

Engineering and installation

Instantaneous water heater

Shower units

Water boilers

Automatic water boilers

Wall mounted cylinder

Small water heater

Under-worktop cylinder

Floor mounted cylinder

Engineering and installation

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Specification

Dimensions in the diagrams are in millimetres unless stated otherwise. Pressure figures may be stated in pascal (MPa, hPa, kPa) or bar (bar, mbar). The details of threaded connections are given in accordance with ISO 228. Fuse types and sizes are stated in accordance with VDE. Output data applies to new appliances with clean heat exchangers.

DHW basic principles

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DHW basic principles

System selection

Types of supply

As for any technical building services, it is possible to formulate generally applicable requirements for domestic hot water heating systems. DHW heaters must fulfil the following conditions:

- » Meet the hot water demand at the required time and in the required volume
- » Maintain the required water temperature
- » Meet hygienic requirements
- » Supply the heated water to the draw-off point with low losses
- » Keep the necessary consumption of final and primary energy as low as possible
- » Be durable, reliable and safe
- » Be easy to operate and adjust

To fulfil these requirements, it is important not only to select the right appliances, but also to examine the different types of supply and select one which suits the requirements profile of the application.

Decentralised DHW heating

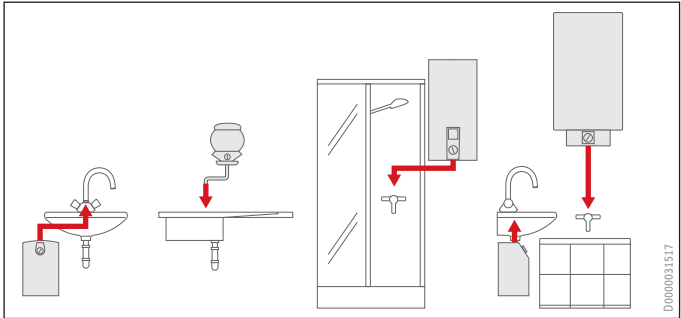
The water is heated directly at or near the draw-off point. The most suitable decentralised appliance for the draw-off point and consumer is selected. Decentralised DHW heating systems can be usefully further categorised as individual supply/individual draw-off point.

Individual supply, individual draw-off point

Individual draw-off points are supplied independently of one another, each by a suitable appliance.

Appliance category	Application area
Comfort instantaneous water heater	Washbasin, kitchen sink, hand washbasin, shower, bath tub
Compact instantaneous water heater	Sink, washbasin, hand washbasin
Mini instantaneous water heater	Hand washbasin
Wall mounted cylinder or instantaneous water cylinder	Washbasin, kitchen sink, hand washbasin, shower, bath tub
Non-pressurised or pressure-tested small water heater	Washbasin, kitchen sink, hand washbasin
Water boiler	Kitchenette, kitchen sink

Examples of decentralised supply with individual supply



DHW basic principles

System selection

Group supply / centralised apartment supply, multiple draw-off points

An appliance in the immediate vicinity, e.g. in the same room or on the same plumbing wall, supplies multiple draw-off points.

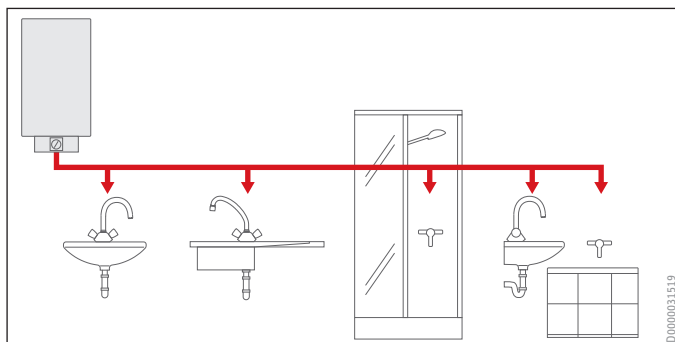
Appliance category	Application area
Instantaneous water heater	Bathroom with washbasin, shower and/or bath tub in one room. Depending on the building characteristics, it may also be possible to supply other rooms.
Wall mounted cylinder or instantaneous water cylinder	Bathroom, kitchen, toilet in one apartment / on a shared plumbing wall. Depending on the building characteristics, it may also be possible to supply other rooms.
DHW heat pump	Centralised apartment supply for all draw-off points

Efficient and convenient operation of decentralised appliances or appliances for centralised apartment supply requires short pipe runs and electricity as an available energy source at the specific location. With a product range designed for a range of different requirements, there is a solution available for virtually any dimension or output.

Investors, design engineers and users of a decentralised appliance or system benefit from the following advantages:

- » DHW heating close to the point of use, short pipe runs
- » Capacity of DHW pipeline < 3 l
- » Low losses, very little standby energy consumption, no DHW circulation
- » Low, needs-based water requirement, hot water available immediately
- » Simple calculation of energy costs per apartment
- » Ideal for modernisation, connection to existing cold water connection
- » Low capital investment, easy installation
- » Minimum space requirement
- » Can be used regardless of the type of room heating
- » Silent water heating
- » Accurate temperature delivery, possible limiting of temperature for safety reasons

Examples of decentralised supply with group supply



DHW basic principles

System selection

Central DHW heating

If the DHW heat generator supplies multiple apartments in one building centrally, for example from a DHW cylinder installed in the basement, this is described as a central system.

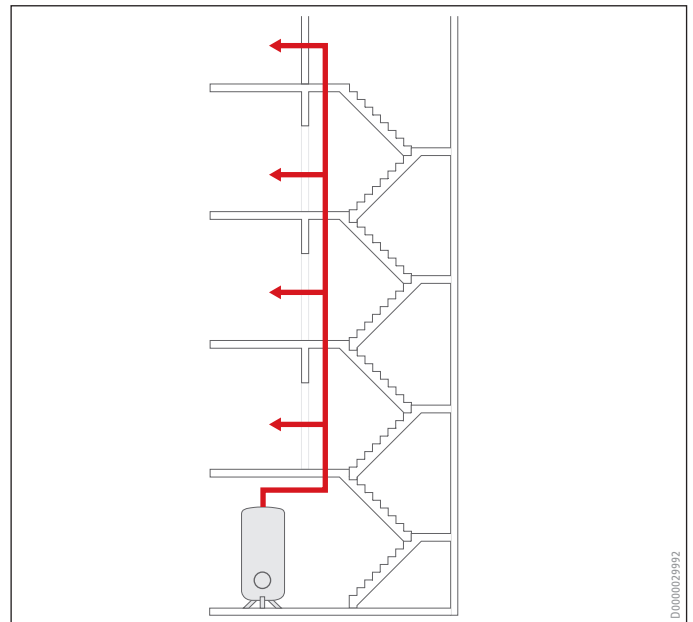
The heated water is conveyed through DHW pipes to multiple draw-off points. The distribution network is pressure-tested and usually has a DHW circulation line to ensure a constant, uniform DHW outlet temperature. Examples:

Appliance category	Application area
Pressure-tested DHW cylinders, wall or floor mounted cylinders	Single-family house, apartment building, sports facility, commercial kitchen
Integral cylinders, instantaneous water cylinders	Single-family house, two-unit apartment building
Pressure-tested DHW cylinders, floor mounted cylinders	Hotels, hostels and other residential facilities, barracks

Before centralised DHW heaters can be planned and the right sizes selected, it is necessary to know the expected consumption profile and the level of demand that will occur at any one time. It is essential to match the capacities of the DHW cylinder and the heat generator to one another and to the demand and consumption profile.

Design engineers/installers of central systems must also account for losses during storage and distribution, in addition to the actual DHW demand. These may be considerable and may increase the total energy consumption. For instance, system temperatures greater than 60 °C are needed in order to meet hygiene requirements. Nonetheless, centralised systems offer the following advantages:

- » Provision / storage of large volumes of water
- » High DHW convenience
- » Low connected loads for heat generators
- » Option of combining different energy sources
- » Use of special electricity tariffs or self-generated power
- » Modernisation of an existing centralised hot water boiler
- » No decentralised appliances, e.g. in apartments



DHW basic principles

Drinking Water Ordinance [Germany]

Introduction

Drinking water is one of the most important forms of sustenance, if not the most important. In accordance with the accepted engineering standards, the following rules apply:

- » Drinking water must be free of pathogens.
- » Drinking water must not have any properties that are harmful to health.
- » Drinking water should be colourless, clear, cool, odourless and neutral in taste.
- » Drinking water should always be available in adequate quantities and at adequate pressure.
- » Drinking water and the materials in contact with it should be compatible in such a way that no corrosion damage is caused.

In addition to the accepted engineering standards, statutory specifications must also be observed, e.g. the Drinking Water Ordinance [Germany] (TrinkwV).

The Drinking Water Ordinance [Germany] has the purpose of protecting human health from detrimental effects such as those that might result from contamination of drinking water.

The Drinking Water Ordinance [Germany] covers the following points:

- » Action to be taken if permissible limits are breached
- » Possible means of treatment and disinfection
- » The obligations of the operators of a water supply facility
- » The level and extent of monitoring
- » Information provided to consumers

The Drinking Water Ordinance [Germany] requires operators of large scale, centralised DHW heating systems to have their systems inspected for Legionella every three years. Operators are defined as private landlords, apartment owners' associations or housing corporations.

These parties are also obliged to notify the health authorities of any inspection results over the threshold for action.

This obligation also applies to installations supplying water to the public, such as in schools, nursery schools, hospitals, pubs and restaurants.

Legionella bacteria

In Germany, Legionnaires' disease is one of the most significant diseases that can be transmitted through water. It is caused by Legionella, a kind of bacteria which grows in warm water, such as in domestic hot water and air conditioning systems or dry cooling systems. If Legionella bacteria are inhaled, they can cause serious pneumonia and Pontiac fever.

Every year at least 20.000 - 32.000 people in Germany fall ill with community-acquired pneumonia caused by Legionella. To that figure must be added 10 to 100 times that number of cases of Pontiac fever, which is milder in its effects and is also caused by Legionella.

The pathogen is found throughout the world and occurs in all fresh water in concentrations which are not harmful to people. It is a natural component of our drinking water.

A precondition for infection or illness is an increased concentration of the pathogen in the air or in steam, which is then breathed in, for example when showering. Drinking the water poses no known risk.

The risk of an increased concentration of pathogens in drinking water is especially high when water stagnates for days, in other words for a relatively long period of time, at temperatures between 25 and 55 °C. This is frequently the case where there are sections of pipework which are rarely or never used.

Risk prevention measures are described by accepted engineering standards, such as DVGW Code of Practice W551 or DIN 1988-200. The possibility of DHW stagnating can be minimised early, in the design stage, by measures such as the following:

- » Using decentralised DHW heaters
- » Keeping DHW distribution lines as short as possible
- » Ensuring that DHW cylinders and pipeline networks are not oversized
- » Using a DHW circulation line and DHW circulation pump, and operating them according to accepted engineering standards
- » Avoiding dead legs
- » Maintaining required DHW temperatures

DHW basic principles

Drinking Water Ordinance [Germany]

Definition of a large scale system

Large scale systems are all systems with DHW cylinders with capacity > 400 l, or a pipeline capacity > 3 l in at least one pipeline from the outlet of the DHW cylinder to the most distant draw-off point. This does not include DHW circulation lines.

Systems in single-family houses or two-unit apartment buildings are not counted as large scale systems for DHW heating.

Inspection obligations according to TrinkwV

Obligations for rented residential buildings with large scale DHW heating systems include the following:

- » Obligation to inform the tenants.
- » Compulsory testing for Legionella in accordance with para. 14.

The following are not affected:

- » Systems in single-family houses or two-unit apartment buildings, regardless of whether they are owner-occupied or occupied by third parties
- » Decentralised systems, such as the use of instantaneous water heaters or wall mounted small water heaters within the residential unit itself

Examples of pipeline cross-sections and up to 3 litre capacity

Pipe diameter	mm	15	18	22
Pipe length	m	20	15	9

DHW basic principles

DVGW Code of Practice W551

DVGW Code of Practice W551

DVGW Code of Practice W 551 "Drinking water heating and drinking water piping systems; Technical measures to reduce Legionella growth; " outlines the main requirements for hygiene and for the operation of relevant systems and is regarded as the accepted engineering standard.

The Code of Practice also distinguishes between large and small systems, and describes the following additional specifications.

Requirements for the operation of a large system

- » The temperature of the water at the outlet of the DHW heater must always be $\geq 60\text{ }^{\circ}\text{C}$.
- » The entire cylinder content, including all preheating stages, must be heated at least once a day to $\geq 60\text{ }^{\circ}\text{C}$.
- » Branch lines with a capacity greater than 3 l must be fitted with DHW circulation.
- » The temperature drop in the DHW circulation line must be no more than 5 K.

Definition of small system

All systems with DHW cylinders or centralised instantaneous DHW heaters in single-family houses or two-unit apartment buildings, regardless of the capacity of the DHW cylinder/heater or the pipe-work capacity.

All systems with a capacity ≤ 400 litres and ≤ 3 l in each pipeline from the outlet of the DHW heater to the most distant draw-off point, not counting DHW circulation lines.

Requirements for installing a small system and recommendations for its operation

The following requirements apply:

A centralised DHW cylinder or centralised instantaneous water heater must be able to maintain an outlet temperature of $60\text{ }^{\circ}\text{C}$. This is not intended to suggest recommended operating temperatures, but to provide specifications for designing and installing the systems. Branch lines with a capacity greater than 3 l must be fitted with DHW circulation. The temperature drop in the DHW circulation line must be no more than 5 K.

The following recommendations apply:

It is recommended to set a thermostat temperature of $60\text{ }^{\circ}\text{C}$. Operating temperatures less than $50\text{ }^{\circ}\text{C}$ should be avoided. The user must be informed about the possible health risk when commissioning the system and instructing the user in its use.

Requirements for decentralised instantaneous DHW heaters, regardless of type of building

No requirements if the capacity of every pipeline from the DHW heater to the most distant draw-off point is ≤ 3 l.

If that is the case, there are no costs incurred for taking samples or testing by accredited laboratories.

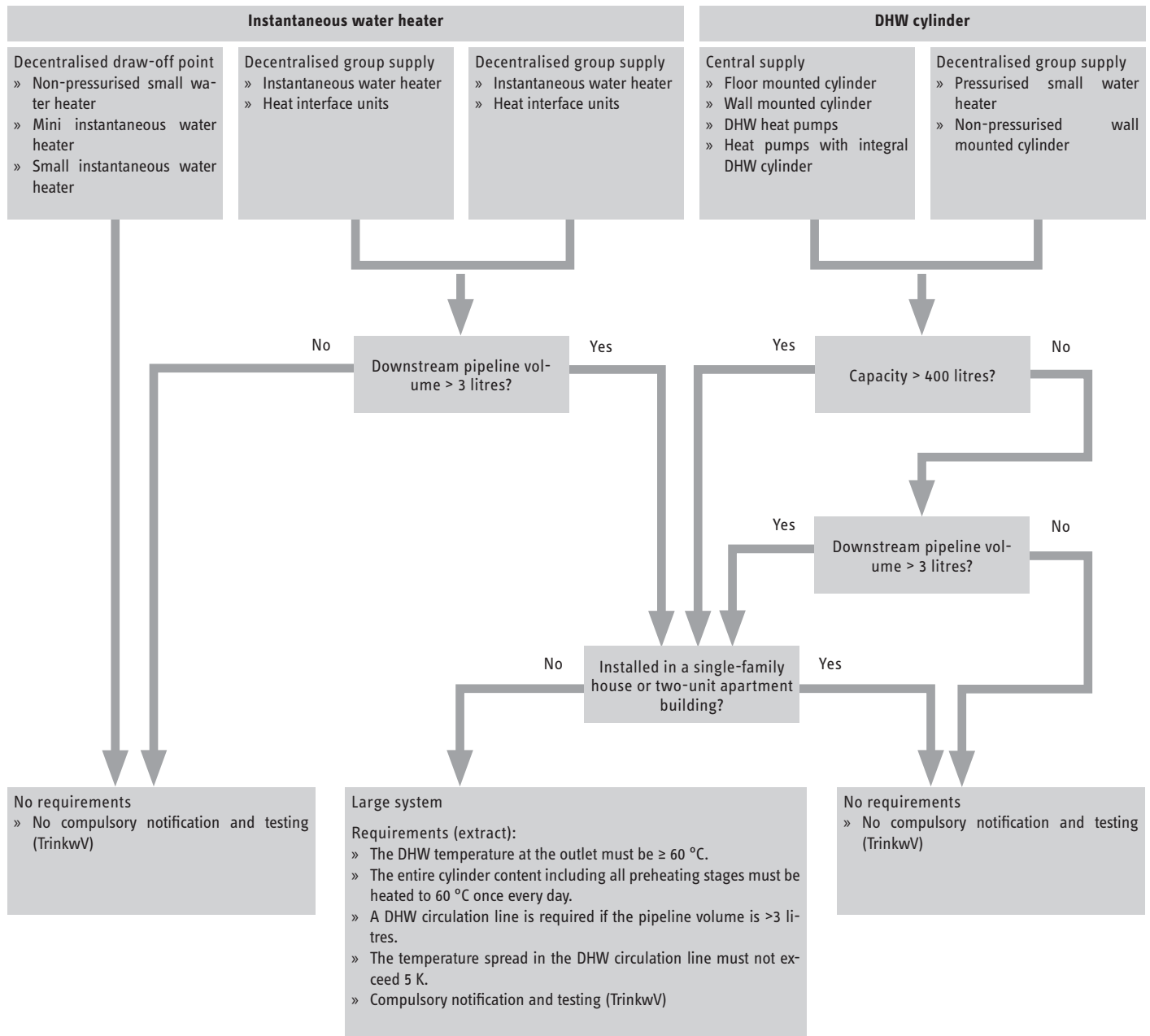
There is no need to check every riser. Moreover, it would often be necessary to install suitable sample collection points in such risers first.

DHW basic principles

DVGW Code of Practice W551

Requirements of the DVGW W 551 Code of Practice

The following provides an overview of the requirements to DVGW W 551.

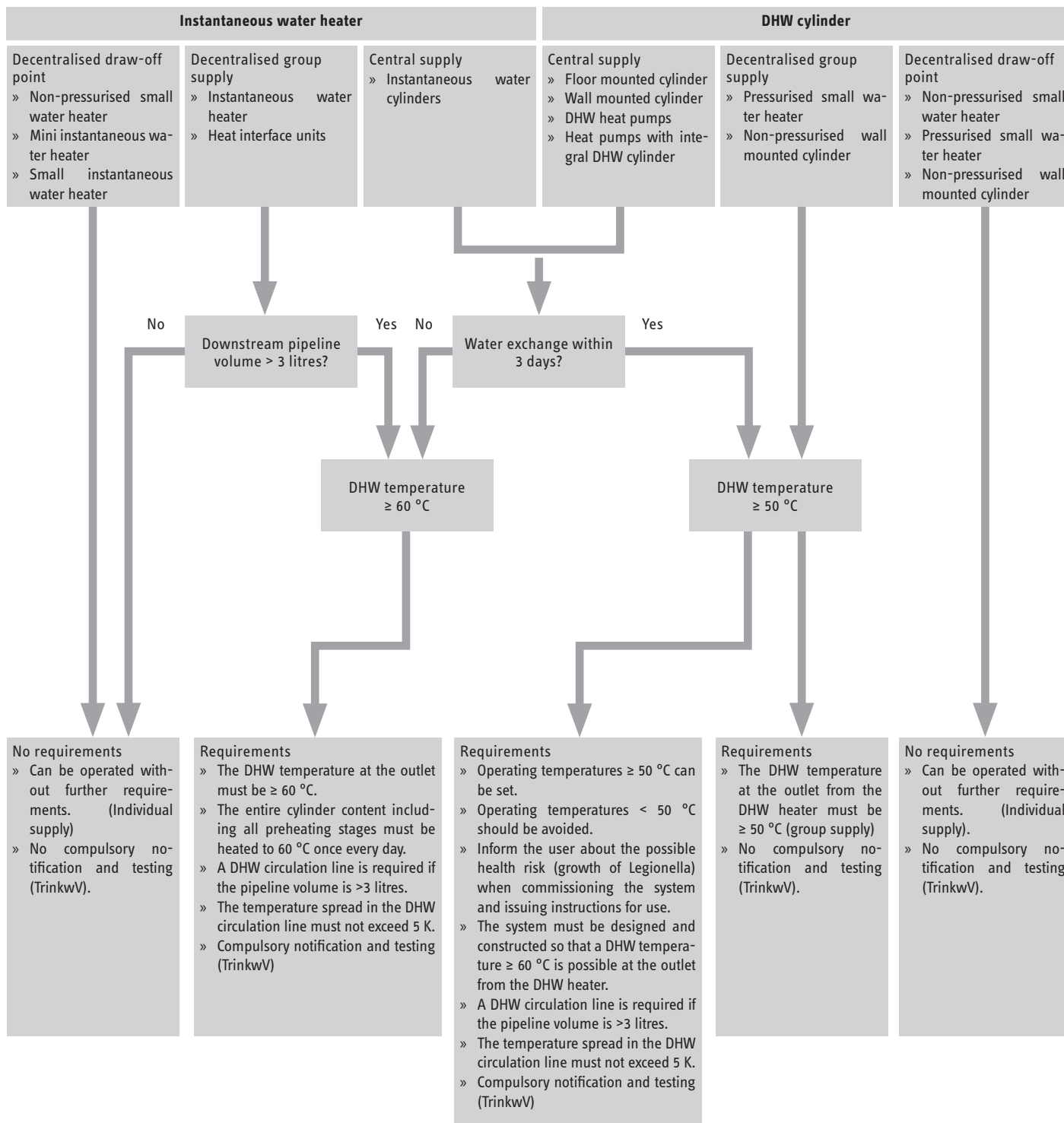


DHW basic principles

DIN 1988-200

Requirements to DIN 1988-200

The following provides an overview of the requirements to DIN 1988-200.



Notes

DHW basic principles

ERP – Energy-related Products

The EU-wide identification of energy-related products

Since 2015, electric DHW appliances have been required to have an Energy Label. The purpose of the Energy Label designation is to provide transparency regarding the differences between the various appliances.

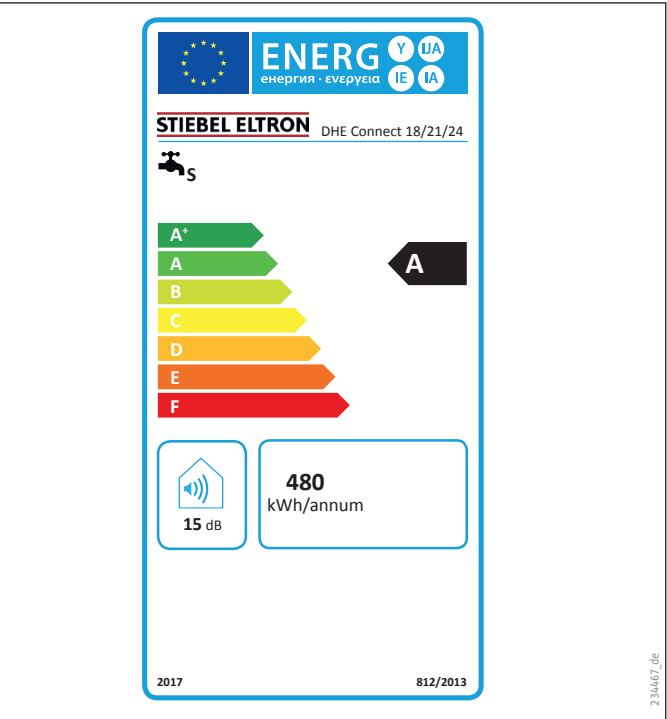
The statutory regulation for energy-related products rates different appliances and categorises them into various energy efficiency classes.

The label is similar to that for large domestic appliances. The categories have a background of coloured bars from green (very efficient) to red (very inefficient). The abbreviation "ErP" stands for "energy-related products".

The label in detail

The product label provides detailed information about the draw-off profile that the appliance in question can cover, and the expected approximate annual energy consumption if the appliance is used in accordance with this draw-off profile. The energy efficiency class is also provided.

Example for appliances: DHE Connect 18/21/24



Draw-off profiles and their meaning

With the validity of EN 16147 and the regulation, every manufacturer must indicate which draw-off profile was used to measure the hot water appliance or which draw-off profile the appliance can cover. EN 16147 stipulates the draw-off profiles S, M, L, XL and XXL, with S being the lowest and XXL the highest profile. The higher the draw-off profile, the higher the DHW convenience provided by the appliance.

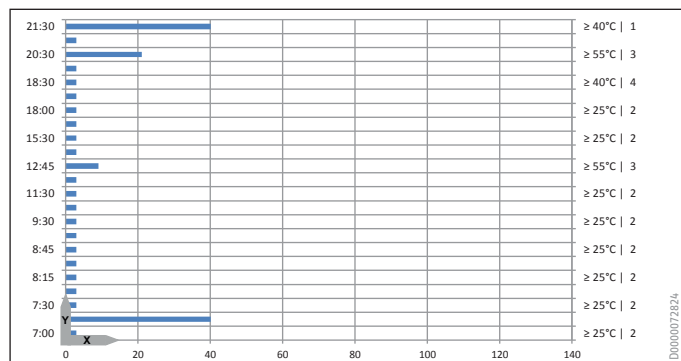
Draw-off profiles to EN 16147	-	S	M	L	XL	XXL
Draw-off energy	kWh/d	2	6	12	19	25
Draw-off energy	kWh/a	767	2133	4254	6961	8953
Corresponds approx. to a mixed water amount at 40 °C with a 10 °C cold water supply	L/d	60	168	334	547	703
Draw-off peaks (shower/bath)	-					
Mornings		-	1	2	2	3x shower and bath at the same time
Evening		-	1	1	2	

DHW basic principles

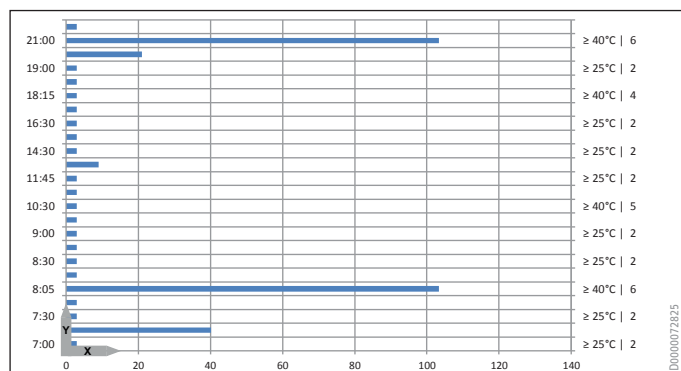
ERP – Energy-related Products

The following is a simplified visualisation of energy draw-off for draw-off profiles M, L and XL based on a theoretical 40 °C mixed water amount and a cold water temperature of 10 °C. EN 16147 specifies the minimum temperatures per draw-off and consequently the illustration is to be regarded as a simplification.

