BRITISH STANDARD

BS EN
1444:2001

Fibre-cement pipelines — Guide for laying and on-site work practices

The European Standard EN 1444:2000 has the status of a British Standard

ICS 23.040.50

National foreword

This British Standard is the official English language version of EN 1444:2000.

The UK participation in its preparation was entrusted by Technical Committee B/504, Water supply, to Subcommittee B/504/6, Fibre-cement pipes, 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 the 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

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 39 and a back cover.

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English version

Fibre-cement pipelines - Guide for laying and on-site work practices

Conduites en fibres-ciment - Guide pour la pose et le travail sur chantier

Faserzement-Rohrleitungen - Hinweise für die Verlegung und für die bauseitige Bearbeitung

This European Standard was approved by CEN on 27 November 2000.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 164 "Water supply", the secretariat of which is held by AFNOR.

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 June 2001, and conflicting national standards shall be withdrawn at the latest by June 2001.

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.

Annex A is informative.

Introduction

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by this standard :

1) this standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA ;

2) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

1 Scope

This draft European Standard, applies to both types of fibre-cement pipes AT and NT as defined in EN 512:1994, gives installation recommendations for this pipelines in above or below ground situations. It complements the general principles for all types of water supply systems specified in EN 805:2000, “Water supply - Requirements for systems and components outside buildings”, and should be used in conjunction with that standard.

This standard gives guidance in on-site working methods and in the selection and use of approved tools for cutting and machining fibre-cement pipes.

This standard does not cover the following :

a) installation by thrust boring and pipe jacking methods which require the use of highly specialized techniques ;

b) problems caused by the use of special installations procedures (e.g. removal of pile sheeting in very deep trenches, etc.).

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 (including amendments).

EN 512:1994, *Fibre-cement products - Pressure pipes and joints*.

EN 805:2000, *Water supply - Requirements for systems and components outside buildings.*

EN 1295-1, *Structural design of buried pipelines under various conditions of loading –*
Part 1: General requirements.

ISO 2785, *Directives for selection of asbestos-cement pipes subject to external loads with or without internal pressure.*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply:

3.1 Pressures

For the designation of pressures in English, French and German see table 1 and EN 805:2000 annex A.

Table 1 — Designation of pressures in English, French, German

Abbreviation [a]	English	French	German	
DP	design pressure	pression de calcul en regime permanent	Systembetriebsdruck	System related
MDP	maximum design pressure	pression maximale de calcul	höchster Systembetriebsdruck	
STP	system test pressure	pression d'épreuve du réseau	Systemprüfdruck	
PFA	allowable operating pressure	pression de fonctionnement admissible	zulässiger Bauteilbetriebsdruck	Component related
PMA	allowable maximum operating pressure	pression maximale admissible	höchster zulässiger Bauteilbetriebsdruck	
PEA	allowable site test pressure	pression d'épreuve admissible sur chantier	Zulässiger Bauteilprüfdruck auf der Baustelle	
OP	operating pressure	pression de fonctionnement	Betriebsdruck	System related
SP	service pressure	pression de service	Versorgungsdruck	

[a] Valid for all language versions.

3.1.1
allowable maximum operating pressure (PMA)
maximum pressure occuring from time to time, including surge, that a component is capable of withstanding in service

3.1.2
allowable operating pressure (PFA)
maximum hydrostatic pressure that a component is capable of withstanding continuously in service

3.1.3
allowable site test pressure (PEA)
maximum hydrostatic pressure that a newly installed component is capable of withstanding for a relatively short duration, in order to ensure the integrity and tightness of the pipeline

3.1.4
design pressure (DP)
maximum operating pressure of the system or of the pressure zone fixed by the designer considering future developments but excluding surge

3.1.5
maximum design pressure (MDP)
maximum operating pressure of the system or of the pressure zone fixed by the designer considering future developments and including surge, where :

— MDP is designed MDPa when there is a fixed allowance for surge ;

— MDP is designed MDPc when the surge is calculated.

3.1.6
operating pressure (OP)
internal pressure which occurs at a particular time and at a particular point in the water supply system

3.1.7
pressure zones
areas of pressure ranges within a water supply systems

3.1.8
service pressure (SP)
internal pressure delivered at the point of connection to the consumer's installation at zero flow in the service pipe

3.1.9
surge
rapid fluctuations of pressure caused by flow alterations over short periods of time

3.1.10
system test pressure (STP)
hydrostatic pressure applied to a newly laid pipeline in order to ensure its integrity and tightness

3.2 System

3.2.1
gravity system
system where flow and/or pressure are caused by the force of gravity. There are two kinds of such systems :

— pressurized gravity system, where the pipeline operates full ;

— non-pressurized gravity system, wherethe pipeline operates partially full.

3.2.2
local main
water main which connects principal main(s) with service pipes

3.2.3
potable water
water intended for human consumption as defined by the relevant national authorities

3.2.4
principal main
water main serving as a principal distributor within the supply area, normally without direct consumer connections

3.2.5
pumped and gravity system
system where the gravity system and the pumped system are used, either separately or in combination, to provide the flow and/or pressure

3.2.6
pumping station
pumping installation designed to provide adequate pressure and flow within the distribution system. Three types can be distinguished (see Figure 1) :

— main lift : normally at the outlet of the treatment works, or source if there is no treatment, to provide flow to the service reservoir ;

