

# HEATING WITH WOOD

A guide to clean and  
proper heating

EDITION 2013





## **WOOD HEATING AND CLEAN AIR – AREN'T THESE TWO CONFLICTING CONCEPTS?**

When correctly used, wood is an eco-friendly fuel. By using well-processed wood from local sources in a properly handled modern fireplace, you can enjoy the cosy warmth from your wood-burning stove or boiler without causing significant environmental damage. The environment and your neighbours will be grateful for this.

This brochure is intended to give you tips on how to properly operate a wood-based heating system – in technical terms referred to as a small combustion installation. Especially the burning of poor quality wood in old and insufficiently maintained stoves and unfavourable combustion conditions will result in the emission of unnecessarily high levels of greenhouse gases having adverse effects on the climate, and pollutants detrimental to your health. Particularly in urban agglomerations and valleys, the air quality is affected by wood heating systems due to low chimneys. Often, neighbours will feel annoyed.



## WHAT HAPPENS WHEN WOOD BURNS?

Burning or combustion designates a rapid oxidation of matter associated with flame formation. When wood burns, oxygen in the air combines with carbon and hydrogen contained in the wood. During this process, energy is released in the form of heat and light. Ideally, the only products of complete combustion are carbon dioxide, ashes formed primarily by the mineral components of the wood, and water.

Roughly, the combustion process of solid fuels can be divided into three phases:

**Heating and drying** – In this first phase, the water and other volatile substances present in the fuel will evaporate.

**Pyrolysis** – In this second phase, the fuel will decompose at temperatures of about 150 degrees Celsius ( $^{\circ}\text{C}$ ) and above. During this process, a gas mixture is formed, which contains carbon monoxide, hydrocarbons and other compounds. In addition, oils and tars are formed, which undergo further decomposition at higher temperatures. At temperatures of about 400 to 500 $^{\circ}\text{C}$  and above, also the solid organic components will gasify, combine with atmospheric oxygen and form predominantly carbon monoxide. At this stage, only charcoal will remain from the wood that served as a starting material.

**Combustion proper** – In this third phase, the gases formed in the first two phases will react with additional atmospheric oxygen to form carbon dioxide and water. Also any remaining charcoal will burn down completely with time, in the firebed of the combustion zone. Only ashes remain as the single residue from combustion. Each phase of combustion can be observed very easily in an open fire.

## **Emissions cannot be completely avoided**

Ideally, combustion of wood will produce only carbon dioxide, ashes and water (see box). The carbon dioxide produced will not contribute to global warming if the amount of wood burned does not exceed that of regrowing wood, because regrowing trees and shrubs will bind the carbon dioxide formed during combustion. However, the wood used should originate from your local sources because any transport of wood to your place of residence would involve the consumption of petrol or diesel.

In practice, wood will always contain certain low amounts of nitrogen compounds, sulphur compounds and chlorine compounds. This is why harmful nitrogen oxides and sulphur oxides as well as hydrochloric acid are formed during combustion. In addition, dust is released into the air, 90 % of which consists of fine particulates. These ultrafine particles are not visible for the unaided human eye. They may enter the lungs by inhalation and therefore, are hazardous to health. Adverse health effects may include bronchitis, an increase in asthmatic attacks and stress on your cardiovascular system. In addition, fine particulates are suspected of being carcinogenic.

Incomplete combustion may also result in the formation of carbon monoxide, a toxic gas, and methane, a climate-damaging gas. Methane has a global warming potential 21 times as strong as that of an equivalent amount of carbon dioxide. Other products formed during incomplete combustion include organic compounds, among others also

the carcinogenic polycyclic aromatic hydrocarbons (PAH) in the ashes and the flue gas, and unpleasantly smelling compounds. Using materials for heating that must not be burned such as wood treated with wood preservatives or paints, may even result in the formation of dioxins and furans (highly toxic substances that had been involved in the Seveso chemical accident in the 1970s).

## **There are four essentials to achieve clean heating**

Operating your wood-fired heating system in such a way as to avoid unnecessary effects on the climate and human health is fairly simple. It should be based on four essentials:

- ↗ A low-emission and efficient fireplace;
- ↗ Suitable, dry fuel material that has been properly stored;
- ↗ Proper operation of the system; and
- ↗ Regular maintenance and inspection of the installation by trained professionals.