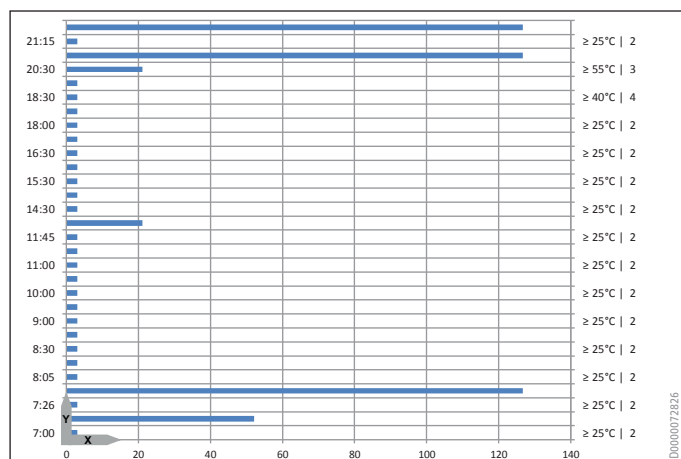
Draw-off profile M



Draw-off profile L



Draw-off profile XL



- x Litres
- y Time
- 1 Shower
- 2 Low
- 3 Dishwashing
- 4 Household cleaning
- 5 Floor cleaning
- 6 Bath

In order for an appliance to be assigned a draw-off profile, it must meet these requirements. This means that, for each individual draw-off, the appliance is capable of providing the draw-off energy required by the profile over a 24 hour period without the temperature falling below the specified minimum.

In order to be able to determine the amount of energy for a draw-off profile over 24 hours, the appliance output, cylinder size and set DHW temperature must be known.

DHW demand

The selection of a suitable appliance for DHW heating requires knowledge of the requirements of the respective draw-off point or the area to be supplied.

The following details are important:

- » The flow rate of the draw-off tap
- » The duration of draw-off
- » The available temperature at the draw-off tap
- » The time between draw-offs, or usage frequency per day
- » The available DHW requirement per draw-off or day
- » Draw-off profile of the centralised supply

The following tables contain data for different draw-off points and types of supply. These are standard values which can be applied if no exact details are available for the building.

The details describe the useful energy demand at the draw-off point. In addition to that there is energy consumed in distribution, generation and storage of the domestic hot water.

DHW basic principles

DHW demand

Residential buildings

Supply type: individual supply

Draw-off point	Flow rate V [l/min]	Duration of draw-off	Available temperature	Available DHW require- ment per draw-off
		dt [min]	t _N [°C]	v _N [l]
Shower, low flow shower head	6	2 - 6	40	12 - 36
Shower, normal shower head	8	2 - 6	40	16 - 48
Shower, luxury shower head	10	2 - 6	40	20 - 60
Bath tub, standard	8 - 10	10 - 13	40	80 - 130
Bath tub, large	10 - 12	13 - 15	40	130 - 180
Washbasin	4	1 - 2	40	4 - 8
Bidet	6	1 - 2	40	6 - 12
Sink	4	2 - 3	50	8 - 12

Supply type: group supply

Draw-off points, group	Usage frequency				Total available DHW requirement for t_N				Total energy demand			
	Shower	Bath	Washbasin	Sink	per person per day		per person per year		per person per day		per person per year	
	f [1/d]	f [1/d]	f [1/d]	f [1/d]	$v_{N,r} \text{ tot,d}$ [l/d]		$v_{N,r} \text{ tot,a}$ [m³/p.a.]		$q_{N,r} \text{ tot,d}$ [kWh/d]		$q_{N,r} \text{ tot,a}$ [kWh/p.a.]	
						Average value		Average value		Average value		Average value
Shower (normal), washbasin, dishwasher + sink	0.5	-	2	0.13	15 - 47	31.0	5.2 - 16.2	10.7	0.5 - 1.6	1.1	190 - 570	380
Shower (normal), washbasin, sink	0.5	-	2	0.60	19 - 51	35.0	6.5 - 17.5	12.0	0.7 - 1.8	1.3	250 - 630	440
Bath tub (normal), washbasin, dishwasher + sink	-	0.3	2	0.13	33 - 56	44.0	11.7 - 19.3	15.7	1.1 - 1.9	1.5	400 - 680	540
Bath tub (normal), washbasin, sink	-	0.3	2	0.60	37 - 60	48.5	13.0 - 20.6	16.8	1.3 - 2.1	1.7	460 - 720	590
Bath tub (large), washbasin, dishwasher + sink	-	0.3	2	0.13	48 - 71	59.0	16.6 - 24.5	20.7	1.7 - 2.5	2.1	580 - 860	720
Bath tub (large), washbasin, sink	-	0.3	2	0.60	52 - 75	63.5	17.9 - 25.8	21.9	1.9 - 2.7	2.5	640 - 920	780
Bath tub (normal), shower (normal), washbasin, dishwasher + sink	0.4	0.1	2	0.13	22 - 54	38.0	7.5 - 18.6	12.7	0.7 - 1.9	1.3	270 - 650	460

Statistical number of occupants in apartments

If the number of persons in the apartment or building is not known, the following reference values can be used.

Number of rooms in RU	Number of occupants nP
1	1.2
2	1.6
3	2.3
4	2.8
5	3.1
6	3.4
≥ 7	3.8

RU - residential unit

nP - normal (average) person

DHW basic principles

DHW demand

Non-residential / commercial buildings

Application	Specific demand per day at 60 °C DHW temperature l	Per
Bakers		
Dough preparation, cleaning of machines and appliances	50	1 m ² baking area
Cleaning the workplace	0.5	1 m ² operating area
Personal hygiene (showers and washing of hands)	40	Employee
Butchers		
Cleaning machines and appliances	80	1 pig/week
Cleaning the workplace	1	1 m ² operating area
Personal hygiene (showers and washing of hands)	40	Employee
Hairdressers		
Barber, station with basin	40 - 60	Station with basin
Ladies' hairdresser, up to 8 stations with basin	100 - 120	Station with basin
Ladies' hairdresser, 9 to 14 stations with basin	80 - 100	Station with basin
Ladies' hairdresser, more than 14 stations with basins	60 - 80	Station with basin
Cleaning the workplace	0.5 - 1	Station with basin
Nurseries		
Washbasins in nurseries	2.5	Child
Pubs		
Washbasin	15	Guest
Full-size bath tub	90	Guest
Shower	50	Guest
Room cleaning, kitchen	5	Room
Without dishwashing (preparation without cleaning)	5	Dining area
Hotels		
Room with shower and bath	120 - 180	Guest
Room with bath	95 - 140	Guest
Room with shower	50 - 100	Guest
Other hotels, B&Bs, residential homes	25 - 50	Guest
Bath and shower facilities		
Indoor pool, public	40	User
Indoor pool, private	20	User
Sauna facility, public	100	User
Sauna facility, private	50	User
Communal washrooms in schools and sports facilities	40	User
Communal washrooms in hostels	60	User
Communal washrooms in hospitals	60 - 120	User
Communal washrooms in industry	30	User
Hospitals and residential homes		
Hospitals	200	Bed
Residential homes e.g. retirement homes, residential home for young people, children's homes	40 - 80	Bed

DHW basic principles

DHW demand

Application	Specific demand per day at 60 °C DHW temperature l	Per
Agriculture		
Calf fattening and rearing, preparation of drinking trough	8	Calf
Calf fattening and rearing, cleaning of feeders	50 - 100	Stall
Calf fattening and rearing, disinfection of stalls	10 - 20	Stall
Milking parlour and milk preparation centre, udder shower	3	Cow
Milking parlour and milk preparation centre, cleaning of milking installation	1 - 2	1 m pipework
Milking parlour and milk preparation centre, cleaning of milk collecting tank	5 - 10	100 l capacity
Milking parlour and milk preparation centre, cleaning of milk room	1	1 m ² floor area
Hand washbasin	10	

DHW basic principles

Losses from DHW heating systems

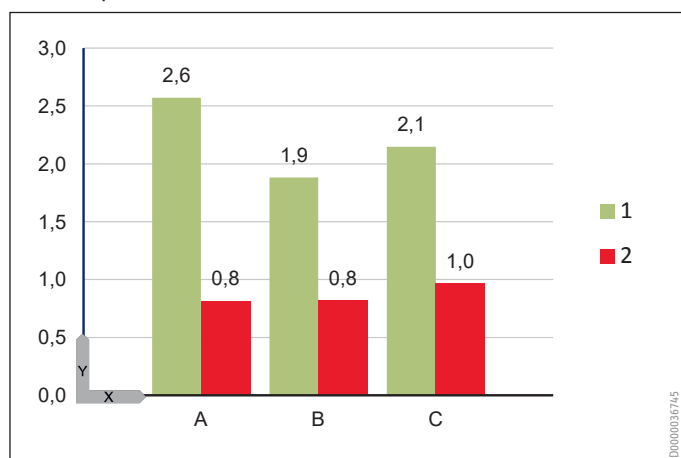
Introduction

In addition to the actual DHW demand or useful energy demand, additional energy consumption for distribution, generation and storage of the domestic hot water must be considered, especially when assessing the cost effectiveness of different systems and supply types.

The magnitude of the losses in each case will vary depending on the planned building and its features, such as insulation of the distribution network. The following types of losses can be applied as a rough guide, subject to the type of building and hot water boiler in question. All details are taken from the study "Reduzierung von Energieverbrauch und CO₂-Emissionen durch dezentrale elektrische Warmwasserversorgung" [Reduction of energy consumption and CO₂ emissions through decentralised DHW supply], July 2011, from "FFE - Forschungsgesellschaft für Energiewirtschaft mbH".

Start-up losses

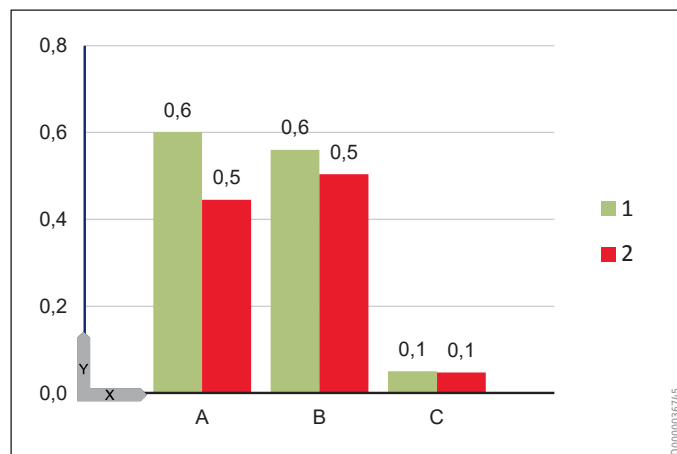
Start-up losses will vary depending on the positioning of the draw-off points in/on the pipework and/or the distance from a draw-off point to the DHW circulation line. Generally speaking, cooled water lying in the DHW pipeline must be pushed out before the water with the required temperature becomes available at the outlet. Likewise, the pipe material, having cooled, must be heated up as well.



- Y % of the useful energy demand
 A Single-family house
 B 3-unit apartment building
 C 12-unit apartment building
 1 Centralised supply with oil / gas heating
 2 Decentralised electric instantaneous water heaters

Distribution losses

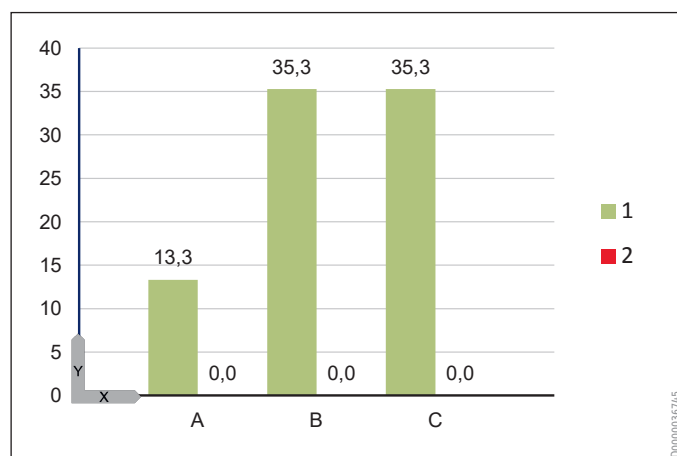
Distribution losses are dependent on the installed branch lines, their size, material and insulation. Distribution losses arise when DHW is drawn off through branch lines, e.g. from the DHW circulation branch to the tap.



- Y % of the useful energy demand
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DHW circulation losses

Centralised supply systems usually have a DHW circulation line to meet hygiene requirements and also to prevent high start-up losses and to maximise convenience. While the DHW circulation pump is operating, heat is given off into the surrounding environment. After interruptions, pipeline heating losses must be taken into account as well. All these losses are dependent on the water temperature, the standard of insulation, the operating times and the control of the circulation pump, as well as the pipe material and the distribution network.



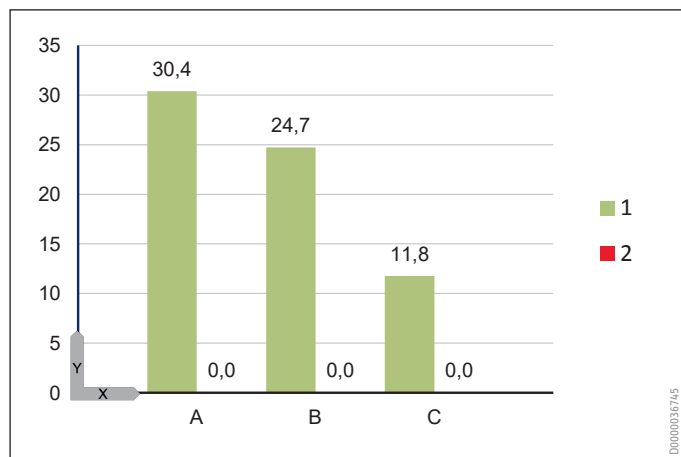
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 1 Centralised supply with oil / gas heating
 2 Decentralised electric instantaneous water heaters

DHW basic principles

Losses from DHW heating systems

Cylinder losses / standby heat loss

Both the DHW cylinder and the installed pipework constantly give off energy to the surrounding environment e.g. the utility area in the basement. These losses, also called the standby heat loss, are usually stated in kWh/24h.



Y % of the useful energy demand

A Single-family house

B 3-unit apartment building

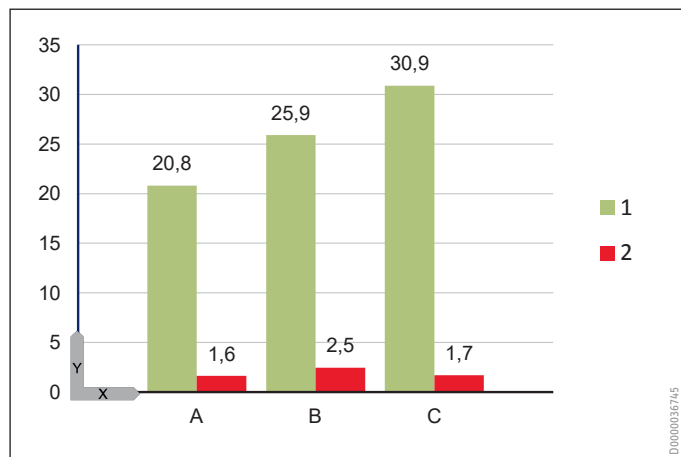
C 12-unit apartment building

1 Centralised supply with oil / gas heating

2 Decentralised electric instantaneous water heaters

Generation and technical system losses

For every heat generator or boiler, efficiency, energy used for control and auxiliary energy must be considered.



Y % of the useful energy demand

A Single-family house

B 3-unit apartment building

C 12-unit apartment building

1 Centralised supply with oil / gas heating

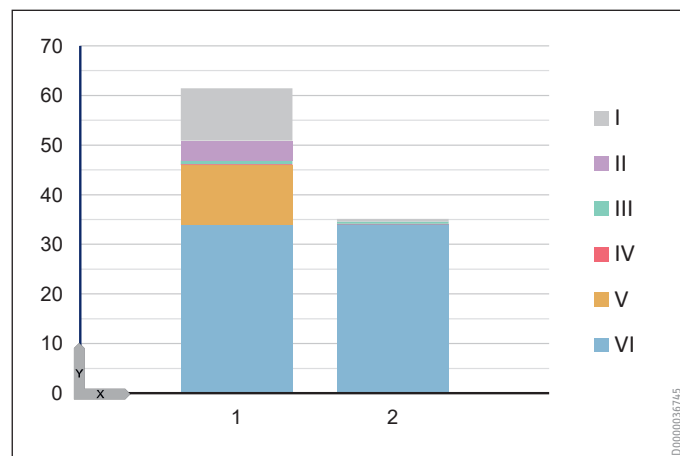
2 Decentralised electric instantaneous water heaters

Summary

When all types of loss are considered, the example of the "12-unit apartment building" clearly indicates that the economical operation of a centralised supply system depends to a great extent on the planning, design, quality and operation of the installed distribution system.

Decentralised DHW heating is an attractive option because its final energy demand is considerably lower.

The appliances can be installed in close proximity to the respective draw-off points. That results in short pipe runs, which in turn reduce start-up, standby and distribution losses to a minimum.



Y Total energy demand [kWh/d]

1 Centralised supply with oil / gas heating

2 Decentralised electric instantaneous water heaters

I Generation and system losses

II Cylinder losses

III Start-up losses

IV Distribution losses

V DHW circulation losses

VI Useful energy demand

DHW basic principles

Sizing instantaneous water heaters

Bases of calculations

The following formulas and bases of calculation are essential when sizing instantaneous water heaters.

Flow rate $\dot{m}_D$ [kg/min]

$$\dot{m}_D = \frac{P}{c \cdot \Delta\vartheta} \cdot \frac{1h}{60min}$$

$\dot{m}_D$	Flow rate [kg/min]
P	Output [W]
c	Specific thermal capacity (water: 1,163 Wh/(kg·K))
$\Delta\vartheta$	Temperature differential ($\vartheta_2 - \vartheta_1$) [K]

Example: Instantaneous water heater with rated output of 21 kW

What is the flow rate $\dot{m}_D$, if the DHW temperature is $\vartheta_2 = 38^\circ\text{C}$ and the cold water temperature is $\vartheta_1 = 10^\circ\text{C}$?

$$\begin{aligned}\dot{m}_D &= 21000 \text{ W} / (1,163 \text{ Wh}/(\text{kg}\cdot\text{K}) \cdot 28 \text{ K}) \cdot 1/60 \text{ h/min} \\ \dot{m}_D &= 10.7 \text{ kg/min} \triangleq 10.7 \text{ l/min}\end{aligned}$$

Rules of thumb for temperature increase $\Delta\vartheta$ [K]

$\Delta\vartheta = 28 \text{ K}$ (from 10°C to 38°C)

$$\begin{aligned}\dot{m}_D &\approx P/2 \\ \dot{m}_D &\approx 21/2 \text{ l/min} = 10.5 \text{ l/min}\end{aligned}$$

$\Delta\vartheta=43 \text{ K}$ (from 10°C to 53°C)

$$\begin{aligned}\dot{m}_D &\approx P/3 \\ \dot{m}_D &\approx 21/3 \text{ l/min} = 7.0 \text{ l/min}\end{aligned}$$

DHW temperature ϑ_2 [$^\circ\text{C}$]

$$\vartheta_2 = \frac{P}{c \cdot \dot{m}_D} \cdot \frac{1h}{60min} + \vartheta_1$$

ϑ_2	DHW temperature [$^\circ\text{C}$]
P	Output [W]
c	Specific thermal capacity (water: 1,163 Wh/(kg·K))
$\dot{m}_D$	Flow rate [kg/min]
ϑ_1	Cold water temperature [$^\circ\text{C}$]

Example: Instantaneous water heater with rated output of 21 kW

What is DHW temperature ϑ_2 if the flow rate is $\dot{m}_D=10.7 \text{ g/min}$ and the cold water temperature is $\vartheta_1=10^\circ\text{C}$?

$$\begin{aligned}\vartheta_2 &= 21000 \text{ W} / (1,163 \text{ Wh}/(\text{kg}\cdot\text{K}) \cdot 10.7 \text{ kg/min}) \cdot 1/60 \text{ h/min} + 10^\circ\text{C} \\ \vartheta_2 &= 28 \text{ K} + 10^\circ\text{C} \triangleq 38^\circ\text{C}\end{aligned}$$

Rule of thumb for DHW temperature

$$\begin{aligned}\vartheta_2 &\approx 14 \cdot P / (\dot{m}_D) + \vartheta_1 \\ \text{Factor } 14 &= 1000 / (60 \cdot 1,163)\end{aligned}$$

$$\begin{aligned}\vartheta_2 &\approx 14 \cdot 21 \text{ kW} / 10.7 \text{ kg/min} + 10^\circ\text{C} \\ \vartheta_2 &\approx 37.5^\circ\text{C}\end{aligned}$$

Rule of thumb for connected load P [kW]

$$P \approx 0.073 \cdot \dot{m}_D \cdot \Delta\vartheta$$

Example

What is the connected load in kW required to increase a flow rate of 10 l/min from 10°C to 38°C ?

$$\begin{aligned}P &\approx 0.073 \cdot 10 \text{ kg/min} \cdot (38^\circ\text{C} - 10^\circ\text{C}) \\ P &\approx 20.4 \text{ kW}\end{aligned}$$

DHW basic principles

Sizing instantaneous water heaters

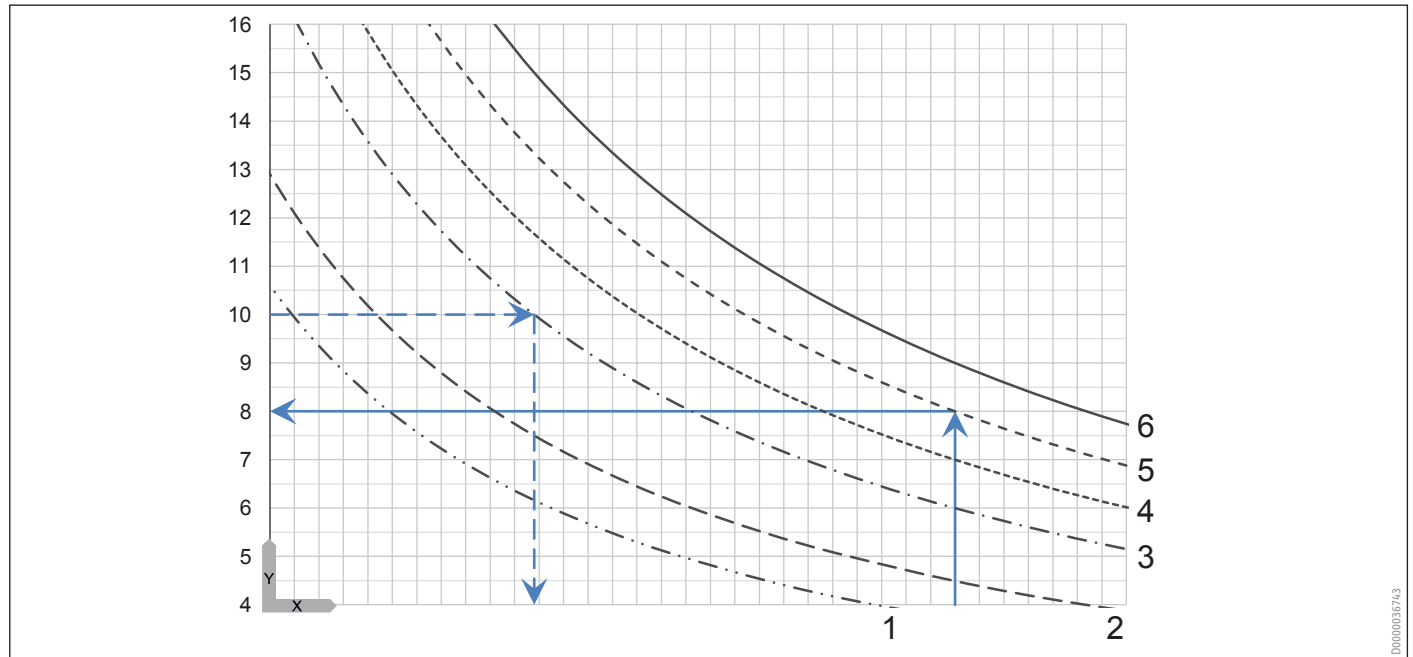
Sizing graphs

Example A

Given: Flow rate 10 l/min

To be determined: Outlet temperature with cold water temperature of 10 °C and output of 18 kW

Solution: 35.8 °C



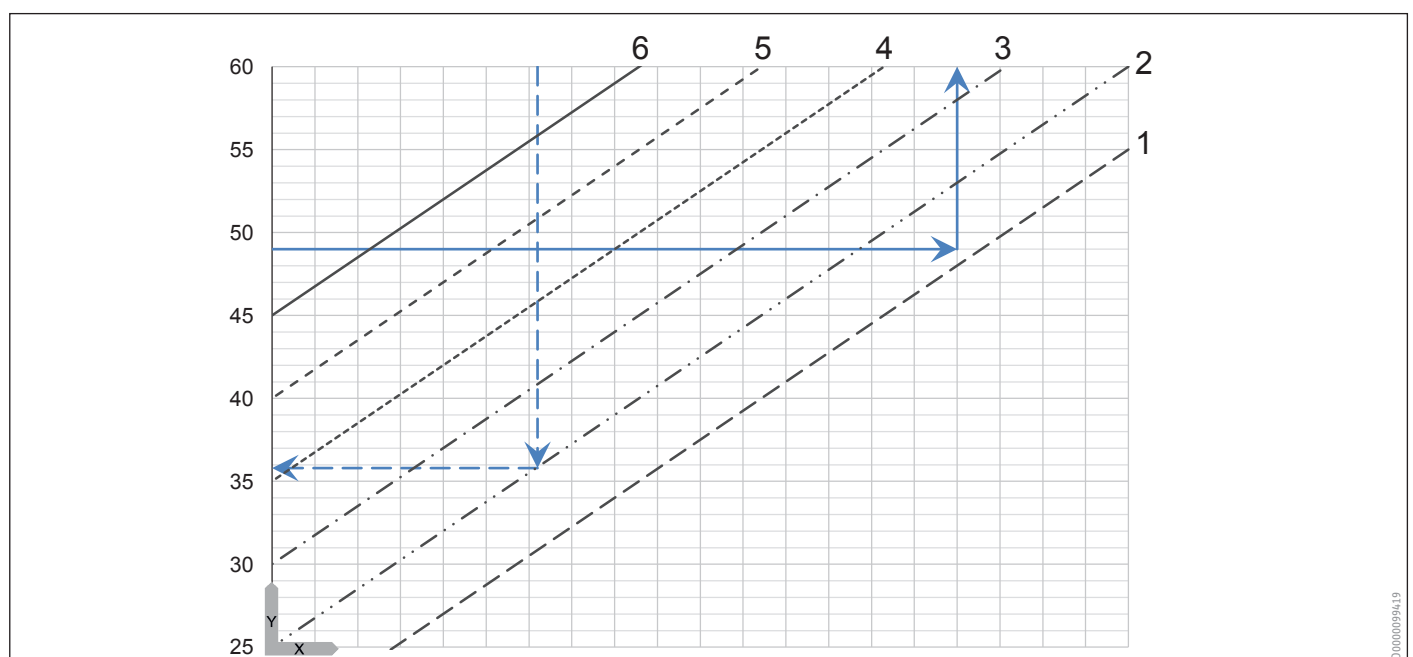
X	Output in kW	1	11.1 kW	3	18 kW	5	24 kW
Y	Draw-off flow rate in l/min	2	13.5 kW	4	21 kW	6	27 kW

Example B

Given: Outlet temperature 49 °C at cold water temperature of 6 °C

To be determined: Maximum draw-off flow rate with a 24 kW appliance

Solution: 8 l/min



X	Temperature increase in °C at cold water inlet temperature of 10 °C	Y	DHW outlet temperature in °C	3	15 °C	6	30 °C
		1	5 °C	4	20 °C		
		2	10 °C	5	25 °C		

DHW basic principles

Sizing DHW cylinders

Cylinder

The sizing of electrically heated cylinders for group or centralised supply depends on the type of building, the number of units to be supplied in the building, and the facilities in those units. The connected electrical load of the cylinder is not usually based on the peak DHW demand. Instead, the peak demand for DHW must be stored in the cylinder. Sizing is carried out based on the required amounts of heat and DHW. To do that, one must determine the longest continuous period of use, such as filling a bath tub, and the associated pattern of consumption. Alternatively the reference values listed above can be used.

