BRITISH STANDARD

BS EN
1293:1999

General requirements for components used in pneumatically pressurized discharge pipes, drains and sewers

The European Standard EN 1293:1999 has the status of a British Standard

ICS 23.040.01; 91.140.80; 93.030

National foreword

This British Standard is the English language version of EN 1293:1999.

The UK participation in its preparation was entrusted by Technical Committee B/505, Waste water engineering, to Subcommittee B/505/1, General requirements for pipes and fittings, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 9 and a back cover.

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EUROPEAN STANDARD
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EN 1293

April 1999

ICS 13.060.30; 23.040.01

English version

General requirements for components used in pneumatically pressurized discharge pipes, drains and sewers

Prescriptions générales pour les composants utilisés dans les réseaux d'èvacuation, de branchement et d'assainissement sous pression pneumatique

Allgemeine Anforderungen an Bauteile von pneumatisch betirebenen Abwasserdruckleitungen

This European Standard was approved by CEN on 16 December 1998.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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

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

Ref. No. EN 1293:1999 E

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 165, Waste water engineering, the Secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 1999, and conflicting national standards shall be withdrawn at the latest by October 1999.

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

This European Standard provides the basis for the preparation or revision of product standards for discharge pipes, drains and sewers operating as pneumatically pressurized systems (see clause **1** "Scope")

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

Contents

1 Scope

This standard specifies general requirements for components for use in pneumatically pressurized discharge pipes, drains and sewers.

This European Standard provides the general basis for the preparation or revision of product standards. Some of the provisions may need modifications when drafting harmonized European Standards. It is not applicable for the evaluation of products.

It is applicable as a reference for drawing up a product specification, if there is no product standard available.

Components covered are pipes, fittings and joints.

This European Standard includes marking, quality control and optional certification requirements.

Components are those used in systems that convey in a satisfactory manner:

— domestic wastewater;

— rainwater and surface water;

— other waste waters (e.g. industrial wastewater) that will not damage the components.

This European Standard applies equally to components which are factory-made and to those constructed on site, where applicable.

2 Normative references

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

EN 681-1, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber.*

prEN 681-2, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 2: Thermoplastic elastomers.*

prEN 805:1996, *Water supply — Requirements for systems and components outside buildings.*

EN ISO 9001:1994, *Quality systems — Model for quality assurance in design, development, production, installation and servicing.*
(ISO 9001:1994)

EN ISO 9002:1994, *Quality systems — Model for quality assurance in production, installation and servicing.*
(ISO 9002:1994)

EN 45011, *General requirements for bodies operating product certification systems.*
(ISO/IEC Guide 65:1996)

EN 45012, *General requirements for bodies operating assessment and certification/registration of quality systems.*
(ISO/IEC Guide 62:1996)

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (Hardness between 10 IRHD and 100 IRHD).*

3 Definitions, symbols and abbreviations

For the purposes of this standard, the following definitions apply.

3.1

adjustable joint

joint which permits significant angular deflection at the time of installation but not thereafter

3.2

allowable maximum operating pressure PMA

maximum hydrostatic pressure including surge that a component can withstand from time to time in service

3.3

allowable operating pressure PFA

maximum hydrostatic pressure that a component can withstand continuously in service

3.4

allowable test pressure PEA

maximum hydrostatic pressure that a newly installed component can withstand for a relatively short duration when either fixed above ground level or laid and backfilled under-ground, in order to ensure the integrity and tightness of the pipeline

3.5

external diameter OD

mean external diameter of the pipe barrel at any cross-section. For pipes with external profiles on the barrels, the external diameter is the maximum diameter when viewed in cross-section

3.6

factory production control

surveillance mode in which a manufacturer performs its own surveillance on the result of its production according to a set of rules formally specified in quality assurance or quality management provision

3.7

flexible joint

joint which permits significant angular deflection, both during and after installation and which can accept a slight offset of the centre line

3.8

joint

connection between the adjacent ends of two components including the means of sealing

3.9
mean internal diameter ID
mean internal diameter of the pipe barrel at any cross-section

