UDC 628.1.033 : 696.11
: 628.147.22 : 614.777

DEUTSCHE NORM

December 1988

Drinking water supply systems

Drinking water protection and drinking water quality control (DVGW Code of practice)

DIN 1988 Part 4

Technische Regeln für Trinkwasser-Installationen (TRWI); Schutz des Trinkwassers, Erhaltung der Trinkwassergüte (Technische Regel des DVGW)

This standard, together with DIN 1988 Parts 1 to 3 and Parts 5 to 8, December 1988 editions, supersedes DIN 1988, January 1962 edition.

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

This standard has been prepared in agreement with *DVGW Deutscher Verein des Gas- und Wasserfaches e.V.* (German Association of Gas and Water Engineers). It has been included in the body of *DVGW* Codes of practice for water.

© No part of this standard may be reproduced without the prior permission of DIN Deutsches Institut für Normung e.V., Berlin.
In case of doubt, the German-language original should be consulted as the authoritative text.

Contents

1 Scope and field of application

This standard, in conjunction with DIN 1988 Parts 1 to 3 and Parts 5 to 8, applies to the design, installation, modification, maintenance and operation of drinking water supply systems ('systems', for short) inside buildings and their curtilages. It deals with the possible causes of drinking water contamination and describes measures to preserve the water quality in these systems.

2 General

The quality of drinking water in a system, from the service connection to draw-off points, shall be deemed to fulfil the quality requirements given in the *Trinkwasserverordnung* (German Drinking Water Regulation) provided that the specifications of this standard are complied with.

Drinking water may be affected with the result that its quality is impaired or represents a health hazard. An impairment is understood to be a change in water that does not represent a health hazard, and a health hazard is deemed to exist if the impairment in water quality is such that the water no longer complies with the stipulations of the *Lebensmittel- und Bedarfsgegenständegesetz* (German Foodstuffs Act) and with the definitions given in the *Bundesseuchengesetz* (German Contagious Diseases Act).

The effect of changes in drinking water quality may be direct or indirect.

If, for example, appliances operated with solid or liquid fuels, are connected to or integral with such a system, there is a risk of contaminating substances escaping into the system. For the consumer, this case represents a direct impairment or health hazard if the water drawn from the appliance (e.g. water heater) is used as drinking water.

Continued on pages 2 to 15

Beuth Verlag GmbH, Berlin, has the exclusive right of sale for German Standards *(DIN-Normen)*.
07.92

DIN 1988 Part 4 Engl. Price group 11
Sales No. 0111

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:08 2001

Even if the water drawn from an appliance is not used as drinking water, an indirect impairment or health hazard may arise (e.g. in the case of appliances in which chemicals are dissolved using drinking water). Substances that have escaped from a defective appliance (as a result of a drop in pressure or pipe failure) may flow back and be present in the drinking water after the defect in the system has been repaired.

3 Causes of water contamination

3.1 Backflow

As a result of backflow, drinking water may be adversely affected or contaminated to such an extent that it represents a health hazard. Backflow of water into the system may occur:

a) if the pressure in the system drops as a result of differences in elevation (i.e. in head);

b) if the pressure generated in an appliance exceeds the working pressure in the system;

c) if a vacuum develops in the service pipe or in the system (e.g. due to backsiphonage caused by sudden drainage of pipes on failure).

The installation of backflow prevention devices ('safety devices', for short) shall be as specified in clause 4.

3.2 Cross-connection

3.2.1 Cross-connection of drinking water and non-drinking water supply systems

The direct connection of drinking water to non-drinking water supply systems is not permitted (cf. figures 1 and 2 for examples of indirect connection).

3.2.2 Cross-connection of drinking water supply systems

The direct connection of different supply systems (e.g. of a public and a private system or of two public systems) via pipes is not permitted (cf. figures 1 and 2), except where

a) the water in both systems complies at all times with the requirements specified in DIN 2000;

b) the water in both systems is subject to regular quality control as stipulated in the *Trinkwasserverordnung*;

c) mixing of the water from both systems, in accordance with *DVGW-Arbeitsblatt* (DVGW Code of practice) W 216, does not impair its quality as defined in DIN 2000 (e.g. as a result of a chemical reaction).

Such exceptions shall be dealt with in a contract between the public water supplier ('water supplier', for short) and the building owner (or occupier).

Any measures to be taken to ensure water supply in the event of a public emergency shall be agreed with the water supplier.

3.2.3 Marking

To facilitate identification and to prevent operating errors, drinking water and non-drinking water supply systems shall be marked as specified in subclause 3.3.2 of DIN 1988 Part 2, where buildings or premises are served by both systems.

In food processing companies served by different systems, the drinking water pipes shall, in accordance with article 15 of the *Trinkwasserverordnung*, be identified by different colours (cf. DIN 2403).

3.3 Other influencing factors

3.3.1 To preclude drinking water in buried pipes being contaminated by waste water, the following shall be observed.

a) Drinking water pipes shall not be laid in or through cesspools, manholes on sewers, waste water channels, and similar installations.

b) Drinking water pipes shall be laid at a distance of not less than 0,2 m from site drainage systems. Where this distance cannot be maintained, the service pipes shall, by agreement with the water supplier, be adequately protected.

c) Where the distance between drinking water pipes and sewers is 1 m or less, the former shall not be laid deeper than the latter.

d) Where the outlet of flushing and drainage facilities is located so that there is a risk of backflow of waste water, it shall be suitably safeguarded against the ingress of water (cf. clause 4).