The heat amount for a period of use can be calculated as follows:

$$Q_{ges} = N_{WE} \cdot Q_{ges,WE}$$

Q_{tot}	Heat amount for a period of use [kWh]
N_{WE}	Number of residential units with the same profile
$Q_{tot,WE}$	Heat amount of a residential unit for a period of use [kWh]

The heat amount can then be used as the basis for calculating the required amount of DHW at the temperature level of the intended use. Alternatively, the DHW amount can be taken directly from the listed reference values.

$$V_{TWW} = \frac{Q_{ges,WE}}{c \cdot (t_{sol} - t_{KW})}$$

V_{TWW}	Required DHW amount for a period of use [l]
c	Specific thermal capacity (water: 1,163 Wh/(kg·K))
t_{set}	Temperature level of use, e.g. 40 °C for a bath tub
t_{KW}	Cold water temperature

The calculation of the required minimum cylinder size must factor in the standby losses, the cylinder efficiency and any losses from DHW circulation lines.

Circulation losses only need to be taken into account for centralised DHW systems.

Group and individual supply systems are usually designed without circulation lines, due to the shorter pipe runs and lower water capacity.

A decisive factor for sizing is the maximum possible or required cylinder temperature.

$$V_{Sp} = \frac{V_{TWW} \cdot (t_{sol} - t_{KW})}{(t_{Sp} - t_{KW})}$$

V_{cyl}	Required cylinder volume
V_{TWW}	Required DHW amount for a period of use [l]
t_{set}	Temperature level of use, e.g. 40 °C for a bath tub
t_{KW}	Cold water temperature
t_{cyl}	Required cylinder temperature

15-20 % of the cylinder capacity can be assumed to be a supplement compensating for the cylinder volume that cannot be used due to mixing.

$$t_{Sp} = V_{Sp} \cdot 1,15$$

V_{cyl}	Required cylinder volume
t_{cyl}	Required cylinder temperature

Example: Calculating cylinder volume in single circuit operation

A DHW cylinder is required for supply of a group of draw-off points. The required DHW amount is determined by the standard bath tub draw-off point. The maximum cylinder temperature is 60 °C; the cold water temperature is 10 °C; electrical connection: Single circuit

$$t_{Sp} = (110 \text{ l} \cdot (40 \text{ °C} - 10 \text{ °C})) / (60 \text{ °C} - 10 \text{ °C})$$
$$t_{Sp} = 66.3 \text{ l} \cdot 1.15 = 76 \text{ l}$$

Recommendation: Wall mounted cylinder with nominal capacity of 80 l

The required connected load for the cylinder is based on the time available between individual periods of use and the off-peak enable times.

$$P_{EL} = \frac{V_{Sp} \cdot c \cdot (t_{Sp} - t_{KW})}{T_{Hz}}$$

P_{EL}	Required connected electrical load [W]
V_{cyl}	Cylinder volume [l]
c	Specific thermal capacity (water: 1,163 Wh/(kg·K))
t_{cyl}	Set cylinder temperature
t_{KW}	Cold water temperature
T_{Hz}	Time between periods of use [h] Recommendation: For single circuit operation $\triangleq 2 \text{ h}$ Off-peak enable time for dual circuit operation $\triangleq 8 \text{ h}$

Example: Calculating the connected electrical load for single circuit operation

The calculation must determine the minimum connected load for the wall mounted cylinder selected earlier, with single circuit operation.

$$P_{EL} = (80 \text{ l} \cdot 1,163 \text{ Wh}/(\text{kg} \cdot \text{K}) \cdot (60^\circ\text{C} - 10^\circ\text{C})) / T_{Hz}$$

$$P_{EL} = 4650 \text{ Wh} / 2 \text{ h} = 2325 \text{ W}$$

Recommendation: connected electrical load $\geq 3 \text{ kW}$

Example: Calculating the cylinder volume and connected electrical load for dual circuit operation

The calculation must determine the cylinder size and the minimum connected load with dual circuit operation if a bath tub is expected to be filled twice in one day, but outside the off-peak enable time.

$$V_{Sp} = 2 \cdot 110 \text{ l} / ((60^\circ\text{C} - 10^\circ\text{C})) / ((40^\circ\text{C} - 10^\circ\text{C}))$$

$$V_{Sp} = 2 \cdot 66.3 \text{ l} \cdot 1.15 = 152.9 \text{ l}$$

Recommendation: Wall mounted cylinder with nominal capacity of 150 l

$$P_{EL} = (150 \text{ l} \cdot 1,163 \text{ Wh}/(\text{kg} \cdot \text{K}) \cdot (60^\circ\text{C} - 10^\circ\text{C})) / T_{Hz} =$$

$$P_{EL} = 8722 \text{ Wh} / 8 \text{ h} = 1090 \text{ W}$$

Recommendation: connected electrical load $\geq 2 \text{ kW}$

DHW basic principles

Sizing DHW cylinders

Required heat amount Q [Wh]

$$Q = m \cdot c \cdot \Delta\vartheta$$

Q	Heat amount [Wh]
m	Water amount [kg] (1 kg $\triangleq$ 1 l)
c	Specific thermal capacity (water: 1,163 Wh/(kg·K))
$\Delta\vartheta$	Temperature differential ($\vartheta_2 - \vartheta_1$) [K]

Example

How many Wh are required to heat 80 kg of water from $\vartheta_1 = 10^\circ\text{C}$ to $\vartheta_2 = 55^\circ\text{C}$?

$$Q = 80 \text{ kg} \cdot 1,163 \text{ Wh}/(\text{kg}\cdot\text{K}) \cdot 45 \text{ K}$$

$$Q = 4187 \text{ Wh} \triangleq 4.2 \text{ kWh}$$

Required energy demand (work) W [Wh]

$$W = \frac{m \cdot c \cdot \Delta\vartheta}{\eta}$$

W	Energy demand [Wh]
m	Water amount [kg] (1 kg $\triangleq$ 1 l)
c	Specific thermal capacity (water: 1,163 Wh/(kg·K))
$\Delta\vartheta$	Temperature differential ($\vartheta_2 - \vartheta_1$) [K]
η	Efficiency

Example

How much energy is required to heat 80 kg of water from $\vartheta_1 = 10^\circ\text{C}$ to $\vartheta_2 = 55^\circ\text{C}$?

$$W = 80 \text{ kg} \cdot 1,163 \text{ Wh}/(\text{kg}\cdot\text{K}) \cdot 45 \text{ K} / 0.98$$

$$W = 4272 \text{ Wh} \triangleq 4.3 \text{ kWh}$$

Required output P [W]

$$P = \frac{m \cdot c \cdot \Delta\vartheta}{t \cdot \eta}$$

P	Output [W]
m	Water amount [kg] (1 kg $\triangleq$ 1 l)
c	Specific thermal capacity (water: 1,163 Wh/(kg·K))
$\Delta\vartheta$	Temperature differential ($\vartheta_2 - \vartheta_1$) [K]
t	Heat-up time [h]
η	Efficiency

Example

80 kg of water are to be heated from $\vartheta_1 = 10^\circ\text{C}$ to $\vartheta_2 = 55^\circ\text{C}$ in 8 hours.

$$P = (80 \text{ kg} \cdot 1,163 \text{ Wh}/(\text{kg}\cdot\text{K}) \cdot 45 \text{ K}) / (8 \text{ h} \cdot 0.98)$$

$$P = 534 \text{ W}$$

Heat-up time t [h]

$$t = \frac{m \cdot c \cdot \Delta\vartheta}{P \cdot \eta}$$

m	Water amount [kg] (1 kg $\triangleq$ 1 l)
c	Specific thermal capacity (water: 1,163 Wh/(kg·K))
$\Delta\vartheta$	Temperature differential ($\vartheta_2 - \vartheta_1$) [K]
P	Output [W]
η	Efficiency

Example

Required heat-up time for 80 kg of water heated from $\vartheta_1 = 10^\circ\text{C}$ to $\vartheta_2 = 55^\circ\text{C}$ with connected load of 2000 W.

$$t = (80 \text{ kg} \cdot 1,163 \text{ Wh}/(\text{kg}\cdot\text{K}) \cdot 45 \text{ K}) / (2000 \text{ W} \cdot 0.98)$$

$$t = 2.1 \text{ h}$$

Mixed water temperature ϑ_M [°C]

$$\vartheta_M = \frac{m_1 \cdot \vartheta_1 + m_2 \cdot \vartheta_2}{m_1 + m_2}$$

ϑ_M	Mixed water temperature [°C]
m_1	Cold water amount [kg]
ϑ_1	Cold water temperature [°C]
m_2	DHW amount [kg]
ϑ_2	DHW temperature [°C]

Example

When 80 kg of water (m_2) at $\vartheta_2 = 55^\circ\text{C}$ is mixed with 40 kg of water (m_1) at $\vartheta_1 = 10^\circ\text{C}$

$$\vartheta_M = (40 \text{ kg} \cdot 10^\circ\text{C} + 80 \text{ kg} \cdot 55^\circ\text{C}) / (40 \text{ kg} + 80 \text{ kg})$$

$$\vartheta_M = 40^\circ\text{C}$$

Mixed water amount m_M [kg] or [l]

$$m_M = \frac{m_2 \cdot (\vartheta_2 - \vartheta_1)}{\vartheta_M - \vartheta_1}$$

m_M	Mixed water amount [kg]
m_2	DHW amount [kg]
ϑ_2	DHW temperature [°C]
ϑ_1	Cold water temperature [°C]
ϑ_M	Mixed water temperature [°C]

Example

How much mixed water at a temperature of $\vartheta_M = 40^\circ\text{C}$ do you get by mixing cold water at $\vartheta_1 = 10^\circ\text{C}$ into 80 kg of DHW at $\vartheta_2 = 55^\circ\text{C}$?

$$m_M = (80 \text{ kg} \cdot (55^\circ\text{C} - 10^\circ\text{C})) / (40^\circ\text{C} - 10^\circ\text{C})$$

$$m_M = 120 \text{ kg} \approx 120 \text{ l}$$

Notes

DHW basic principles

Economic feasibility study to VDI 2067

Introduction

Economic feasibility studies are used to compare different system concepts, and form the basis for objective decision making. For this, all possible costs should be included and split over the respective cost categories. This will then enable the influence of the different types of costs to be examined separately.

Cost calculation to VDI 2067

The Guideline concerns the viability calculation of technical services for buildings; it uses the annuity method.

Group 1 (Parts 10 to 14)

Energy demand of heated and air-conditioned buildings.

Group 2 (Parts 20 to 27)

Energy expenditure for benefit transfer, for example for DHW heating

Group 3 (Part 30)

Energy expenditure in distribution.

Group 4 (Parts 40 to 46)

Energy expenditure for generation

This calculation takes into account the dynamic development of costs, interest and prices for a period in the future. The guideline details the required interest and annuity factors which are applied, over the period under consideration, to the investment amounts which remain the same each year. Costs are split over various categories for this calculation.

Capital costs

These costs include interest and repayment of the invested capital for the respective DHW system.

Costs of consumption

This include above all the energy costs, but can also include costs for auxiliary energy or fuels and other operating fluids.

Operational costs

This cost category includes primarily the costs of maintenance, monitoring, meter reading and cleaning.

Example: Apartment building with 7 residential units

The following example of a cost calculation is based on the terms and definitions explained here as well as the annuity method from VDI 2067. Payback periods are also determined and displayed, based on the present value method.

The example compares the following two system concepts for DHW heating in the same building with seven residential units.

Calculation bases for system comparison

The total costs were determined with reference to VDI 2067. Savings over the period of 20 years were determined using the present value method, incorporating rates of inflation for various energy sources. All costs include value added tax at the rate of 19 %.

Every care has been taken in arriving at these costs, but deviations from the calculations shown are nevertheless possible. This may be due to differences in energy prices or fluctuations in the investment costs.

The calculation is based on the following conditions:

- » Current: €0.305/kWh
- » Gas: €0.605/kWh
- » Interest rate: 1.5 %
- » Gas price increase: 5 %/a
- » Electricity price increase: 2 %/a

DHW basic principles

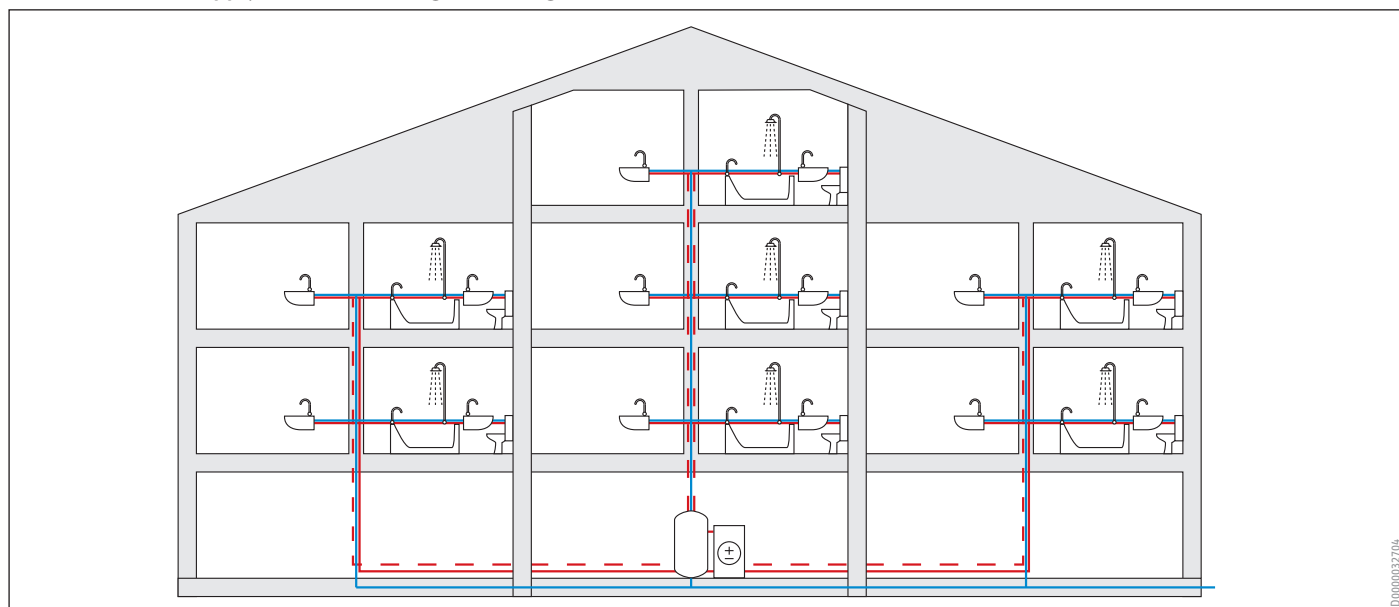
Economic feasibility study to VDI 2067

Centralised DHW supply, fossil fuel heat generator (gas)

The DHW is heated centrally, in an unheated basement. The pipework is laid out for comparison purposes in accordance with EnEV / DIN4701-10 and is structured as follows:

Section	Length m	Heat losses kWh/a
Pipework between DHW generator and risers	44.1	2230
Main lines in the heated area, including DHW circulation	67.9	2735
Branch lines, connection between main line and draw-off point including DHW circulation	45.3	912

Centralised DHW supply, fossil fuel heat generator (gas)



DHW basic principles

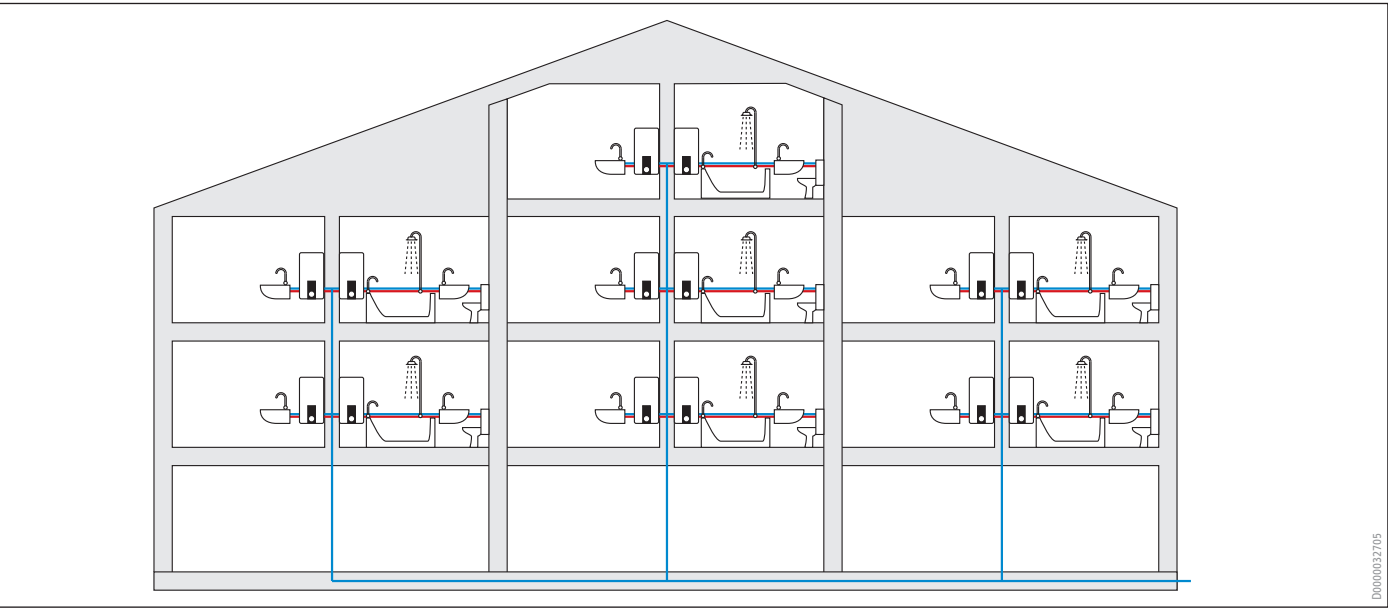
Economic feasibility study to VDI 2067

Decentralised DHW supply, electronic instantaneous water heater

The DHW heating is decentralised in each apartment, set up as group supply using instantaneous water heaters with electronic closed loop control. The DHW pipework is laid out for comparison purposes in accordance with EnEV / DIN4701-10 and is restricted to:

Section	Length m	Heat losses kWh/a
Branch lines between DHW generator and draw-off point	11.3	228

Decentralised DHW supply, electronic instantaneous water heater



DHW basic principles

Economic feasibility study to VDI 2067

System comparison

Apartment building, 7 residential units	
Available floor space AN [m²]	905
Observation period	20
Interest charge	1.5
EL price trend	2
GAS price trend	5
Amortisation	0.0736
Electricity tariff	30.5
Gas tariff	6.5

		decentralised DHW heating		centralised DHW heating	
		Electronic instantaneous water heaters		Gas condensing, central heating	
DHW demand					
Annual heat demand (DHW)	kWh/a	11312.0		11312.0	
Annual energy demand (DHW) including losses	kWh/a	12322.0		20107.0	
Annual energy demand for auxiliary energy / generator losses	kWh/a	0.0		360.0	
Final energy demand, DHW	kWh/a	12322.0		20107.0	
Final energy demand relative to the decentralised electric system	%	100.0		163.2	
Investment					
Heat generator, cylinder, instantaneous water heaters including installation	€	4900.0		6500.0	
Hydraulic distribution system including installation and meters	€	3900.0		19500.0	
Total investment outlay	€	8800.0		26000.0	
Investment costs relative to the decentralised electric system	%	100.0		295.5	
Average service life	Years	20.0		20.0	
Average annuity		0.1		0.1	
Capital costs	€/a	647.7		1913.6	
Energy and operating costs					
Energy costs for DHW	€/a	3758.2		1307.0	
Energy costs for household/auxiliary energy	€/a	0.0		109.8	
Fixed costs, meter standing charge	€/a	0.0		0.0	
Total energy costs	€/a	3758.2		1416.8	
Maintenance, service, repairs	€/a	132.0		390.0	
Inspections according to TrinkwV	€/a	0.0		155.0	
Expenses for annual meter reading and billing	€/a	0.0		220.0	
		132.0		765.0	
Total energy and operation-related costs	€/a	3890.2		2181.8	
Total costs					
Total costs	€/a	4537.9		4095.4	
Total costs	€/m²/	5.0		4.5	
	p.a.				
Total costs relative to the decentralised electric system	%	100.0		90.2	
Payback period					
Capital differential	€	-		17200	
	Year	Energy/operating costs	Present value factor	Energy/operating costs	Cumulative return

DHW basic principles

Economic feasibility study to VDI 2067

Payback period

Payback period					
Capital differential	€	-		17200	
	Year	Energy/operating costs	Present value factor	Energy/operating costs	Cumulative return
	1	3890	0.985	2182	15517
	2	3965	0.971	2253	13855
	3	4042	0.956	2327	12215
	4	4120	0.942	2405	10599
	5	4200	0.928	2487	9009
	6	4281	0.928	2573	7447
	7	4364	0.901	2663	5914
	8	4449	0.888	2758	4413
	9	4535	0.875	2858	2946
	10	4623	0.862	2963	1515
	11	4713	0.849	3073	123
	12	4805	0.836	3188	-1229
	13	4898	0.824	3309	-2539
	14	4993	0.812	3436	-3804
	15	5090	0.800	3570	-5020
	16	5189	0.788	3710	-6186
	17	5290	0.776	3857	-7300
	18	5393	0.756	4012	-8357
	19	5498	0.754	4174	-9356
	20	5605	0.742	4344	-10294

Notes

Underlying standards and regulations

The DIN 1988:2012-05 series of standards constituted important regulations specifically designed for national standardisation in Germany. The standard currently consists of the following parts (technical rules for drinking water installations – Part 200: Installation Type A (closed system) – Planning, components, apparatus, materials; DVGW code of practice):

- » Part 100: Protection of drinking water, maintaining the drinking water quality – Technical rules of the DVGW
- » Part 200: Installation Type A (closed system) – Planning, components, apparatus, materials; DVGW code of practice
- » Part 300: Calculating pipe diameters; technical rules of the DVGW
- » Part 500: Pressure raising systems with variable speed pumps; technical rules of the DVGW
- » Part 600: Drinking water installations in conjunction with fire fighting and fire safety systems; technical rules of the DVGW

The DIN 1988:2012-05 series of standards applies together with European standard EN 806-2:2005-06 for the engineering of drinking water installations. It supplements EN 806-2 and makes additional determinations reflecting national laws and regulations (technical rules for drinking water installations – Part 200: Installation Type A (closed system) – Planning, components, apparatus, materials; DVGW code of practice).

This standard divides DHW heaters according to their operating mode into systems or appliances for the following applications.

- » Decentralised supply, and specifically individual supply or group supply
- » Centralised supply

Different requirements also apply based on function (instantaneous DHW heaters, DHW cylinders), structural design (non-pressurised, pressure-tested DHW heaters) and the type of heating (direct or indirect).