3.10
nominal size DN
numerical designation of size of component, which is a convenient integer approximately equal to a manufacturing dimension in mm. This can apply to either the internal diameter (DN/ID) or the external diameter (DN/OD)

3.11
pipe barrel
cylindrical part of the pipe with a uniform cross-section excluding socket and spigot

3.12
pneumatically pressurized system
system where flow is caused by pneumatic pressure and where the pipe normally operates full. The pneumatic pressure can be applied either as compressed air upstream or partial vacuum downstream

3.13
proof load
specified test load which a component withstands where the related requirements of the product standard are met

3.14
quality control system
organizational structure, responsibilities, procedures, processes and resources for implementing quality management

3.15
rigid joint
joint that does not permit significant angular deflection, either during or after installation

3.16
ring stiffness
resistance of a pipe to diametrical deflection in response to external loading applied along one diametric plane is given as follows:

$$S = \frac{EI}{D_m^3}$$

where

S is the ring stiffness of the pipe in kilonewtons per square metre;

E is the modulus of elasticity in flexure in the circumferential direction in kilonewtons per square metre;

I is second moment of area of the pipe wall in the longitudinal direction, per unit length, in metres to the fourth power per metre;

D_m is the diameter of the neutral axis of the pipe wall, in metres.

3.17
ultimate load
that load which causes failure of component (under test) which shall be as specified in product standards

4 Functional and dimensional requirements

Product standards may include specifications which are more stringent, but not less stringent than those of this European Standard.

4.1 Dimensions of pipes and fittings

4.1.1 *Nominal sizes*

Nominal sizes DN shall be given in product standards as DN/ID or DN/OD.

Nominal sizes specified in product standards should preferably be selected from Table 1 or Table 2.

Other nominal sizes may be specified in product standards.

Table 1 — Nominal sizes DN/ID

30, 40, 50, 60, 80, 100, 125, 150, 200.

Table 2 — Nominal sizes DN/OD

32, 40, 50, 63, 75, 90, 100, 110, 125, 140, 160, 180, 200.

4.1.2 *Internal diameters and limit deviations*

Product standards shall specify:

— internal diameters and limit deviations; or

— external diameters, wall thicknesses and limit deviations; or

— minimum bores (see **5.1**).

Limit deviations on the internal diameter are shown in Table 3:

Table 3 — Limit deviations on internal diameters

Nominal size	Limit deviations on mean internal diameter mm	Limit deviations on individual internal diameter mm
DN ≤ 100	±0,05 DN	±0,1 DN
100 < DN ≤ 200	±5	±10

NOTE DN in Table 3 can be applied to either DN/ID or DN/OD.

4.2 Geometry of pipes

Except in the case of pipes delivered in coils, pipes shall be straight, within tolerances specified in product standards (see **5.2**). If pipes are delivered in coils, product standards shall specify a minimum radius of the coils.

The angle between the planes of the end faces of the pipe and the relevant axis shall be 90° with a tolerance such that the function of the pipe joint shall not be impaired (see **5.3**).

A range of pipe lengths can be specified in product standards.

Limit deviations on the wall thickness and the pipe length shall be specified in product standards where the thickness and/or the length themselves are not specified, product standards shall require the manufacturer to declare the limit deviations.

4.3 Geometry of fittings

4.3.1 *General*

Angles for fittings shall be stated in the product standards.

Where applicable, tolerances on angles shall be specified in product standards.

4.3.2 *Bends*

Angles α for bends shall be specified in product standards. Angles α should preferably be selected from Table 4.

Table 4 — Angles α for bends

11°15′, 15°, 20° to 22°30′, 30°, 45°, 60°, 90°

Other angles α may be allowed in product standard.

NOTE Radii r for bends should be specified in product standards.

4.3.3 *Branches*

Angles β for branches specified in product standards should preferably be selected from Table 5.