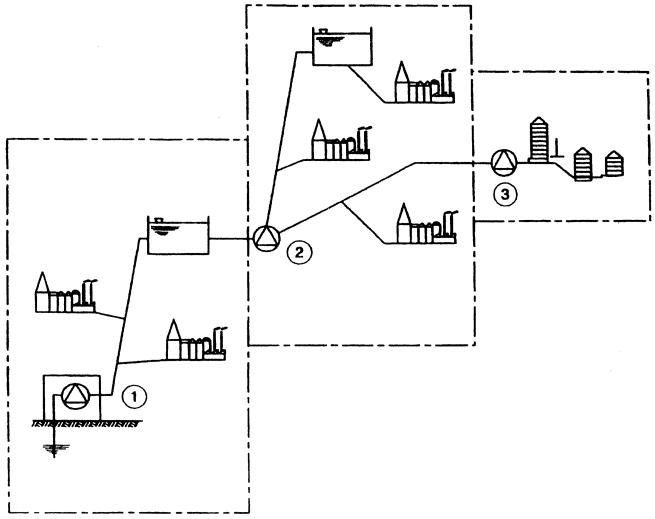
— intermediate : to deliver flow on the way to a service reservoir or supply area ;

— booster : to pump directly from and to the area without storage.

3.2.7
pumped system
system where flow and/or pressure are provided by means of one or more pumps and where the pipeline operates full

3.2.8
reservoir
storage facility for water

3.2.9
service pipe
water pipe which supplies water from the local main to the consumer



Key
1 Main lift
2 Intermediate
3 Booster

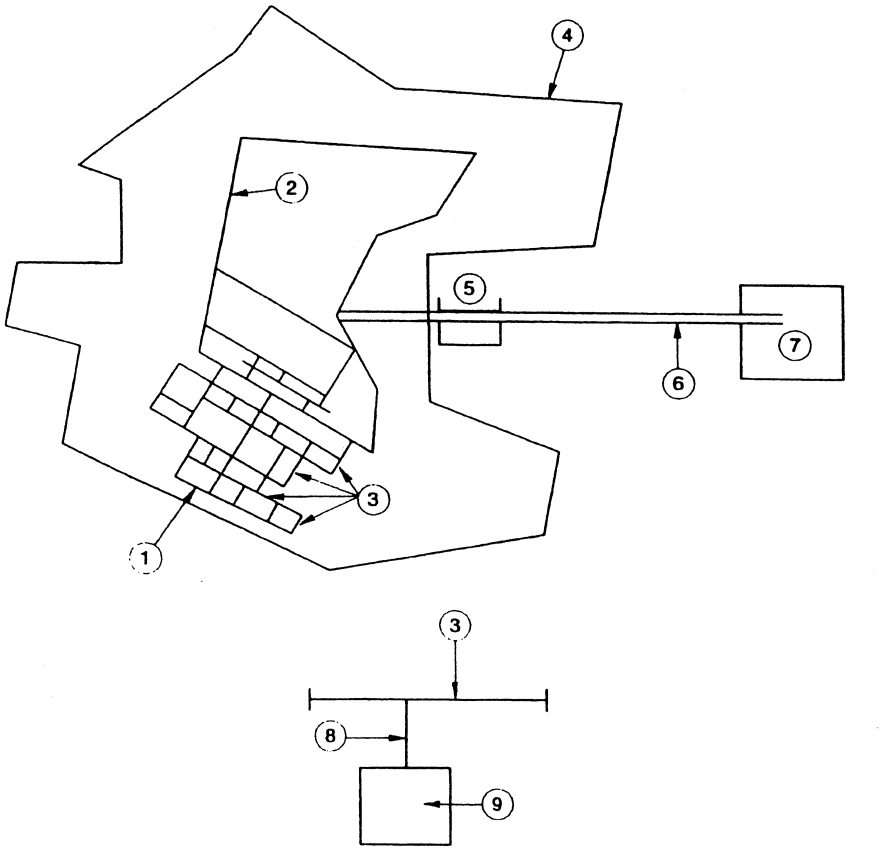
Figure 1 — Example of different types of pumping stations

3.2.10
service reservoir
covered reservoir for potable water which includes water compartment(s), control building, operation equipment and access arrangement providing reserve supplies, pressure stability and balancing demand fluctuations

3.2.11
standby plant
plant or system, such as additional pumps or duplicate mains, installed to provide secondary means for the supply of services in the event of failure or malfunction of the normal operating unit

3.2.12
trunk main
water main which interconnects source(s), treatment works, reservoir(s) and/or supply areas, normally without direct consumer connection(s)

3.2.13
water distribution system
part of the water supply system comprising pipelines, service reservoirs, pumping stations and other assets by which water is distributed to the consumers. It begins at the outlet from the water treatment works (or source, if there is no treatment) and ends at the point of connection to the consumer's installation (see Figure 2)



Key

1 Network
2 Principal main
3 Local main
4 Supply area
5 Service reservoir (may be present)
6 Trunk main
7 Source or treatment works
8 Service pipe
9 Consumer

Figure 2 – Example of a water distribution system

3.3 Components

3.3.1
accessories
components, other than pipes, fittings or valves, which are used in a pipeline, glands, bolts, locking rings for joints, ferrules

3.3.2
adjustable joint
joint which permits significant angular deflection at the time of installation but not thereafter

3.3.3
coating
additional material applied to the external surface of a component to protect it from corrosion, mechanical damage or chemical attack

3.3.4
ferrule
component used to connect a service pipe to a main, usually capable of shutting off the flow of water to the service pipe

3.3.5
fitting
component, other than a pipe, which allows pipeline deviation, change of direction or bore. In addition, flanged-socked pieces, flanged-spigot pieces and collars/couplings are also defined as fittings

3.3.6
flexible joint
joint which permits significant angular deflection, both during and after installation and which can accept a slight offset of the centre line

3.3.7
flexible pipe
pipe whose load carrying capacity is limited by deformation (diametral deflection and/or strain) under load to the ultimate design criteria without breaking or overstressing (flexible behaviour)