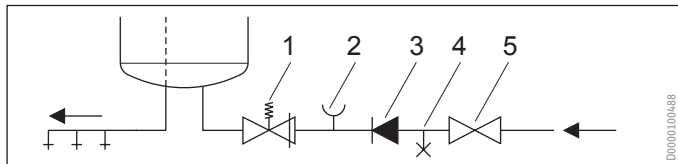
DHW basic principles

DHW installation

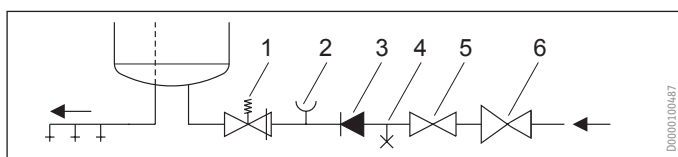
Cold water connection

Follow the requirements of EN 12897 and DIN 1988 Part 200 for the cold water connection. The connection can be established like those in the following illustrations.

Cold water connection



Cold water connection with additional pressure reducing valve



- 1 Safety valve
- 2 Pressure gauge test connector
- 3 Non-return valve
- 4 Test valve
- 5 Straight-through shut-off valve (butterfly)
- 6 Pressure reducing valve

- » Regardless of the type of heating used by the DHW heater, a non-return valve must be installed in the cold water line.
- » A shut-off valve must be installed upstream and downstream of the non-return valve to allow for inspection and replacement. The second, downstream shut-off valve can be dispensed with if the nominal capacity is 200 l or less.
- » A service valve must be installed between the shut-off fitting and the non-return valve to allow the function of the non-return valve to be checked.
- » A connection point for a pressure gauge must be provided as a minimum.

Measures to prevent excessively high pressure; pressure control

For reasons of stability, all parts of DHW systems must be designed for permissible operating pressure of 1 MPa, unless allowance must be made for higher permissible operating pressures or temperatures.

If any DHW heaters are designed only for operating pressures less than 1 MPa, appropriate safety valves must be used and approved.

Non-pressurised DHW heaters

These appliances are constantly open to, and cannot be shut off from, the atmosphere. Decentralised small water heaters are therefore not under mains water pressure. A pressure of 100 kPa must not be exceeded during operation.

Non-pressurised DHW cylinders do not require any safety equipment in the cold water supply line.

Pressure-tested DHW heaters

These appliances are permanently under pressure from the cold water mains line.

Every pressure-tested DHW cylinder must be equipped with at least one suitable diaphragm safety valve.

Nominal diameter of safety valves for pressure-tested DHW heaters:

Valve size *	Nominal capacity	Heating output
Min. DN	l	Max. kW
15 (Rp 1/2)	≤ 200	75
20 (Rp 3/4)	≥ 200 ≤ 1000	150
25 (Rp 1)	≥ 1000 ≤ 5000	250

* The size of the inlet connection is used as the valve size.

DHW basic principles

DHW installation

Diaphragm safety valves

The following applies to the installation of diaphragm safety valves:

- » Install these safety valves in the cold water line. No shut-off valves, restrictions or strainers must be installed between the DHW heater and the safety valve connection.
- » The safety valves should be close to the DHW heater and must be easily accessible. The supply line to the safety valve must be at least of the same nominal diameter as that of the safety valve and must have a length $< 10 \times \text{DN}$.
- » Install the safety valve high enough to enable the connected discharge pipe to be installed with a downward slope. We recommend that the safety valve is fitted above the DHW heater, enabling it to be replaced without having to drain the heater.

The following details apply to the setting pressure (response pressure) of safety valves:

The safety valves supplied by the manufacturer have a fixed setting. The response pressure of the safety valve must be less than or equal to the permissible operating pressure of the water heater. The maximum pressure in the cold water line must be at least 20 % below the response pressure of the safety valve. If the maximum pressure in the cold water line is higher, a pressure reducing valve must be installed.

Max. permissible pressure of the DHW heater MPa	Response pressure of the safety valve MPa	Max. pressure in the cold water line MPa
0.6	0.6	≤ 0.48
0.7	0.7	≤ 0.56
1.0	1.0	≤ 0.8

Pressure-tested instantaneous DHW heater

These appliances are permanently under pressure from the cold water mains line. The water is heated during draw-off.

Appliances with nominal volume $\leq 3 \text{ l}$ can be installed without a safety valve.

DHW distribution and hygiene requirements

DIN 1988-200 states that 30 seconds after the draw-off point is fully opened, the DHW temperature at the draw-off point must be 55 °C. All decentralised devices and DHW heaters with high rates of water exchange are exempt from this rule.

- » Decentralised appliances with a draw-off tap for individual supply, such as small water heaters or mini instantaneous water heaters can be operated without additional hygiene requirements.
- » Decentralised DHW heaters, e.g. instantaneous water heaters, can be operated without additional hygiene requirements if the downstream pipeline volume from heater to draw-off point is less than 3 l.
- » Decentralised cylinders for supply of a group, e.g. in a bathroom, must supply a temperature ≥ 50 °C at the outlet of the cylinder.
- » Centralised DHW heaters, e.g. cylinders, must be designed and constructed so that the temperature at the outlet of the cylinder is always ≥ 60 °C. Brief deviations in the minute range, e.g. during or after peak draw-off, are permitted.
- » When planning and constructing centralised DHW heaters, e.g. cylinders in single-family houses/two-unit apartment buildings or instantaneous water heaters with a downstream pipeline volume of < 3 l, it is important to ensure that a temperature of ≥ 60 °C is possible at the outlet of the DHW heater and a temperature of 55 °C is possible at the inlet of a DHW circulation line. The required cylinder temperature can be set to ≥ 50 °C if the water in the cylinder and pipeline is guaranteed to be exchanged within 3 days of operation and the user is informed during commissioning about the possible health risk (growth of Legionella). Otherwise the set temperature should be 60 °C. Operating temperatures < 50 °C should be avoided.

As a basic rule when installing pipes in systems for group and centralised supply, one should ensure that the pipes are in straight lines, parallel and with pipe runs and distances kept as short as possible.

If the pipeline between the cylinder outlet and the most distant draw-off point has capacity > 3 l, a DHW circulation line should be installed. The temperature in the DHW circulation system must not fall below the water temperature at the cylinder outlet by more than 5 K.

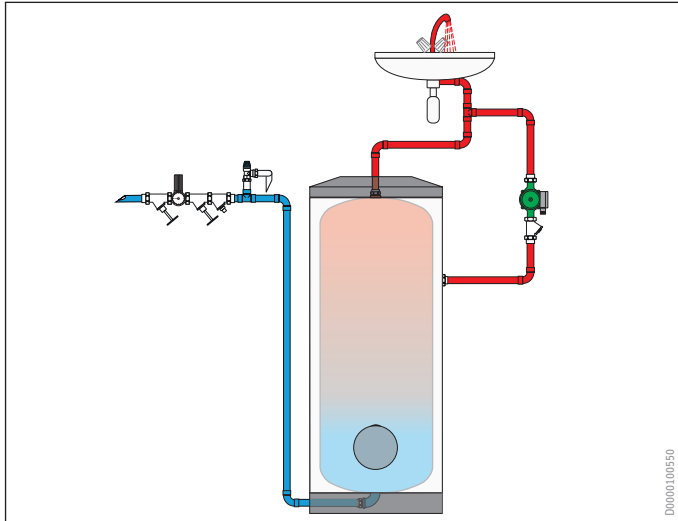
The connecting circuitry for centralised or decentralised cylinders can vary. A few examples are shown below.

DHW basic principles

DHW installation

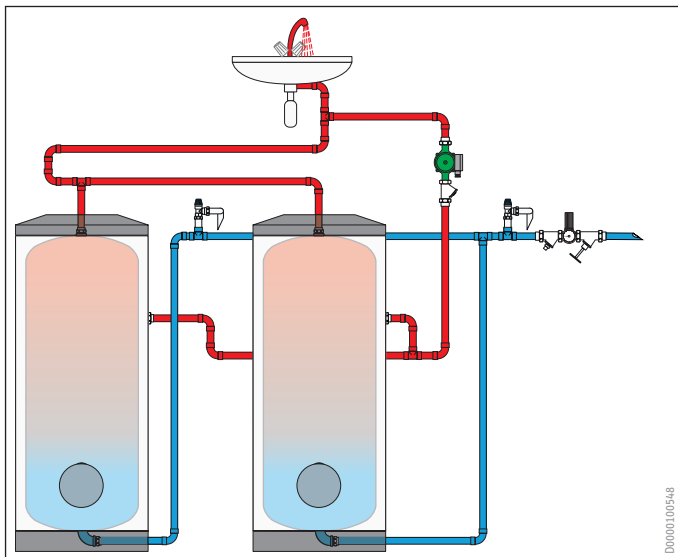
Installation examples

Connection of a floorstanding or wall mounted cylinder, with or without DHW circulation line



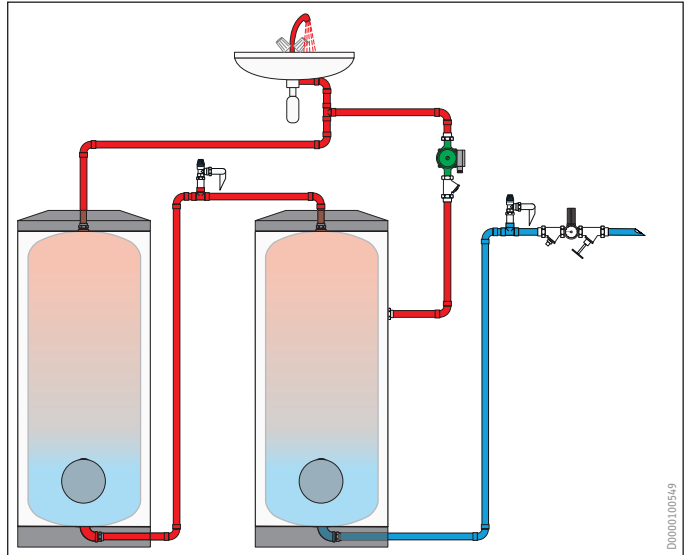
Parallel connection of one or more floor mounted cylinders

Suitable for achieving high peak draw-off flow rates, e.g. in the case of high simultaneous use of the consumers, with simultaneously high availability of reheating, e.g. electrical single circuit operation.



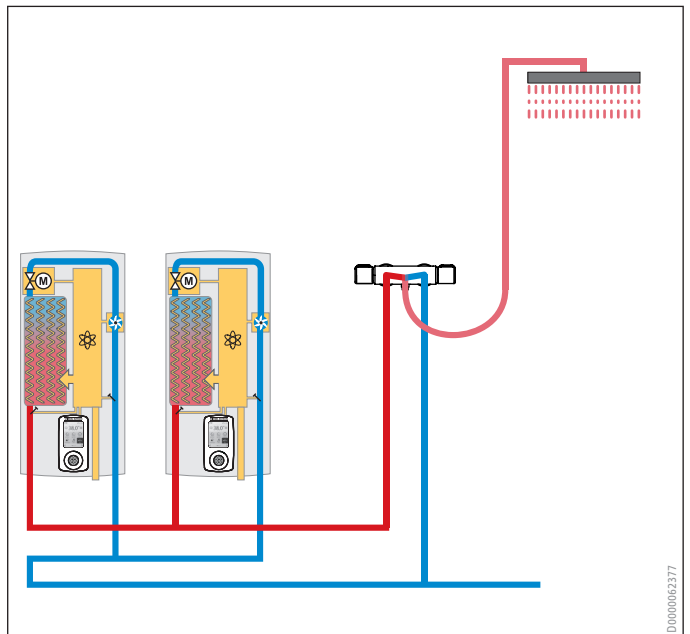
Series connection of one or more floor mounted cylinders

Suitable for achieving high DHW delivery capacity at low draw-off flow rates and with restricted availability of reheating, e.g. electrical dual circuit operation.



Parallel connection of two or more instantaneous water heaters

Suitable for covering higher DHW demands such as rain showers or commercial applications.



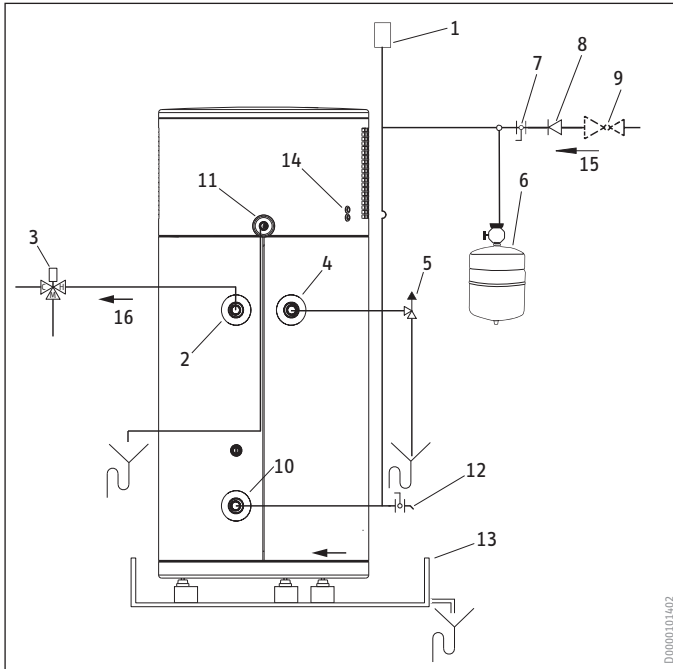
DHW basic principles

DHW installation

Sample installation

In some countries, the connection to the water supply requires the installation of a temperature and pressure-dependent (T&P) valve.

Connecting a DHW cylinder with T&P valve using a DHW heat pump as an example

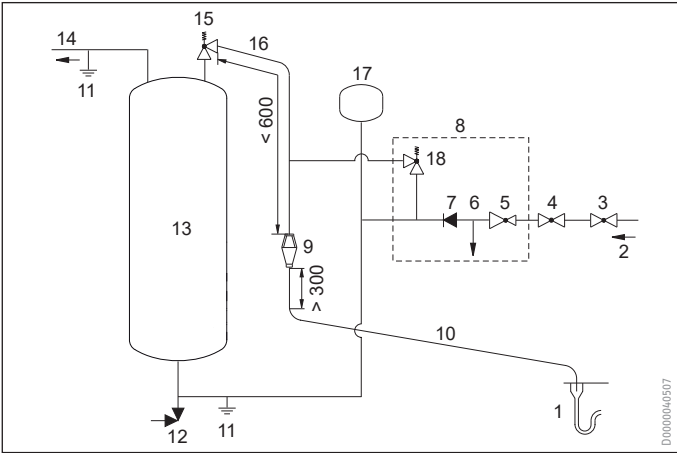


- 1 Vacuum breaker (poppet valve)
- 2 Hot water connection
- 3 Central thermostatic valve
- 4 Connection for T&P valve
- 5 T&P valve
- 6 Diaphragm expansion vessel
- 7 Straight-through shut-off valve
- 8 Non-return valve
- 9 Pressure relief valve
- 10 Cold water connection
- 11 Condensate drain
- 12 Drain valve
- 13 Drip pan
- 14 Condensate overflow

DHW basic principles

DHW installation

DHW installation with T&P valve



- 1 Drain with trap
- 2 Cold water inlet
- 3 Shut-off valve
- 4 Dirt trap
- 5 Pressure reducer
- 6 Test valve
- 7 Non-return valve
- 8 Safety assembly
- 9 Intermediate container (tundish)
- 10 Drain pipe (D2) with constant fall
- 11 Equipotential bonding connection
- 12 Drain valve
- 13 DHW cylinder
- 14 DHW outlet
- 15 T&P valve
- 16 Drain pipe (D1) with constant fall
- 17 Diaphragm expansion vessel
- 18 Safety valve

Diameter of drain pipe (D1)	min. mm			22
Diameter of drain pipe (D2)	min. mm	28	35	42
Maximum permissible pressure drop, expressed as length of straight pipe (i.e. no elbows or bends)	m	9	18	27
Pressure drop per elbow or bend	m	1.0	1.4	1.7

Notes

DHW basic principles

Sound insulation

Sound insulation for instantaneous water heaters and taps

Sound insulation requirements apply in Germany, e.g. the DIN 4109 series of standards. The standard provides information on permissible sound pressure levels in rooms and requirements for appliances and taps.

The general Building Regulation test certificate [Germany] verifies the suitability of the product listed in the certificate in accordance with the State Building Order with regard to noise emissions.

To verify their suitability regarding noise emissions, valves/taps and instantaneous water heaters must have a designation beginning with a Ü (conformity symbol), based on a "general building regulation test certificate", and must also have a "P" mark. This does not apply to DHW cylinders.

The previous format of the P-IX test symbol forms part of the Ü designation.

	Meaning
	Conformity symbol for building products in accordance with the State Building Orders [Germany]. The manufacturer certifies conformity for fittings/taps and instantaneous water heaters based on their noise characteristics. A general test certificate is issued by the building supervisory authority. Example: The test certificate number for the instantaneous water heater type DHE is PA-IX.

DHW basic principles

Water quality and cylinder protection

Introduction

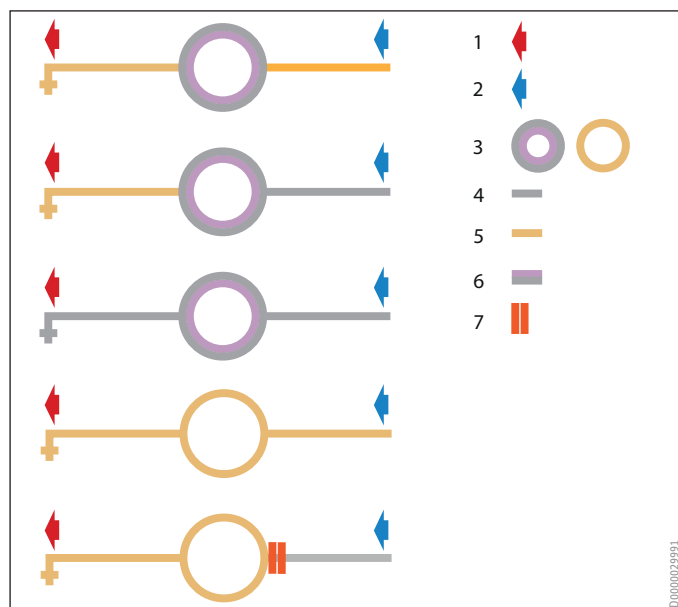
Combining appliances, internal cylinders and pipes of different materials may affect the likelihood of corrosion of particular components.

The functioning and durability of DHW appliances are therefore highly dependent on selecting the right materials for inner cylinders and pipes.

In addition to the operating conditions and the installation design, the corrosion characteristics of a material are strongly influenced by the chemical composition of the water.

The following table and diagram show possible suitability and possible installation options for the DHW heater.

Cylinder material	Suitability
Copper	For any kind of water
Polypropylene	For any kind of water
Steel with internal directly applied enamel coating	For any kind of water



- 1 DHW outlet line
- 2 Cold water supply line
- 3 Appliance
- 4 Galvanised steel
- 5 Copper
- 6 Steel with internal enamel coating
- 7 Intermediate piece made of gunmetal

It is thus possible to combine copper pipes with pipes made from galvanised steel, for example. In this case, the products made of galvanised steel must be installed before the copper in the direction of flow.

The water flows from the galvanised steel material to the components made of copper. Direct contact between the two materials must be prevented, e.g. by using an intermediate piece made of gunmetal. Using both materials in a DHW circulation system is not possible.

The use of taps made from copper alloys is not critical in this context, because the surface area of the taps is relatively small.

Likewise, the corrosion risk from the use of instantaneous water heaters with galvanised pipes is quite low because only a relatively small copper surface is exposed to the water by such appliances. The number of copper ions leaching into the water is minimal. However, this requires a sound water quality at the installation location plus adequate flushing of the pipework to prevent the formation of corrosion nuclei. The relevant decision regarding use has to be made on site by the qualified contractor.

With respect to the water quality, it is recommended to make use of practical experience of the water at the site, or to consult the local water supply utility in order to make an assessment using a water analysis or to find out about any expected changes in the water quality.

The EN 12502 series of standards, for example, lists the values required in the water analysis and the procedure for an assessment.

The assessment of the electrical conductivity of the water is important for the use of instantaneous water heaters with a bare wire heating system.

DHW basic principles

Water quality and cylinder protection

Applications for instantaneous water heaters

Standard specification at		15 °C	20 °C	25 °C	30 °C	45 °C	55 °C	60 °C
Resistance	Ω cm	≥900	≥800	≥735	≥670	≥550	≥490	≥470
Conductance	μS/cm	≤1110	≤1250	≤1360	≤1490	≤1820	≤2040	≤2130
Resistance	Ω cm	≥1000	≥890	≥815	≥739	≥600	≥540	≥515
Conductance	μS/cm	≤1000	≤1120	≤1230	≤1350	≤1670	≤1850	≤1940
Resistance	Ω cm	≥1100	≥970	≥895	≥810	≥660	≥590	≥565
Conductance	μS/cm	≤910	≤1030	≤1120	≤1240	≤1520	≤1700	≤1770
Resistance	Ω cm	≥1200	≥1070	≥985	≥900	≥720	≥650	≥615
Conductance	μS/cm	≤830	≤940	≤1020	≤1110	≤1390	≤1540	≤1630
Resistance	Ω cm	≥1300	≥1175	≥1075	≥970	≥780	≥700	≥670
Conductance	μS/cm	≤770	≤850	≤930	≤1030	≤1280	≤1430	≤1490

Conversion factor: 10 μS/cm = 1 mS/m

For bare wire DHW heaters, the maximum leakage current is 5 mA in accordance with EN 60335.

According to EN 60335, the resistivity of the water at 15 °C must not fall below 1300 Ω cm.

Enamelled cylinders

All steel cylinders have a high quality enamel coating on the inside for corrosion protection.

For additional corrosion protection, protective magnesium anodes or impressed current anodes are installed on some models.

Protective magnesium anode

Protective magnesium anodes compensate for any flaws in the enamel coating.

Signal anode with display element

Protective magnesium anodes can be equipped with a display element. As soon as the anode is consumed, water penetrates into the visual display element which contains food colouring.

Signal anode

Protective magnesium anodes can be equipped with a signalling facility. A service indicator on the user interface illuminates as soon as the anode has been consumed.

Impressed current anode

If the appliance has an impressed current anode, the intensity of the protective current required will vary depending on the presence of any flaws. The impressed current anode is electronically controlled. Unlike the protective magnesium anode, it does not need to be replaced. A permanent power supply is required to ensure that the cylinder is protected.

DHW basic principles

Electrical connection - Fuses

Fuses/MCBs and cable cross-sections

The power supply connection specifications vary according to country, region and power supply utility and must be clarified in advance.

General design information

When designing a system for DHW heating, the design engineer must also deal with the electrical power supply to the system.

Important aspects of this include the following:

- » Determining the output demand
- » Selecting diversity factors
- » Complying with general and engineering standards
- » Using protective equipment
- » Determining safety measures and zones of use

The standards and regulations to be observed when designing the electrical connection include the following.

Neither this list of standards and regulations nor the excerpts of them that follow are intended to be exhaustive. All accepted engineering standards must always be followed in their currently applicable versions.

- » DIN 18015-1:2020- 05, Electrical installations in residential buildings, Part 1: Planning principles
- » DIN VDE 0100-430 (VDE 0100-430), Low-voltage electrical installations, Part 4-43: Protection for safety; Protection of cables and leads against overcurrent
- » DIN VDE 0100-520 (VDE 0100-410), Low-voltage electrical installations, Part 520: Wiring systems, Supplement 2: Protection against overload, Selection of overcurrent protective devices
- » EN 60269-1, VDE 0636-1, Low-voltage fuses, Part 1: General requirements
- » EN 60898-1, VDE 0641-11, Electrical accessories – Circuit breakers for overcurrent protection for household and similar installations, Part 1: Circuit-breakers for AC operation

In the preliminary design / planning / engineering phases, the electricity network operator or local power supply utility must be consulted regarding the connection requirements for the building project. The requirements of the locally applicable building laws must also be observed.

Primary power supply and diversity factor

The design engineer must determine the cross-section, type and number of main lines based on the number and type of the appliances to be connected. Simultaneity during operation must also be considered. Main lines must always be designed as AC lines.

DIN 18015-1:2007-09 defines the basis for sizing main lines in residential buildings without electric central heating. Based on that, the following information can be used for the sizing of main lines in conjunction with the use of decentralised electric instantaneous water heaters.

The detailed planning and design must be carried out in accordance with the requirements of the standard.

With electric DHW heating for bath or shower purposes, without electric central heating

Maximum number of apartments *	Maximum output kVA	Rated current for overcurrent protection devices in residential buildings, main line A
1	34	63
2	52	80
3	64	100
4-6	87	125
7- 11	110	160
12-22	138	200
23-45	170	250
46-100	205	315

* with reference to DIN 18015-1:2007-09

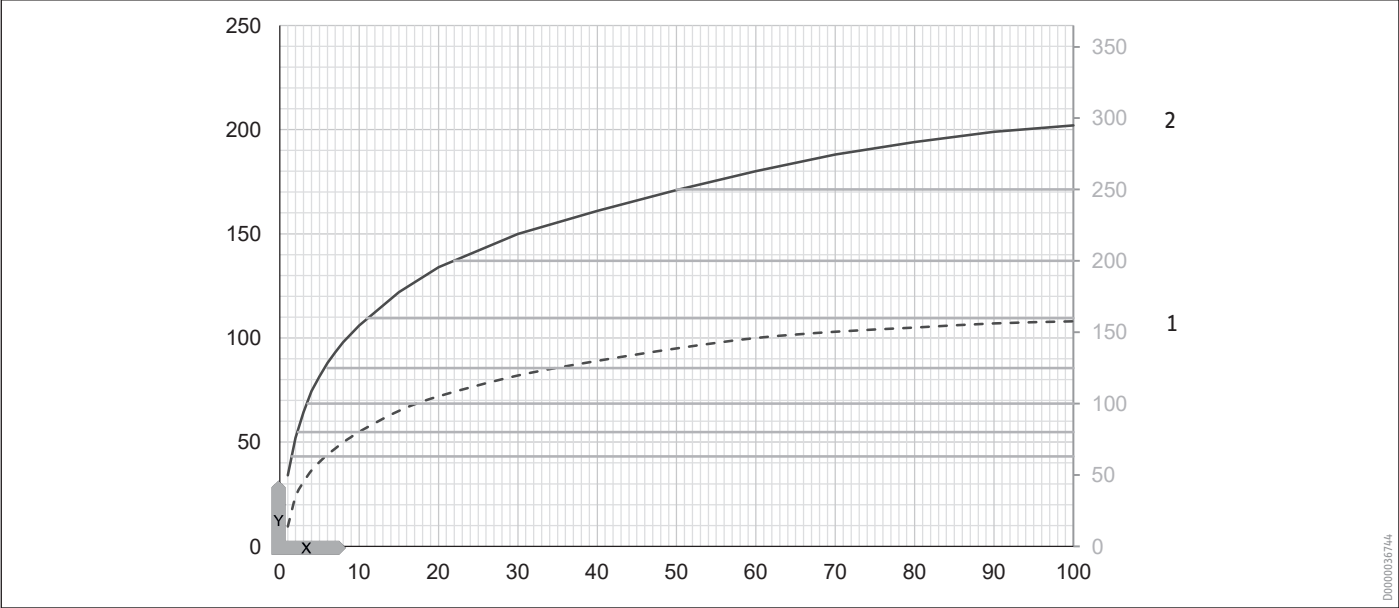
Without electric DHW heating for bath or shower purposes, without electric central heating

Number of apartments *	Maximum output kVA	Rated current for overcurrent protection devices in residential buildings, main line A
1	14.5	63
2-10	55	80
11-17	69	100
18-36	87	125
37-100	108	160

* with reference to DIN 18015-1:2007-09

DHW basic principles

Electrical connection - Diversity factor



- x Number of apartments
- Y Electric power, derived from the required current carrying capacity and the rated voltage [kW]
- 1 Minimum required current carrying capacity [A]
- 2 With electric DHW heating for bath or shower purposes

The curves shown on the graph represent a basis for sizing main lines in apartments without electric central heating.