3.3.2 The water quality in industrial and commercial establishments may be adversely affected by radiation (e.g. where water comes into contact with radioactive substances), by diffusion or by corrosion (e.g. due to chemical fumes).

Where, under normal service conditions, the ingress of gases or fumes into the system through a safety device (e.g. free outlet, anti-vacuum valve) is to be anticipated, suitable protection shall be provided.

Protective measures taken to prevent drinking water being contaminated shall be agreed with the responsible experts (e.g. radiological safety engineer) and the water supplier.

3.4 Materials

The materials used for the manufacture and operation of pipes, fittings and appliances shall meet the requirements specified in subclause 2.2 of DIN 1988 Part 2. Where no relevant specifications exist, only such materials shall be used as are unobjectionable or, if irreplaceable for technical reasons, are acceptable in terms of the smell and taste of the water and of the health hazard it represents.

On completion, the system shall be flushed well so as to remove unacceptable quantities of jointing materials, such as thread cutting emulsions, fluxes, descaling and cleaning agents, which might otherwise impair the drinking water quality.

3.5 Stagnation

After prolonged periods of disuse, stagnation may cause the quality of the water in the system to be impaired by materials entering the water in increased concentrations or by bacterial growth, to such an extent that the quality requirements are no longer complied with. Stagnation in this sense is particularly likely to occur where systems are not used during holiday periods, the level of impairment being a function of the materials used, temperature and quality of the water and the duration of disuse.

For health reasons, pipework should be thoroughly flushed after prolonged periods of stagnation (e.g. a period of disuse longer than four weeks in domestic applications). Pipes which, by virtue of their function, are used infrequently or at long intervals, shall be shut off in such interim periods and be flushed before operation recommences. Where pipes are no longer to be used, they shall be disconnected.

3.6 Damage to the system due to lack of, or lack of proper, maintenance

As a result of damage to valves with a safety function or appliances used to heat or treat drinking water, changes in the water may occur which impair its quality or represent a

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:13 2001

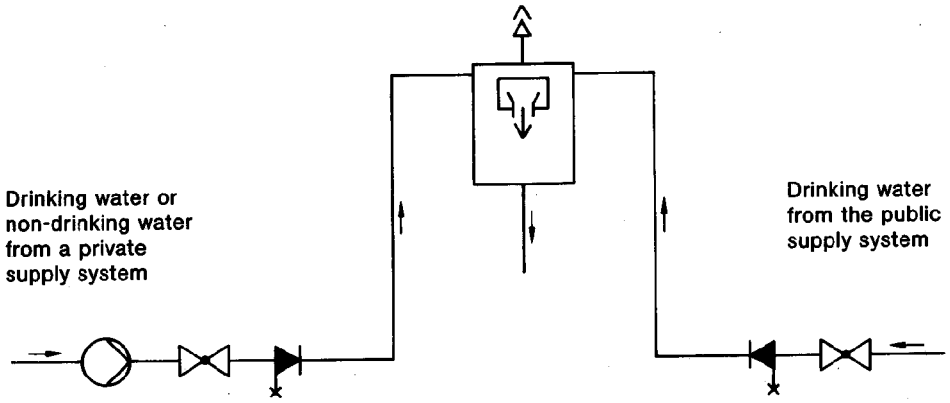


Figure 1. Indirect connection of different types of supply system via elevated cistern

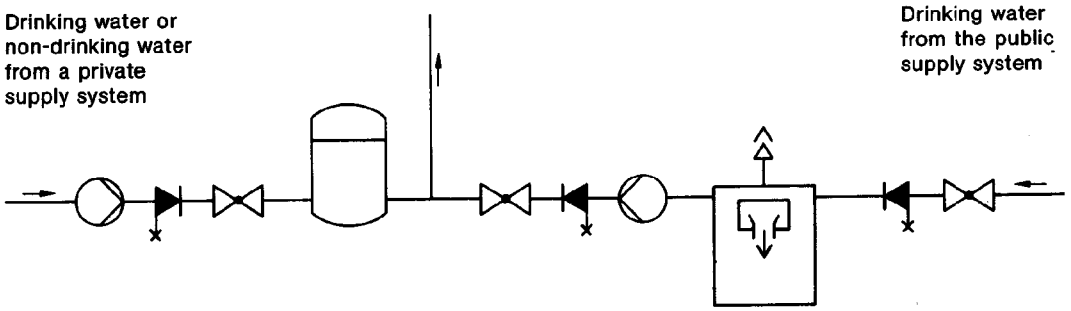


Figure 2. Indirect connection of different types of supply system via underground cistern

health hazard. In cases of damage, backflow prevention devices may entirely or partially loose their safety function while in the case of appliances, unacceptable substances or other substances in unacceptable quantities may escape into the system (cf. clause 5).

To prevent, or to detect in good time, any damage to the system or to the appliances installed or connected to it, appropriate maintenance procedures shall be adopted taking into account the specifications of DIN 1988 Part 8.

3.7 Improper operation

Improper operation of the system (e.g. when appliance connections are in continuous service although designed for short-term service), may lead to the water becoming contaminated and shall be avoided.

4 Backflow prevention

Water contamination as a consequence of backflow shall be prevented by the following measures.

To prevent backflow of water from the installation to the supply mains, a check valve shall be installed directly downstream of the water meter of each system served by the public system. In the case of private systems, the check valve shall be installed downstream of the pump or of the pressure vessel.

Check valves shall be inspected for correct functioning and maintained at regular intervals [1]). Existing systems that are not yet adequately protected against backflow shall be provided with a check valve within three years after publication of this standard.

Check valves may be replaced by devices providing a higher level of protection, without this necessitating a corresponding replacement of safety devices downstream.