Table 5 — Angles β for branches

45°, 60°, 90°

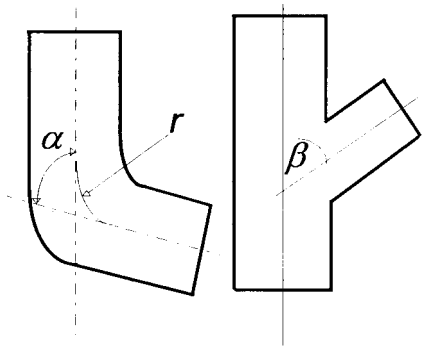


Figure 1 — Illustrations of angles and radius of fittings

4.4 Smoothness of bore

The interior surfaces of pipes and fittings shall be smooth and free from visible defects that may adversely affect their hydraulic performance. Where appropriate, the product standard shall specify the acceptable imperfections, or specific hydraulic performance test for which consideration shall be given to the effects of joint geometry.

4.5 Appearance and soundness

Pipes and fittings shall be free from defects which could impair their performance in service.

4.6 Longitudinal bending moment resistance

Product standards shall specify for long rigid and semi-rigid pipes of small diameters either longitudinal bending moment resistance in kilonewtons per metre or bending load in kilonewtons for a specified span and loading conditions. Alternatively, limiting values of length to diameter ratios shall be given in product standards (see **5.4**).

NOTE This is to minimize problems e.g. overloading when transporting, lifting, handling and installing pipes.

4.7 Interconnection

Product standards shall state whether or not components within the same dimensional series (or tolerances) are capable of interconnection.

Where such interconnection is not confirmed, product standards shall specify the means (e.g. adapters) required to effect interconnection.

4.8 Corrosion resistance

Pipes, fittings and joints shall be resistant to corrosion by domestic waste water, surface water and the effects of soil and groundwater. Corrosion resistance tests can be specified in product standards.

4.9 Abrasion resistance

Pipes, fittings and joints shall be resistant to the abrasive effects of hard particles in domestic waste and surface waters. Abrasion resistance tests can be specified in product standards.

4.10 Modification

Any modification on site shall be carried out, in accordance with appropriate product standards and/or manufacturer's instructions, without adversely affecting functional requirements.

4.11 Coatings and linings

Where appropriate, coatings, linings or other protective measures shall be specified in product standards. Where appropriate, additional protection for joints should be specified.

4.12 Long-term behaviour

Where appropriate, long term behaviour of components shall be specified in product standards.

4.13 Durability

Product standards shall give details of which characteristics are subject to durability requirements.

4.14 Sealing elements

Product standards shall either specify the sealing elements or require specification from the pipe manufacturer.

NOTE Sealing elements should be supplied by the pipe manufacturer.

4.15 Mechanical strength

Pipes and, where appropriate, fittings shall be classified according to their characteristic structural behaviour. This behaviour can depend on:

— the material, particularly its ability to either deform, and/or crack and/or rupture at failure under load;

— the geometry, diameter, shape and wall thickness;

— the internal pressure in service;

— the mechanical characteristics of the surrounding soil, after installation.

The mechanical strength of components shall take into account all their relevant factors for safe and reliable operation in systems, in particular:

— the minimum and maximum operation temperatures and the temperature-induced loads;

— the effects of constant or variable long term loading on the material properties (e.g. creep, fatigue);

— the effects of potential hazards such as ground subsidence.

Product standards shall state methods by which resistance to internal and external loadings is assessed. Pipes, fittings and joints shall be capable of withstanding pressure of 80 kPa below atmospheric (approximately 20 kPa absolute pressure).

4.16 Pressure classes for pipes, fittings and joints

Where appropriate, pressure classes for components shall be given in product standards. When product standards specify pressure classes, the related PMA, PFA and PEA values shall be given (see prEN 805).

4.17 Airtightness and watertightness

Pipes, fittings and joints shall be designed and manufactured to ensure airtightness and watertightness (both internal air pressure above and below atmospheric) throughout the design life, under the design loading conditions.

NOTE This is the main difference between EN 773 and EN 1293.