The curve "With electric DHW heating for bath or shower purposes" is applied if the bath and shower water is sourced from instantaneous water heaters, DHW cylinders or instantaneous water cylinders.

Example

The connected load for 10 residential units is either 55 kW (without DHW heating) or 105 kW (with DHW heating). For the 10 installed instantaneous water heaters, it is therefore not the total installed output of e.g. 10 x 27 kW which is applied but simultaneity in operation that is considered. The overcurrent protection device or the building connection would need to have a rating of 160 A for this example.

If in addition to a centralised supply, appliances with connected loads < 6 kW are used, such as small water heaters or mini instantaneous water heaters, the curve "without electric DHW heating" would apply. However, in that case, the connected load of the centralised heat generator for DHW heating would need to be added to the value determined.

Priority control

A load shedding relay is required for the operation with priority control.

A load shedding relay is used when the cable cross-sections are too small to allow two large electrical loads to be operated at the same time.

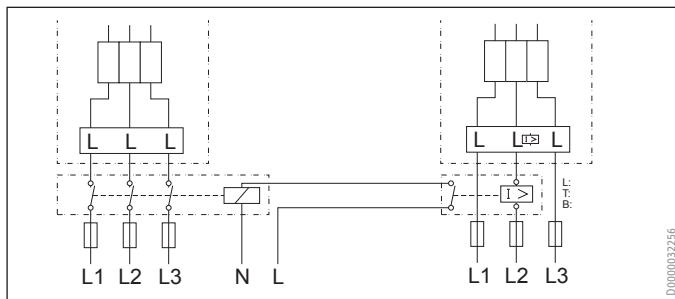
This is often the case in apartments where an instantaneous water heater is to be installed for DHW heating in addition to DHW cylinders, for example.

If a load shedding relay is used, the power connection does not need to be able to handle simultaneous operation of both large loads.

When the appliance that operates for short periods is switched on, the load shedding relay switches off the load that operates long-term.

The maximum selectable output of the instantaneous water heater must be taken into account when sizing.

The load shedding relay and the contactor must be installed in the control panel.



Overcurrent protection devices

Cable and wiring systems must be installed according to DIN VDE 0100-520. The choice of overcurrent protection device and the cable cross-section depends on factors such as the routing method, the cable length and the cable design.

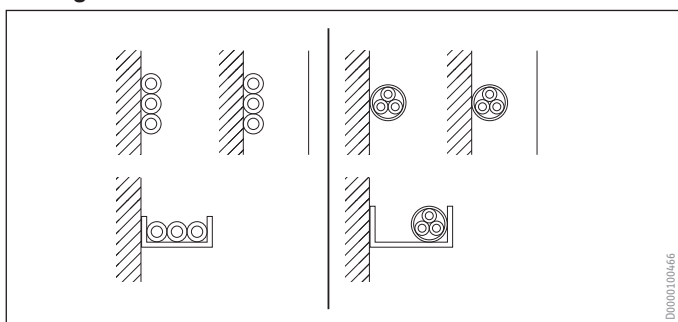
The guidelines shown here must always be compared and checked with reference to the local conditions, the requirements of the power supply utility, and accepted engineering standards.

Once the design engineer has identified a cable and wiring design suitable for the purpose, the next step is to select the cable or conductor cross-section based on the expected operating current and the routing method. Then the device for protection against overload is selected.

The following table contains reference values for various connected loads and routing methods.

Connected load	Voltage	Operating current	Routing method B2: Routing in electrical conduits on or in walls		Routing method C: Direct routing on or in walls	
			Nominal conductor cross-section mm ²	Maximum permissible rated current for overcurrent protection device A	Nominal conductor cross-section mm ²	Maximum permissible rated current for overcurrent protection device A
3.5	230	15.2	1.5	16	1.5	16
4.4	230	19.1	2.5	20	2.5	20
5.7	230	24.3	4	32	2.5	25
6.5	400	9.4	2.5	2x16	2.5	2x16
11.0	400	15.9	2.5	3x16	2.5	3x16
12.0	400	17.3	2.5	3x20	2.5	3x20
13.5	400	19.5	2.5	3x20	2.5	3x20
15.0	400	21.7	4	3x25	2.5	3x20
18.0	400	26.0	6	3x35	4	3x35
21.0	400	30.3	6	3x35	4	3x35
24.0	400	34.6	6	3x35	6	3x40
27.0	400	39.0	10	3x40	6	3x40

Routing method "C"



Example

Given: Routing method C, nominal conductor cross-section 4 mm²

To be determined: Maximum permissible rated current for overcurrent protection device for a connected load of 18.0 kW, voltage 400 V, operating current 26.0 A

Solution: 3x35 A, (3 live cores, each 35 A)

Connected load	Voltage	Operating current	Routing method B2: Routing in electrical conduits on or in walls		Routing method C: Direct routing on or in walls	
			Nominal conductor cross-section	Maximum permissible rated current for overcurrent protection device	Nominal conductor cross-section	Maximum permissible rated current for overcurrent protection device
kW	V	A	mm ²	A	mm ²	A
3.5	230	15.2	1.5	16	1.5	16
4.4	230	19.1	2.5	20	2.5	20
5.7	230	24.3	4	32	2.5	25
6.5	400	9.4	2.5	2x16	2.5	2x16
11.0	400	15.9	2.5	3x16	2.5	3x16
12.0	400	17.3	2.5	3x20	2.5	3x20
13.5	400	19.5	2.5	3x20	2.5	3x20
15.0	400	21.7	4	3x25	2.5	3x20
18.0	400	26.0	6	3x35	4	3x35
21.0	400	30.3	6	3x35	4	3x35
24.0	400	34.6	6	3x35	6	3x40
27.0	400	39.0	10	3x40	6	3x40

DHW basic principles

Electrical connection - Safety zones

Residential complexes

A power distribution board for the required overcurrent and residual current devices must be provided in each apartment. The appliances for DHW heating must be taken into account when selecting the power distribution board capacity.

The electric cable from the meter panel to the power distribution board must be an AC cable designed with a carrying capacity of at least 63 A.

An AC line with permissible current carrying capacity of at least 35 A must be provided for the connection of electric DHW heating with instantaneous water heaters for bath and/or shower purposes in the apartment.

If rooms/bathrooms/toilet are fitted with a bath tub or shower, special requirements must be considered, e.g. regarding the separation of protection zones according to DIN VDE 0100-701 or additional protective devices.

Departments

The defined zones and rooms with bath tub or shower can be separated by walls with or without windows and doors, horizontal or inclined ceilings, floors and/or permanently installed partitions. If the dimensions of the permanently installed partitions are smaller than the dimensions of the respective zones, the minimum clearance must be maintained horizontally and vertically. This applies, for example, in the case of partitions with a height less than 225 cm. The minimum clearance may also be called the reach-round radius, overreach radius, or safety distance.

Description of zone 0

Zone 0 (zero) is the inside of the bath tub or shower tray. Zone 0 does not apply to showers without tray.

Only electrical equipment with IP X7 protection may be installed in this zone.

Electrical consumers in this zone must meet the following conditions:

- » The appliance must be suitable for use and installation in this zone, according to the manufacturer's details.
- » The appliance must be permanently installed in a fixed position and permanently connected to the power source.
- » The appliance must be protected by SELV with a rated voltage not in excess of 12 V AC or 30 V DC.

Description of zone 1: Zones in rooms with a bath tub or shower tray

Horizontal limits of zone 1

- » Surface of the finished floor
- » The horizontal plane at the height of the highest fixed shower head or highest fixed water outlet, or at a height of 225 cm above the surface of the finished floor, whichever is the higher

Vertical limits of zone 1

- » Outer edges of the bath tub or shower tray, or for showers without tray, at a distance of 120 cm from the centre of the fixed shower head or fixed water outlet on the wall or ceiling

Zone 1 is not included in zone 0. Zone 1 includes the area below bath tubs and shower trays down to the surface of the finished floor.

Description of zone 2

Horizontal limits of zone 2

- » Surface of the finished floor
- » The horizontal plane at the height of the highest fixed shower head or highest fixed water outlet, or at a height of 225 cm above the surface of the finished floor, whichever is the higher

Vertical limits of zone 2

- » Vertical planes at the limit of zone 1 and the vertical planes parallel to them at a distance of 60 cm from the limit of zone 1

There is no zone 2 in the case of showers without tray. In such cases, zone 1 is enlarged to 120 cm in its horizontal dimension.

Water heaters can be installed in zones 1 and 2 as long as they are permanently installed in a fixed position and permanently connected to their power source. The protection rating required for zones 1 and 2 is at least IP X4.

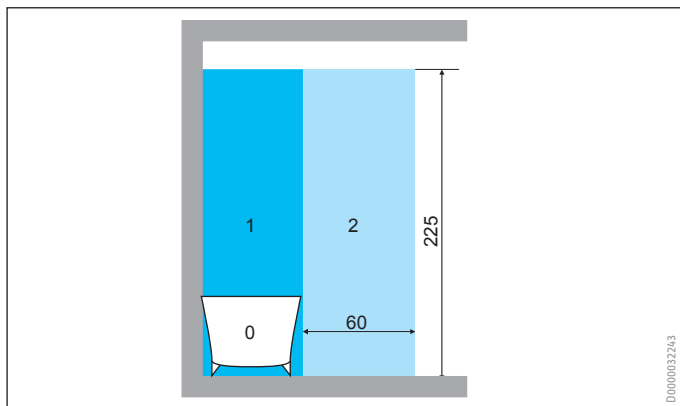
If electrical equipment is exposed to water jets or hose water, e.g. for cleaning purposes, IP X5 protection must be adhered to in zones 1 and 2.

There are no requirements laid down for protection ratings for areas beyond zones 0 to 2.

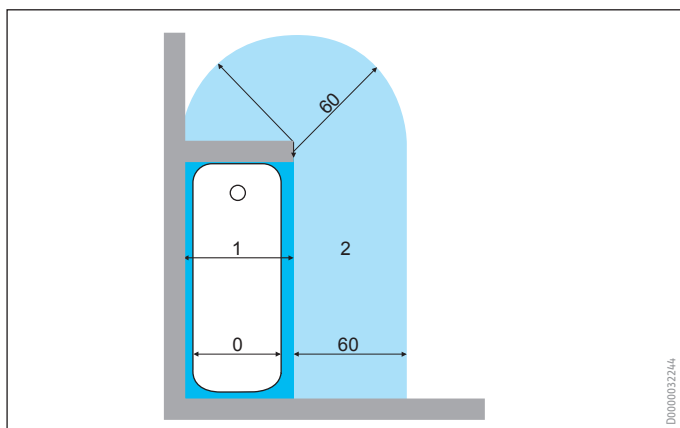
DHW basic principles

Electrical connection - Safety zones

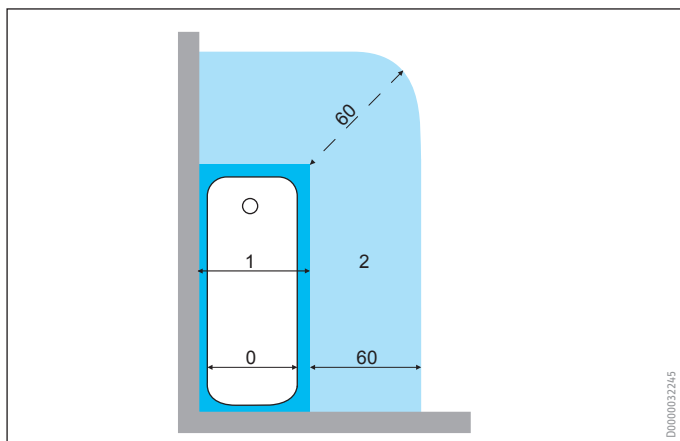
Dimensions of zones 0, 1 and 2 in rooms with bath tub or shower tray



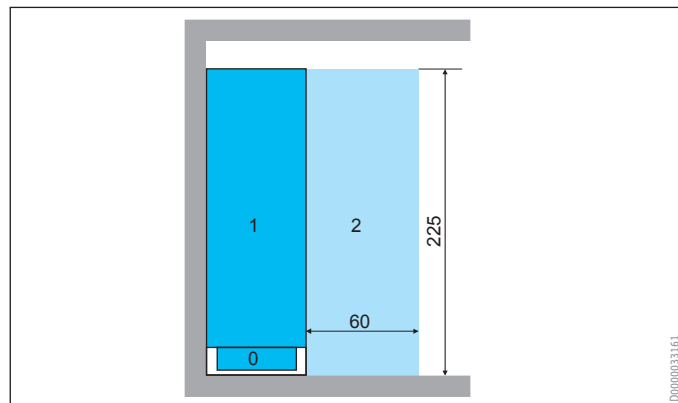
Side view



Plan view with permanently fitted partition and minimum clearance radius for reach-round



Plan view

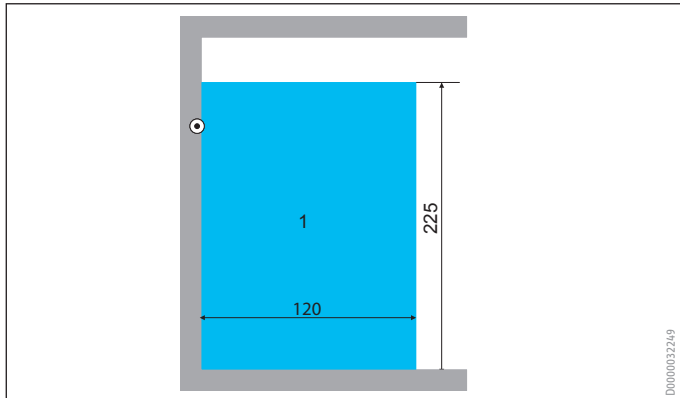


Side view, shower

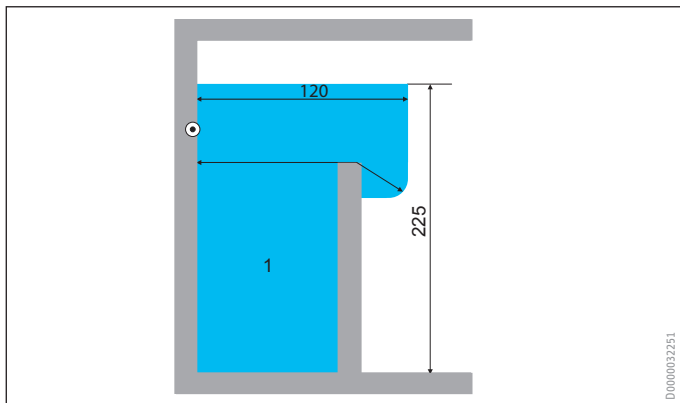
DHW basic principles

Electrical connection - Safety zones

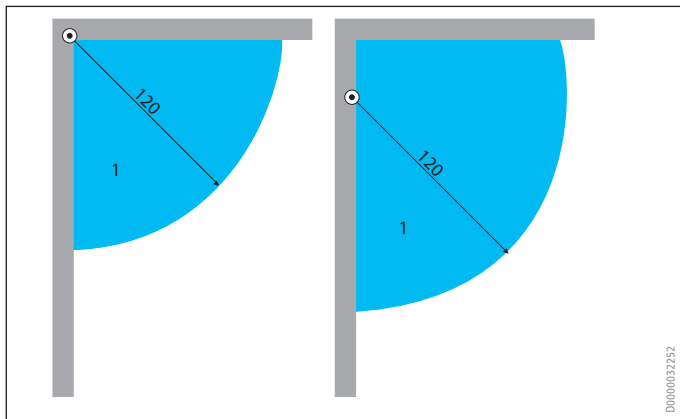
Dimensions of zone 1 in rooms with shower but without bath tub



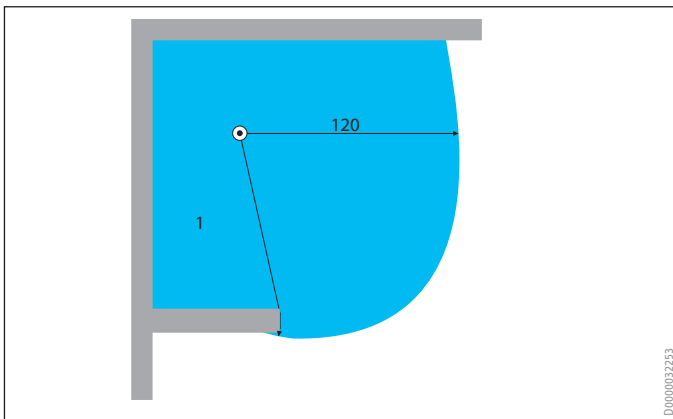
Side view



Side view with permanently fitted partition and clearance for overreach



Plan view with alternate water outlet points



Plan view with permanently fitted partition and clearance for reach-round
All dimensions in cm

- ⊙ Permanently installed water outlet

DHW basic principles

Electrical connection - Protection ratings

IP rating of enclosures to EN 60529

The IP rating of the appliance is shown on the type plate.

IP code

Component	Numerals or letters	Meaning for protection of the equipment	Meaning for protection of people
Letter code	IP	–	–
First digit	2	Prevents ingress of solid foreign bodies ≥ 12.5 mm diameter	Prevents access to dangerous parts with fingers
Second digit	3	Protected against sprayed water	Water falling as a spray at any angle up to 60° from the vertical shall have no harmful effect
	4	Protected against splashed water	Water splashed against the enclosure from any direction shall have no harmful effect
	5	Protected against water jets	Water projected as a jet against the enclosure from any direction shall have no harmful effect

If a digit in the code is not specified, it is replaced by an "X". Example: IP X4

Additional protection through residual current devices (RCD)

For power circuits in rooms with a bath tub or shower, it is necessary to provide one or more residual current devices with a rated residual current of $I_{\Delta N} \leq 30$ mA. In the following cases, the additional protection of residual current devices (RCDs) is not required:

- » Power circuits which are exclusively intended for the supply of permanently connected DHW heaters
- » Power circuits with the protective measure "Protection by safety separation" and which supply an individual consumer
- » Power circuits with the protective measure "Protection by extra low voltage:

Supplementary equipotential bonding

In buildings with protective equipotential bonding of the entire installation with the main earthing bar, supplementary protective equipotential bonding is not required.

If that is not the case, the following extraneous conductive parts leading into rooms with a bath tub or shower must be integrated into a supplementary equipotential bonding arrangement:

- » Parts of water mains and drain networks
- » Parts of heating and air conditioning systems
- » Parts of gas supply systems

Protection of cable and wiring systems

- » Cable and wiring systems supplying electrical equipment, such as DHW heaters in rooms with a bath tub or shower, and which are installed in those rooms or in walls of those rooms, must be fitted with an earth conductor which has continuity with the earth conductor of the electrical system.
- » If the appliance is permanently fitted over the bath tub or shower tray, or over the cubicle floor in the case of showers without tray, electric cables and leads supplying the appliance in zone 1 must be laid vertically from above or horizontally through the adjoining wall to the back of the appliance.
- » If the appliance is permanently fitted under the bath tub or shower tray, electric cables and leads supplying the appliance in zone 1 must be laid vertically from below or horizontally through the adjoining wall to the back of the appliance.
- » All other electric cables and leads and their accessories must be laid at a depth of at least 6 cm from the surface of the wall.
- » When compliance with the latter requirement is not possible, DIN VDE 0100-701 describes exceptions.
- » Flat webbed house wire to DIN VDE 0250-201 (VDE 0250 part 201) must not be laid up to a depth of 6 cm from the wall surface inside walls, ceilings, sloping roofs or fixed partitions, in rooms containing a bath tub or shower.

Comfort instantaneous water heater

Basics



Comfort instantaneous water heater

Application

Application

Install the instantaneous water heaters in a room that is free from the risk of frost and near the draw-off points. Observe VDE 0100, part 701 [or local regulations for protection zones].

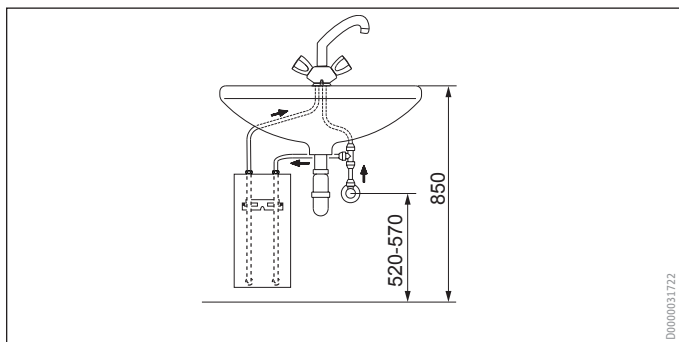
In accordance with EN 60335-2-35:2016 or VDE 0700-35, instantaneous water heaters in shower applications must be limited to $T_{\max} = 55^{\circ}\text{C}$. The temperature limit must be adjusted by the qualified contractor as part of the installation process. Our instantaneous water heaters can be limited by means of technical measures or are provided with instructions for use in the operating and installation instructions.

Installation examples

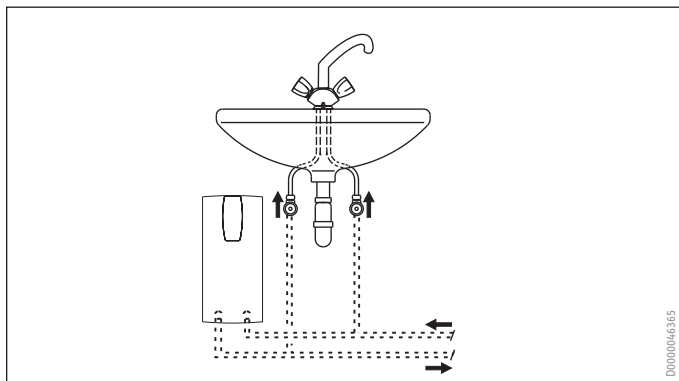
The following installation dimensions are recommended. Always check the dimensions of the site and compare.

Comfort instantaneous water heater

Washbasin, undersink, surface-mounted

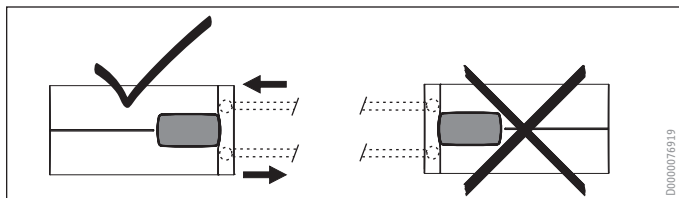


Washbasin, undersink, flush-mounted



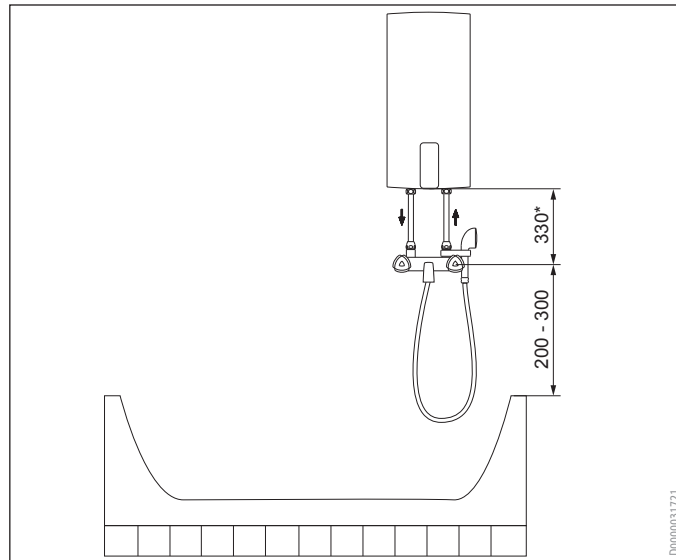
On some types of instantaneous water heater, the cover can be turned the other way up for optimum operating convenience.

Horizontal in a suspended ceiling

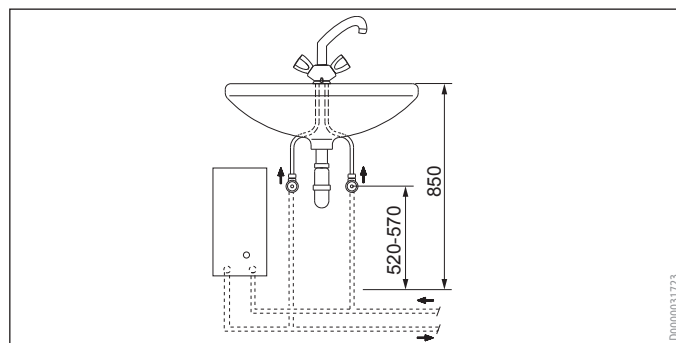


Not applicable to all instantaneous water heaters.