4.1 Single-unit and multiple-unit backflow prevention devices

In addition to the check valves to be integrated in the water meter assembly, single-unit or multiple-unit safety devices shall be installed to prevent water being contaminated as a result of backflow.

4.1.1 Single-unit protection

Where single-unit backflow prevention is required, a safety device shall be fitted to each draw-off point or appliance where backflow may occur (cf. figures 3 and 5).

---

[1]) Regular inspection and maintenance of such valves may coincide with the exchange of the water meter as required by law.

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:14 2001

4.1.2 Multiple-unit protection

In the case of multiple-unit backflow prevention, some or all draw-off points and appliances are protected by a single device, the type of device to be used being selected as a function of the unit representing the maximum hazard (disregarding those units for which single-unit protection is provided) (cf. figure 4).

The water in the system downstream of the multiple-unit safety device may have a quality corresponding to the level of protection provided by the device (cf. subclause 4.5.1) unless backflow is prevented between individual units of the section concerned.

4.2 Types of safety devices to be used

The maximum level of protection against water being contaminated as a result of backflow is provided by a free outlet. For economic and operational reasons, other safety devices may be used, these being selected in accordance with table 1 or on the basis of the requirements specified in subclause 4.5.

Only devices of proven suitability (e.g. as demonstrated by a DIN/DVGW or DVGW registered test mark) shall be used.

Appliances for which proof of this suitability in respect of backflow prevention has been provided (e.g. by a DIN/DVGW or DVGW test mark) may be installed in or connected to the system, further safety devices not being required. In other cases, separate safety devices shall be provided.

Backflow prevention devices are presented below in descending order, according to the level of protection they provide (cf. subclause 4.5.2).

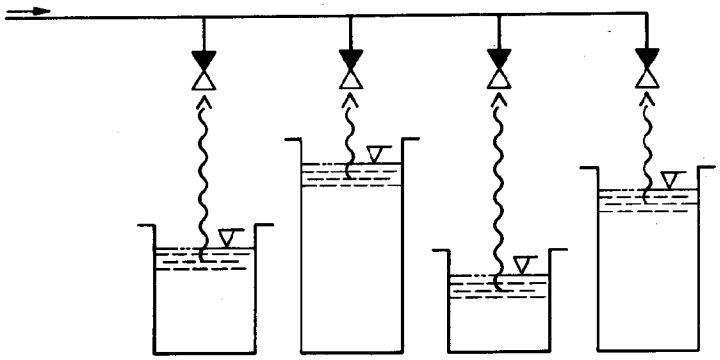


Figure 3. Example of single-unit backflow prevention

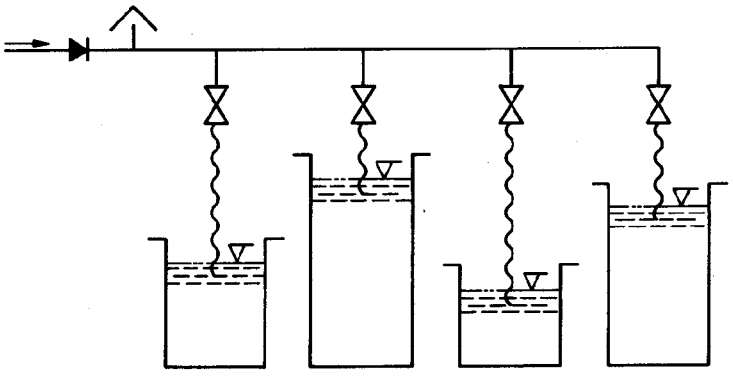
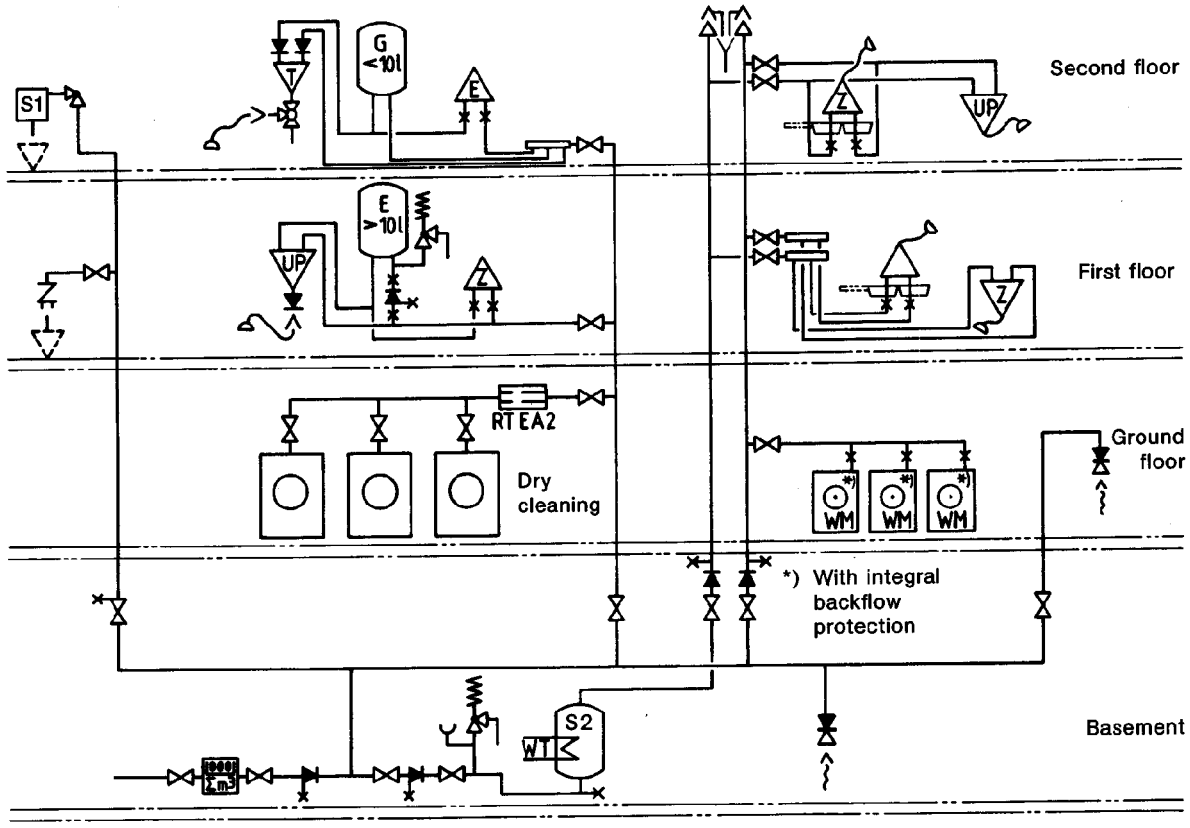


