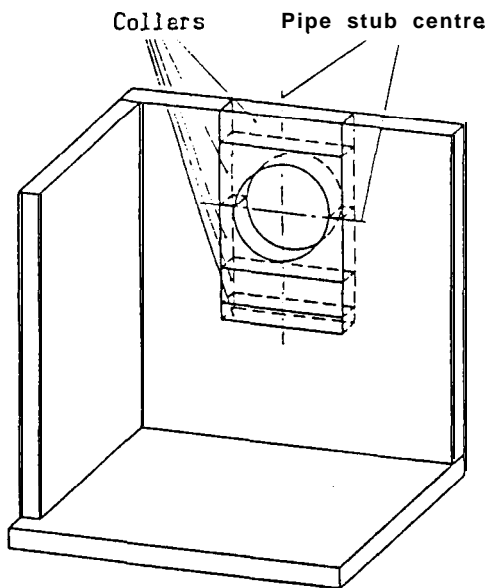


Fig. 4. Test floor and test walls with accessories.

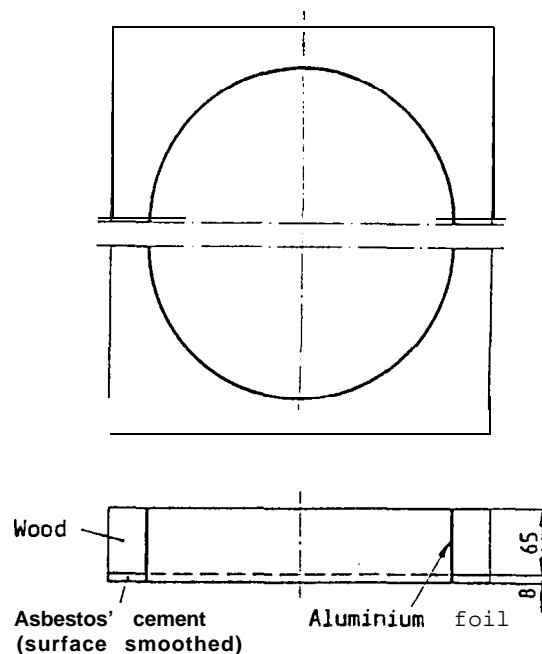


fig. 5. Collar for pipe stub opening.

5.7.3 Creation of steady condition and basic embers in a closed fire box  
Depending on the loading required or expected in conjunction with each test, the basic embers shall be produced by the use of a sufficient quantity of test fuel to ensure that the necessary quantity of basic embers is still available after each of the test periods of identical duration. For this purpose the regulators and the delivery pressure shall be adjusted in accordance with the conditions of testing.

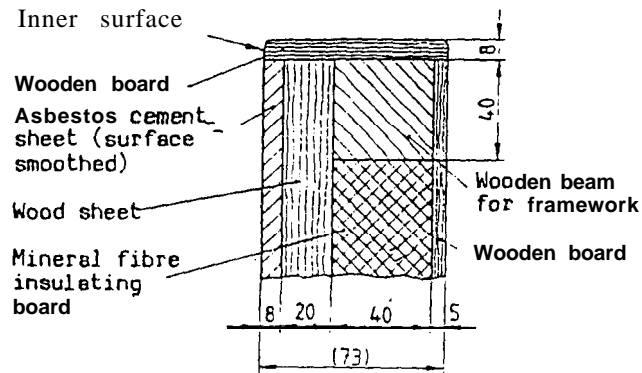


Fig. 6. Section through test floor and test wall.

#### 5.7.4 Testing of safety

##### 5.7.4.1 Testing of safety of Model 1 and 2 stoves with the fire box closed.

Measurement of surface temperatures of the test floor, the test walls, and inside the wood store.

Steady condition and basic embers shall be created. In the steady condition, and before the basic embers are produced, the hottest points shall be determined in each case under the most unfavourable connection conditions on the rear and Lateral test walls and on the test floor beneath and in front of the stove. A circular area on the rear test wall with a radius 200 mm greater than the radius of the waste gas pipe and concentric with the waste gas pipe shall be ignored for this purpose.