The maximum internal water test pressure shall be at least the allowable test pressure (PEA) of the component under static conditions. The minimum internal air test pressure shall be 80 kPa below atmospheric (approx. 20 kPa absolute pressure). Where the airtightness and watertightness of the joint assembly is mainly dependent on internal air pressure below atmospheric, an additional external hydrostatic pressure test or a partial vacuum test shall be carried out.

Product standards shall indicate the necessary tests to demonstrate compliance (see **5.7**).

4.17.1 *Seals for joints*

Product standards shall specify requirements for sealing materials. Where appropriate, EN 681-1 and prEN 681-2 shall apply.

The seals shall be designed in such a way as to ensure long term airtightness and watertightness, taking into account the properties of the sealing materials (e.g. elasticity, strength, relaxation, temperature sensitivity) and the possibility of movements during the design lifetime of the system.

4.17.2 *Rigid joints*

Product standards shall state the performances of rigid joints and shall specify the necessary test methods assessing their airtightness and watertightness.

4.17.3 *Adjustable joints*

The airtightness and watertightness of adjustable joints shall be tested with the specified joint deflection value a as illustrated in Figure 2.

The value shall be at least 30 mm.

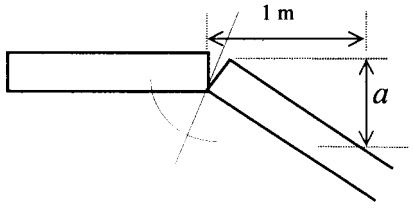


Figure 2 — Joint deflection value a

If the adjustable joint includes an elastomeric gasket, it shall be tested with a shear load as stated for flexible joints according to **4.17.4**.

4.17.4 *Flexible joints*

The airtightness and watertightness of flexible joints shall be tested under the following conditions:

— the joint deflected up to the specified value a, as illustrated in Figure 2. This value shall be at least 30 mm for semi-flexible joints and 60 mm for fully flexible joints;

— the joint subjected to a shear force expressed in newtons at least 10 × DN or where appropriate (e.g. flexible pipes), to a diametral deflection applied to the spigot near the joint of at least 5 % of the external pipe diameter;

— or a combination of the two conditions.

Product standards shall state test methods by which airtightness and watertightness is assessed.

4.18 Restrained joints

Where available, performances of restrained joints shall be specified in product standards.

4.19 Temperature

Pipes, fittings and joints, at an ambient temperature of 10 °C, shall be suitable for a continuous water discharge temperature of 45 °C.

Where appropriate, temperature resistance tests shall be specified in product standards.

4.20 Dimensional stability

Rigid pipes and fittings and pipe joints shall be dimensionally stable, when installed.

For flexible and semi-rigid pipes and fittings, the practical admissible deformation when installed, shall be stated in product standards by giving both short-term and long-term values.

A test for buckling shall be stated in product standards, where appropriate.

5 Test methods

Details of test methods shall be stated in product standards.

5.1 Measurement of diameters and wall thicknesses

5.1.1 ***Mean internal diameter of barrels***

Where measurement of internal diameter is a requirement of the product standard, it shall be carried out adjacent to all ends of the component. At least two measurements shall be taken near each end and the mean internal diameters calculated. The measurements shall be taken at approximately equal angular spacing.

5.1.2 ***Mean external diameter of barrels***

Where measurement of external diameter is a requirement of the product standard, it shall be carried out near all ends of the component in a similar manner to that in **5.1.1**, or by calculation from the circumference near all ends of the component.

5.1.3 ***Wall thickness of barrels***

Where measurement of wall thickness is a requirement of the product standard, it shall be carried out near all ends of the component. Near each end, the thickness shall be measured with a minimum of four points. The measurements shall be taken at approximately equal angular spacing. Alternatively minimum and maximum values shall be determined near each end.

5.2 Measurement of deviation from straightness of barrels

Where measurement of deviation from straightness is a requirement of the product standard, the method of measurement shall be stated. Deviation shall be measured at the centre point of a line of length not less than two-thirds of the barrel length.

5.3 Measurement of deviation from squareness of the ends of the pipes

Where measurement of deviation from squareness is a requirement of the product standard, the method of measurement shall be stated.