Figure 4. Example of multiple-unit backflow prevention

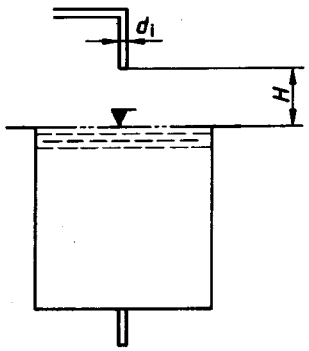
Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:14 2001



Key to symbols:
E, T, UP, Z – draw-off points
S1 – flushing cistern
S2 – storage water heater
WT – heating medium
G – gas water heater
E – electric water heater
WM – washing machine

Figure 5. Typical examples for the safeguarding of a water supply system

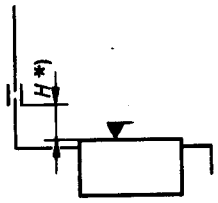
4.2.1 Free outlet



▼ spill-over level (maximum water level; cf. DIN 1988 Part 1).
d_i outlet bore diameter
H minimum clearance between outlet end and spill-over level: $2d_i$, with a minimum of 20 mm.

Figure 6. Free outlet

4.2.2 Pipe interrupters (e.g. in a flushing valve)



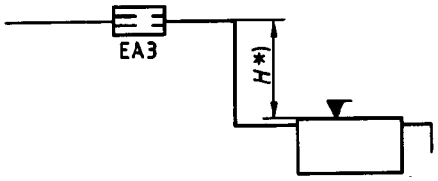
A distinction is made between type A1 (without moving element) and type A2 (with moving element) pipe interrupters, installation of a stopvalve downstream of the type A2 pipe interrupters not being permitted.

Pipe interrupters shall be installed at a height, H, not less than 150 mm above the spill-over level of the cistern, vessel or appliance and, in the case of flushing cisterns, not less than 400 mm above the top of the WC pan.

*) H is to be measured from the bottom end of the air inlet apertures.

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:14 2001

4.2.3 Type 3 air gaps

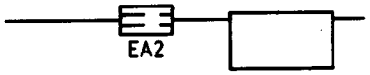


Normal-flow position only if water is drawn.

When the air gap becomes operative, air shall be admitted into the vertical pipe section immediately downstream of it (over a minimum length of 300 mm), i.e. no check valve shall be installed in or downstream and no stopvalve downstream of the air gap.

The installation conditions shall be as for type 2, except that the air gap is to be mounted at least 300 mm above the spill-over level and immediately upstream of the appliance or system.

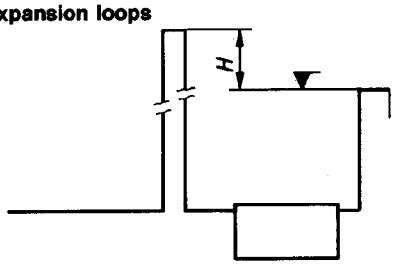
4.2.4 Type 2 air gaps



Normal-flow position only if water is drawn.

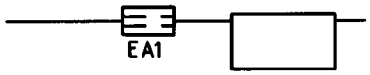
Installation conditions shall be as specified in subclause 4.3.3.5 of DIN 1988 Part 2, December 1988 edition.

4.2.5 Expansion loops



Expansion loops shall be installed so that H is not less than 10,5 m above the highest water level.

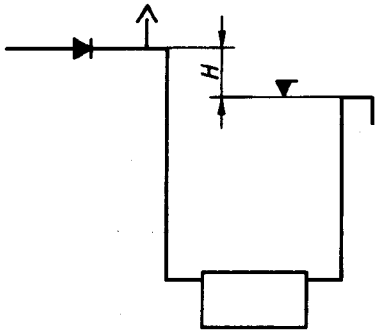
4.2.6 Type 1 air gaps



Disconnects in the case of a pressure drop.

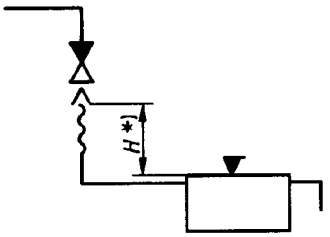
The air gap is permanently in the normal-flow position and becomes operative once the upstream pressure drops below the response pressure (not less than 0,5 bar).