3.3.8
joint
connection between the ends of two components including the means of sealing

3.3.9
lining
additional material applied to the internal surface of a component to protect it from corrosion, mechanical damage or chemical attack

3.3.10
pipe
component of uniform bore, normally straight in axis, having e.g. socket, spigot or flanged ends

3.3.11
pipe barrel
cylindrical part of the pipe with a uniform cross section excluding socket and spigot where appropriate

3.3.12
rigid joint
joint that does not permit significant angular deflection, either during or after installation

3.3.13
rigid pipe
pipe whose load carrying capacity is limited by breaking without significant deformation of its cross section (rigid behaviour)

3.3.14
semi-rigid pipe
pipe whose load carrying capacity is limited either by deformation/overstressing (flexible behaviour) or by breaking (rigid behaviour) depending on its ring stiffness and/or the conditions of installation

3.3.15
valve
component isolating or controlling flow and pressure, e.g., isolating valve, control valve, pressure reducing valve, air valve, non-return valve, hydrant

3.4 Diameters

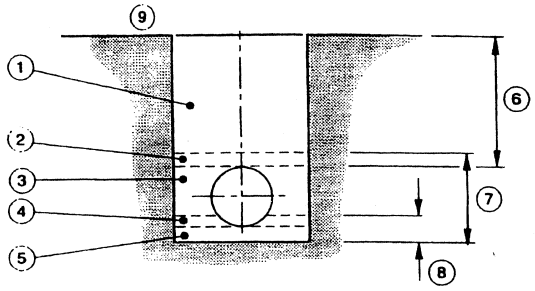
3.4.1
external diameter (OD)
mean external diameter of the pipe barrel at any cross section. For pipes with externally profiled barrels, the external diameter is taken as the maximum diameter when viewed in cross-section

3.4.2
internal diameter (ID)
mean internal diameter of the pipe barrel at any cross section

3.4.3
nominal size (DN/ID or DN/OD)
numerical designation of the size of a component, which is a whole number approximately equal to the actual dimension in millimetres. This applies to either the internal diameter (DN/ID) or the external diameter (DN/OD)

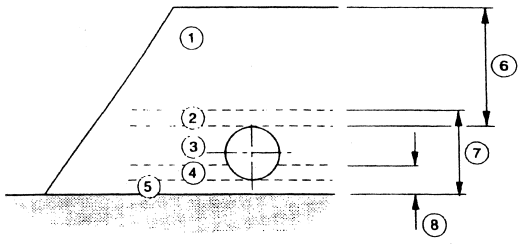
3.5 Installation

Installation terms are sow in Figure 3.



Key
1 Main backfill including road construction, if any
2 Initial backfill
3 Side fill
4 Upper bedding
5 Lower bedding
6 Depth of cover
7 Embedment
8 Bedding
9 Ground surface

Figure 3a) – Example for trench condition



Key
1 Main backfill including road construction, if any
2 Initial backfill
3 Side fill
4 Upper bedding
5 Lower bedding
6 Depth of cover
7 Embedment
8 Bedding

Figure 3b) – Example for embankment conditions

Figure 3 — Illustration of terms used in pipe installation

3.5.1
aggressive soil
soil which could have a corrosive or other adverse effect on a component and which requires special consideration with respect to protective measures

3.5.2
contaminated soil
soil which has been affected by previous land use or by direct or indirect infiltration of chemicals or other substances, such that it requires special consideration

3.5.3
depth of cover
distance from the crown of the pipe barrel or fitting to the existing or future surface of the terrain

3.6 Hydraulic design

3.6.1
back siphonage
flow of water from outside the system in a direction contrary to the intended one

3.6.2
equivalent length
addition to the real length of a pipeline to simplify the allowance for local head losses at fittings, valves, etc., used for calculating the total head loss of a pipeline

3.6.3
peak flow factor
ratio between peak flow and average flow in the same period of time

3.6.4
water demand
estimated quantity of water required per unit of time

3.7 Structural design

3.7.1
bedding reaction angle
angle used for calculation pumoses corresponding to the arc of soil bearing reaction applied at the underside of the component

3.7.2
ring stiffness
resistance of a pipe to diametral deflection in response to external loading applied along one longitudinal diametric plane. The ring stiffness is defined by the following formula :

$$S = \frac{E x \mathrm{I}}{D_{\mathrm{m}}{}^{3}}$$

where

S is the ring stiffness of the pipe per unit length in Pascals (1 Pa = 1 N/m^2) ;

E is the modulus of elasticity in flexure in the circumferential direction in Pascals (1 Pa = 1 N/m^2) ;

I is the 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 mean diameter of the neutral axis of the pipe wall in metres.

This definition applies to both short and long term values.

3.7.3
ultimate load
load which causes failure as defined in the product standards

4 General requirements

In all aspects, including health and safety, the national standards transposing ENs as available, shall apply as well as the regulations valid at the place where the system is being constructed and/or operated.

4.1 Qualifications

Suitably trained and experienced personnel, capable of assessing the quality of the work within the scope of this standard, shall be employed for the supervision and the execution of the construction project. Contractors appointed by the employer shall possess the qualifications necessary for the execution of the work. The employer shall satisfy himself that the necessary qualifications are held.

4.2 Rules for the execution of construction work

Construction work shall be executed in accordance with national standards transposing ENs as available, the requirements of the water supply company and taking into account any specific instruction of the manufacturer of pipeline components.

4.3 Health and safety

All work shall be carried out in accordance with the National Health and Safety Regulations applicable at the place of work.

4.3.1 General requirements

Personal protection equipment shall be provided in accordance with the relevant accident prevention regulations.

All personnel shall be instructed on the relevant accident prevention regulations.