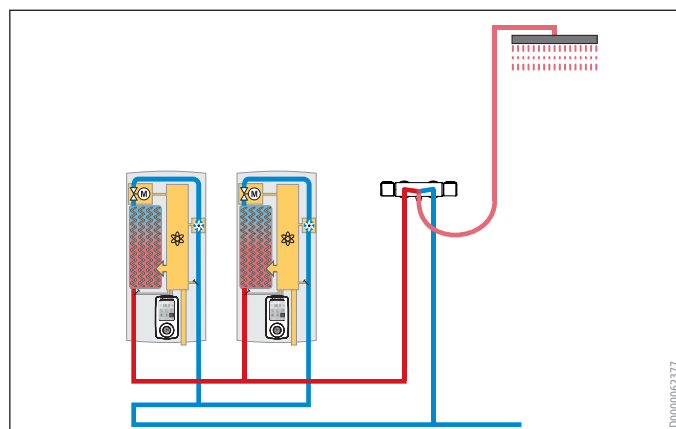
Bath tub, oversink, surface-mounted



Washbasin, undersink, flush-mounted



Parallel connection of two or more instantaneous water heaters



Suitable for covering higher DHW demands such as rain showers or commercial applications.

Operation with preheated water is an option for many electronically controlled comfort instantaneous water heaters.

Comfort instantaneous water heater

Installation

STIEBEL ELTRON Profi-Rapid®

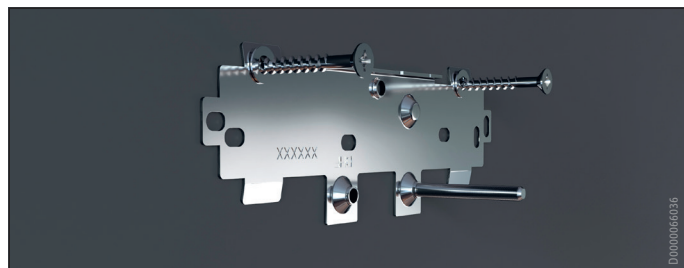
The STIEBEL ELTRON Profi-Rapid® installation system offers many practical details to enable professional and rapid installation.

- » Universal mounting rail with central tile compensation
- » Freely accessible installation area for the water connections (flush-mounted or surface-mounted)
- » Central fixing screw for service
- » Optional installation inside the water jet area in a shower cubicle
- » Installation in self-supporting frames
- » Universal water connection with twin nipple technology fits all instantaneous water heaters from STIEBEL ELTRON
- » Cold water shut-off valve for shutting off in finished or unfinished wall installations
- » Operating convenience for undersink installation thanks to rotatable cover
- » Suitable for use with plastic pipes
- » Freely accessible electrical connection at the top or bottom
- » Special kits for extreme installation requirements

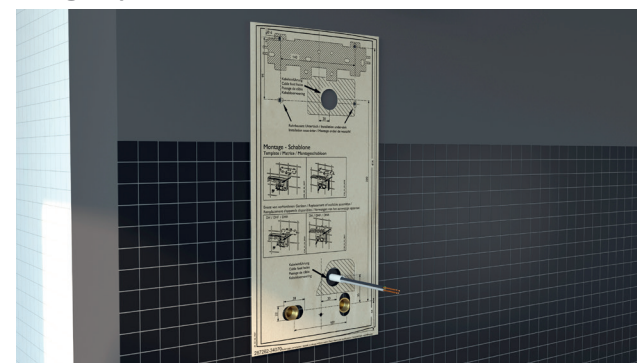
Wall mounting

The universal mounting rail fits without new holes needing to be drilled when replacing appliances. Existing rawl plug fixing holes, even from third party manufacturers, can be used.

Tile offsets of up to 20 mm can be compensated.

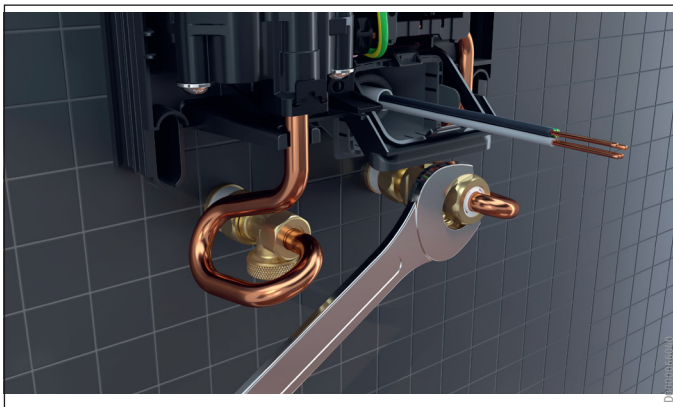
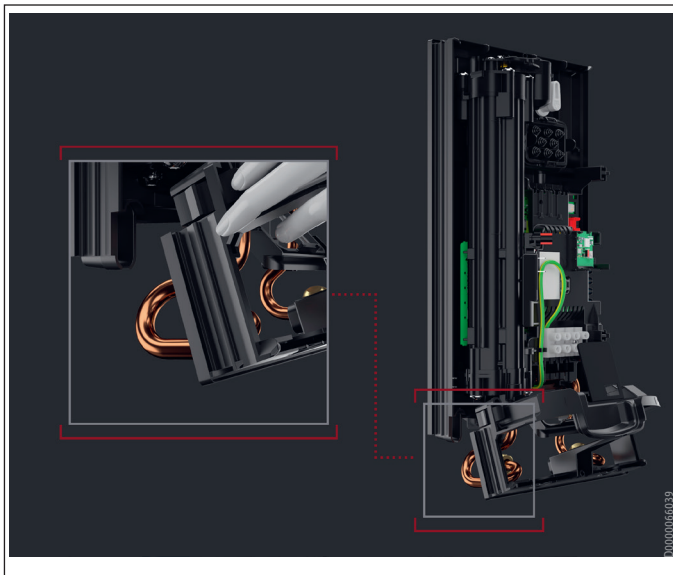


Drilling template to aid installation



Easily accessible installation area

Back of appliance can be removed without tools for convenient access to the water connection.



Comfort instantaneous water heater

Installation

Hoseproof to IP 25

The casing is designed to be hoseproof. Installation inside the shower or above the bath tub in protection zone 1 is permissible.

Self-supporting installation

The slimline design of some of the model series makes them an ideal choice for integration into self-supporting systems in conjunction with a recessed enclosure. In particular the electronic instantaneous water heaters with remote control are an excellent choice for self-supporting installations.



Hydraulic connection

Observe the details regarding water quality and materials, EN 806/DIN 1988, and the regulations specified by your local water supply utility. Subject to the flow rate, instantaneous water heaters feature a varying pressure drop that must be taken into consideration during engineering and when selecting the installation location. Operation with preheated water is an option for many electronically controlled instantaneous water heaters.

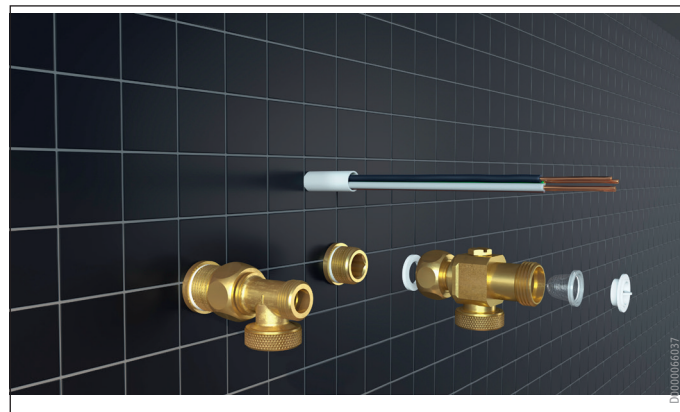
The standard water connection system for all STIEBEL ELTRON instantaneous water heaters ensures quick and smooth connection of the cold and hot water lines, in both new and replacement installations.

Twin nipple technology (comfort instantaneous water heaters only)

The twin nipple method has proven to be very useful in practice over several decades. The interface to the water installation remains detachable, even in very old pipework systems.

Three-way shut-off with ball valve (only comfort instantaneous water heaters)

The universal three-way ball valve is set onto the twin nipple. The shut-off is effective for water connections on finished and unfinished walls. In case of replacement, the existing three-way ball valve can remain installed in the cold water piping so that it is not necessary to shut off the water in the branch or main line. For flush-mounted installation, a surface-mounted tap, or a surface-mounted tap with additional draw-off point.



Flow limiter

Comfort instantaneous water heaters have an integral flow limiter. Other flow limiters can be used if required.

Suitable for use with plastic pipes

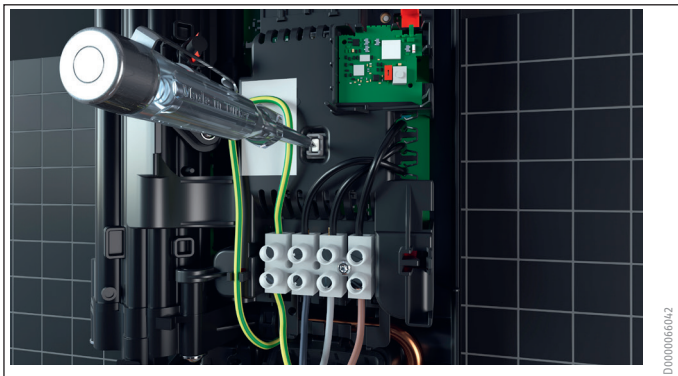
The manufacturer's details for the plastic pipe systems and the specifications of the DHW appliances must be observed.

Comfort instantaneous water heater

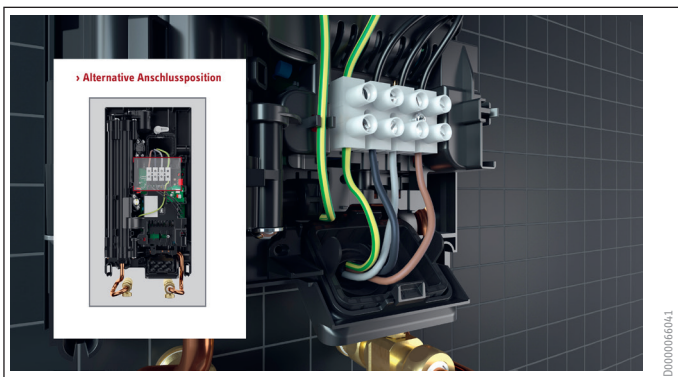
Installation

Electrical connection

As standard, the electrical connection is made in the lower section of the appliance.



When replacing third party appliances, the electrical connection is frequently made in the upper part of the appliance. By relocating the terminal block, the electrical connection can be easily moved to provide the connection at the top.



Output adjustment

On many electronic instantaneous water heaters, it is possible to reduce the maximum connected load from e.g. 24 kW to 21 kW or 18 kW.

This enables the output of the instantaneous water heater to be adjusted at the installation location to suit the available cable cross-sections and fuse ratings.

Profi-Direct

The app is the ideal service tool to enable qualified contractors to diagnose faults and carry out repair work on STIEBEL ELTRON instantaneous water heaters.

Simply scan the QR code on either the type plate or the appliance display screen to receive all of the required service information, such as step-by-step diagnostics, relevant spare parts, conversion instructions and product-specific documents.

With this app, you'll always have all the information you need in your pocket – on your smartphone or tablet.

Appliance information by scanning the QR code.



Service information for diagnosis and repair.



Notes

Compact instantaneous water heater

Basics



Compact instantaneous water heater

Application

Application

Compact instantaneous water heaters are available both as pressure-tested and non-pressurised appliances.

For non-pressurised operation, suitable taps must be used. Only one single draw-off point can be supplied in non-pressurised operation.

Install the compact instantaneous water heaters in a room that is free from the risk of frost and near the draw-off points. Observe VDE 0100, part 701 [or local regulations for protection zones].

Operation with preheated water is an option for many electronically controlled compact instantaneous water heaters.

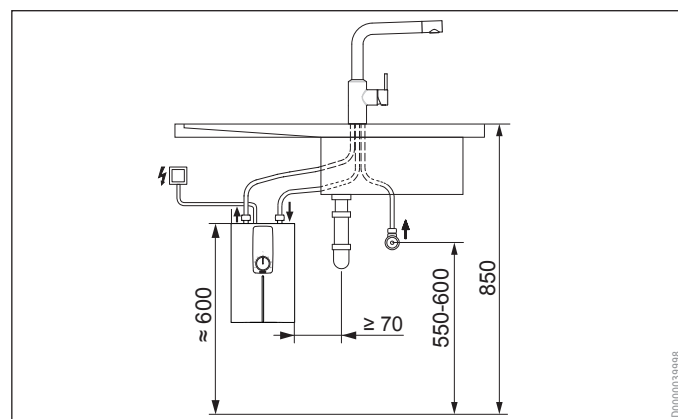
In accordance with EN 60335-2-35:2016 or VDE 0700-35, instantaneous water heaters in shower applications must be limited to $T_{\max} = 55\text{ °C}$. The temperature limit must be adjusted by the qualified contractor as part of the installation process. Our instantaneous water heaters can be limited by means of technical measures or are provided with instructions for use in the operating and installation instructions.

Installation examples

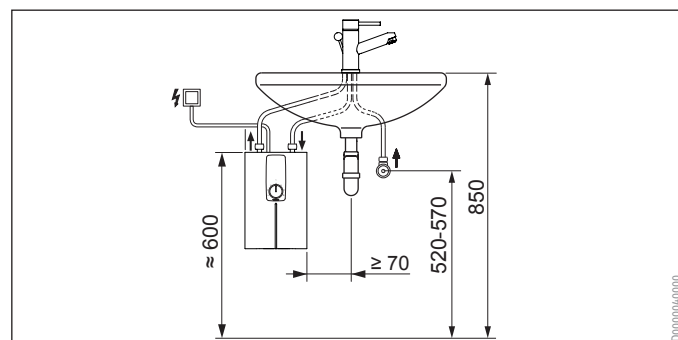
The following installation dimensions are recommended. Always check the dimensions of the site and compare.

Non-pressurised compact instantaneous water heaters

Kitchen sink, undersink, surface-mounted



Washbasin, undersink, surface-mounted



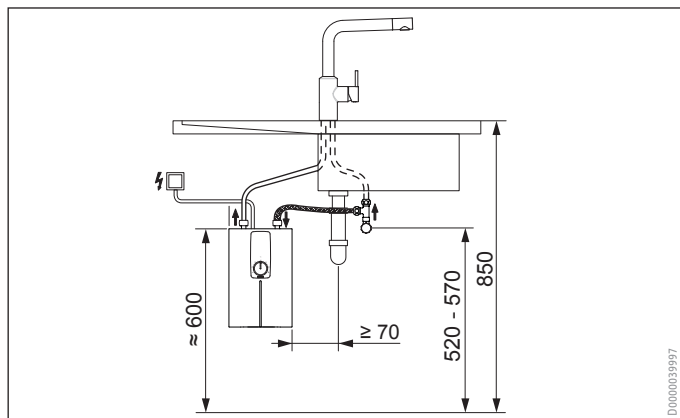
Depending on the specific product, the power cable may also be routed downwards or an appliance may offer both options.

Compact instantaneous water heater

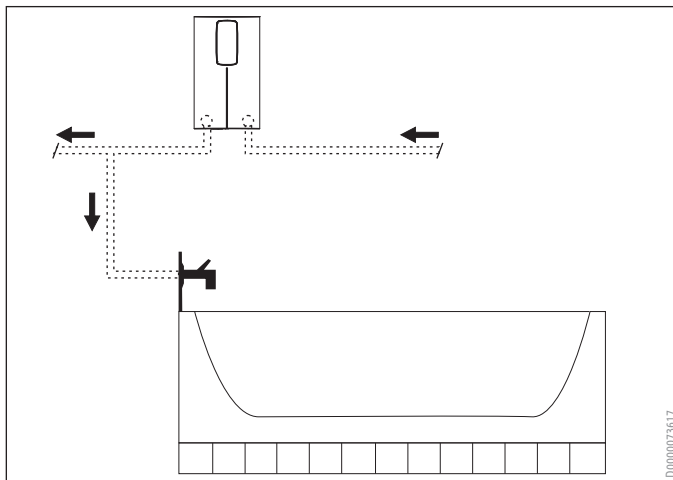
Installation

Pressure-tested compact instantaneous water heaters

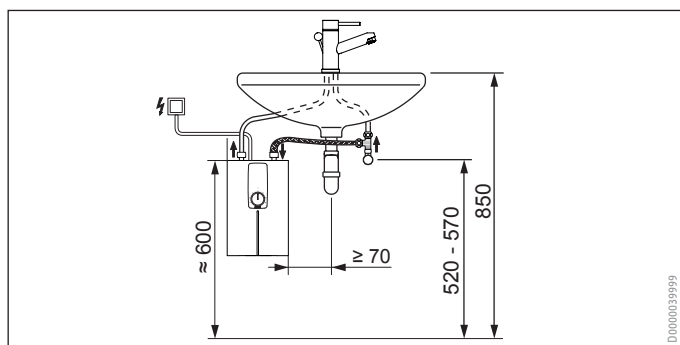
Kitchen sink, undersink, surface-mounted



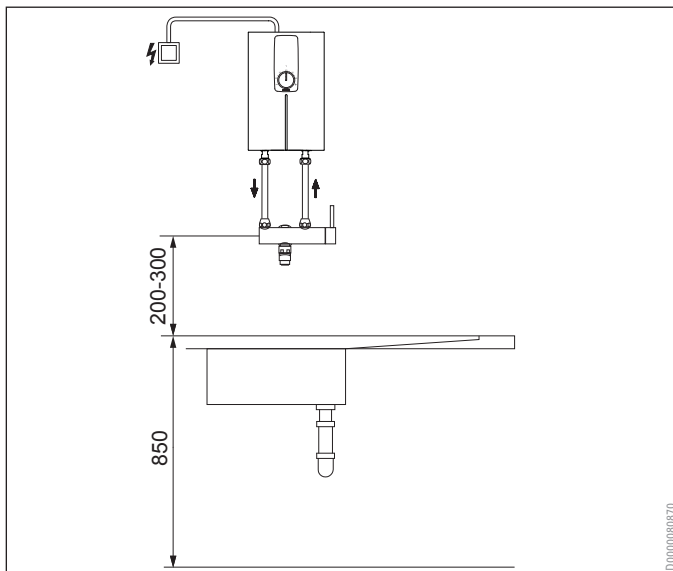
Oversink, flush-mounted



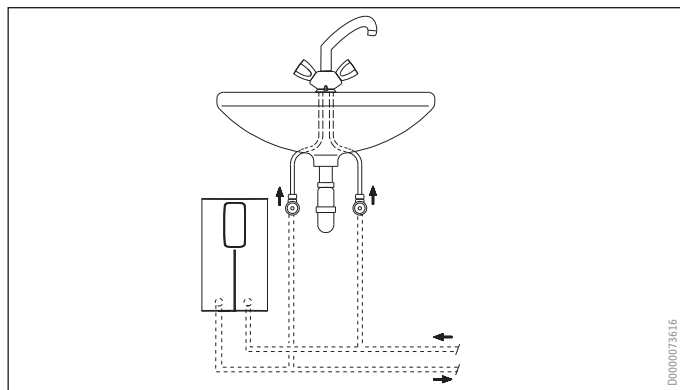
Washbasin, undersink, surface-mounted



Washbasin, oversink, surface-mounted



Washbasin, undersink, flush-mounted



Hydraulic connection

Observe the details regarding water quality and materials, EN 806/DIN 1988, and the regulations specified by your local water supply utility.

Subject to the flow rate, compact instantaneous water heaters feature a varying pressure drop that must be taken into consideration during engineering and when selecting the installation location.

For surface-mounted installations, connection to the water supply is usually carried out using pressure hoses and union nuts. For flush-mounted installations, a permanent connection is used.

Electrical connection

The appliances are intended for permanent electrical connection.

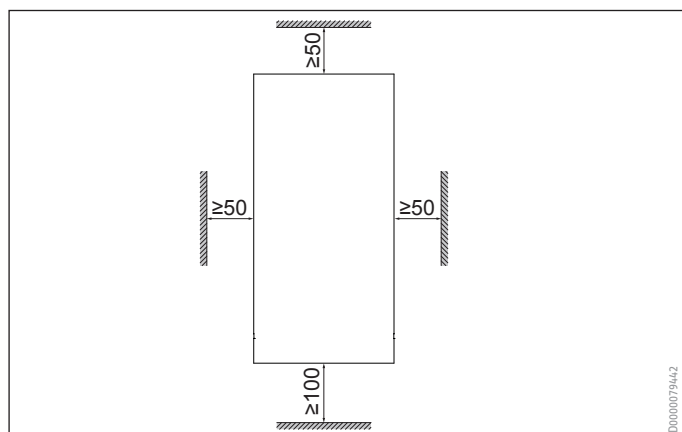
The electrical connection can be done in various ways and can be flush-mounted or surface-mounted.

On some models, the appliance output can be reduced at the installation stage.

Compact instantaneous water heater

Installation

Minimum clearances



Mini instantaneous water heater

Basics



Mini instantaneous water heater

Application

Application

Mini instantaneous water heaters are available both as pressure-tested and non-pressurised appliances.

For non-pressurised operation, suitable taps must be used. Only one single draw-off point can be supplied in non-pressurised operation.

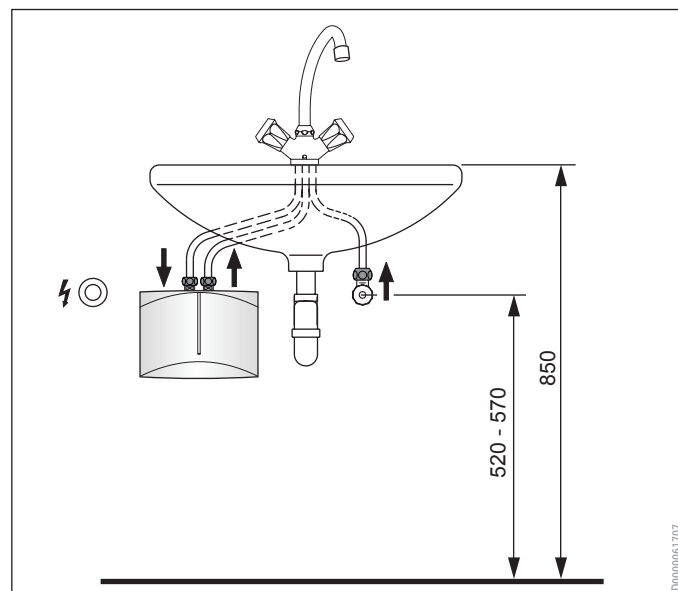
Install the mini instantaneous water heaters in a room that is free from the risk of frost and near the draw-off points. Observe VDE 0100, part 701 [or local regulations for protection zones].

Installation examples

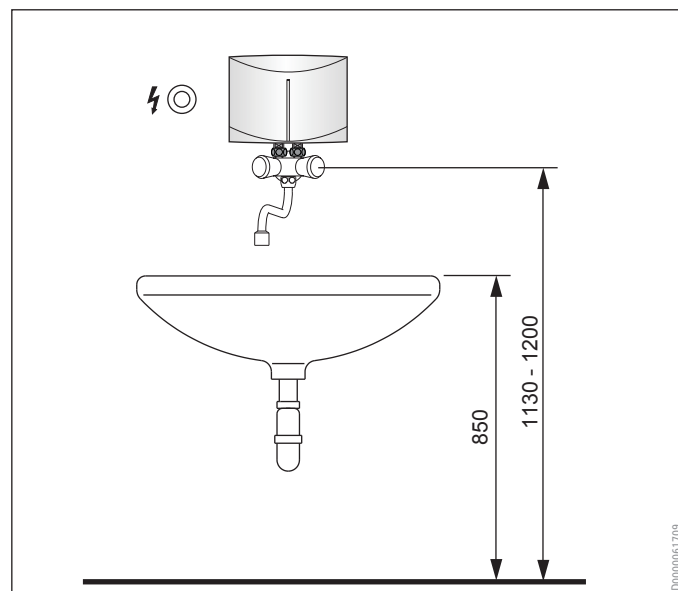
The following installation dimensions are recommended. Always check the dimensions of the site and compare.

Non-pressurised mini instantaneous water heaters

Washbasin, undersink



Washbasin, oversink

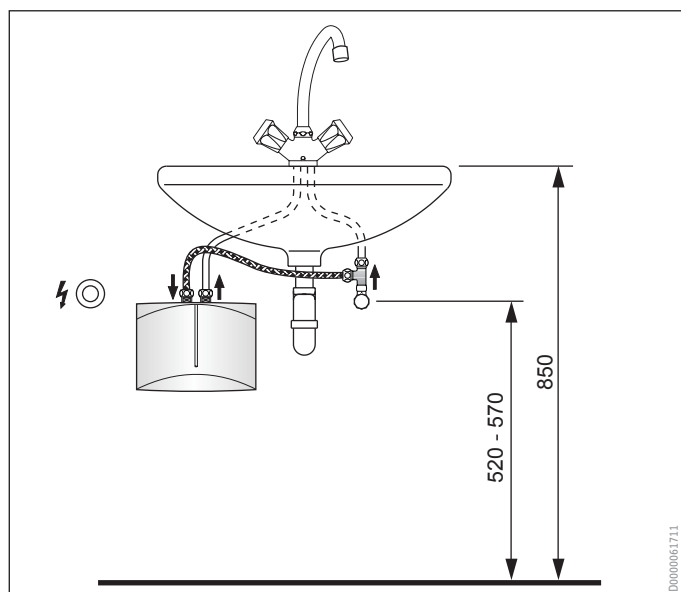


Mini instantaneous water heater

Installation

Pressure-tested mini instantaneous water heaters

Washbasin, undersink



Hydraulic connection

Observe the details regarding water quality and materials, EN 806/DIN 1988, and the regulations specified by your local water supply utility.

Subject to the flow rate, mini instantaneous water heaters feature a varying pressure drop that must be taken into consideration during engineering and when selecting the installation location.

Operation with preheated water is an option for some electronically controlled mini instantaneous water heaters.

Electrical connection

The appliances are equipped with a power cable and, depending on output, a standard plug.