## THE SUITABLE TYPE OF INSTALLATION

### WHICH TYPES OF WOOD-FIRED INSTALLATIONS EXIST?

If you consider using wood for heating, you will have to choose from different types of installation:

### Room heaters

Mostly used as a comfort and supplemental heating, a room heater is intended to heat a single room or two adjacent rooms. Heat is delivered by stoves predominantly in the form of radiant heat. Some types of stoves are equipped with additional air/water heat exchangers and capable of supporting a central heating system.

### Open fireplaces and fireplaces with heating insert

In open fireplaces the combustion zone is open to the living room. This is why they are unable to control the supply of combustion air. Due to low combustion temperatures and too much excess air, open fireplaces usually produce high levels of pollutants while delivering only little heat. A better option is provided by fireplaces with a heating insert because they are closed by means of a glass door or glass pane. Thus, controlling air supply becomes easier, and energy efficiency is improved.

### Free-standing room heaters with or without a window pane

In free-standing room heaters logs are placed directly into the combustion chamber through a door. The ashes in the ash pan can be removed through an opening in the lower part of the stove. The air quantity supplied can be controlled by means of opening or closing dampers and valves or the ash removal door. These room heaters are available as continuous burning



appliances (slow combustion) or intermittent burning appliances. They differ in the period needed for combustion until reloading of fuel is required. Intermittent burning appliances are predominantly used only during the transitional seasons because their use for permanent heating involves considerable effort. Modern wood-burning stoves often have a large door with a window pane.

### Tiled stoves (storage heaters)

More than 50 % of the outer casing of tiled stoves is made of stove tiles, tile stones or plastered surfaces. Additional functions may be included such as the preparation of hot water for consumption or heating.

**Masonry or storage heaters** have a large mass capable of heat storage consisting of tiles, cement plaster, clay, chamotte or soapstone. The large surface of these stoves reaches relatively low temperatures (80 to 130 degrees Celsius) only. Storage heaters are operated under full load during the combustion phase (about one hour), and the stored heat continues to give off warmth to the air in the room for many hours. In the majority of cases, operating the heater at reduced combustion, i.e. with reduced air supply in order to maintain a firebed for as long as possible, is not

required. This is why these systems produce relatively low emission levels. Overheating of rooms will hardly ever occur with storage heaters.

**Warm-air tiled stoves** consist of a heating or fireplace insert and most often, a metallic heating gas flue. They are cased with stove tiles, tile stones or other mineral building materials. The warm-air tiled stove heats the room by passing the warm air through air ducts. Heat is emitted mainly by convection. As compared to storage heaters proper, warm-air tiled stoves have a lower heat storage mass, heat emission after starting the fire takes less time.

#### ➤ Pellet stoves

Pellets are made from compressed natural wood shavings and sawdust. There is a special feature to pellet stoves: The fuel is fed automatically and continuously from a storage hopper (20 to 30 litres) to a burn pot in the com-

bustion chamber. The supply of fuel is automatically adjusted depending on the thermal output required. Pellet heaters are available as free-standing wood-burning stoves with a window pane or tiled stove heating inserts. Pellets produce lower emission levels than other wooden fuels. In addition, their use is much more convenient than that of split logs because pellet heaters work largely automatically. The pellets can be stored and dispensed in an optimal way.

#### Central heating boilers

Central heating boilers heat both the entire home and the water for human consumption. Like oil and gas boilers also wood-burning boilers are mostly placed in a special boiler room.

#### ➤ Manually fed log wood boilers

In wood-burning central heating boilers, the technology predominantly used is that of the downdraught type. In these systems, the flame does not burn upwards through the fuel layer but in lateral direction or downwards in a separate combustion chamber. Such wood-burning boilers are quite comfortable to operate: Since only the fuel placed above the firebed is involved in combustion, burning is continuous and very steady. Reloading of wood is therefore required at long intervals only.

#### ➤ Automatically loaded wood-fired boilers

The best possible operating conditions for wood-fired heating systems are provided by installations in which feeding of the fuel, e.g. in the form of pellets, is a continuous process. Wood pellets



have a very uniform composition and are suitable for automatic ignition. Pellet heating systems are almost as convenient to operate as oil or gas heating systems. Large-size installations are often fuelled with wood chips. However, individual-household heating systems rarely use this type of fuel.

### **Choosing the appropriate size of installation is important**

Particularly combustion installations fed with split logs can be controlled within a very narrow range only. In most cases, optimum emission results are obtained only at full-load operation. Part-load operation, i.e. for example operating the combustion installation at half the proper thermal output, will result in clearly elevated emission levels, which will also become apparent by a development of smell and smoke. Particularly problematic is the mode of operation with reduced combustion air where the installation is set to maintain a firebed while hardly producing any heat.