4.2.7 Valve combinations



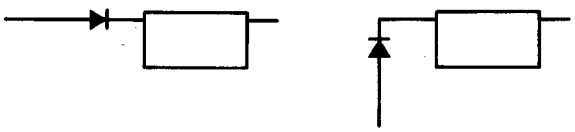
a) Combined check valve and type D or type E anti-vacuum valve, to be installed at a height, H, not less than 300 mm above the spill-over level.

The check valve in the water meter assembly shall not form part of the valve combination.



b) Combined outlet valve with check valve and type C anti-vacuum valve, to be installed at a height, H, not less than 150 mm above the spill-over level.

4.2.8 Check valves



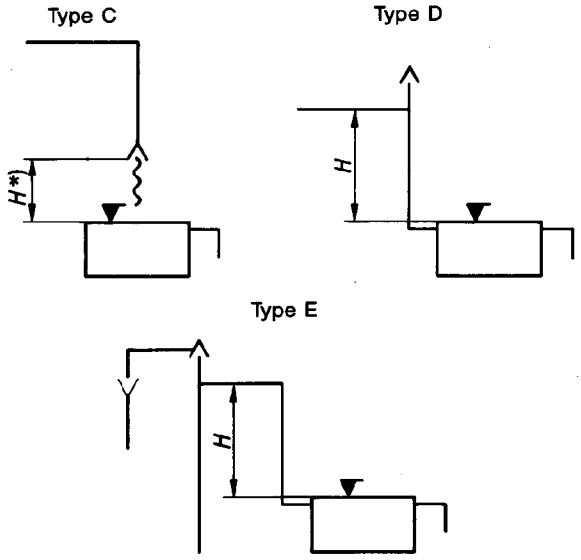
4.2.9 Anti-vacuum valves

A distinction is made between:

a) type C: in-line anti-vacuum valves;

b) type D: anti-vacuum valves without dripping water conduit;

c) type E: anti-vacuum valves with dripping water conduit.



Type C anti-vacuum valves shall be installed at a height, H, not less than 150 mm, and types D and E anti-vacuum valves, at a height not less than 300 mm above the spill-over level.

4.3 Typical applications of safety devices

Table 1 correlates backflow prevention devices which may be used for typical draw-off points, appliances and plant.

Safeguarding of draw-off points, appliances and plant against backflow in industrial, commercial and medical applications, which have not been included in table 1 and which shall also be used for appliances and plant that have been newly developed, shall be based on the specifications given in subclause 4.5.

---

*) H is to be measured from the bottom end of the air inlet apertures.

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:14 2001

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:15 2001

Table 1. **Typical applications of backflow prevention devices (assuming proper use)**

Item No.	Water fitting or appliance	1	2	3	4	5	6	7	8	9	10
		Free outlet	Type A1 pipe interrupter	Type 3 air gap	Type A2 pipe interrupter	Type 2 air gap	Expansion loop	Type 1 air gap	Valve combi-nation	Check valve	Anti-vacuum valve
											
1	Activated charcoal filter in chemical apparatus	●	●	●	●	●	●	–	–	–	–
2	Bath or shower tub with shower hose a) in dwellings, hotels, etc.	●	●	●	●	●	●	●	●	–	–
	b) in hospitals, nursing homes, etc.	●	●	●	●	–	–	–	–	–	–
3	Water outlet below top edge of bath a) in dwellings, hotels, etc.	●	●	●	●	–	–	–	–	–	–
	b) in hospitals, nursing homes, etc.	●	●	–	–	–	–	–	–	–	–
4	Appliances supplying water to storage tanks (e.g. road tankers, manure tanks, pesticide containers)	●	●	Ⓚ	Ⓚ	–	–	–	–	–	–
5	Lawn sprinkler irrigation systems a) Surface irrigation systems	●	●	●	●	●	●	●	●	–	–
	b) Subsurface irrigation systems	●	●	●	●	–	–	–	–	–	–
6	Dosing apparatus for chemicals (e.g. disinfectants, fertilizers, pesticides, detergents)	●	●	●	●	●	●	–	–	–	–
7	Dry cleaning machines (e.g. for operating with perchloroethylene, trichloroethylene)	●	●	●	●	●	●	–	–	–	–
8	Dialysing machines (cf. DIN VDE 0753 Part 4) (see Item No. 10c for disinfection of water softeners)	●	–	–	–	–	–	–	–	–	–

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:15 2001

Table 1 (continued).

Item No.	Water fitting or appliance	1	2	3	4	5	6	7	8	9	10
		Free outlet	Type A1 pipe interrupter	Type 3 air gap	Type A2 pipe interrupter	Type 2 air gap	Expansion loop	Type 1 air gap	Valve combination	Check valve	Anti-vacuum valve
											
9	Printer's shops, copying service, photographic laboratory (e.g. block etching machines (operating with ethanol or propanol), printing ink or dyestuff containers (with aniline or acetone), red or yellow potassium ferrocyanide containers, stop baths (with glacial acetic acid), chemical bath (e.g. developing baths, fixing tanks, nitric acid containers))	●	●	●	●	●	●	–	–	–	–
10	Softening and de-acidifying equipment, not bearing DVGW test mark a) Regeneration without acids and salts	●	●	●	●	●	●	●	●	–	–
	b) Regeneration with acids and salts	●	●	●	●	●	●	–	–	–	–
	c) Disinfection with formalin (e.g. for dialysing machines)	●	●	●	●	●	●	–	–	–	–
11	Hose union taps on domestic premises (e.g. in a garden)	●	●	●	●	●	●	●	●	–	–
12	Photographic developing equipment, not bearing DVGW test mark	●	●	●	●	●	●	–	–	–	–
13	Fish tanks	●	●	–	–	–	–	–	–	–	–
14	Meat and fish processing machinery	●	●	–	–	–	–	–	–	–	–
15	Galvanic baths	●	●	●	●	●	●	–	–	–	–
16	Gas (e.g. acetylene) generators	●	●	●	●	●	●	–	–	–	–
17	Beverage vending or dispensing machines (e.g. for coffee, juices)	●	●	●	●	●	●	●	●	●	●
18	Glass washing facilities (e.g. in catering establishments)	●	●	–	–	–	–	–	–	–	–

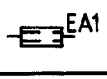
Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:15 2001

Table 1 (continued).