The temperature inside the wood store shall be measured at the hottest point. After creating the basic embers, the fire box floor or the grate shall be covered with pieces of wood. A quantity of fuel equivalent to a thermal loading of 400 MJ per m<sup>2</sup> of fire box floor shall be selected for this purpose. This quantity of wood shall be introduced consecutively in two halves and burned until only the basic embers remain in each case. This procedure shall be repeated as often as necessary until there is no longer a significant variation in the surface temperatures which are to be measured. The length of the pieces of wood shall be selected so that at least the grate structure is covered, and that the length is at least two-thirds of the length of the fire-box or two-thirds of the depth of the fire box. The wood shall be positioned uniformly over the fire box floor, if necessary with alternate layers arranged cross-wise.

The fuel shall be burned with the operating control set to its maximum position and with a mean delivery pressure of  $(0.17 \pm 0.03)$  mbar until the basic embers present at the start of the test are produced.

During the test the surface temperatures of the test floor, the test walls, and inside the wood store shall be measured continuously at the hottest points, as shall the delivery pressure and the ambient temperature.

Compliance or otherwise with the requirements of Paragraphs 4.2.11 and 4.2.13 shall then be determined.

5.7.4.2 Testing of safety of Model 2 stoves with the fire box open.

Unlike the test procedure outlined in Paragraph 5.7.4.1, a layer of logs shall be placed on the basic embers on the fire box floor or on the grate. This quantity of test fuel shall be burned at a delivery pressure in accordance with the manufacturer's specifications, although this shall not exceed 0.1 mbar. Compliance or otherwise with the requirements of Paragraph 4.2.13 shall then be determined. The mass flow rate of waste gas, the waste gas temperature and the necessary delivery pressure shall be determined in conjunction with this.

5.7.5 Testing of rated thermal output with the fire box closed, determination of efficiency, and measurement of waste gas temperature and temperature of operating handles

Unlike Paragraph 5.7.4, once the basic embers have been produced, the fire box floor or the grate shall be covered with logs or with a layer of brown coal briquettes, a layer of mineral coal briquettes or a layer of mineral coal Grade 2 or Grade 3 nuts to a depth of 30 to 40 mm. This quantity of fuel shall be burned at a mean delivery pressure of  $(0.10 \pm 0.02)$  mbar, with the operating controls at their maximum setting or at a reduced setting. At least three consecutive burning periods shall be carried out and evaluated.

During the test the surface temperatures of the operating handles, the temperature and composition of the waste gas, the delivery pressure and the ambient temperature shall be measured continuously. Compliance or otherwise with the requirements of Paragraphs 4.1.1, 4.1.4, 4.2.10, 4.2.11 and 4.2.12 shall then be determined. The requirements of Paragraph 4.2.12 shall be considered to have been satisfied if the waste gas temperature in the measured section does not exceed ambient temperature by more than 350 K on average at the rated thermal output.

In the event of these requirements not being met in one or more respects, due to the actual thermal output having been greater than the rated thermal output, testing shall be repeated with the regulator set to produce the rated thermal output. The thermal output, calculated from the consumption period, the results of measurement and the fuel, shall be at least equivalent to the rated thermal output. Compliance or otherwise with the requirements of Paragraph 4.2.12 shall then be determined. The mass flow rate of the waste gas, the waste gas temperature and the necessary delivery pressure shall be determined as a minimum for this purpose.

#### 5.7.6 Testing at reduced rated thermal output

Unlike Paragraph 5.7.5, testing shall be performed with the delivery pressure reduced to such an extent that 0.8 times the rated thermal output is achieved. In the event of 0.8 times the rated thermal output not being achieved, the results shall be calculated by interpolation from the recorded data for the testing in accordance with Paragraph 5.7.5.

#### 5.7.7 Testing of re-kindling ability with the fire box closed

After having produced the basic embers, the same quantity of test fuel in the form of coal as was used in conjunction with testing in accordance with Paragraph 5.7.5 shall be introduced, and shall be burned with the regulator set to its minimum setting and with a mean delivery pressure of  $(0.07 \pm 0.02)$  mbar.