When buying a free-standing wood-burning stove or a boiler for central heating or hot water supply, it is therefore essential for you to choose an installation of appropriate dimension, i.e. having an appropriate thermal output, expressed in kilowatts [kW]. You should get advice on this issue from an energy consultant, chimney sweep or heating installer. An installation that is too big in dimensions will predominantly be run at reduced output, causing clearly elevated emission levels at lower efficiency rates.

A manually fed central heating system requires an appropriately large heat

accumulator. The latter will enable the installation to be operated in full-load mode producing lower emission levels while storing the heat that is not immediately required. New installations are required to be capable of buffer storage (see also the section entitled "Legal provisions applying to wood-combustion installations").

### **Important: advanced low-emission technology**

In recent years, industry has developed modern installations characterised by convenient control, optimum heat utilisation, low fuel consumption and good emission behaviour. However, numerous old installations producing disproportionately high emission levels are still in operation.

To make operating your installation as convenient as possible, you should take care to use modern control technology. It will automatically ensure that there is fairly little to do for you. Many modern wood-burning boilers are already equipped with sensors for flue gas control (e.g. a lambda sensor). By means of this technology, combustion is permanently monitored and to a certain degree, also optimised and controlled. While being common for heating boilers, automatic control is still an exception in room heaters. But also in installations of the latter type, automatic control can contribute to improving combustion.

### **How to identify a particularly low-emission wood-combustion installation**

In Germany all types of combustion installations have become subject to new requirements for emissions and ef-

ficiency applying since March 2010. It is particularly recommended to purchase an installation already complying with the requirements under Level 2 of the Ordinance regarding small and mid-sized combustion installations (First Ordinance Implementing the Federal Immission Control Act [Erste Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes - 1.BImSchV]). This second level of limit values is binding for systems installed as of 2015. These limit values are markedly stricter than those of the first level presently already in effect. Just ask a specialised dealer for appropriate installations. For detailed explanations on the 1.BImSchV please refer to the section entitled "Legal provisions applying to wood-combustion installations".



If you intend purchasing a particularly low-emission pellet stove or pellet boiler, you should look out for the Blue Angel (Blauer Engel) environmental label. The Blue Angel ecolabel is only awarded to appliances complying with strict requirements in terms of efficiency, auxiliary power needs and emission of nitrogen oxide, carbon monoxide, dust and total carbon. An up-to-date list of manufacturers and products and the complete award criteria for all product groups is provided on the Internet at [www.blauer-engel.de](http://www.blauer-engel.de).

Also the DINplus quality label vouches for low-emission characteristics. It is awarded to fireplace inserts and firebo-

xes, free-standing wood-burning stoves and tiled stove heating inserts burning split logs. Installations of this type already comply with the Level 2 requirements of the 1.BImSchV. In addition, a number of criteria exceeding these legal provisions are required for being awarded the quality label.

### The fuel: Dry and appropriately sized – wood and wood storage

#### Split logs

The water content of firewood has a great effect on its burning properties. Your wood should be as dry as possible. Only in this case, it can give off much heat and burn without polluting the environment. Depending on the season and type of wood, freshly cut wood contains between 45 and 60 per cent water. After optimal drying, the water content is reduced to 15 to 20 per cent. Depending on the type of wood used, this may take about one to two years. Only then the wood will be suitable for heating. To allow for proper drying of your firewood, it should be stacked in a sunny place protected from rain and snow. In addition, the firewood should not directly contact the soil because





otherwise, it may draw moisture from the soil (you should use a subconstruction allowing for ventilation, e.g. two bars placed in cross direction). Wood logs that are split will dry better and show a better burning behaviour. If you buy firewood from a dealer, you should have him or her confirm the water content and carefully follow the dealer's hints for proper storage.

Kiln-dried wood may also be overdried. Such wood will burn too fast and may cause elevated emission levels, above all if used in simple appliances. Therefore, kiln-dried wood should be stored outdoors and covered for some time.

### Wood briquettes

The quality of commercially available wood briquettes may vary to a great extent. The best option is to make sure that the wood briquettes you buy comply with the DIN 51731 or the (new) DIN EN 14961-3 standard.