Item No.	Water fitting or appliance	1 Free outlet	2 Type A1 pipe interrupter	3 Type 3 air gap	4 Type A2 pipe interrupter	5 Type 2 air gap	6 Expansion loop	7 Type 1 air gap	8 Valve combination	9 Check valve	10 Anti-vacuum valve
											
19	Equipment for commercial kitchens a) Bain-maries, boiling pans, convection ovens	●	●	–	–	–	–	–	–	–	–
	b) Boiling pans with automatic devices for filling water into the steamer or recooling unit, convection steamers, pressure steamers, pressure cookers	●	●	●	●	●	●	●	●	●	–
20	Heating system filling device, not bearing DVGW test mark a) Water not containing inhibitors	●	●	●	●	●	●	●	●	Ⓚ	–
	b) Water containing inhibitors	●	●	●	●	●	●	–	–	–	–
21	High pressure cleaners	●	●	Ⓚ	Ⓚ	–	–	–	–	–	–
22	Potato peeling machines	●	●	–	–	–	–	–	–	–	–
23	Potato starch separators	●	●	–	–	–	–	–	–	–	–
24	Air-conditioners	●	●	●	●	●	●	●	●	–	–
25	WC pans, urinal bowls	●	●	–	–	–	–	–	–	–	–
26	WC cleaning sprays	●	●	Ⓚ	Ⓚ	–	–	–	–	–	–
27	Laboratory benches a) Chemical laboratory (e.g. in pharmacy, school)	●	●	●	●	●	●	–	–	–	–
	b) Bacteriological laboratory (e.g. in doctor's surgery)	●	●	–	–	–	–	–	–	–	–
28	Automatic milking machine cleaners, with disinfectant dosing apparatus	●	●	●	●	●	●	●	●	Ⓚ	–
29	Equipment for cleaning beverage supply pipes in catering establishments	●	●	●	●	●	●	●	●	Ⓚ	–

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:16 2001

Table 1 (concluded).

Item No.	Water fitting or appliance	1	2	3	4	5	6	7	8	9	10
		Free outlet	Type A1 pipe interrupter	Type 3 air gap	Type A2 pipe interrupter	Type 2 air gap	Expansion loop	Type 1 air gap	Valve combi-nation	Check valve	Anti-vacuum valve
											
30	X-ray apparatus cooling	●	●	●	●	●	●	●	●	●	●
31	Hoses with spray head (kitchen)	●	●	●	●	●	●	●	●	–	–
32	Welding machinery cooling	●	●	●	●	●	●	●	●	●	●
33	Swimming and bathing pools a) Filling and refilling devices	●	●	Ⓚ	Ⓚ	–	–	–	–	–	–
	b) Water treatment and disinfection equipment, as specified in DIN 19 643	●	●	●	●	●	●	–	–	–	–
34	Flushing and cleaning devices for drainage pipework	●	●	Ⓚ	Ⓚ	–	–	–	–	–	–
35	Animal drinking troughs	●	●	–	–	–	–	–	–	–	–
36	Reverse osmosis equipment	●	●	●	●	●	●	●	●	–	–
37	Underwater massage equipment	●	●	–	–	–	–	–	–	–	–
38	Washing machines and dishwashers (cf. DIN VDE 0700 Part 600)	●	●	–	–	–	–	–	–	–	–

Key to symbols:

● backflow prevention device permitted

– backflow prevention device not permitted

Ⓚ only permitted for temporary connection (cf. subclause 4.5.2.2)

4.4 Backflow protection of water heaters

The safety equipment of water heaters shall comply with the requirements specified in subclause 6.4 of DIN 4753 Part 1, March 1988 edition, the devices being selected in accordance with table 2.

A check valve shall be installed in the flow pipe upstream of water heaters with a capacity exceeding 10 l, except for vented instantaneous heaters.

4.5 Criteria for the selection of safety devices

4.5.1 Classification

To permit safety devices to be selected to suit the particular application, the substances and microorganisms which might enter the drinking water and thus impair its quality or represent a health hazard, are taken as a criterion for classifying the water into five classes. Where different types of such substances or microorganisms may enter the drinking water at the same time, classification is to be based on the most hazardous substance present, irrespective of its concentration.

Class 1

Water represents no health hazard or impairment (e.g. causing a change in taste, odour, colour).

Examples: heated water, temporary turbidity caused by air bubbles.

Class 2

Water represents no health hazard, but its quality is impaired by substances causing a change in taste, odour, or colour.

Examples: coffee, water containing iron bacteria, stagnant water in a supply system.

Class 3

Water represents a health hazard due to substances of low toxicity, i.e. substances which are not to be assigned to class 4.

Examples: water containing ethylene glycol (anti-freeze), copper sulphate solution, water in heating systems, without additives or with additives of low toxicity.

Class 4

Water represents health hazard due to toxic, highly toxic, carcinogenic or radioactive substances being present (risk to life).