Instantaneous water heater - single-phase

Basics



Instantaneous water heater - single-phase

Application

Application

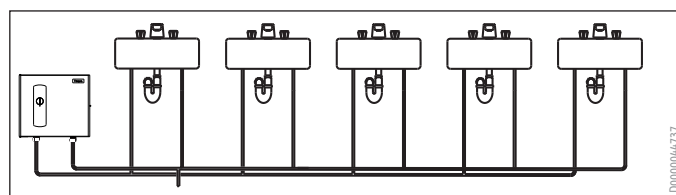
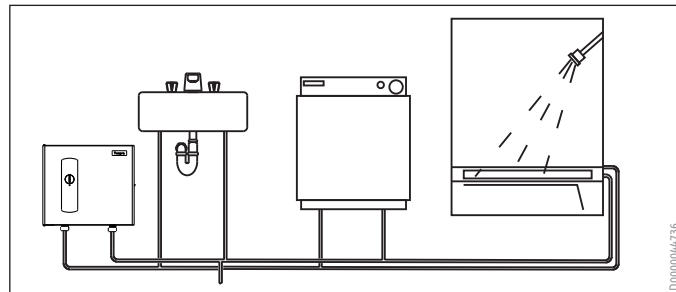
The appliances are designed for centralised DHW supply in one apartment or one house.

Install the instantaneous water heaters in a room that is free from the risk of frost and near the draw-off points. Observe VDE 0100, part 701 [or local regulations for protection zones].

In accordance with EN 60335-2-35:2016 or VDE 0700-35, instantaneous water heaters in shower applications must be limited to $T_{\max} = 55\text{ }^{\circ}\text{C}$.

Installation examples

The following installation dimensions are recommended. Always check the dimensions of the site and compare.



Instantaneous water heater - single-phase

Installation

Hydraulic connection

Observe the details regarding water quality and materials, EN 806/DIN 1988, and the regulations specified by your local water supply utility.

Subject to the flow rate, instantaneous water heaters feature a varying pressure drop that must be taken into consideration during engineering and when selecting the installation location.

Operation with preheated water is an option for many electronically controlled instantaneous water heaters.

Electrical connection

As standard, the electrical connection is made in the lower section of the appliance.

Notes

Shower units - single-phase

Basics



Shower units - single-phase

Application

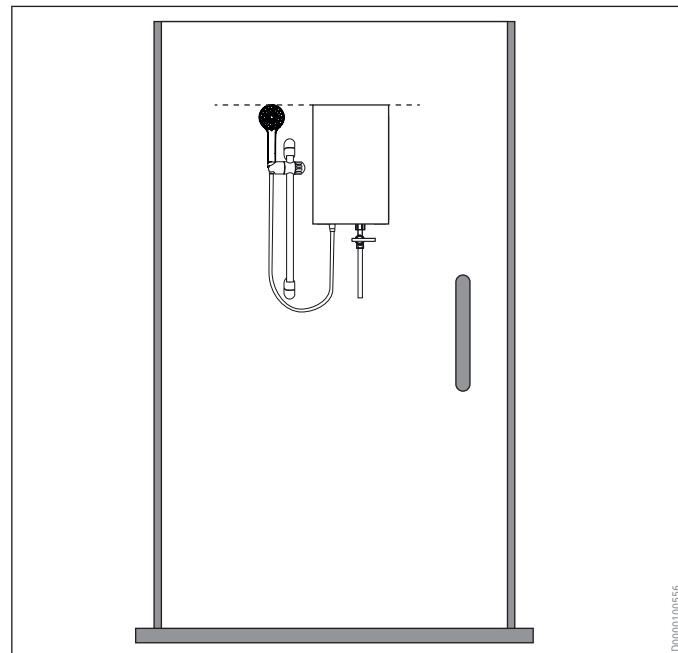
Application

Shower units are designed for installation directly in the shower. Shower units are non-pressurised in operation.

Depending on the design, the flow of water is started by means of either the tap or the integral push-button in the appliance.

Installation examples

The following installation dimensions are recommended. Always check the dimensions of the site and compare.



Shower units - single-phase Installation

Hydraulic connection

Observe the details regarding water quality and materials, EN 806/DIN 1988, and the regulations specified by your local water supply utility.

Subject to the flow rate, instantaneous water heaters feature a varying pressure drop that must be taken into consideration during engineering and when selecting the installation location.

Operation with preheated water is an option for many appliances, depending on the design.

Electrical connection

As standard, the electrical connection is made in the lower section of the appliance.

Notes



Water boilers

Application

Application

All water boilers for permanent wall installation are equipped with a fill and drain tap, making them suitable for installation directly over the kitchen sink, for example.

Water boilers are designed to supply water to a single draw-off point. The water connection of the appliance is non-pressurised.

Fill & drain tap

The tap can be used to fill the container with cold water, draw off cold water directly, draw off boiling water, or mix hot and cold water as required.

Programming unit

The set temperature can be adjusted variably on the programming unit, up to the boiling point. An indicator lamp lights up when heating is in progress. When the set temperature is reached, the appliances switch off automatically (automatic shutdown).

Overflow pipe

The overflow pipe drains off condensate or water vapour formed when boiling. It also acts as an overflow in the event of accidental overfilling. The overflow pipe is fastened to the appliance in a way that allows it to be pointed in various directions.

Level indicator

The level of the water is indicated by the markings on the various DHW containers.

Cleaning / descaling aperture

Cleaning or descaling of the appliance is possible either directly via a sufficiently large opening on the container or by adding a descaling agent through a service aperture.

Tile offset

The wall mounting bracket is used for tile compensation or to adapt to the existing cold water connection. This allows the appliance seat to be adjusted either variably or via a number of pre-defined positions.

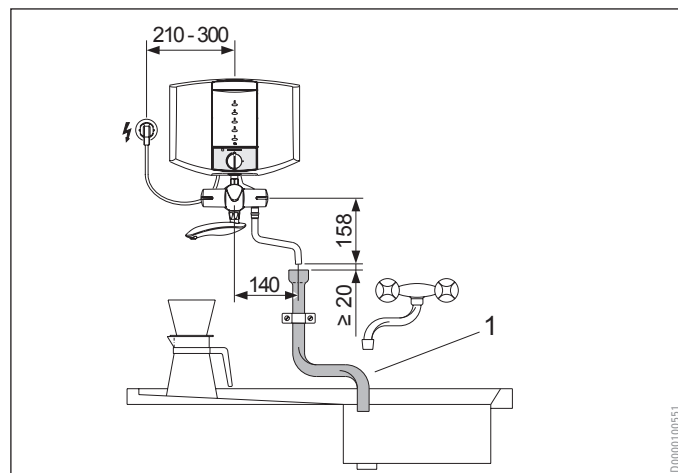
Throttle facility in the tap

This allows the flow rate to be adjusted for the prevailing pressure conditions in the water supply network in accordance with the manufacturer's specifications.

Installation examples

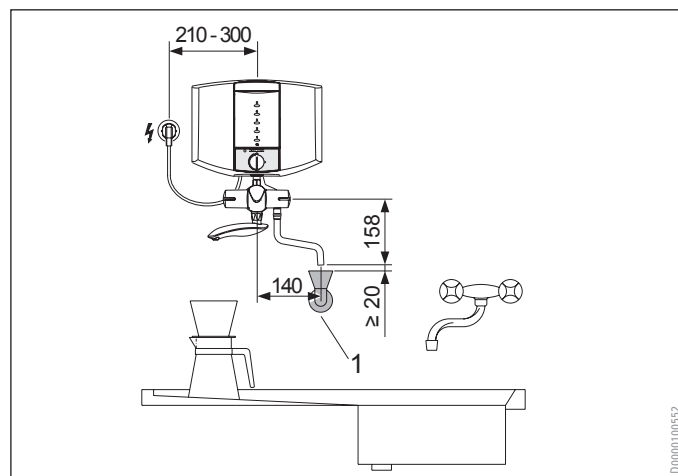
The following installation dimensions are recommended. Always check the dimensions of the site and compare.

Surface-mounting the overflow / steam pipe



1 Outlet pipe to the sink

Flush-mounting the overflow / steam pipe



1 Drain outlet with trap

Water boilers

Installation

Hydraulic connection

Always observe accepted engineering standards, such as EN 806 and DIN 1988, and the regulations specified by your local water supply utility. Do not exceed the maximum permissible pressure specified on the type plate.

Installation is particularly easy because, being a non-pressurised system, there is no need to install a safety assembly or a drain.

Electrical connection

Observe the VDE 0100 [or local equivalent] and the regulations specified by your local power supply utility as well as the type plate.

Compare the voltage, select an adequate cable cross-section and the correct fuse/MCB. The appliances are supplied with a 3-core power cable and standard plug.

Notes

Automatic water boilers

Basics



Automatic water boilers

Application

Automatic water boilers are designed to supply water to a single draw-off point. The water connection of the appliance is non-pressurised.

Automatic water boilers are non-pressurised in operation and are designed to supply a draw-off point with near-boiling hot water close to 100 °C.

The temperature can be selected from 65 °C to 97 °C. With non-pressurised appliances, the actual temperature may vary slightly due to differences in air pressure.

Taps

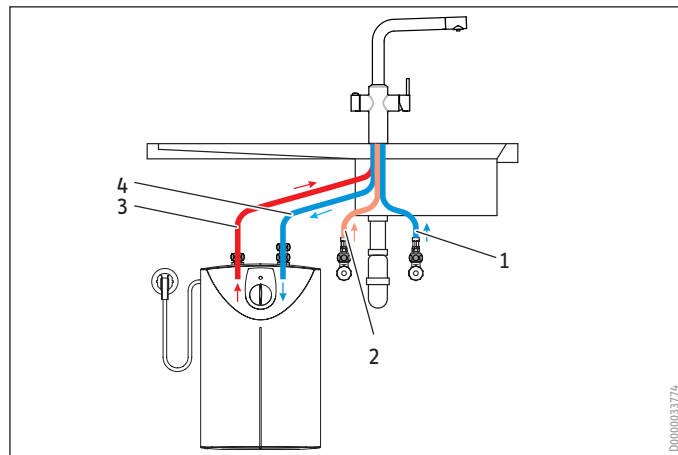
Automatic water boilers require a special tap which is a combination of a non-pressurised tap for hot water and a pressure-tested tap for cold water and DHW.

The handle for drawing the hot water is childproof. The special aerator allows the near 100 °C boiling hot water to be drawn off without vapour or splashing. After the tap is closed, the residual water returns to the cylinder. This means that hot water is available straight away for the next draw-off. The hot water is channelled separately, meaning that the surface of the tap remains cool.

The cold water and DHW are supplied from the central network on site and operated via the integral mono lever mixer in the tap.

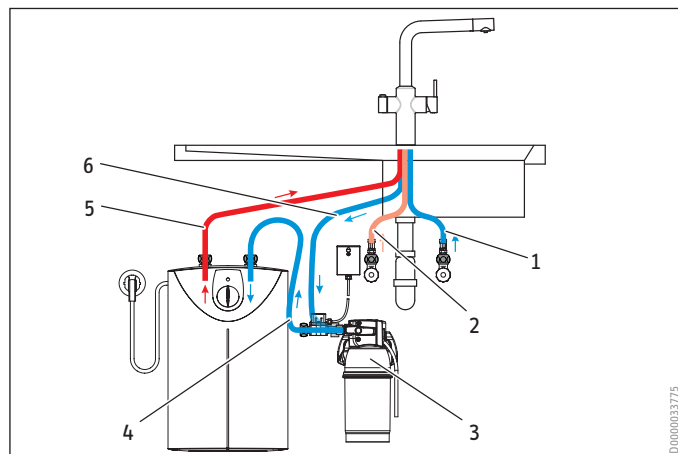
Installation examples

The following installation dimensions are recommended. Always check the dimensions of the site and compare.



- 1 Cold water supply to the tap
- 2 Hot water supply to the tap
- 3 Hot water outlet
- 4 Cold water supply to the appliance

Hydraulic installation with water filter



- 1 Cold water supply to the tap
- 2 Hot water supply to the tap
- 3 Water filter
- 4 Cold water supply to the appliance
- 5 Hot water outlet
- 6 Cold water supply to the filter
- 7 Electrical connection

Automatic water boilers

Installation

Hydraulic connection

Always observe accepted engineering standards, such as EN 806 and DIN 1988, and the regulations specified by your local water supply utility.

Never exceed the maximum permissible pressure specified on the type plate.

Installation is particularly easy because, being a non-pressurised system, there is no need to install a safety assembly or a drain.

Water filter

For even higher potable water quality in food and beverage preparation areas, an upstream water filter is recommended. This filter is installed in the cold water supply line between the tap and automatic water boiler.

Electrical connection

Observe the VDE 0100 [or local equivalent] and the regulations specified by your local power supply utility as well as the type plate.

Compare the voltage, select an adequate cable cross-section and the correct fuse/MCB. The appliances are supplied with a 3-core power cable and standard plug.

Notes

Wall mounted cylinder

Basics



Wall mounted cylinder

Application

Application

Wall mounted cylinders are available in several model series with various different functions and equipment features.

Depending on the appliance series, a range of equipment features ensure that the appliances are easy to install and service.

Wall mounted cylinders are suitable for DHW supply to multiple draw-off points, e.g. for simultaneous supply to the bathroom and kitchen.

Pressure-tested appliances are suitable for use with commercially available pressure fittings.

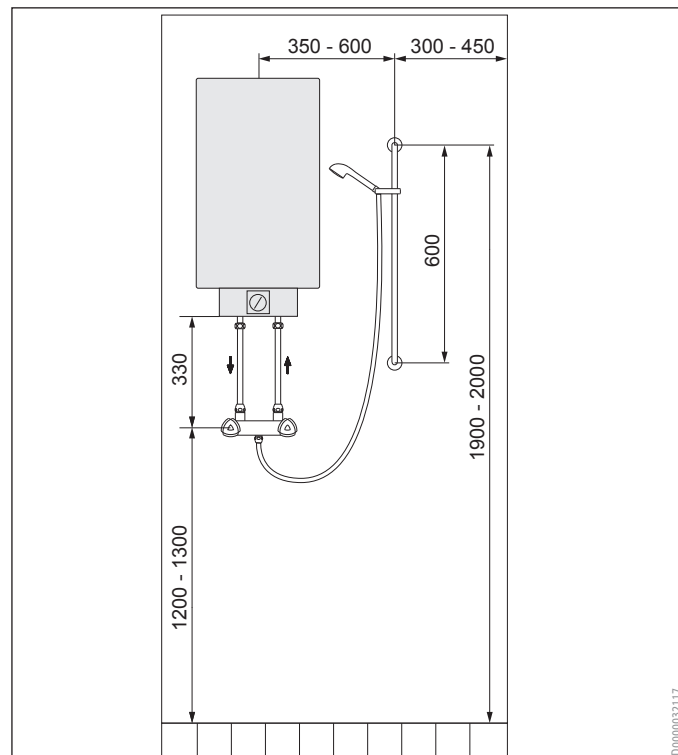
Wall mounted cylinders can also be used as non-pressurised appliances for supplying a single draw-off point.

Depending on the specific product, appliances can be operated in single circuit operation, dual circuit operation, manual rapid heat-up operation or as instantaneous water cylinders.

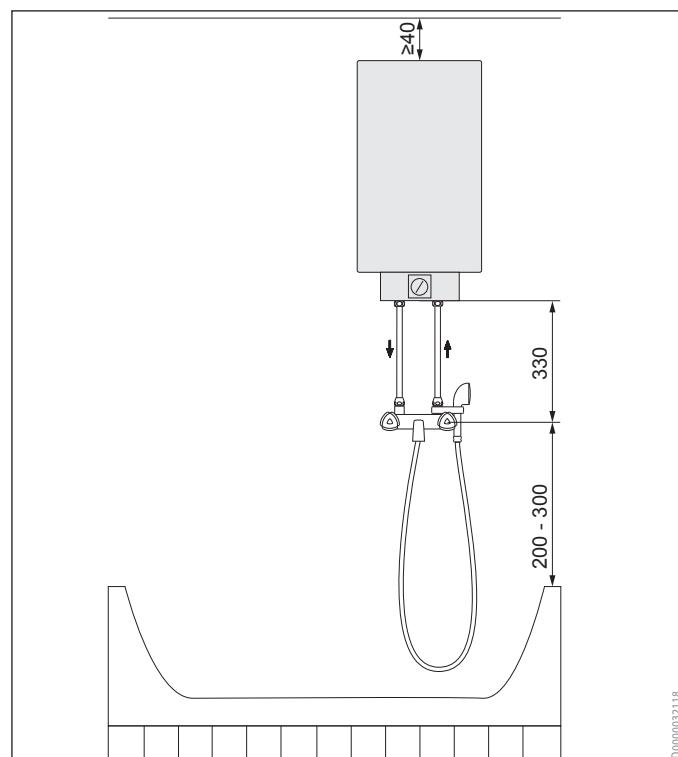
Installation examples

The following installation dimensions are recommended. Always check the dimensions of the site and compare.

Shower, surface-mounted, non-pressurised cylinder



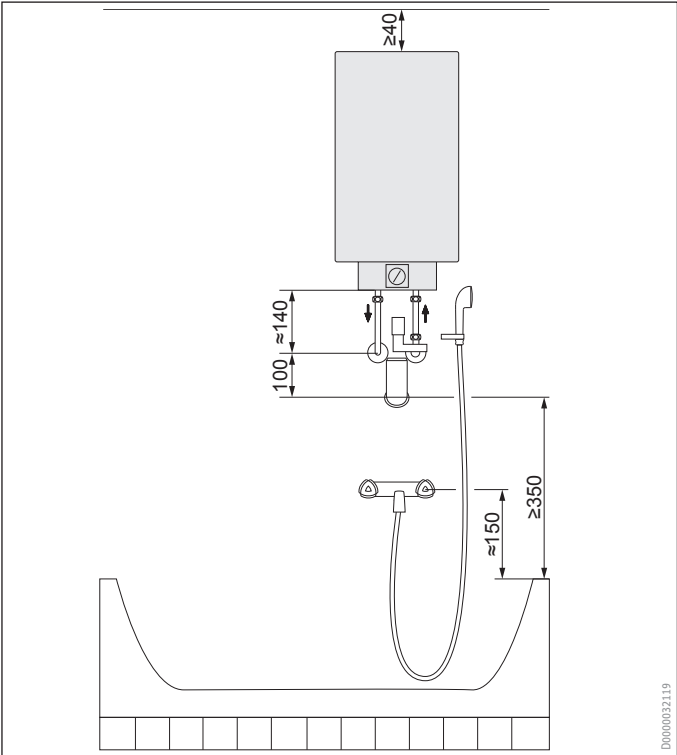
Bath tub, surface-mounted, non-pressurised cylinder



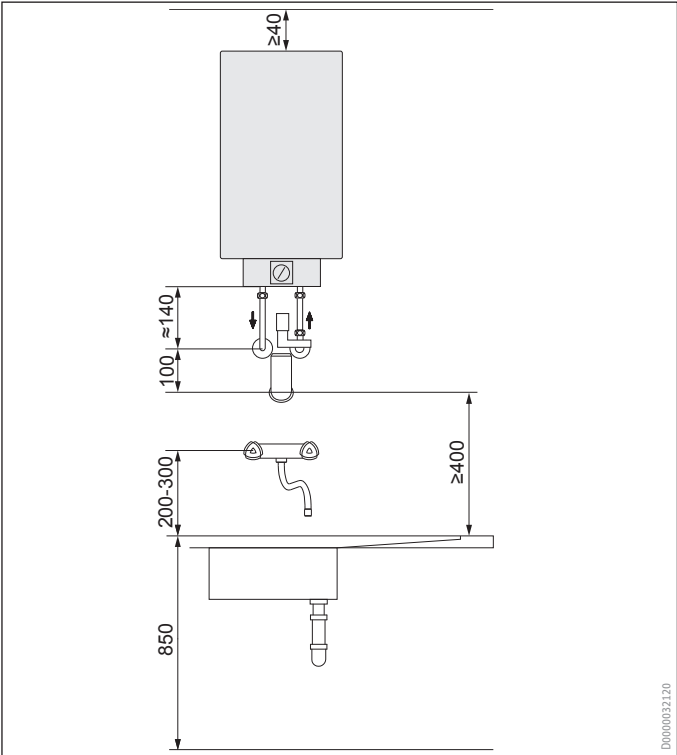
Wall mounted cylinder

Application

Bath tub, flush-mounted, pressure-tested cylinder



Sink, flush-mounted, pressure-tested cylinder



Wall mounted cylinder

Features and functions

General features

Mounting brackets

Wall mounted cylinders are mounted using one or two mounting brackets, depending on size. Precisely sized spacers are provided to permit tile compensation. Some models also have side caps to conceal the wall mountings.

Drain

All appliances have a drain connector for easy draining of the cylinders. Some models have a drain valve allowing metered draining. Both the drain connector and the drain valve are fitted with a hose connection.

Suitable for use with plastic pipes

Wall mounted cylinders can be equipped as standard with a safety concept that permits the appliance to be connected to plastic pipework systems:

On some cylinders, it is possible to select operating temperatures of up to 85 °C or 82 °C. Limitation to lower temperatures, e.g. 60 / 65 °C, may be possible according to type.

Should faults develop, temperatures up to 95 °C (max. 0.6 MPa) can occur. Any plastic pipework used must be suitable for these conditions. These operating conditions must be checked against the manufacturer's details regarding the application limits of the plastic pipe.

Non-pressurised 2/3 draw-off

When appropriately equipped, non-pressurised wall mounted cylinders can also supply two draw-off points if required. However, only a maximum of 1/3 of the volume can be drawn off via the second draw-off point.

The DHW connector can be extended with the use of suitable accessories. If the maximum pipe length of 1 metre is exceeded, an air vent valve must be installed in the DHW line.

Wall mounted cylinder

Features and functions

Model series-dependent features

The following features are available, depending on the type and model series.

Immersion heater plug

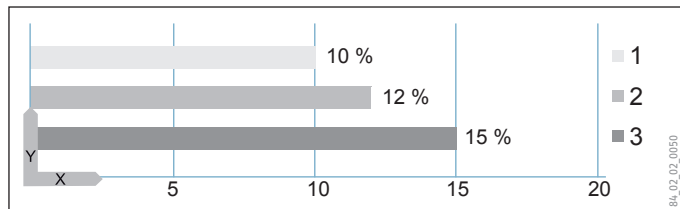
Some appliances have a special immersion heater plug. Following service work on the electric flanged immersion heater, the electrical contacts can be connected quickly and without risk of errors.

ECO Comfort function

Some appliances have automatic set temperature reduction from 85 °C to 60 °C one week after commissioning the appliance.

ECO Plus

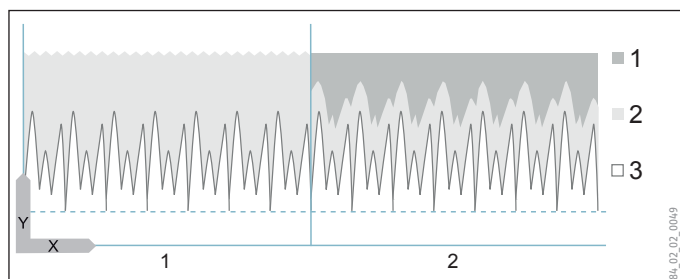
Some appliances have an additional energy saving function. This delays re-activation of the heater until approx. 40 % of the available DHW amount has been drawn off.



- X Potential savings [%]
- Y ECO function
- 1 ECO Comfort
- 2 ECO Plus
- 3 ECO Dynamic

ECO Dynamic functionality

Activation of an intelligent learning curve: Constant matching of the available DHW amount to the actual DHW demand by capturing user patterns; however, not less than 60 °C and 40 % heating



- X Charge level
- Y First week without ECO Dynamic; second week with ECO Dynamic
- 1 DHW amount saved
- 2 DHW amount stored
- 3 DHW amount used

Reverse control

Appliances with the programming unit with LCD adapt automatically to the off-peak tariff periods set by the local power supply utility. The charge level of the appliance will thus only be guaranteed to be 100 % at the end of the off-peak tariff period. That results in a considerable reduction in standby energy consumption.

Scale build-up indicator

Scale build-up on the flanged immersion heater is detected and displayed automatically.

- » Automatic immersion heater monitoring
- » Signals in good time when the system needs to be descaled
- » The Ca symbol appears automatically
- » Prevents appliance failure and triggering of the safety element
- » Independent of potable water quality and user habits
- » Automatic reset by self-test after descaling
- » Ensures safe, reliable operation and a long service life

Temperature limit

Depending on the design of the programming unit, the maximum outlet temperature can be limited to the exact degree or to a choice of three stages, e.g. as anti-scalding protection.

Wall mounted cylinder

Installation

Hydraulic connection

The wall mounted cylinders can be operated in various ways, with supply of one or more draw-off points, depending on the type and model of the cylinder. The water connection of the cylinder will vary according to how it is operated.

Non-pressurised operating mode

Non-pressurised DHW cylinders supply only one single draw-off point. These cylinders must not be subjected to pressure and must be identified by the manufacturer as non-pressurised DHW cylinders.

When the DHW stopcock is opened in the mixer tap, cold water flows into the bottom section of the DHW cylinder. The hot water in the cylinder is pushed upwards out of the cylinder, through the permanently open spout of the mixer tap. For this reason, the outlet connector and pivoting tap spout must never be shut off and the aerator must never be fitted with a hose.

Always observe accepted engineering standards, such as EN 806 and DIN 1988, and the regulations specified by your local water supply utility.

Matching connection accessories are available for every cylinder. Use in combination is recommended because all safety equipment is already built in. This also ensures that the flow rate specified on the type plate, and thus the DIN standard limits for appliance and tap noise, will not be exceeded even during surges in water pressure. In addition there will be a minor mixing effect and consequently a more efficient utilisation of the stored hot water.

The DHW connector can be extended with the use of suitable accessories. However, if the maximum permissible length of 1 m needs to be exceeded, an air vent valve should be installed in the DHW line.

Pressurised operating mode

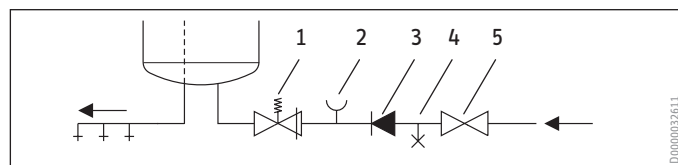
Pressurised DHW cylinders, i.e. those under full mains pressure, can supply multiple draw-off points. For safety reasons, water will visibly drip from the safety valve of the safety assembly during heat-up.