Compliance or otherwise with the requirements of Paragraph 4.1.5 shall be determined after 10 hours have elapsed.

### 5.8 Evaluation of measurements

The indicated formulae are numerical equations; the symbols and units are set out in Paragraph 5.8.4.

#### 5.8.1 Efficiency

The losses shall be determined from the mean values of the waste gas temperature and ambient temperature, the waste gas composition, and the combustible matter in the material which has fallen and has been raked through the grate. The efficiency is determined on the basis of these losses.

##### 5.8.1.1 Loss of free heat, in kJ/kg, in the waste gases

$$Q_a = \left[ c_{pm} \cdot \frac{C - C_r}{0,536 \cdot (CO_1 + CO)} + 1,92 \cdot \frac{9H + W}{100} \right] \cdot (t_a - t_r) \quad (1)$$

or as a percentage of the calorific value  $H_U$  of the test fuel

$$q_a = \frac{Q_a}{H_u} \cdot 100 \quad (2)$$

5.8.1.2 Loss of latent heat, in kJ/kg, in the waste gases

$$Q_b = \frac{12\,644 (C - C_r)}{0,536 \cdot (CO_2 + CO) \cdot 100} \quad (3)$$

or as a percentage of the calorific value  $H_u$  of the test fuel

$$q_b = \frac{Q_b}{H_u} \cdot 100 \quad (4)$$

5.8.1.3 Heat loss, in kJ/kg, of combustible residues in the material which has fallen and has been raked through the grate

$$Q_r = \frac{b \cdot R \cdot 335}{100} \quad (5)$$

or as a percentage of the calorific value  $H_u$  of the test fuel

$$q_r = \frac{Q_r}{H_u} \cdot 100 \quad (6)$$

5.8.1.4 Efficiency, as a percentage value

$$\eta = 100 - (q_a + q_b + q_r) \quad (7)$$

5.8.2 Thermal output

The thermal output  $P$  in kW is calculated from the quantity of fuel  $B$  consumed per hour, from the calorific value  $H_U$  of the test fuel, and from the efficiency:

$$P = \frac{B \cdot H_u}{100 \cdot 3600} \eta \quad (8)$$

5.8.3 **Mass flow** rate of waste gas, in g/s

The mass flow rate of the waste gas is determined as an approximate value in relation to the CO<sub>2</sub> content of the waste gases and the fuel-specific data:

$$\dot{m} = \frac{\left[ \frac{C - C_r}{0,536 (CO_2 + CO)} + \frac{9H + W}{100} \right] \cdot B \cdot 1,3}{3,6} \quad (9)$$

## 5.8.4 Meaning of symbols

- B** Quantity of test fuel burned per hour, in kg/h.
- b** Combustible matter present in the material which has fallen and has been raked through the grate, as a percentage by mass.
- c** Carbon content of the test fuel; as a percentage by mass.
- CO** Carbon monoxide content of the dry waste gases, as a percentage by volume (this can be substituted in the formulae for the calculation of  $Q_a$  and  $Q_b$  for CO in the denominator for the mean (CO + H<sub>2</sub>) content, because hydrogen is present in the waste gas only as traces at the most).
- CO<sub>2</sub>** Carbon dioxide content of the dry waste gases, as a percentage by volume.
- c<sub>r</sub>** Carbon content of the matter which has fallen and has been raked through the grate, in relation to the quantity of the test fuel burned, as a percentage by mass.
- $c_r = \frac{R \times b}{100}$  is approximately true.
- c<sub>pm</sub>** Specific heat of the dry waste gases, dependent on the temperature and composition of the waste gases (normal state), expressed in kJ/(m<sup>3</sup> x K).

See Fig. 7 for graphical representation.

