UDC 628.245-033.3 : 624.131.63
: 625 : 620.1

DEUTSCHE NORM

February 1991

# Subsoil and dual-purpose concrete field drains for use in road construction and civil engineering

Requirements and testing

**DIN 4262** Part 3

Sicker- und Mehrzweckrohre für Verkehrswege- und Tiefbau aus Beton; Anforderungen und Prüfungen

*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.*

Dimensions in mm



## 1 Scope and field of application

This standard specifies requirements and methods of test for concrete pipes for use as subsoil (fully or partially perforated) or dual-purpose field drains in road construction and civil engineering.

Note. A subsoil drain is a drain designed to collect and discharge gravitational water, a dual-purpose drain combining the functions of a partially perforated subsoil drain and a fully perforated drain (quoted from: DIN 19 666).

DIN 4032 may be used by analogy, unless specified otherwise in this standard.

## 2 Material

Drains shall be made from aerated concrete and/or concrete of dense structure and be provided with perforations.

## 3 Requirements

At the time of delivery or after 28 days at the latest, drains shall meet the requirements specified in subclauses 3.1. to 3.9.

### 3.1 Dimensions

Drains shall, unless otherwise agreed, have the cross-sectional form and the dimensions specified in DIN 4032 [1]).

#### 3.1.1 Nominal size

Subsoil drains shall generally be of nominal sizes DN 100 to 1000 and dual-purpose drains, of nominal sizes DN 200 to DN 1000.

#### 3.1.2 Overall length

Aerated concrete drains shall be supplied in overall lengths, $l_1$, of 500, 750 and 1000 mm, and perforated pipes of concrete of dense structure in overall lengths as specified in DIN 4032.

#### 3.1.3 End faces

Pipe end faces shall be square to the pipe axis, the difference in the lengths of two opposed lines running from end face to end face not exceeding the values given in the relevant tables in DIN 4032.

#### 3.1.4 Straightness

The deviation from straightness of the pipe inside surface shall not deviate by more than 0,5 % of the overall length from a straight line. For drains supplied with pedestal, this shall be parallel to the drain axis, its deviation from a straight line not exceeding 0,5 % of the overall length.

#### 3.1.5 Fittings

##### 3.1.5.1 Bends

Bends shall be supplied in nominal sizes and with radii and overall lengths as specified in DIN 4032. DN 250 bends shall be supplied with a bend radius of at least 400 mm and an overall length, $l_2$, of 392,5 mm.

##### 3.1.5.2 Branches

Side and top branches shall be manufactured as specified in DIN 4032.

##### 3.1.5.3 Connectors

The connectors required for connecting drain pipes and fittings of dissimilar materials or flexible joints to a structure shall be designed on the lines of DIN 4032.

#### 3.1.6 Quantities, symbols and designations

| | |
|---|---|
| $l_1$ | overall pipe length |
| $l_2$ | overall length of bend |
| MZ | dual-purpose drain |
| TS | partially perforated drain |
| VS | fully perforated drain |
| DN | nominal size |
| K | drain of circular cross section, without pedestal |
| KW | drain of circular cross section, with reinforced wall |
| KF | drain of circular cross section, with pedestal |
| KFW | drain of circular cross section, with pedestal and reinforced wall |
| F | rebated |
| M | socketed |
| D | concrete of dense structure |
| P | aerated concrete |

[1]) Except for drains of oval cross section and with pedestal (EF).

Continued on pages 2 to 5

*Beuth Verlag GmbH*, Berlin, has the exclusive right of sale for German Standards *(DIN-Normen)*.
09.93

*DIN 4262 Part 3 Engl. Price group 6*
Sales No. 0106

Designation of a DN 300 fully perforated rebated (F) subsoil drain pipe (VS-P) of aerated concrete, of circular cross section, with pedestal (KF) and an overall length, $l_1$, of 1000:

Concrete pipe DIN 4262 VS – P – KF – F
300 × 1000

### 3.2 Appearance

Drain pipes and fittings shall be of uniform appearance and shall not exhibit any signs of damage or imperfections which might impair their serviceability.

The pipe ends shall have fully formed edges. The joint faces of the ends of aerated concrete pipes shall be free from porosity, dressing of the pipe ends being permissible.