### Wood pellets

Wood pellets constitute a standardised fuel of uniform quality. The following labels may serve as guidance for you:

- DIN EN 14961-2: Wood pellets used in private homes have to comply with Class A1 of this standard;
- DINplus is a quality label confirming both compliance with the above European standard and regular monitoring of the production process.



➤ The ENplus quality label has been in existence since 2010. It confirms compliance with the quality requirements stipulated by EN 14961-2, however, not only requires compliance during the production process, but also when transported and stored. Pellets for stoves and small boilers should comply with Class ENplus A1.



➤ Wood pellets may also be awarded the Blue Angel label. The respective requirements apply not only to the fuel, but also to the raw materials used and an ecofriendly production.

### How to properly operate your wood combustion installation

From one's own experience, almost everybody knows how difficult lighting a fire can be. Similar problems may also occur with regard to heating installations. They may produce elevated emission levels when a fire is started for heating.

You can exert considerable influence on the actual emission levels produced by your wood-burning heating system. This applies particularly to older installations. An essential factor will consist in air supply. In addition, for manually fed installations, the loading timing and fuel quantity loaded will play an important role. In the box below, it is explained how to properly start a fire in a manually fuelled room heater.



## PROPER HEATING

For split-log stoves, there are two ways to light a fire that differ as to how the kindling material is arranged:

### The top-down method

- ↗ Place the split logs on the floor of the combustion zone.
- ↗ Place kindling over the logs in crosswise direction. Place the fire starter in between, on one of the logs.
- ↗ On top of it, place more kindling material in a crosswise direction.

It is an advantage of this method that only low amounts of unburned combustion gases are released from the combustion zone. It takes somewhat longer than the bottom-up method.

### The bottom-up method

- ↗ Place one layer of kindling across the bottom grid with the fire starter in between.
- ↗ On top of these, place more kindling material in crosswise direction.
- ↗ Place two or three medium-sized logs next to each other on the kindling, or with the slid edges downward. Open the combustion air damper. This is the method most frequently described in the operating instructions for combustion installations equipped with a grid.

Particularly during the starting phase, it is important to ensure a sufficient supply of combustion air. However, air supply dampers should be sufficiently opened during the entire combustion process. For details please refer to your operating instructions. The air supply is properly set if the inner coating of the stove remains clean, i.e. without black soot deposition.



Filling your stove with too big loads of fuel will result in development of high amounts of combustion gases. These undergo incomplete combustion, leading to a formation of harmful substances. Also, your stove may become damaged. This is why you should avoid overfeeding your installation. Rather, you should reload smaller amounts of fuel at shorter intervals. Also the size of logs will play an important role: Too large logs will lead to a clear increase in the level of harmful substances emitted. Also in this respect, you should be guided by the operating instructions.

## **Have your installation inspected by a trained professional once a year**

Though quite normal for cars, regular maintenance and inspection by a trained professional are not yet common practice for wood combustion installations. You should have your firing installation thoroughly inspected by a professional before the heating period starts.

## **Save money by making observations of your own**

You should regularly inspect the combustion chamber of your wood heating system, observe its combustion behaviour and have a look at the waste gas plume appearing over the chimney. If you find massive deposits in the stove chamber, the appliance will probably require an extra cleaning or maintenance. In this way, costs for expensive repeat measurements may be saved for installations where emissions are regularly measured by a chimney sweep. Such repeat measurements are required if on an official inspection, the system is found to exceed the emission limit values. Your efforts will be rewarded by benefits not only for the environment but also for your wallet.

## **What to do with the ashes?**

Wood ashes may contain incompletely burned residues, e.g. polycyclic aromatic hydrocarbons known to be carcinogenic, such as benzo(a)pyrene. When disposing of the ashes, you should therefore follow the principles of health protection: Make sure you avoid stirring up dust because inhalation of ash particles may be harmful to your health. You should also avoid skin contact with

ashes. You may dispose of the ashes in the same way as your household refuse.

## **Where can I get help in case of problems?**

In case of problems with your installation, you should have the size of fuel material, its amount and quality (moisture content of the wood) and air supply checked by a trained professional. You may get assistance from your installer, the manufacturer or the local chimney sweep. Just mention any problems with your installation to the chimney sweep when she or he is doing the regular inspection. In many cases, a solution is found quickly and easily. The chimney sweep is able to assess whether extra maintenance is required, and give information about fire protection and the potential formation of toxic flue gases.