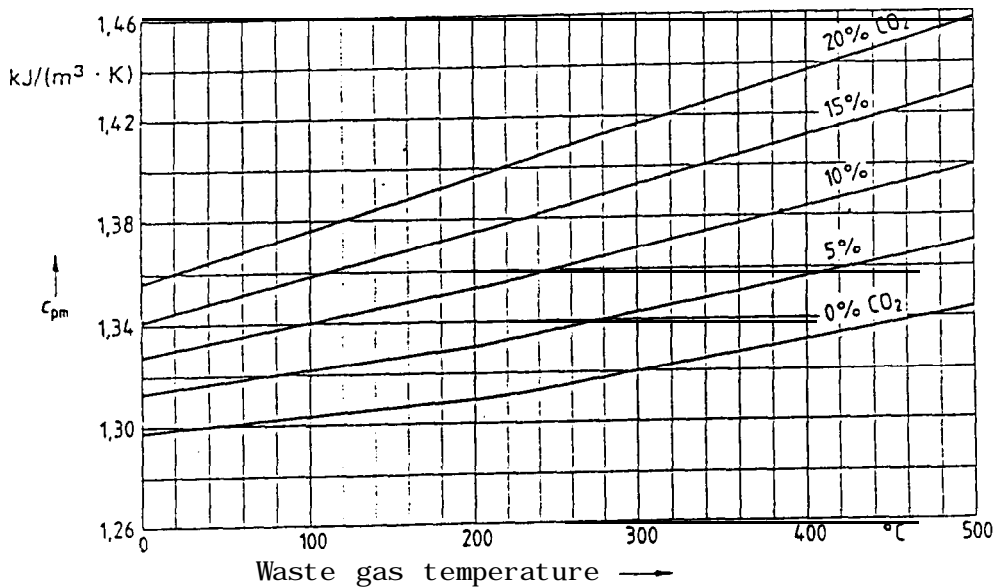


Fig. 7. Mean specific heat of the dry waste gases (normal state), in kJ/(m<sup>3</sup> x K).

H	Hydrogen content of the test fuel, as a percentage by mass.
$H_U$	Calorific value of the test fuel, in kJ/kg.
$\dot{m}$	Mass flow rate of waste gas, in g/s.
$\eta$	Efficiency, as a percentage.
P	Thermal output, in kW.
$Q_a$	Loss through free heat present in the waste gases, in relation to the unit of quantity of the test fuel, in kJ/kg.
$Q_b$	Loss through latent heat present in the waste gases, in relation to the unit of quantity of the test fuel, in kJ/kg.
$Q_r$	Heat loss due to combustible components in the material which has fallen and has been raked through the grate, in relation to the unit of quantity of the test fuel, in kJ/kg.
$q_a$	Proportion of the loss due to free heat in the exhaust gases $Q_a$ in relation to the calorific value $H_U$ of the test fuel, as a percentage.
$q_b$	Proportion of the loss due to latent heat in the exhaust gases $Q_b$ in relation to the calorific value $H_U$ of the test fuel, as a percentage.
$q_r$	Proportion of the energy loss due to combustible components in the material which has fallen and has been raked through the grate $Q_r$ , in relation to the calorific value $H_U$ of the test fuel, as a percentage.
R	Material which has fallen and has been raked through the grate, in relation to the burned test fuel, as a percentage by mass.
$t_a$	Waste gas temperature, in °C.
$t_r$	Ambient temperature, in °C.
W	Water content of the test fuel, as a percentage by mass.

## 5.9 Test report

Neither the full text nor any extracts from the test reports shall be published.

## 6 Installation and operating instructions

Every stove shall be accompanied by operating instructions in the German language, which shall contain all necessary details in respect of installation, suitable fuels, operation, servicing and maintenance, etc.

### 6.1 Installation instructions

The installation instructions for a given fuel shall contain the following details:

#### a) Operation with the fire box open:

- mass flow rate of waste gas, in g/s;
- waste gas temperature after the waste gas pipe stub, in °C;
- minimum delivery pressure at rated thermal output, in mbar.