Sites shall be equipped with appropriate alarm devices and other emergency equipment in order that suitable immediate action can be taken in case of an accident.

The degree of maintenance and the reliability of the emergency equipment provided, including utilities and materials, shall be checked regularly. Defective equipment shall be removed from the site and replaced.

Prior to the commencement of construction, information (e.g. plans) on all apparatus of other operators shall be obtained. Safety precautions shall be taken as necessary.

4.3.2 Installation requirements

Excavations sites, shall be secured in a manner that prevents any danger to the personnel employed, other persons, properties and traffic (e.g. traffic control, foot bridges, lighting).

The support for excavations, including trenches, shall be installed in a manner to provide for safe working conditions. Access ladders shall be provided where necessary and secured in position when in use.

Construction operations shall not cause damage to existing structures.

The storage and transport of pipes, other components and materials shall be carried out in a manner which presents no danger to the personnel employed, other persons and properties.

When laying pipelines and installing components, relevant health and safety regulations shall be observed (e.g. wearing protective clothing and equipment when cutting, welding or otherwise treating materials). For fibre-cement components containing asbestos, national regulations will apply. When using asbestos-cement components special precautions shall be taken when cutting, machining or carrying out other operations likely to create dust.

4.3.3 Cutting and machining

Precautions need to be taken when cutting or machining fibre-cement pipes. Breathing dust is dangerous to health and work methods should be selected which effectively do not create unnecessary and respirable fine dust (see clauses 15, 16 and 17).

5 Transport, handling and storage

5.1 General recommendations

The pipeline components shall be protected against damage. Only suitable equipment shall be used for the loading and unloading as well as for transport. Pipeline components shall be transported and stored in such a way that they do not come into contact with hazardous substances. The pipeline components shall not be contaminated by earth, mud, sewage or other deleterious substances. If such contamination is unavoidable, the pipeline components shall be cleaned before being installed. The information and instructions provided by the manufacturers of pipeline components, with regard to avoidance of damage, degradation and contamination, shall be strictly observed.

Pipes joints and fittings shall be handled with care at all times and in accordance with the manufacturer's instructions. Severe impact can cause damage particularly in the form of crushed laminations or hair cracks at the pipe ends. In particular, they shall not be dropped or, when slung, be allowed to collide with solid objects. The pipes may be rolled under control on a surface free from protuberances.

The pipeline installer shall provide, at the outset, suitable equipment for unloading pipes and fittings at the agreed delivery point and also for stacking and stringing out.

5.2 Off-loading

The pipeline installer shall examine the materials being delivered before off-loading commences. Any damaged or suspect materials shall be clearly marked.

Pipes over 600 DN, heavy thickwall pipes and bulky fittings shall be lifted by suitable mechanical means. Unless pipes and fittings are delivered in banded bundles or on pallets designed for site handling, they shall be handled singly.

When mechanical lifting equipment is used the whole sequence of off-loading shall be carried out smoothly and without snatch. Rope or fabric belt slings can be used with or without lifting beams. When hooks are used with lifting beams or two-legged slings they shall be of the flattened type and shall be correctly padded with rubber strip or other suitable material to prevent damage to the pipe ends.

If, for pipes in sizes up to 600 DN, mechanical equipment is not available, the pipes may be unloaded laterally down planks under the manual restraint of at least two suitably anchored ropes. The planks shall have ample beam strength and be of sufficient length to ensure that the gradient does not exceed 45°. The planks shall be placed at about 1/5 of the pipe length from each end. Each rope should be looped once around the pipe (or twice for heavier pipes) and have one end securely attached to the vehicle. The free ends shall be fed out simultaneously and slowly by men standing on the vehicle.

5.3 Stacking of pipes

The first layer of pipes shall be placed on two timber runners set on a firm level foundation and situated about 1/5 of the pipe length from each end. The width of the runner is a function of the mass of the stack and it shall not be less than 70 mm or according to the manufacturer's literature. Wedges shall be firmly nailed in position at the ends of each runner. Where the pipes are delivered to site in bundles, they may remain stored in their bundles on level ground until commencement of laying.

Subsequent layers shall be placed either by nesting in pyramid fashion or by placing on additional runners (prismatic stacking). The latter method is recommended for small diameter pipes or where space is limited. Wedges shall be nailed to the ends of each runner.

The height of the stack shall be limited to suit the handling facilities available on-site but should not exceed that recommended by the manufacturer.

5.4 Storage of joints and fittings

Until required for use, joints, rubber rings, fittings and lubrificant shall be stored in a compound and the rubber rings kept in the bags of cartons in which they have been delivered to site. Rubber rings shall be protected from sunlight, oils and greases and sources of heat.

If the rubber rings have been tied, they shall be separated a few days before required for use in order to eliminate minor impressions which the ties may have caused. Ties shall be of a type which, during normal handling and separating, will not cut the rings.

6 Stringing out

Stringing consists of placing pipes on the ground in line ready for laying. Care shall be taken to prevent damage during this operation. Pipes shall not be dragged along the ground.

Suitable vehicles with protrusion-free platforms and side walls shall be used. Where protrusion cannot be eliminated, wooden planks shall be provided at about 1/5 of the pipe length from each end.

Prismatic stacking (see 5.3) is recommended for on-site transport. The load shall be secured by ropes and tensioners. In the case of very large diameter pipes it is advisable to use the same wooden blocks as those used for transport between factory and site. Pipes shall not protrude more than 1 m beyond the rear of the vehicle.

Unloading shall take place as near as possible to the point of installation, care being taken to ensure that all pipes are in a stable position clear of traffic. When necessary and particularly in highways verges, stakes or stout pegs shall be firmly driven into the ground to prevent pipes from rolling. Where necessary, steps shall be taken to prevent surface water accumulations or any foreign material from entering the bores of the pipes, joints and fittings.