Toxic or highly toxic are substances the acute or chronic toxicity of which, when expressed as lethal dose *LD 50*, does not exceed 200 mg per kg of body weight or, when expressed as lethal concentration *LC 50* does not exceed 2 mg per litre of air over a period of four hours. The values are to be obtained from the manufacturer or importer [1].

Carcinogenic substances include, in particular, those listed in clauses III A 1, III A 2 and III B of the current *MAK-Liste* (MAK list) (cf. page 14).

Examples: water containing lindane, phosalon, parathion (insecticides), or hydrazine.

Class 5

Water represents no health hazard due to contagious disease pathogens (epidemic, risk to life).

Examples: water containing hepatitis viruses or salmonella.

4.5.2 Classification of safety devices

Safety devices shall be selected as a function of the classes (as defined in subclause 4.5.1 and table 2).

Table 2. **Correlation of safety devices and water quality classes**

Item No.	Type of safety device (cf. subclause 4.2)	Classification of substances (cf. subclause 4.5.1)			
		Classes 1 and 2	Class 3	Class 4	Class 5
1	Free outlet	●	●	●	●
2	Type A1 pipe interrupter	●	●	●	●
3	Type 3 air gap	●	●	●	Ⓚ
4	Type A2 pipe interrupter	●	●	●	Ⓚ
5	Type 2 air gap	●	●	●	–
6	Expansion loops	●	●	●	–
7	Type 1 air gap	●	●	–	–
8	Valve combination	●	●	–	–
9	Check valve	●	Ⓚ	–	–
10	Anti-vacuum valve	●	–	–	–

Key to symbols:
● backflow prevention device permitted
– backflow prevention device not permitted
Ⓚ only permitted for temporary connection (cf. subclause 4.5.2.2)

Example: An appliance intended for permanent connection which might supply class 3 water (possibly only in the event of damage) shall be protected by one of the devices listed under item Nos. 1 to 8, with due consideration being given to the specifications of subclause 4.2.

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:16 2001

4.5.2.1 Determination of greatest risk

The type of safety device is to be selected as a function of the greatest risk in the event of damage, it being assumed that such damage and backflow occur simultaneously.

Before appliances for which the risk in terms of impairment of water quality or a health hazard are not known are installed in or connected to the system, the water supplier shall be consulted.

4.5.2.2 Temporary connection

Where an appliance is connected to the system only temporarily, so that it is in contact with the water only during the connection period, such a connection shall be monitored by the operator and not maintained for more than one working day.

5 Protection of drinking water in water heaters

A distinction is made between directly heated (direct systems) and indirectly heated (indirect systems) water heaters (cf. subclause 3.2 of DIN 4753 Part 1).

Where water is heated directly by flue gases (from the combustion of solid, liquid or gaseous fuels), or by electric energy, its quality will not be impaired in the event of perforation of the wall between water and combustion or heating element.

In indirect systems, particular care shall be taken to ensure adequate protection of the drinking water from being contaminated by the heating medium. Where the heating medium (gas or steam) might escape from draw-off points, a heat exchanger complying with DIN 4753 Part 11 shall be installed so as to prevent any contact between heating medium (except where chlorinated fluorocarbons are used; cf. subclause 5.2) and drinking water in service.

5.1 Types of water heaters

As set out in DIN 1988 Part 2, water heaters are classified as follows:

type A: heating surfaces protected against corrosion;

type B: corrosion-resistant heating surfaces;

type C: highly corrosion-resistant heating surfaces;

type D: heater with heat exchanger.

Water heaters shall be selected on the basis of the operating conditions, taking into account the following factors.

a) Corrosivity of heating medium and drinking water.

   Since a general assessment of a heating medium with regard to its corrosivity cannot be made, this factor has not been included in the following classification scheme (cf. table 3).

   Accordingly, in practice, a further check is to be made whether a design selected on the basis of this scheme is also suitable in terms of corrosivity of heating medium and drinking water.

b) Class of heating medium (or heat transfer medium) from which an impairment or a health hazard may originate.

   If the medium heating the drinking water is itself heated by a second medium of a higher class, care shall be taken to ensure that the latter cannot enter it. If it does, such a failure must be brought to the attention of the operator by way of a display or a similar device. Where no such provision is or is to be made, selection of the water heater shall be based on the higher (i.e. more hazardous) class of heating medium (cf. subclause 4.5.1 and table 3).

c) Allowable working pressure, $p_{e,zul}$, in the heat exchanger.

   An assessment of the risk involved in the event of damage shall be based on whether the allowable working pressure in the heat exchanger, $p_{e,zul}$ [2], is greater or less than 3 bar.

A heater selected on the basis of table 3 represents a minimum level of safety, selection of a design satisfying more stringent requirements (e.g. type C instead of B) being permitted.

---

[2] See subclause 6.2.2 of DIN 4751 Part 2, September 1968 edition.

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:16 2001

Table 3. **Correlation of water heaters (indirect systems) and heating media**

Item No.	Heater type	Class of heating medium (cf. subclause 4.5.1)					
		Classes 1 and 2		Class 3		Classes 4 and 5	
		Escape of heating medium in gaseous form from draw-off point in the event of damage					
		possible	not possible	possible	not possible	possible	not possible
1	Type D	●	●	●	●	●	●
2	Type C	●	●	● Only permitted where chlorinated fluorocarbons are used as heating medium.	●	–	–
3	Type B	●	●	–	● Only permitted for $p_{e,zul}$ not exceeding 3 bar.	–	–
4	Type A	● Permitted, except for automatic refilling device in domestic heating system or district heating.		–	–	–	–

Key to symbols:
● permitted
– not permitted

5.2 Use of chlorinated fluorocarbons as heating medium

Type C heaters using chlorinated fluorocarbons as the heating medium may be installed under the following conditions.

a) Only chlorinated fluorocarbons as listed in table 4 are used.

b) The quantity of chlorinated fluorocarbons escaping from a draw-off point in the event of damage does not exceed the values given in table 4.

c) If the quantity of chlorinated fluorocarbons in the appliance exceeds that specified in table 4, a degasifying device or other suitable means shall be provided to ensure that the requirement specified under b) is complied with.

d) Only lubricants which do not represent a health hazard in the event of damage are used as additives in the refrigerant circuit.