5.4 Longitudinal bending moment resistance test for pipes

Where there is a longitudinal bending moment resistance requirement in the product standard, the following test criteria shall apply:

— the test shall be carried out on a test machine having a load recording facility;

— the pipe to be tested shall be supported at each end and symmetrically loaded (3 or 4 point loading) so that it will break with one circumferential crack;

— the span shall be not less than $5 \times$ DN, expressed in millimetres;

— the supports shall be designed to produce vertical reactions only.

5.5 Crushing test for pipes with rigid behaviour

If a product standard requires a crushing test, it shall be carried out on a test machine having:

— a load recording facility;

— a stiff loading beam the lower face of which is an elastomeric bearing strip of thickness from 10 mm to 40 mm and hardness between 45 IRHD and 65 IRHD (International Rubber Hardness Degree) according to ISO 48. The maximum width of the bearing strip shall be 50 mm;

— a lower beam(s) on which is located a V shaped support which is either covered with or has two bearing strips of elastomeric material having the same thickness and hardness as that on the loading beam. Where the angle (β) of opening of the V is 170° or more, the crushing load shall be as recorded. Where the opening is less than 170°, a reduction factor shall be applied to the recorded strength as given in Table 6.

Table 6 — Reduction factors for V shaped support

Angle	$150° \leq \beta < 160°$	$160° \leq \beta < 170°$	$\beta \geq 170°$
Reduction factor	0,98	0,99	1,00

The test consists of subjecting a complete pipe or pipe section to the action of a uniformly distributed load. To achieve uniform distribution, bearers may, for instance, be divided into sections.

The test load shall be applied symmetrically over the entire loading length. The position of the load may be adjusted to maintain horizontal stability.

During application of at least the final third of the specified load, the rate of increase of load shall be constant and this period of loading shall be at least 30 s.

5.6 Stiffness test for pipes with flexible behaviour

If a product standard requires a stiffness test, it shall be carried out on a test machine, having load and deformation recording facilities. The product standard shall state whether the bearer and the beam shall be flat steel plates (with no bearing faces or strips) or as described in **5.5**.

The determination of ring stiffness and creep value shall be specified in each product standard.

5.7 Pressure tests

5.7.1 *Tests for pipes*

Where applicable, pipe or pipe sections are to be tested under pressure below atmospheric for at least one hour.

A test shall be carried out on one or more pipes or pipe sections at ambient or elevated temperature, under hydrostatic pressure as stated in product standards.

Where applicable, a test shall be carried out on one or more pipes or pipe sections, under partial vaccum as stated in product standards.

5.7.2 *Test for joints*

The tests shall be carried out on two pipes or pipe sections jointed and supported in such a way that they can move in relation to each other to the limits of the requirements stated in product standards.

The test conditions shall be as specified in **4.17**.

NOTE Product standards can combine the tests stated in **5.7.1** and **5.7.2**.

5.7.3 *Test for restrained joints*

Test methods for restrained joints shall be specified in product standards, where appropriate.

5.8 Tests for fittings

Test methods for fittings shall be stated in product standards.

6 Quality control

Product standards shall specify sampling and testing regimes including factory production control.

Product standards shall require the manufacturer to establish and maintain an effective documented quality control system. Systems based on EN ISO 9002:1994 or EN ISO 9002-1:1994 should be considered to comply with this requirement.

Product standards shall define how certification by third party shall be carried out.

Product standards may make third party product certification optional. Where this is the case, product standards shall define how it shall be carried out. The third party body complies with the requirements of EN 45011 and/or EN 45012 or equivalent specifications.

7 Marking

Product standards shall specify the marking requirements.

Each component or, where this is not possible, each package of components, shall be marked indelibly and in a clearly visible manner and identification of the component shall be made in such a way that no doubt is possible.