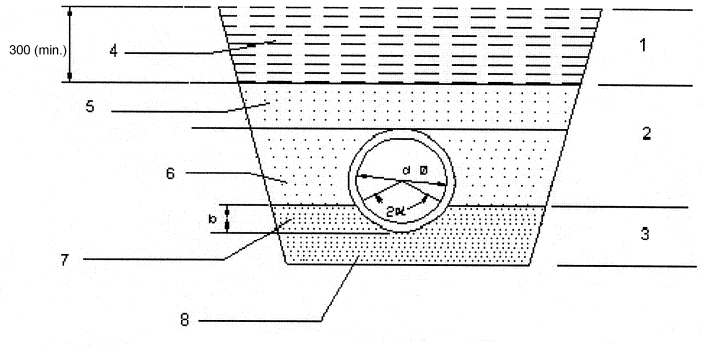
7 Types of beddings and embedments

The most common types are shown schematically and described in the following three clauses.

7.1 Bedding type A is the general recommended way for laying fibre-cement pipes

In bedding of type A, granular material is lightly compacted along the bottom of the trench to a minimum height of “a” =100 + (*D*/10) mm. The uppermost layers of this granular material are shaped concentrically with the pipe on a height “b” defined from a percentage of external diameters of the pipe. This height “b” shall guarantee the designed bedding reaction angle. The pipe shall be evenly bedded in this shaped part of the bottom backfill of the trench. For each joint of the pipeline, a groove is made to prevent the pipes from bearing on the joints. Material, free from lumps and stones, will be placed around and above the pipe and compacted in layers of 150 mm to a minimum of 300 mm over the top of the pipe and over the full width of the trench (see 14.1).

Dimensions in millimeters



Key
1 Compacted ordinary backfill
2 Compacted backfill free from lumps and stones
3 Compacted granular material
4 Main back
5 Initial backfill
6 Side fill
7 Upper bedding
8 Lower bedding

Figure 4 — Bedding type A

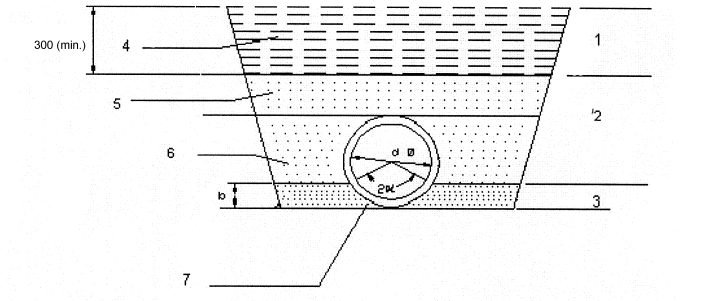
The remainder of the trench or of the necessary embankment is then refilled or built up by ordinary or compacted backfill earth.

7.2 Bedding type B

Type B is recommended for non cohesive or slightly cohesive soils free from lumps, large stones and rocks (see ISO 2785). The pipe is laid directly on the bottom of a trench or on the ground in positive projection conditions. The barrel of the pipe is in continuous contact with the foundation ground, approximately along a line. For each joint of the pipeline, a groove is dug in the foundation to prevent the pipes from bearing on the joints. Selected fill material is compacted on both sides of the pipe up to a height “b” defined from a percentage of external diameters of the pipe. This height “b” shall guarantee the designed bedding reaction angle.

The backfill material in the trench, or the embankment in projecting conditions, is ordinary earth compacted at least up to 300 mm over the top of the pipe (see 14.1).

Dimensions in millimeters



Key
1 Compacted ordinary backfill
2 Compacted backfill free from lumps and stones
3 Compacted granular material
4 Main backfill
5 Initial backfill
6 Side fill
7 Lower bedding

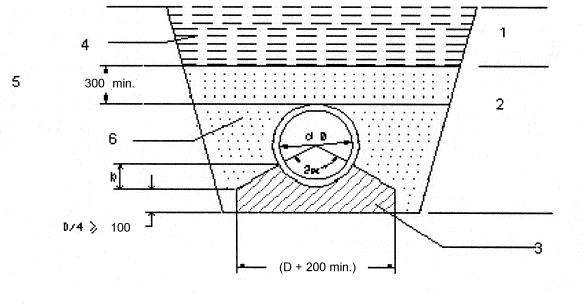
Figure 5 — Bedding type B

7.3 Bedding type C is recommended in laying condition which require special design consideration

This type consists essentially of a continuous concrete hunched bedding cast in-situ under the pipe with suitable grooves to ensure the joints remain flexible. The minimum width of the cradle shall be equal to the external diameter of the pipe plus 200 mm; its thickness shall not be less than one-quarter of the external diameter of the pipe and at least 100 mm. The compressive strength of the concrete, when tested as a cube, shall not be less than 20 N/mm^2 at 28 days.

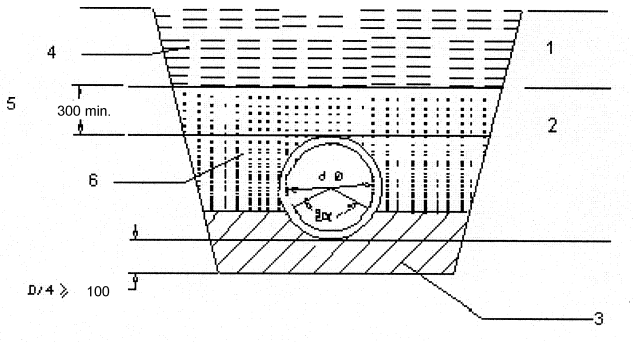
Around the pipe and up to 300 mm over its top, fill material, free from lumps and stones is compacted in layers not thicker than 150 mm. Over this height, normal fill material is used for backfilling the trench of for building the embankment up to the designed level.