Always observe accepted engineering standards, such as EN 806 and DIN 1988, and the regulations specified by your local water supply utility. Never exceed the maximum permissible pressure specified on the type plate.

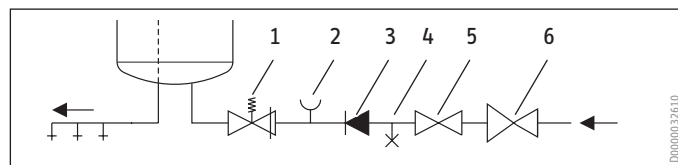
For safety reasons, standards such as DIN 1988 require an individually tested safety assembly to be installed directly on the DHW heater in the cold water line.

The critical factor when selecting a safety assembly is the maximum permissible pressure of the water heater.

Cold water connection ≤ 0.48 MPa with safety valve



Cold water connection > 0.48 MPa with additional pressure reducing valve



- 1 Safety valve
- 2 Pressure gauge test connector
- 3 Non-return valve
- 4 Test valve
- 5 Straight-through shut-off valve (butterfly)
- 6 Pressure reducing valve

Wall mounted cylinder

Installation

Electrical connection

The wall mounted DHW cylinders can be connected electrically for different operating modes depending on cylinder type. Factors to consider include the DHW consumption of the end users, the power supply utility's connection model, and the possible operating mode of the DHW cylinders.

Always observe accepted engineering standards, such as VDE 0100 in Germany, and the regulations of your local power supply utility.

Connect the DHW cylinder permanently to an AC power supply. The cable cross-section must be selected according to the appliance specification and safeguarded with a fuse/MCB.

In addition, the DHW cylinder must be able to be disconnected from the power supply by an isolator that disconnects all poles with at least 3 mm contact separation. For this, install mains isolators, fuses, etc.

Single circuit operation

Single circuit appliances include all electric DHW cylinders that operate at full connected electric heating output each time the control thermostat switches ON. The preselected DHW temperature is maintained continuously.

Manual rapid heat-up operation

This type of connection means that when the appliance is switched on, it heats up the water content once to the set temperature using the full connected electrical heating output and then switches off. If there is additional DHW demand, the appliance must be switched on again manually.

Dual circuit connection

The entire cylinder content is heated with the base heating stage during off-peak tariff periods. The enable times for this are provided by the local power supply utility. During off-peak tariff periods, a lower connected electrical load is usually used to heat the entire cylinder content to the set temperature. With this type of connection, the cylinder size is selected based on the volume of DHW stored until the next enable time.

In the event of additional demand for DHW, the pushbutton can be pressed during the normal tariff period to switch on a rapid heat-up function for one-off heating with a (usually) greater connected electrical load. When the selected temperature is reached, the rapid heat-up function switches off and does not switch on again.

instantaneous water cylinder connection

In this operating mode, the appliance works with normal heating output when drawing off small amounts of water. With a high temperature setting and after large volumes of water or the entire cylinder content are drawn off, the appliance will switch automatically to rapid heat-up with high heating output.

The appliance then operates as an instantaneous water heater with rapid heat-up.

Following a long power failure, the zero volt relay prevents the rapid heat-up function from being switched on straight away. Once the voltage returns, the appliance initially works with normal heating output until the temperature controller reacts for the first time. Subsequently, rapid heat-up is automatically ready for operation again.

Notes

Small water heaters - non-pressurised

Basics



Small water heaters - non-pressurised

Application

Application

Install the small water heaters in a room that is free from the risk of frost and near the draw-off points. Observe VDE 0100, part 701 [or local regulations for protection zones].

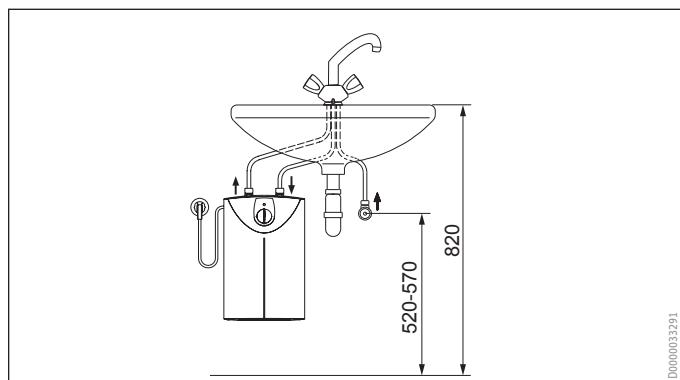
Temperature limit can be set by the qualified contractor as part of the installation process. Our small water heaters can be limited by means of technical measures or are provided with instructions for use in the operating and installation instructions.

Installation examples

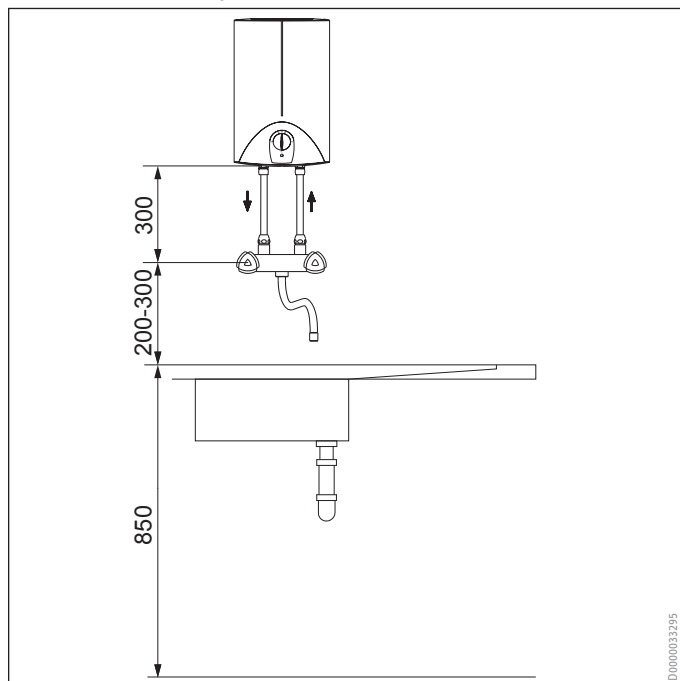
The following installation dimensions are recommended. Always check the dimensions of the site and compare.

Small water heaters - non-pressurised

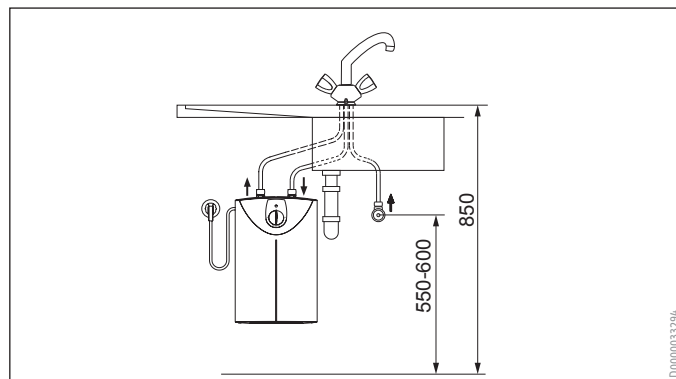
Washbasin, undersink, non-pressurised



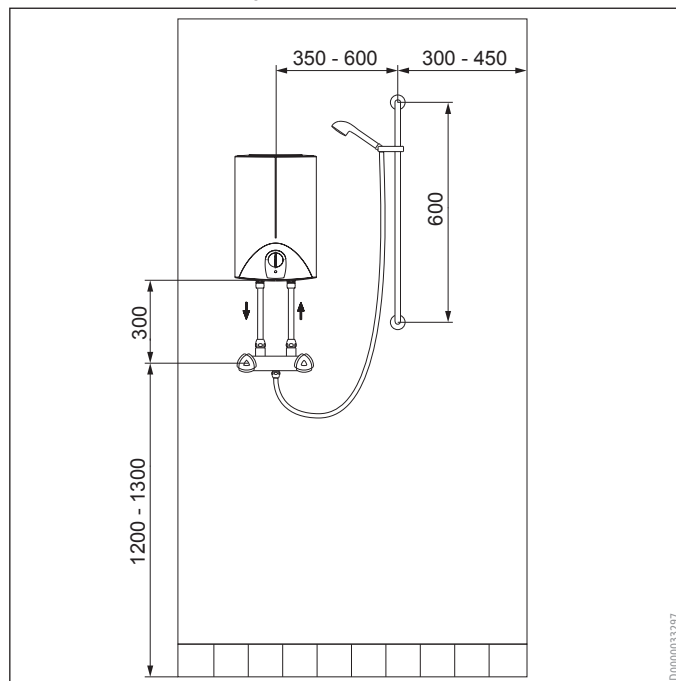
Sink, oversink, non-pressurised



Sink, undersink, non-pressurised



Shower, oversink, non-pressurised



Small water heaters - non-pressurised

Installation

Hydraulic connection

Non-pressurised DHW cylinders only ever supply one single draw-off point.

Non-pressurised appliances must not be subjected to water pressure and are therefore not suitable for operation with standard pressure taps. The outlet connector and pivoting tap spout must never be shut off.

The maximum flow rate stated on the type plate must be complied with. The flow rate is limited by means of a suitable aerator.

The hydraulic connection of the appliances is made using the pipes or pressure hoses of the tap.

Electrical connection

Observe the VDE 0100 [or local equivalent] and the regulations specified by your local power supply utility as well as the type plate.

Compare the voltage, select an adequate cable cross-section and the correct fuse/MCB. The appliances are supplied with a 3-core power cable and standard plug.

Before switching on for the first time, the appliance must be filled by opening the DHW valve.

Small water heaters - pressure-tested

Basics



Small water heaters - pressure-tested

Sample applications

Application

Install the appliances in a room that is free from the risk of frost and near the draw-off points. Observe VDE 0100, part 701 [or local regulations for protection zones].

Observe EN 806 and DIN 1988 and the regulations specified by your local water supply utility.

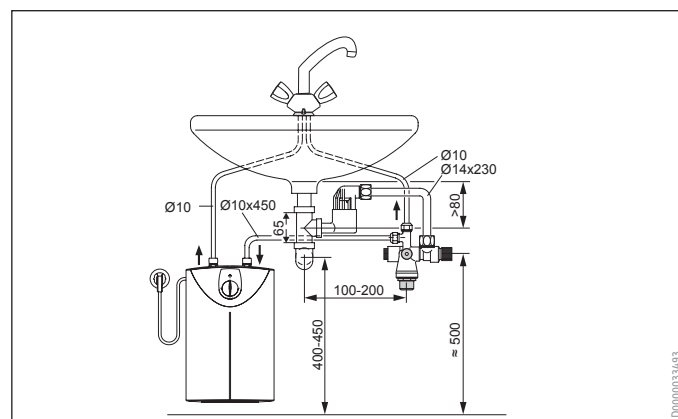
Temperature limit can be set by the qualified contractor as part of the installation process. Our small water heaters can be limited by means of technical measures or are provided with instructions for use in the operating and installation instructions.

Installation examples

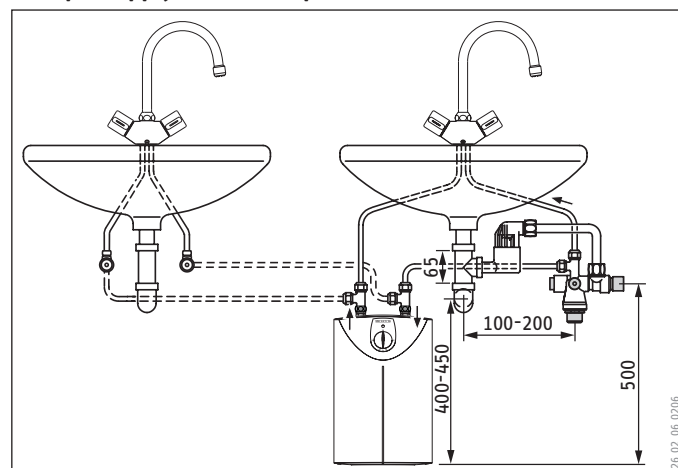
The following installation dimensions are recommended. Always check the dimensions of the site and compare.

Small water heaters - pressure-tested

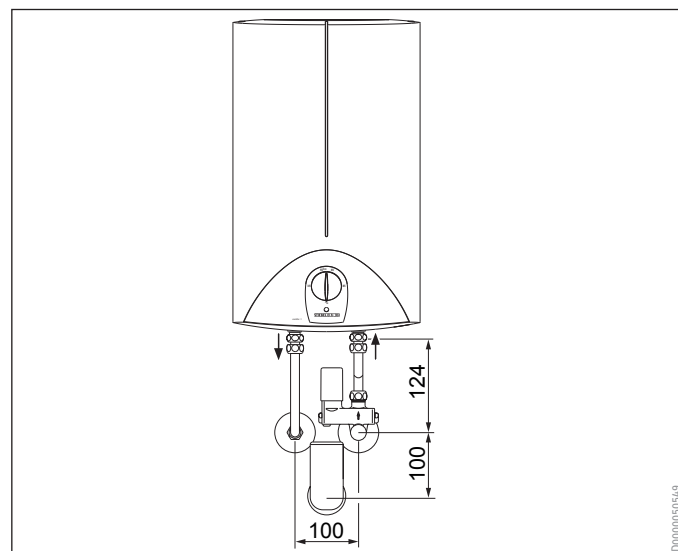
Washbasin system with SVMT, pressure-tested



Multiple supply with SVMT, pressure-tested



Washbasin system with SVMT, oversink, pressure-tested



Small water heaters - pressure-tested

Installation

Hydraulic connection

Pressure-tested DHW cylinders can supply multiple draw-off points.

The maximum flow rate stated on the type plate must be complied with. The flow rate is limited by means of a suitable aerator.

The hydraulic connection of the appliances is made using the pipes or pressure hoses of the tap together with a safety valve or safety assembly.

Electrical connection

Observe the VDE 0100 [or local equivalent] and the regulations specified by your local power supply utility as well as the type plate.

Compare the voltage, select an adequate cable cross-section and the correct fuse/MCB. The appliances are supplied with a 3-core power cable and standard plug.

Before switching on for the first time, the appliance must be filled by opening the DHW valve.

Notes

Under-worktop cylinder

Basics



Under-worktop cylinder

Application

Application

Install the appliances in a room that is free from the risk of frost and near the draw-off points. Observe VDE 0100, part 701 [or local regulations for protection zones].

Under-worktop cylinders are available as undersink appliances for installation into a kitchen unit space or as a standalone unit with full casing.

Observe EN 806 and DIN 1988 and the regulations specified by your local water supply utility.

The temperature limit must be adjusted by the qualified contractor as part of the installation process. Our appliances can be limited by means of technical measures or are provided with instructions for use in the operating and installation instructions.

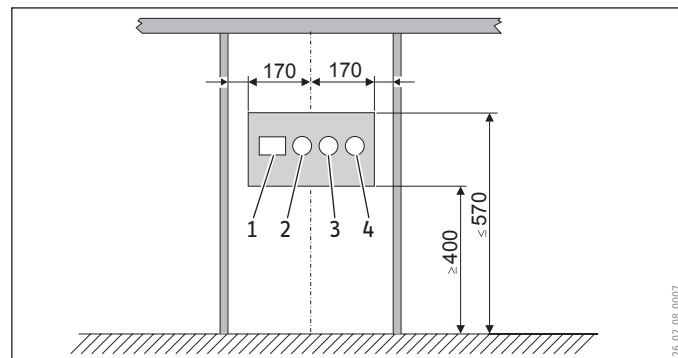
The pressure-tested appliances can be combined with all commercially available pressure taps.

Dual circuit operation is possible.

Installation examples

The following installation dimensions are recommended. Always check the dimensions of the site and compare.

Under-worktop cylinder



- 1 hob connection box
- 2 DHW connection
- 3 Cold water connection
- 4 Drain

Under-worktop cylinder

Installation

Hydraulic connection

Pressure-tested DHW cylinders can supply multiple draw-off points.

For safety reasons, water will visibly drip from the safety valve of the safety assembly during heat-up.

The hydraulic connection of the appliances is made using pipes or pressure hoses.

Electrical connection

Observe the VDE 0100 [or local equivalent] and the regulations specified by your local power supply utility as well as the type plate.

The appliances are intended for permanent electrical connection.

Compare the voltage stated on the type plate, select an adequate cable cross-section and the correct fuses/MCBs.

In addition, the DHW cylinder must be able to be disconnected from the power supply by an isolator that disconnects all poles with at least 3 mm contact separation. For this, install mains isolators, fuses, etc.

Before switching on for the first time, the appliance must be filled by opening the DHW valve.

Operating modes

The appliances can be connected electrically for different operating modes depending on type. Factors to consider include the DHW consumption of the end users, the power supply utility's connection model, and the possible operating mode of the DHW cylinders.

Single circuit operation

Single circuit appliances include all electric DHW cylinders that operate at full connected electric heating output each time the control thermostat switches ON. The preselected DHW temperature is maintained continuously.

Dual circuit operation

The entire cylinder content is heated with the base heating stage during off-peak tariff periods. The enable times for this are provided by the local power supply utility. During off-peak tariff periods, a lower connected electrical load is usually used to heat the entire cylinder content to the set temperature. With this type of connection, the cylinder size is selected based on the volume of DHW stored until the next enable time.

In the event of additional demand for DHW, the pushbutton can be pressed during the normal tariff period to switch on a rapid heat-up function for one-off heating with a (usually) greater connected electrical load. When the selected temperature is reached, the rapid heat-up function switches off and does not switch on again.

Notes

Floor mounted cylinder

Basics



Floor mounted cylinder

Application

Application

Floor mounted cylinders are floorstanding DHW cylinders.

The cylinders are internally enamelled, pressure-tested and are suitable for supplying multiple draw-off points.

Floor mounted cylinders are suitable for indoor installation in a room free from the risk of frost.

Floor mounted cylinders have height-adjustable feet for levelling the cylinder.

Electric floor mounted cylinder

Floor mounted cylinders can be divided into the following categories, based on equipment configuration and usage options.

All electric floor mounted cylinders have an integral electric flanged immersion heater. The flanged immersion heater is located in the lower part of the cylinder so that the entire cylinder content can be heated.

The set DHW temperature is adjusted manually. The water is heated to the selected set temperature, subject to electrical connection and, if applicable, enable times.

Floor mounted cylinders have generously sized connections for cold water, DHW and DHW circulation.

Floor mounted combi cylinder

Floor mounted combi cylinders are internally enamelled cylinders and are not equipped at the factory with flanged immersion heaters.

Floor mounted combi cylinders can be individually equipped with electric flanged immersion heaters. This allows for the option of having a high heating output, for example.

Additional equipment features

Floor mounted cylinders may have the following additional equipment features, depending on model series and type:

Thermal insulation, directly applied

These cylinders have foam thermal insulation applied directly to the wall. With insulation matched to the shape of the tank and an outer casing over that, standby losses are reduced to a minimum.

Thermal insulation as a separate component

If the dimensions of cylinders with directly applied insulation exceed door and transport dimensions, separate thermal insulation elements matched to the cylinder are used instead. Due to the properties of the insulating material and the fixing system, the separate insulation likewise fits very closely to the shape of the tank and ensures excellent insulation.

Temperature display

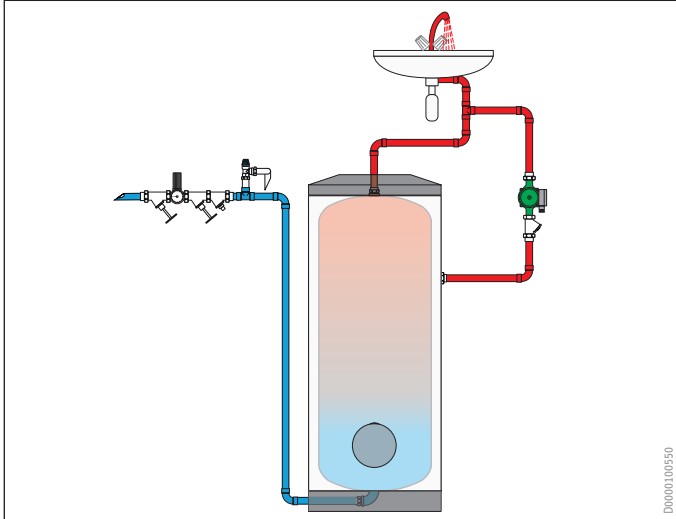
Depending on type, the appliances may be equipped with an analogue thermometer fitted to the outside.

Floor mounted cylinder

Application

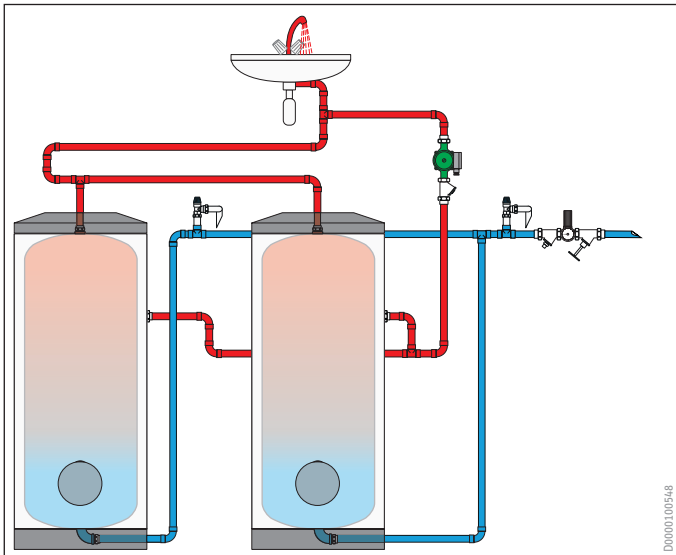
Installation examples

Connection of a floorstanding or wall mounted cylinder, with or without DHW circulation line



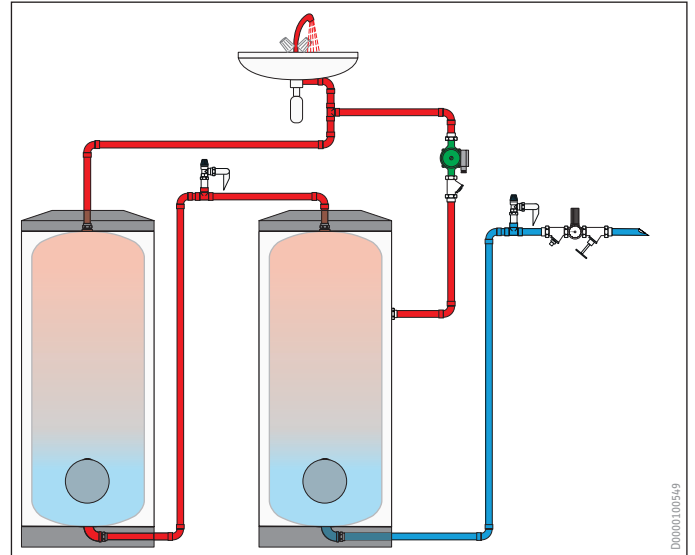
Parallel connection of one or more floor mounted cylinders

Suitable for achieving high peak draw-off flow rates, e.g. in the case of high simultaneous use of the consumers, with simultaneously high availability of reheating, e.g. electrical single circuit operation.



Series connection of one or more floor mounted cylinders

Suitable for achieving high DHW delivery capacity at low draw-off flow rates and with restricted availability of reheating, e.g. electrical dual circuit operation.



Floor mounted cylinder

Installation

Installation

All the floor mounted cylinders are designed to be easy to install and reliable for planning purposes.

Removable cylinder casing

The casing of the cylinder can be removed for transport and installation.

Standard flange dimensions and standard hole circle

The flanged aperture serves as a cleaning aperture and inspection port.

Suitable for use with plastic pipes

Some floor mounted cylinders are equipped as standard with a safety concept that permits the appliance to be connected to plastic pipework systems.

These cylinders enable operating temperatures up to 82 °C to be selected. Limitation to lower temperatures, e.g. 60 / 65 °C, may be possible according to type.

Should faults develop, temperatures up to 95 °C (max. 0.6 MPa) can occur. Any plastic pipework used must be suitable for these conditions. These operating conditions must be checked against the manufacturer's details regarding the application limits of the plastic pipe.

Hydraulic connection

Observe the accepted engineering standards, such as EN 806 and DIN 1988, and the regulations specified by your local water supply utility.

Do not exceed the maximum permissible pressure specified on the type plate.

For safety reasons, standards such as DIN 1988 require an individually tested safety assembly to be installed directly on the DHW heater in the cold water line.

The critical factor when selecting a safety assembly is the maximum permissible pressure of the water heater.

Make sure the safety valve and the associated drain facility are installed correctly. No shut-off valves should be installed between the safety valve and the water heater.

Depending on the type, the cold water connection pipe is routed out of the side and can be rotated in any direction. The cold water connection pipe is also used for drainage

The cylinders have a dedicated connection for DHW circulation.

Floor mounted cylinder

Installation

Electrical connection

Observe the VDE 0100 [or local equivalent] and the regulations specified by your local power supply utility as well as the type plate.

Connect the DHW cylinder permanently to an AC power supply. The cable cross-section must be selected according to the appliance specification and safeguarded with a fuse/MCB.

In addition, the DHW cylinder must be able to be disconnected from the power supply by an isolator that disconnects all poles with at least 3 mm contact separation. For this, install mains isolators, fuses, etc.

Before switching on for the first time, the appliance must be filled by opening the DHW valve.

The appliances can be connected electrically for different operating modes depending on type. Factors to consider include the DHW consumption of the end users, the power supply utility's connection model, and the possible operating mode of the DHW cylinders.

Single circuit operation

Single circuit appliances include all electric DHW cylinders that operate at full connected electric heating output each time the control thermostat switches ON. The preselected DHW temperature is maintained continuously.

Dual circuit operation

The entire cylinder content is heated with the base heating stage during off-peak tariff periods. The enable times for this are provided by the local power supply utility. During off-peak tariff periods, a lower connected electrical load is usually used to heat the entire cylinder content to the set temperature. With this type of connection, the cylinder size is selected based on the volume of DHW stored until the next enable time.

In the event of additional demand for DHW, the pushbutton can be pressed during the normal tariff period to switch on a rapid heat-up function for one-off heating with a (usually) greater connected electrical load. When the selected temperature is reached, the rapid heat-up function switches off and does not switch on again.

Notes



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