Marking shall include at least the following information:

— EN number (product standard number);

— identification of manufacturer and site of production;

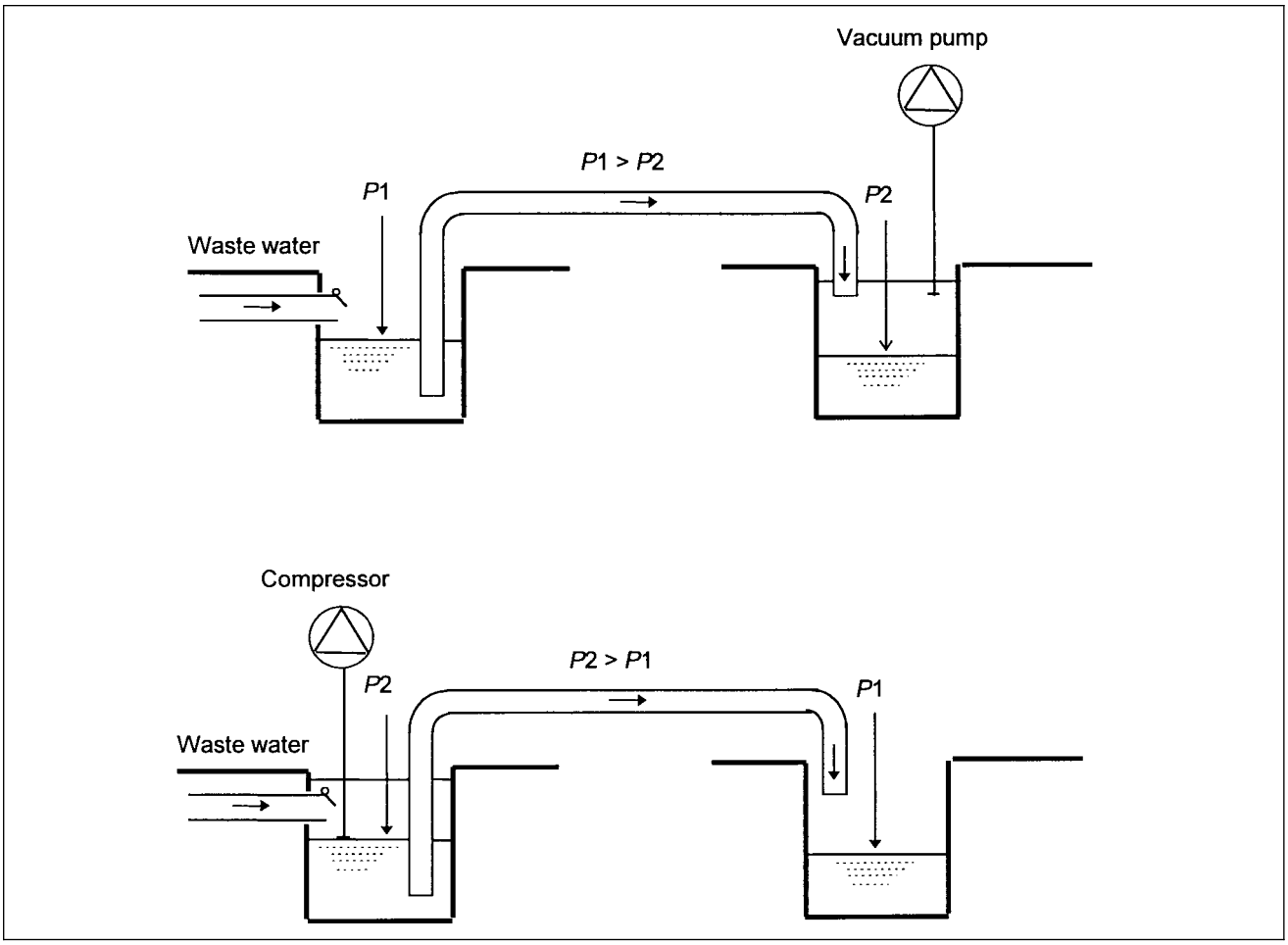
— identification of date or period of manufacture;

— identification of third party certification body, where applicable;

— identification of classes, where applicable;

— identification of use, where applicable.

Annex A (informative)
Examples for principles of pneumatically pressurized waste water systems



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