Dimensions in millimeters



Key
1 Compacted ordinary backfill
2 Compacted backfill free from lumps and stones
3 Concrete
4 Main backfill
5 Initial backfill
6 Side fill

Figure 6a – Bedding type C, conception A



Key
1 Compacted ordinary backfill
2 Compacted backfill free from lumps and stones
3 Concrete
4 Main backfill
5 Initial backfill
6 Side fill

Figure 6b – Bedding type C, conception B

8 Excavation and preparation of the trench

8.1 General recommendations

The trench shall be dug so that the line, gradient, dimensions and type of bedding indicated on the drawings or in the specifications, or as agreed with the pipeline designer, are observed.

The rate of excavation of the trench shall be geared to the rate of laying and shall preferably be no more than a few pipe lengths in advance. During excavation, all large stones, items of plant and debris which could fall and damage the pipes shall be removed from the brink of the trench.

The installer shall take all precautions regarding trench sheeting and strutting, slopes, width of working spaces required by national regulations or dictated by actual circumstances to ensure the safety of the public and the pipe layers and to avoid interrupting or damaging public or private utilities which may be encountered during the course of the work.

8.2 Depth of cover

The pipe trench shall be formed and excavated in such a way that all pipes are finally be laid at a frost free depth. When it is not possible, alternative frost protection shall be provided. The depth of cover shall be as specified, unless a modification is subsequently agreed with the designer.

8.3 Distances from underground installation

The horizontal distance from foundations and similar underground installations shall be not less than 0,4 m in normal circumstances.

Where there is lateral proximity or where the pipeline runs parallel to other pipelines or cables, the distance between them shall be not less than 0,40 m. At points of congestion a distance of at least 0,20 m shall be maintained except where this distance cannot be achieved. In all cases suitable measures shall be taken to prevent direct contact. These measures shall be agreed with the operators.

Where cables and pipelines cross, a clearance of at least 0,20 m shall be maintained. If this is not possible, measures shall be taken to prevent direct contact. The possibility of transmission of forces through direct contact shall be excluded. These measures shall be agreed with the other operators.

Care shall be taken not to affect the stability of other installations when carrying out excavations.

Any special requirement specified by the designer shall be complied with.

8.4 Trench width

The trench width inside any shuttering which can be used shall be sufficient to permit the pipe and joints to be correctly bedded and to allow for adequate compaction of the initial fill, particularly around the underside of the pipe. Unless otherwise specified by national regulations the recommended minimum width at bedding level is D + 0,4 m for pipes of nominal diameter up to 500 mm, and D + 0,6 m for pipes of nominal diameter exceeding 500 mm. D being the external diameter of the pipe in metres. If special equipment is required to mount the joints, it can be necessary to widen the trench at these points.

Where the flexibility of the joint is used to give a slight curve to the pipeline, the base of excavation shall be widened to enable the pipes to be jointed in good alignment before the deflection is made (see 9.3.1 and 9.4.4).

The actual trench width is a factor considered when designing the pipeline see EN 1295-1 and the width shall therefore not exceed the stipulated maximum.

8.5 Trench depth

The trench depth and/or invert level shall be specified by the pipeline designer taking into account the calculations given in EN 1295-1 and any special requirements on minimum depth of cover due to gradient, superimposed loading or climatic conditions.

8.6 Preparation of trench bottom

The trench bottom shall be uniform, and dewatered if necessary to ensure that individual pipes, and the pipelines as a whole, will be evenly supported. Before any pipe is laid the trench bed shall be checked for uniformity with a suitable straight edge or other suitable means. Joints holes of sample size shall be provided to prevent the pipes from resting on the joints. The length and depth of the joint holes depend upon the dimensions of the joints and the method of assembly.

The bottom of the trench shall follow strictly the gradient of the longitudinal elevation. When levelling the trench bottom, any local hard high spots such as projecting stones or nibs of rocks shall be trimmed well back and the resulting irregularities and holes filled in with suitable material, properly compacted.

Where it is not possible to level the bottom of the trench properly using mechanical/hand trim methods, the bottom of the trench shall be covered by a layer of granular material or selected fine earth which is readily compactible, to a depth of at least [100 + (*D*/10)] mm, where *D* is the external diameter of the pipe in millimetres. When pipes are to be laid in rocky ground, the depth of the layer shall be [200 + (*D*/10)] mm.

Consequently, when excavating the trench, the depth specified or shown in the drawings shall be increased over the full width of the trench to allow for such additional depths of bedding.

The bedding shall be of light uniform compaction over the whole length of the trench and, in conjunction with the initial backfill (see 14.1) shall envelop the pipe to the angle appropriate to the bedding condition see EN 1295-1 specified by the pipeline designer.

If the soil at the level of the trench bottom is of uniform nature free from large lumps and stones and the bottom of the trench properly levelled as described above, the pipes can, at the discretion of the pipeline designer, be laid directly on the bottom of the trench. Where pipes exceeding 600 mm DN are to be laid in this way, it is recommended that the bottom of the trench be uniformly loosened so as to ensure that the pipes have an adequate bearing surface (bedding angle) appropriate to the conditions specified by the pipeline designer see EN 1295-1.

Where the trench bottom is unstable, for example in marshy ground or in running sand, special measures are necessary to ensure proper bedding (see also 10.4).

9 Pre-laying inspection of components, lowering pipes, joints and fittings into the trench

9.1 General recommendations

Before being lowered into the trench, pipes, joints and fittings shall be inspected carefully to detect any damage which can have occurred during transport, handling and storage on-site. Suspect areas shall be wetted thoroughly to detect end cracks, crushed laminations, etc. Any damaged pipe shall be marked clearly to avoid laying before appropriate action is taken.