A good and clean combustion will mainly result in fine white ashes. If major amounts of un-burned fuel, coal or soot particles are visible in the ashes, this is an indication of incomplete combustion. Also dark wood smoke and excessive amounts of soot are bad signs. Shiny soot on the inside of the stove or boiler will impair heat supply from the stove to the room and above all, involve the risk of chimney fires. Just do regular checks of the combustion behaviour, the combustion chamber, the flue gas path and the flue gas plume. In this way, you will gain experience in assessing the quality of combustion.

# **LEGAL PROVISIONS APPLYING TO WOOD COMBUSTION INSTALLATIONS IN GERMANY**



There are a number of legal provisions that also refer to regulations on small wood-firing installations. The German Chimney Sweep Trade Act (Schornsteinfegerhandwerksgesetz) requires regular fireplace inspections to ensure the operational safety of the installation. The frequency of chimney sweeping and inspection of chimneys is stipulated in the German Federal rules on sweeping and inspection (Kehr- und Überprüfungsordnung des Bundes).

The most important legal regulation for small wood combustion installations in terms of environmental protection consists in the First Ordinance Implementing the Federal Immission Control Act [Erste Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes - 1.BImSchV]. It refers to the installation and operation of small combustion installations. Among others, these include wood combustion installations in private households. An amended version of this ordinance came into force on 22 March 2010. The 1.BImSchV lays down the requirements for fuels that may be burned in small installations, limit values for the emission of pollutants, provisions regarding the monitoring and regulations for restoration of existing installations.

## Consultation

If you start to operate a new wood combustion installation or take over an existing one from another operator, you must consult a chimney sweep regarding the proper operation of your installation, the use of appropriate fuels and proper storage of the fuels no later than within one year. Such consultation will commonly take place in connec-

tion with other chimney sweeping operations, e.g. when the installation is approved or the regular measurement of emissions is carried out. A one-time consultation is also envisaged for existing installations.

## Which types of wood may be burned?

The 1.BImSchV contains a list of fuels you may use in a small combustion installation. The types of wood that may be used in private households are listed in the box below. In addition, the manufacturers' instructions on appropriate fuels have to be observed.

### Wood fuels that may be used for combustion in private households (1.BImSchV, § 3 para 1)

- ↗ Barbecue charcoal, barbecue charcoal briquettes in accordance with DIN EN 1860, version September 2005,
- ↗ Natural (untreated) chunky wood, including attached bark, especially in the form of split logs, wood chips, brushwood and cones,
- ↗ Natural (untreated) non-chunky wood, especially in the form of sawdust, shavings, abrasive dust or bark<sup>2</sup>,
- ↗ Pressed blocks made from natural wood in the form of wood briquettes in accordance with DIN 51731, version October 1996, or in the form of wood pellets in accordance with the fuel requirements of the DIN plus Certification Programme "Wood pellets for use in small combustion installations in accordance with DIN 51731-HP 5", version August 2007, and other wood pellets made of natural wood with equal quality.

<sup>2</sup>This type of fuel is mainly used in wood-processing establishments where it is generated as a waste product.

### **Water content and wood moisture**

With regard to the moisture contained in the wood, a distinction has to be made between two different concepts:

The water content is defined as the weight of water contained in the wood as referred to the total weight of wood.

The moisture content is the weight of water as referred to the dry weight of wood.

For example, a 20 per cent water content corresponds to a 25 per cent moisture content.

In manually fed installations, the wood fuels listed in the box may only be used in an air-dry state. This means that a moisture content of 25 per cent must not be exceeded. Normally, this is the case for wood stored under a cover over two years in a well-ventilated place. Fuels not listed must not be burned unless a special permission has been granted. Important: chipboard and varnished wood may only be burned by wood-processing establishments and if certain requirements are complied with. Private households are not allowed to do so.

In recent years, small paper briquette presses have been offered commercially also on the Internet. Allegedly, they are suitable for producing cheap fuel from waste paper in a do-it-yourself procedure. However, similar to the so-called paraffin logs also available in some do-it-yourself stores, the briquettes produced in this way must not be burned in private households.

When visiting your home for inspection of the combustion installation, the chimney sweep will from now on also inspect your fuel store and check the moisture content of the stored fuel. If the wood is found not to be sufficiently dry, you will be informed by him or her and if required, given advice with regard to proper storage of the fuel. This is due to the fact that burning damp wood will not only lead to clearly elevated emission levels but also affect the efficiency of your installation.