### 3.3 Concrete composition and crushing strength

Binders, aggregates, admixtures, additions and mixing water used in the manufacture of drain pipes shall be as specified in DIN 1045. However, as a deviation from DIN 1045, aggregate of particle size up to 11,2 mm shall be used for aerated concrete.

When testing the crushing strength, the minimum values of crushing load per unit length specified in table 1 shall be achieved.

**Table 1: Minimum values of crushing load**

| Nominal size DN | Minimum crushing load, in kN/m, of | |
|---|---|---|
| | K and KF | KW and KFW |
| **100** | 24 | 50*) |
| **125** | 25 | 50*) |
| **150** | 26 | 50*) |
| **200** | 27 | 50*) |
| **250** | 28 | 50*) |
| **300** | 30 | 50 |
| **400** | 32 | 63 |
| **500** | 35 | 80 |
| **600** | 38 | 98 |
| **700** | 41 | 111 |
| **800** | 43 | 125 |
| **900** | – | 138 |
| **1000** | – | 152 |

*) Non-standard type.

The cube strength of concrete of dense structure shall correspond to class B 45 as specified in DIN 1045.

### 3.4 Water permeability of aerated concrete pipes

When tested as specified in subclause 4.4, the permeability coefficient, $k_f$,[2]) shall be greater than 0,15 cm/s and less than 0,45 cm/s).

### 3.5 Perforations

In the case of fully perforated subsoil drains, the perforations shall be distributed uniformly over the pipe surface and in the case of partially perforated pipes, the perforations shall be uniformly arranged across the pipe circumference, symmetrical to the vertical pipe axis, within an angle of about 220°.

In the case of dual-purpose drains, the perforations shall be located at the pipe crown, with the unperforated part of the pipe surface corresponding to at least 85% of the total cross-sectional area.

The area of perforations per metre of pipe length of drains made of concrete of dense structure shall be at least 50 $cm^2$, with at least 40 perforations per metre. The hole diameter shall be (12 ± 3) mm, other diameters (up to 20 mm) being subject to agreement.

### 3.6 Pipe joints

The design of pipe sockets and spigot ends shall be as specified in DIN 4032. The joints of dual-purpose drains shall be watertight in their unperforated zone, i.e. when tested in accordance with subclause 4.6, the joints shall show no signs of leakage in the unperforated zone.

Sealing rings shall comply with the requirements specified in DIN 4060.

### 3.7 Chemical resistance

Water, soil and gases shall be assessed for their aggressiveness to concrete in accordance with DIN 4030 Parts 1 and 2, any measures to enhance the chemical resistance of concrete complying with DIN 1045.

### 3.8 Continuity of invert level

It shall be possible to connect drain pipes of one and the same size so that their inverts are level. Differences in invert level shall be no more than 4 mm for sizes up to DN 200, and no more than 2% of the nominal size, in mm, for sizes above DN 200.

### 3.9 Marking

Drains shall be clearly and permanently marked with the following details:

a) 'DIN 4262 Part 3';
b) manufacturer's trademark (and works symbol, where relevant);
c) quality mark or inspection mark[3]);
d) date of manufacture (week and year);
e) nominal size (DN).

Use of symbols is also permitted subject to agreement with the inspection body.

## 4 Testing

### 4.1 Dimensions

Checking of the dimensions specified in subclause 3.1 shall be carried out by analogy with DIN 4032.

### 4.2 Appearance

The appearance as specified in subclause 3.2 shall be checked visually.

### 4.3 Concrete composition and crushing strength

The concrete composition shall be tested in accordance with DIN 1045, the crushing strength test being performed as described in DIN 4032.

### 4.4 Water permeability of aerated concrete pipes

The test assembly shown in figure 1 and described in the Explanatory notes shall only be used for testing drain pipes of nominal size DN 400 or less. Testing the water permeability of larger pipes shall be the subject of agreement between client and inspection body.

---

2) See Explanatory notes.

3) Lists of quality control and quality assurance associations and testing agencies accredited by the building inspectorate, with the imprint of the relevant inspection mark, are kept at the *Institut für Bautechnik* (Institute of Building Technology) and are published and updated in its *Mitteilungen* (obtainable from *Verlag Wilhelm Ernst* & Sohn, Hohenzollerndamm 170, D-10713 Berlin).