Minor irregularities or scoring on the jointing surfaces at the pipe ends which could affect the watertightness of the joint shall be smoothed away by careful rasping in such a way as to avoid a “flat”. Where the irregularities or scoring are too pronounced to be smoothed away by such treatment, the pipe end shall be trimmed back and, if necessary, re-machined (see 4.3.3).

Where impact damage has been detected, the manufacturer’s opinion shall be sought if the integrity of the pipe is in doubt. Consideration can be given reclaiming the sound portion of the pipe. In the case of crushed ends or hair cracks, a sound pipe will usually remain if the damaged end is cut back beyond the visible extent of the damage. Pipes which have been reclaimed on-site shall be suitably marked so that at the time of laying their actual position in the pipeline can be known when pressure tests are subsequently carried out.

Before the pipes are laid, the pipe trench shall be checked for correct depth, gradient and width and also for the condition of the trench bottom.

Pipes, joints and fittings shall be lowered carefully into the trench with tackle suitable for their weight and for the depth of the trench.

9.2 Lowering by hand

Where the pipes and accessories are not too heavy, lowering can be carried out by hand provided that the trench depth does not exceed 1,5 m and that the edge of the trench is sufficiently stable.

9.3 Lowering with ropes

If the trench is deeper than 1,5 m or if the trench edges are inaccessible or if the pipes and accessories are too heavy to be lowered by hand, the method is generally as described in 4.2 except that planks are not normally required. The fixed ends of the ropes shall be properly anchored.

9.4 Lowering with mechanical equipment

Where the use of mechanical equipment is necessary (i.e. when pipes, joints and accessories are very heavy or the trench is very deep) or preferred, a wide sling positioned at the point of balance shall be used.

10 Pipe laying

10.1 General recommendations

Careful site organization shall precede the laying of pipes. The pipeline installer shall have available, at the required time, all material and equipment necessary for carrying out the work in accordance with this guide.

During the pipe laying process a suitable “pull through” (e.g. a swab) can be installed in the pipeline to facilitate cleaning of the pipeline on completion of laying.

To prevent the entry of foreign material during laying, the ends of pipelines for potable water shall be closed with temporary watertight plugs. When the work is interrupted or concluded, all openings shall be closed.

Care shall also be taken to ensure that there is adequate backfill or temporary strutting to prevent flotation. Precautions taken to prevent flotation shall not induce unacceptable localized stress in the pipes.

The pipeline installer shall ensure that the nominal pressure of the pipes, joints, fittings and rubber rings corresponds to the project specifications.

A distinction can be made between the following three types of laying :

a) continuous supports (see 10.1.1) ;

b) intermittent supports (see 10.1.2) ;

c) suspended installation (see 10.1.3).

10.1.1 Laying on continuous supports

10.1.1.1 Normal gradients

This is the normal type for pipelines laid in trench or in embankment conditions. The pipes shall be in contact with the bedding over their whole length and under no circumstances shall their weight be carried by the joints. Adequate joint holes shall therefore be provided.

The pipes shall be laid and assembled in good alignment. If in order to curve the run it is necessary to deflect the pipes at the joints, the deflection shall be applied only after the joint has been mounted (see 8.2 and 10.2.4).

As laying progresses, any necessary permanent anchorages (see 12) shall be installed and backfilling carried out (see 14). Consideration will be given to the installation of short length pipes with flexible joints adjacent to concrete anchorages or other rigid structures.

10.1.1.2 Steep gradients

In the case of steeply inclined runs, it is necessary to provide transverse anchors to prevent movement of the pipeline. The choice of type and spacing of anchorages and any necessary additional requirements shall be determined by the pipeline designer.

Precautions shall also be taken to ensure, as far as possible, that any surface water flow or flooding, capable of undermining the pipes, is prevented.

In addition, it is advisable, before backfilling the trench, to install water-stops perpendicular to the pipeline axis at suitable intervals in the trench to prevent the bedding and backfill being washed down the slope. In extreme cases it can even be necessary to fill the trench completely with gravel, excluding stones larger than about 30 mm.

10.1.2 Laying on intermittent supports

This is the type required when a pipeline is laid on cradles or saddles (for example in tunnels) or on piles (for example crossing rivers or cuttings). Special precautions in design and construction shall be taken when a pipeline supported in this way is subject to external load (for example backfill, traffic, etc.).

10.1.2.1 Number and location of supports

The number and the spacing of the supports shall be determined by the pipeline designer taking into account the diameter and the strength of the pipes and the anticipated external load on the pipeline.

Where laid in the open, the stability of the completed structure shall also be considered and allowance made for wind, impact, subsidence, etc.

Normally two supports are required for each length of pipe. The supports shall be located clear of the joints and at a distance from the pipes ends not exceeding 1/5 of the length of the pipe.

10.1.2.2 Types of support

Concrete, brick and mortar, or metal cradles shall be so shaped as to envelop not less than 60° (120° on heavily loaded pipes) of the external circumference of the pipe. The dimensions of the supporting cradle depend on the external diameter of the pipe, the enveloping angle and the bearing capacity of the soil and shall be determined by the pipeline designer. The design shall allow sufficient space for the joint and its assembly.

To ensure that the pipe is uniformly supported by the cradle, it is advisable to insert between the pipe and the cradle a layer of bitumen-impregnated felt or other suitable durable flexible material having a thickness of approximately 5 mm. Pressure pipes shall be fixed to the supports by means of a flat steel strap protected against corrosion.

10.1.3 Suspended installation

This is the type of installation required when a pipeline is suspended from a structure (for example bridges, walls, ceilings, etc.).