### **Which are the emission limits applying to room heaters?**

#### **Emission limit values**

Installations that are preferentially used to heat the room where they are installed are subject to limit values which have to be complied with in a type test. This means that measurements are carried out before an appliance is put on the market. Such limit values exist for carbon monoxide and dust. In addition, a minimum efficiency level is required. Upon purchase of a stove you are given a certificate by the manufacturer confirming compliance with the limit values laid down in the 1.BImSchV. This certificate must be presented to the chimney sweep. There are two levels of emission limit values for each type of pollutant. Level 1 has come into force with the updated 1.BImSchV, Level 2 applies to newly installed systems as of 2015. For appliances installed earlier, the old limit values continue to apply, on principle. Table 1 shows a list of the relevant values.

**Table 1:** Emission limit values and minimum efficiency of room heaters for solid fuels  
(requirements in the type test)

Type of fireplace	Technical rules	Level 1:		Level 2:		Installation after entry into force of this Ordinance
		CO [g/m³]	Dust [g/m³]	CO [g/m³]	Dust [g/m³]	
Room heaters with flat-layer firing	DIN EN 13240	2.0	0.075	1.25	0.04	73
Room heaters with feeder firing -slow combustion	DIN EN 13240	2.5	0.075	1.25	0.04	70
Heat storage stoves	DIN EN 15250/A1	2.0	0.075	1.25	0.04	75
Fireplace inserts (closed operation)	DIN EN 13229	2.0	0.075	1.25	0.04	75
Tiled stove inserts with flat-layer firing	DIN EN 13229/A1	2.0	0.075	1.25	0.04	80
Tiled stove inserts with feeder firing	DIN EN 13229/A1	2.5	0.075	1.25	0.04	80
Cooking ranges	DIN EN 12815	3.0	0.075	1.50	0.04	70
Heating stoves	DIN EN 12815	3.5	0.075	1.50	0.04	75
Pellet stoves without hot water heat exchanger	DIN EN 14785	0.40	0.05	0.25	0.03	85
Pellet stoves with hot water heat exchanger	DIN EN 14785	0.40	0.03	0.25	0.02	90

In general, open fireplaces produce relatively high emission levels and are unsuitable for heating due to their low efficiency. Such installations should be operated on an occasional basis only.

## Inspection

Based on the German Chimney Sweep Trade Act, the authorised district chimney sweep will from now on perform a fireplace inspection twice in seven years in order to check the operational safety of the installation. According to the 1.BImSchV, such inspections will also cover the checking for a proper technical condition of the installation and the fuel storage.

## New requirements for old stoves

In many cases, very high emission levels are produced by old room heaters. Therefore, it is particularly important to set emission limits for such installations. To prevent an excessive burden on consumers, old stoves are subject to very long transition periods. Depending on the type test dates, these transition periods will expire between 2015 and 2025. Also beyond these years, the

limit values applying to old appliances will be less strict than those fixed for new installations. The limit values for existing appliances are listed in Table 2, the transition periods in Table 3. The exact date of expiration of the transition period for your appliance has to be established by a chimney sweep. After expiration of the transition period you may either

- Retroactively submit a certificate by the manufacturer on the type test emission values for your installation (this will be possible mainly for installations built more recently), or
- Have the emissions measured on the installed system.

If your installation does not comply with the limit values listed in Table 3, it must be retrofitted with a dust separator or replaced by a new one.

**Table 2:** Limit values for existing room heaters

	CO [g/m <sup>3</sup> ]	Dust [g/m <sup>3</sup> ]
room heaters installed prior to 22 March 2010	4	0.15

**Table 3:** Transition periods for existing room heaters

Date of type test (according to type plate)	Date of retrofitting or shutdown
Prior to 01 January 1975 or date of type test no longer ascertainable	31 December 2014
01 January 1975 until 31 December 1984	31 December 2017
01 January 1985 until 31 December 1994	31 December 2020
01 January 1995 until date of entry into force of the Ordinance	31 December 2024

For the sake of social acceptability of the transitional rules, a number of exceptions have been granted: These include appliances representing the only heating option of a residential unit, historical stoves, cooking ranges, bath boilers, open fireplaces and masonry heaters without insert that are installed directly at the site by a craftsman.

#### **Which are the new requirements applying to central heating boilers?**

While most room heaters are used only occasionally, the majority of boilers are used for central heating of an entire house or at least a flat. As a rule, the latter are in operation for markedly longer periods. It is therefore particularly important to reduce the emission levels caused by heating boilers. For this reason, compliance with the limit values applying to heating boilers is ensured, instead of type testing, by means of monitoring by a chimney sweep performing measurements at two-year intervals. This is an innova-

tion mainly for manually fed boilers because prior to the new regulations, emissions were measured by a chimney sweep only once after the start-up of an installation.