Table 4. **Maximum permissible quantities of chlorinated fluorocarbons**

Chlorinated fluorocarbon type	R11	R12	R13	R21	R22	R113	R114	R115	R500	R502
Maximum quantity, in kg	1,29	1,13	0,99	0,45	0,81	0,42	1,62	1,44	0,93	1,04

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:17 2001

Standards and other documents referred to

DIN 1988 Part 1	Drinking water supply systems; general (DVGW Code of practice)
DIN 1988 Part 2	Drinking water supply systems; materials, components, appliances, design and installation (DVGW Code of practice)
DIN 1988 Part 3	Drinking water supply systems; pipe sizing (DVGW Code of practice)
DIN 1988 Part 5	Drinking water supply systems; pressure boosting and reduction (DVGW Code of practice)
DIN 1988 Part 6	Drinking water supply systems; fire fighting installations (DVGW Code of practice)
DIN 1988 Part 7	Drinking water supply systems; measures to prevent corrosion and scale formation (DVGW Code of practice)
DIN 1988 Part 8	Drinking water supply systems; operation (DVGW Code of practice)
DIN 2000	Central drinking water supply systems; basic requirements for drinking water; design, construction and operation of systems
DIN 2403	Marking of pipes according to the fluid transported
DIN 4751 Part 2	Safety equipment for heating installations with flow temperatures up to 110 °C; vented and unvented hot water systems with an output up to 300 000 kcal/h and thermostatic control
DIN 4753 Part 1	Hot water supply systems for drinking water and service water; design, equipment and testing
DIN 4753 Part 11	Hot water supply systems for drinking water and service water; heat exchangers; requirements, testing and marking
DIN 19643	Treatment and disinfection of water for swimming and bathing pools
DIN VDE 0700 Part 600	Safety of household and similar electrical appliances; connection to hot water supply systems, washing machines and dishwashers
DIN VDE 0753 Part 4	Rules for the application of dialysing machines

[1] *Gesetz zum Schutz vor gefährlichen Stoffen* (German Act on the protection against dangerous substances), as of 16 September 1980, *BGBl.* (German Federal Law Gazette) I, p. 1718 *)

Lebensmittel- und Bedarfsgegenständegesetz, as of 15 August 1974, *BGBl.* I, p. 1945 *)

Bundesseuchengesetz, as of 22 December 1979, *BGBl.* I, p. 2263 *)

DVGW W 216 *Versorgung mit unterschiedlichen Wässern* (Water supply from different sources)

Trinkwasserverordnung, as of 22 May 1986, *BGBl.* I, p. 760 *)

MAK-Liste: Maximale Arbeitsplatzkonzentrationen und biologische Arbeitsstofftoleranzwerte (Threshold values for dangerous substances at workplaces and biocompatibility values), *Mitteilung* XXIII, 1987 (obtainable from *Deutsche Forschungsgemeinschaft*, Kennedyallee 40, D-5300 Bonn 2)

Other relevant standards and documents

DIN 4046	Water supply; terminology (DVGW Code of practice)
Supplement 1 to DIN 1988 Part 2	Drinking water supply systems; summary of standards and other technical rules relating to materials, components and appliances (DVGW Code of practice)
Supplement 1 to DIN 1988 Part 3	Drinking water supply systems; examples of calculation (DVGW Code of practice)

Unfallverhütungsvorschrift Kälteanlagen (Accident prevention regulation on refrigeration systems) (VBG 20)

Previous editions

DIN 1988: 08.30, 09.40, 03.55, 01.62.

Amendments

In comparison with the January 1962 edition of DIN 1988, the contents of the standard has been expanded, completely revised and split up into DIN 1988 Parts 1 to 8.

*) Obtainable from *Deutsches Informationszentrum für Technische Regeln (DITR) im DIN*, Burggrafenstraße 6, D-1000 Berlin 30.

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:17 2001

Explanatory notes

This standard has been prepared jointly by Technical Committee IV 7 of the *Normenausschuß Wasserwesen* and the *DVGW Deutscher Verein des Gas- und Wasserfaches e.V.*

DVGW first issued its *Richtlinien für den Anschluß von das Trinkwasser gefährdenden Geräten und Anlagen* (Code of practice for the connection of appliances and equipment representing a hazard to drinking water quality) in June 1966 in *DVGW-Arbeitsblatt* W 503. This code of practice was expanded in March 1972 and September 1976 and included in the specifications of DIN 1988.

This standard now includes the specifications previously given in *DVGW-Arbeitsblatt* W 503 and takes account of EUREAU *) Document 'Protection against pollution'. The method of risk analysis and the choice of appropriate safety devices' prepared by EUREAU Committee 12 and completed in 1981. It has been applied in the EC member states for two years and is due to be issued as a European Standard.

International Patent Classification

E 03 C 1/10

E 03 C 7/09

E 21 B 43/00

---

*) European Association of Water Suppliers.

Copyright by the DIN Deutsches Institut Fur Normung E V
Thu Jun 21 13:44:17 2001