#### 4.4.1 Test assembly

The principle of the test assembly is illustrated in figure 1 (cf. Explanatory notes for details).

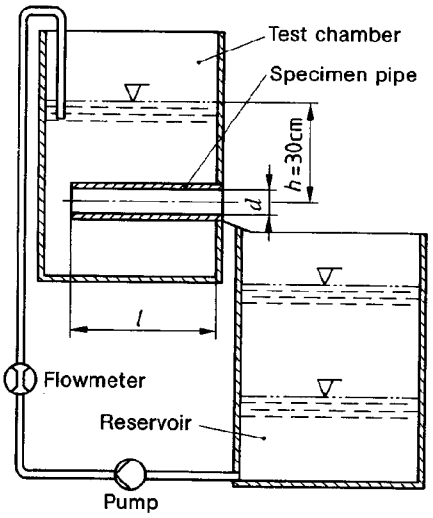


**Figure 1: Assembly for testing the water permeability of subsoil and dual-purpose aerated concrete drains**

Other test assemblies which produce equally accurate results may also be used subject to agreement with the inspection body.

#### 4.4.2 Procedure

Testing shall be carried out using three specimens (pipe sections) each 400 mm in length and with ends cut square.

Partially perforated pipes and dual-purpose pipes shall be installed so that the perforated part faces sideways (i.e. the pipe is turned by 90° as compared to its normal position).

The water level, $h$, shall be 30 cm above the pipe axis so as to produce equilibrium between inflow and outflow for at least 60 seconds. The flow, $Q$, in $cm^3/s$, shall be read from the flowmeter to an accuracy of $\pm 3\%$.

#### 4.4.3 Calculation of permeability coefficient

The water permeability of a single pipe shall be calculated from the flow, $Q$, measured in accordance with subclause 4.4.2, using the following formula, and expressed as permeability coefficient, $k_f$, for a reference temperature of 10 °C.

$$k_f = \frac{Q \cdot (s/h + 0{,}0559)}{3{,}14 \cdot (d+s) \cdot l \cdot [1 + 0{,}03 \cdot (T-10)]}$$

where

| | |
|---|---|
| $Q$ | is the flow, in $cm^3/s$; |
| $h$ | is the water level above pipe axis, in cm (here, $h = 30$ cm); |
| $d$ | is the pipe internal diameter, in cm; |
| $l$ | is the pipe length, in cm; |
| $T$ | is the water temperature, in °C; |
| $s = ½ (s_1 + s_2)$ | is the wall thickness (mean from wall thickness at pipe invert, $s_1$, and soffit, $s_2$), in cm); |
| $3{,}14 \times (d+s)\, l$ | area of fully perforated pipes through which water flows, in $cm^2$; for partially perforated or dual-purpose drains, the actual mean surface area water shall be inserted. |

### 4.5 Perforations

The arrangement of perforations as specified in subclause 3.5 shall be visually checked.

The area of the perforations per metre shall be calculated by measuring the area of 40 different perforations, determining the mean and then multiplying the value by the number of perforations per metre, stated in $cm^2/m$.

### 4.6 Joints

Two dual-purpose drain pipes shall be jointed, the assembly sealed at either end and filled with water up to the perforated zone. After 15 minutes, the joint shall be visually checked for any leakage.

### 4.7 Chemical resistance

The resistance of drains to water, soil and gas aggressive to concrete shall be verified by testing the concrete composition as specified in DIN 1045.

### 4.8 Continuity of invert level

The continuity of invert level at a pipe joint shall be determined to an accuracy of 1 mm.

### 4.9 Marking

The marking shall be visually checked for completeness, legibility and durability.

## 5 Inspection

Compliance with the requirements specified in clause 3 shall be verified by inspection comprising both internal control and third-party inspection, in accordance with DIN 18 200, scope and frequency of testing being detailed in table 2.