## b) Operation with the fire box closed:

- mass flow rate of waste gas, in g/s;
- waste gas temperature after the waste gas pipe stub, in °C;
- minimum delivery pressure at rated thermal output, in mbar;
- minimum delivery pressure at 0.8 x rated thermal output, in mbar;
- nature of chimney use by the stove.

In the case of stoves of Model 1, connection to multiple-use chimneys is possible; the dimensions of the chimney are covered by DIN 4705, Part 3.

In the case of stoves of Model 2, connection shall be made to an individual chimney; the dimensions of the chimney are covered by DIN 4705, Part 1 or Part 2.

In addition, indications shall be given of the room ventilation necessary to ensure an adequate supply of combustion air, and in order to take account of the building regulations applicable in each case to the installation work and to the connection to the chimney.

## 6.2 Operating instructions

The operating instructions shall contain the following details:

Directions relating to operation with:

- suitable types and grades of fuel, with which the stove satisfies the requirements of this standard.
- operation of the fuel selector, if appropriate.
- a direction in the case of Model 1 stoves to the effect that the fire box shall be kept closed at all times, except during servicing, including during periods when the stove is not in use.
- all necessary instructions relating to normal operation.
- all necessary instructions relating to operation during the transitional period at external temperatures of more than 15°C (e.g. frequent raking, further opening of the regulator).
- instructions relating to cleaning.
- instructions relating to operation with the fire box open. The stove shall bear the instruction "Bedienungsanleitung beachten" (see operating instructions) in a permanent and clearly visible manner. None of the other printed material issued by the manufacturer shall contain details which contradict the operating instructions.



## 7 Marking

The stove shall bear the following marking in a clearly visible position on a permanently legible and permanently attached rating plate, or in characters cast into the stove:

- a) Manufacturer and/or registered trade mark;
- b) Type designation;
- c) Model;
- d) DIN Test and Control Mark, with registered number;
- e) Rated thermal output.

These details shall agree with the information contained in the printed material issued by the manufacturer.

Note: It is recommended that the rating plate be executed in accordance with DIN 825 Part 1, with characters in accordance with DIN 1451 Part 1.

Approval to bear the DIN Test and Control Mark will be granted if the stove corresponds to the requirements of this standard in all respects, and if the manufacturer has demonstrated compliance with the standard in the form of a test report from a recognized testing station and has received a registration number from the FNH office in response to an application. Applications shall be addressed to the headquarters of the FNH.

Through this approval, the manufacturer confirms that the stove complies with this standard.

### Standards and other documents referred to in the text

DIN 823	Technical drawings; Sheet sizes.
DIN 824	Technical drawings; Folding to filing formats.
DIN 825 Part 1	Plate dimensions; Square and rectangular plates.
DIN 1298	Connecting pieces for heating installations; Pipes, bends and elbows made of metal, for waste gases.
DIN 1451 Part 1	Lettering; Sanserif Linear-Antiqua; General.
DIN 4705 Part 1	Calculation of chimney dimensions; Terminology; Detailed calculation procedure.
DIN 4705 Part 2	Calculation of chimney dimensions; Approximation procedure for single-use chimneys.
DIN 4705 Part 3	Calculation of chimney dimensions; Approximation procedure for multiple-use chimneys.
DIN 7168 Part 1	General tolerances; Longitudinal and angular dimensions.
DIN 18 890	Controlled-combustion stoves for solid fuels.

First Decree relating to the Implementation of the Federal German Immission Control Act (Erste Verordnung zur Durchführung des Bundesimmissionsschutzgesetzes).

### Explanatory Notes

The "Stoves" ("Kaminöfen") Working Committee of the FNH (the Heating and Cooking Appliances Standards Committee) has compiled this standard as part of its standardization work in response to a request from the AREGEBAU-Arbeitskreises Haustechnische Anlagen organization.

The standard contains requirements in respect of design and operation, safety requirements, and the relevant test requirements for factory-built, ready-to-install fireplaces for solid fuels with a fire box opening into the room in which the fireplace is installed or closed by means of a sight glass, which correspond to the current state of the art.

### International Patent Classification

F 24 B 1-18