It is another new feature that emission limit values now also apply to small-sized heating boilers with a rated thermal output of less than 15 kW.

The new emission limit values for small wood-firing boilers are listed in Table 4. Similar to room heaters, there are also two levels for the limit values applying to boilers. Also for boilers, Level 2 applies only to systems installed as of 2015.

**Table 4:** Emission limit values for wood-firing boilers

	Fuel	Rated thermal output [kW]	Dust [g/m <sup>3</sup> ]	CO [g/m <sup>3</sup> ]
Level 1: Installations set up after entry into force of the Ordinance	Chunky and non-chunky wood (split logs, sawdust)	> 4 - 500	0.1	1.0
	Wood pellets	> 4 - 500	0.06	0.8
Level 2: Installations set up after 31 December 2014	Chunky and non-chunky wood (split logs, sawdust), wood pellets	> 4	0.02	0.4

**Table 5:** Transition periods for existing heating boilers

Date of set-up	Expiry of the transitional period
Until 31 December 1994	01 January 2015
01 January 1995 until 31 December 2004	01 January 2019
01 January 2005 until date of entry into force of the Ordinance	01 January 2025

Emission levels of heating boilers are particularly high if these are operated at partial load, i.e. if their output is reduced for example to half power. In order to avoid this, new heating boilers must, on principle, be equipped with a heat storage tank. Also a minimum volume is required for such storage tank. If possible, it should provide a volume of twelve litres per litre of fuel filling space. The minimum requirement, however, is a volume of 55 litres per kilowatt rated thermal output. Exceptions may be made for pellet boilers showing low emission levels also at partial load conditions.

#### Do these requirements also apply to old wood-fired boilers?

The new ordinance provides for long transition periods also for existing heating boilers (see Table 5). When these transition periods have expired, the Level 1 limit values will also apply to existing boilers. In 2012 at the latest, a chimney sweep will establish the date of expiration for the transition period of a certain installation. Until that time, the old limit values, i.e. those in effect prior to the amended 1.BImSchV will continue to apply.

#### Which are the new requirements applying to chimneys?

In order to avoid neighbours being disturbed by flue gases from your chimney, the outlet must tower above the ridge by at least 40 centimetres or

- ↗ on flat roofs (roof slope up to and including 20 degrees) be at least 1 m away from the roof surface; and
- ↗ on steep roofs (roof slope of more than 20 degrees) have a horizontal distance to the roof surface of at least 2 m and 30 cm

In addition, in the case of combustion installations with a total thermal output of up to 50 kilowatts, the chimney outlets must, within a radius of 15 meters, tower above the top edges of ventilation openings, windows or doors by at least 1 m.



# FREQUENTLY ASKED QUESTIONS

## **My neighbour's wood-fired heating system gives off black smoke. Who can I turn to?**

On principle, complaints in individual cases are dealt with by the authorities of the federal Länder. This is why we recommend you to contact the local responsible authority. Depending on the federal Land, this could be the environmental office, the building authority or a district office.

## **Why is burning of paper briquettes not allowed?**

These briquettes are made of paper likely to contain a great number of contaminants. During combustion, these may form harmful substances. In addition, no system has been designed for the burning of paper briquettes. For this reason, burning of paper in your installation may lead to high emission levels and other problems such as fouling of or damage to the installation. Other problems may result from burning incompletely dried briquettes because these will additionally deteriorate combustion conditions.

## **Are there already dust separators available for wood-fired heating systems?**

There are already electric dust separators for very small installations. In simple terms, they work on the basis of dust particles being electrically charged and then collecting on the wall of the flue gas pipe. In addition, a catalyst is available that reduces the formation of carbon monoxide, hydrocarbons and fine particulates.

However, a development of further advanced technology is to be expected for the next years.

## **Which are the pollutants responsible for odours from wood-fired installations?**

Odour as a nuisance from wood combustion is mainly caused by organic compounds forming during incomplete combustion of wood. However, strong odours are often associated with increased emission levels of other pollutants such as fine particulates and carbon monoxide because the latter are formed under similar conditions.

## **Aren't fine particulates emitted by wood- combustion installations much less harmful than diesel exhaust particulates?**

Up to the present, only a few studies have been performed on the different effects of fine particulates of different origin. However, first studies carried out in Switzerland<sup>3</sup> have suggested fine particulates from normal wood-fired stoves to pose a health risk similar to that from diesel exhaust particulates.