**Table 2: Scope and frequency of testing for internal control and third-party inspection purposes**

| No. | Drain type | Item to be checked | | Frequency of testing per size (DN) | | Requirement as in subclause | Testing as in subclause |
|---|---|---|---|---|---|---|---|
| | | | | Internal control | Third-party inspection | | |
| 1 | All | Dimensions | | 3 pipes per size and week | At least twice a year [6] | 3.1 | 4.1 |
| 2 | All | Appearance | | | | 3.2 | 4.2 |
| 3 | All | Crushing strength [4] Particle size [5] | | 1 pipe of a different size per week | | 3.3 | 4.3 |
| 4 | All | Permeability for water [5] | | | | 3.4 | 4.4 |
| 5 | All | Perforations | Dimensions | When manufacturing conditions are changed | | 3.5 | 4.5 |
| | | | Appearance | Twice every 8 hours | | | |
| 6 | All | Joints | | Proof of suitability [6] | | 3.6 | 4.6 |
| 7 | All | Continuity of invert level | | Proof of suitability [6] | | 3.8 | 4.8 |
| 8 | All | Marking | | Once a day | | 3.9 | 4.9 |
| 9 | All | Chemical resistance | | Proof of suitability, where required | – | 3.7 | 4.7 |

[4] In the case of concrete of dense structure, the crushing strength test may be replaced by the cube strength test. In case of doubt, the results of the former test shall be relevant.

[5] For aerated concrete only.

[6] Also to be applied in the case of changes in the production conditions.

## Standards referred to

| | |
|---|---|
| DIN 1045 | Structural use of concrete; design and construction |
| DIN 4030 Part 1 | Assessment of water, soil and gases for their aggressiveness to concrete; principles and limiting values |
| DIN 4030 Part 2 | Assessment of water, soil and gases for their aggressiveness to concrete; collection and examination of water and soil samples |
| DIN 4032 | Concrete pipes and fittings; dimensions and technical delivery conditions |
| DIN 4060 | Elastomeric seals for pipe joints in drains and sewers; requirements and testing |
| DIN 18200 | Inspection of construction materials, structural members and types of construction; general principles |
| DIN 19666 | Subsoil drain pipes and percolation pipes; general requirements |

## Other relevant standard

| | |
|---|---|
| DIN 4226 Part 3 | Aggregates for concrete; testing of heavy and lightweight aggregates |

## Explanatory notes

The test assembly shown in figure 1 shall consist of a vessel with a skirt (curtain wall) which divides it into a receiving chamber and a test chamber, and a reservoir.

The specimen pipe shall be lifted to the required level and mounted horizontally in the vessel, with the inward pipe end sealed with a rubber-clad steel plate. The face of the other pipe end shall be flush with the outside vessel wall. The diameter of the opening in the wall shall be made to fit the relevant pipe internal diameter by using annular sections differing in size. Steel plate and pipe shall be compressed against the vessel wall by means of a spindle (not shown in figure 1) located at the level of the pipe axis.

Somewhat lower than the vessel, a reservoir of about 3 $m^3$ capacity shall be located from which water is pumped into the receiving chamber of the vessel via a flowmeter. From this chamber the water passes to the test chamber through an opening below the skirt (the purpose of the skirt being to still the water and to ensure a constant water level in the test chamber). Since the joint at the inward pipe end and the joint between the pipe and the vessel wall are sealed, the water can only enter the pipe through the pipe wall and leaves the pipe through its front end. In order to maintain a water level, $h$, of 30 cm above the pipe axis (cf. figure), equilibrium must exist between inflow and outflow. This level being achieved, the rate of water inflow, $Q$, shall be established and expressed in l/s.

The design of the test assembly may be modified so that the pump and flowmeter are not required. In this case, $Q$ is established by measuring the quantity of water passing through the pipe wall and collected in a tank, as a function of the flow time.

The principles of determining the permeability coefficient are outlined in

Wellenstein, R. *Durchlässigkeitsbeiwert $k_f$ (cm/s) des porösen Rohrmantels von Betonfilterrohren für laminare Sickerströmung* (Determination of permeability coefficient, $k_f$, of concrete filter drains designed for laminar flow), *Betonwerk + Fertigteil-Technik*, 1975: **41** (1), 13–18 [7]).

## International Patent Classification

A 01 G 25/00
E 02 B 11/00
E 01 C 11/22
E 03 F 3/04
F 16 L 9/08
G 01 B 21/00
G 01 N 33/38

7) Obtainable from *Bau-Verlag*, Wittelsbacher Straße 10, D-65189 Wiesbaden.