<sup>3</sup> Klippen, Norbert und Nussbaumer, Thomas (2006): Feinstaubbildung in Holzfeuerungen und Gesundheitsrelevanz von Holzstaub im Vergleich zu Dieselruss. In: Thomas Nussbaumer (Hrsg.), Feinstaubminderung und Stromerzeugung im Rahmen der zukünftigen Energieversorgung.

9. Holzenergie-Symposium, 20. Oktober 2006, ETH Zürich, Zürich 2006, Verenum, Zürich und Bundesamt für Energie, Bern, ISBN 3-908705-14-2, S. 21-40. <http://www.holzenergiesymposium.ch/Dokumente/Tgband9HES.pdf>

# FURTHER INFORMATION SOURCES

## Money from the State – Where can I get financial support for my wood-fired installation?

There are different funding programmes run by the federal government and the federal Länder.

A good overview of the great variety of support programmes offered is found in the funding database provided by the Federal Ministry of Economics and Technology (Bundesministerium für Wirtschaft und Technologie – BMWi). Download at  
[www.Foerderdatenbank.de](http://www.Foerderdatenbank.de)

An important funding programme of the federal government is the market incentive programme for renewable energies. Information on the latter is found at

[http://www.bafa.de/bafa/de/energie/  
erneuerbare\\_energien/](http://www.bafa.de/bafa/de/energie/erneuerbare_energien/)

## Saving energy when heating

### Das Energie-Sparschwein (The Energy Piggy Bank)

Information on thermal insulation and heating energy saving for home-owners and house builders

Umweltbundesamt, Dezember 2003;  
Download at  
[http://www.umweltbundesamt.de/uba-  
info-medien/2595.html](http://www.umweltbundesamt.de/uba-info-medien/2595.html)

## Emissions from wood-firing/combustion installations

UBA background paper “Die Nebenwirkungen der Behaglichkeit – Feinstaub aus Kamin und Holzofen” (Side effects of cosiness: particulates from open fireplaces and wood-burning stoves), download at  
[http://www.umweltbundesamt.de/uba-  
info-medien/dateien/3556.html](http://www.umweltbundesamt.de/uba-info-medien/dateien/3556.html)

## Low-emission wood pellet stoves and boilers

<http://www.blauer-engel.de>

## Low-emission room heaters, heating inserts and storage heaters

[www.dincertco.de](http://www.dincertco.de)

## RELATED LITERATURE

Hartmann, Hans (Hrsg.): Handbuch Bioenergie-Kleinanlagen. Fachagentur Nachwachsende Rohstoffe e. V., Gülzow 2003

[http://mediathek.fnr.de/handbuch-  
bioenergie-kleinanlagen.html](http://mediathek.fnr.de/handbuch-bioenergie-kleinanlagen.html)

Struschka, M. et al: Effiziente Bereitstellung aktueller Emissionsdaten für die Luftreinhaltung; UBA-Texte 44/08, Dessau-Roßlau, November 2008

Download at  
[www.umweltdaten.de/publikationen/fpdf-  
l/3677.pdf](http://www.umweltdaten.de/publikationen/fpdf-l/3677.pdf)

# IMPRINT

## Published by:

Federal Environment Agency  
Wörlitzer Platz 1, 06844 Dessau-Roßlau  
Telephone: +49 340 / 2103 - 0  
E-Mail: [info@umweltbundesamt.de](mailto:info@umweltbundesamt.de)  
Internet: [www.umweltbundesamt.de](http://www.umweltbundesamt.de/index-e.htm)  
<http://www.umweltbundesamt.de/index-e.htm>

## Photographs:

p. 6: Wodtke, Tübingen  
p. 18: Mella / photocase.com  
p. 2, p. 3, p. 8, p. 9, p. 10, p. 12, p. 18  
shutterstock.com

## Authors:

Anja Behnke  
Federal Environment Agency (Section III 2.1)  
Dr. Bernd-Michael Kemper  
Landesanstalt für Umweltschutz,  
Baden-Württemberg

## Edited by:

Anja Behnke

## Translated:

from German by Andrea Bartel, Berlin

## Design:

Studio GOOD, Berlin  
[www.studio-good.de](http://www.studio-good.de)

## Date:

January 2013

## Edition:

xxxxxx copies  
Printed on Blue Angel recycled paper