The pipes are supported by straps at specified intervals (10.1.2.1). The straps shall be made of flat steel, at least 50 mm wide, protected against corrosion, and under no circumstances shall they compress the pipe. Roundsection straps shall not be used.

10.2 Special laying conditions

10.2.1 Unstable ground

In case of unstable ground, the pipeline designer shall consider all the factors in order to determine the appropriate laying method. The following possibilities shall be taken into account :

— use of short length pipes ;

— use of long or locked joints ;

— special preparation of trench bottom and pipe foundation.

10.2.2 Passing under highways or railways

Backfill above the crown of the pipes shall have a height of at least 1 m. The pipe bedding, side backfill and the first 300 mm of material covering the pipe shall be selected non cohesive soil or granular material. The laying bed shall be of a depth at least [200 + (*D*/10)] mm. *D* being the external diameter of the pipe in millimetres, and shall fill the whole width of the trench.

Flexible joints shall be positioned at both extremities of the crossing.

Care shall be taken to comply strictly with the provisions laid down in the structure regulations as applicable in national standards.

10.2.3 Passing through rigid structures

If the pipeline has to pass through walls or concrete blocks, it is essential to ensure that the adjacent pipes are nor rigidly held. A short length of pipe shall be built into the wall and a further short length of pipe with flexible joints shall be laid immediately adjacent so that full flexibility can be ensured in the event of differential settlement.

If the structure is not thick, the length of pipe can be replaced by building in a fibre-cement joint. In some cases it can be possible to install suitable sleeve pipes.

10.2.4 Changing of direction

Changes in direction, either horizontal or vertical, can be achieved by using :

a) bends or angled couplings ;

b) the inherent flexibility of the joints.

Where method b) is used, the angular deflection between two consecutive pipes shall not exceed that recommended by the manufacturer. The pipes shall be jointed, in the first instance, in a straight line, and the trench shall be widened towards the outside of the curve (see 8.2 and 10.3.1). The required curve is obtained by successively moving the ends of each last pipe thus laid. The deflection shall be equally distributed from joint to joint. Initial deflection of any joint shall not exceed the manufacturer's permissible angle and also shall take into account possible subsequent movements.

Bends subject to internal pressure shall be adequately anchored (see 12).

11 Jointing

11.1 General requirements

Jointing shall be carried out in accordance with the pipe manufacturer's instructions. In general, the pipeline installer shall ensure that :

— the rubber rings used correspond to the size and class (or wall thickness) of the pipes ;

— the rubber rings and the jointing surfaces of both pipe and joint are clean ;

— the rubber rings are correctly positioned in the grooves of the joint or on the pipe ends, as applicable ;

— where the use of lubrificant is specified, the pipeline designer shall verify that the instructions of the manufacturer are stringently followed ;

— care is taken to prevent the entry of bedding material into the joint ;

— a suitable gap is provided between pipe ends after jointing.

11.2 Unrestrained joints

Pipelines with unrestrained joints shall be securely anchored at blank ends, tees, bends, tapers and valves to resist thrust arising from internal pressure. Anchors and thrust blocks shall be constructed to withstand the forces resulting from the internal pressure including site test and dynamic forces, taking into account the safe bearing pressure of the actual surrounding soil.

11.3 Restrained joints

Joints restrained by mechanical means shall be installed in accordance with the manufacturer's instruction.

11.4 Lubrificant for joints

Any lubrificant which will come into contact with potable water intended for human consumption shall satisfy relevant national standards transposing ENs as available.

12 Anchorages

At points in a pipe run where there are horizontal or vertical changes in direction, reduction in pipe size, valves, branches or capped ends, it is necessary to construct permanent anchorages where movement can occur due to thrust generated by internal pressure.

Temporary anchorages are those which serve only to hold the temporary end closures installed for progressive testing of sections of the pipeline.

Permanent anchorages are intended to form an integral part of the pipeline and consist usually of blocks of concrete. The shape of the concrete blocks depends on the type of the fittings which have to be anchored, while the size of the blocks depends on the thrust to be withstood due to internal pressure, the resistance of the soil and any other local loads. The desing of anchors shall not adversely affect flexibility of unrestrained joints.

In the case of vertical curves, the anchorage can comprise flat steel straps held in place by embedding in concrete blocks and suitably protected against corrosion. Such anchorage shall not hold the piping rigid and shall be constructed merely to withstand the thrust generated in a given direction by the internal pressure. Wherever possible, the adjacent joints shall remain accessible.

To determine the size of each anchorage, it is necessary to calculate thrust resulting from the maximum internal pressure which will be attained at the anchorage point during testing and to consider the resistance of the soil and/or local conditions.

Before a pressure test is carried out, all permanent and temporary concrete anchor blocks shall have developed adequate strength. Rapid hardening cement can be used.

13 House service connections

Tapping for service connections can be carried out directly or indirectly. In the first case (13.1), the connection is made directly to the pipe, in the second case (13.2), the connection is made by interposing a suitable adaptor.

Drilling and tapping shall be carried out in accordance with the pipe manufacturer's instructions. Suitable precautions shall be taken during installation of the service pipe to ensure that the length adjacent to the ferrule can accommodate any minor settlements in order to prevent undue loading on the ferrule.

13.1 Direct connection

Drilling, with subsequent tapping if threaded ferrules are to be employed, can be used with DN 100 and DN 150 diameter pipes provided that the ferrule does not exceed 20 mm diameter and with pipes of larger diameter provided that the ferrule does not exceed 25 mm diameter. The type of device used shall be compatible with the thickness of the pipe.

13.2 Indirect connection

In this type of connection, a suitable fitting is inserted between the main pipe and the ferrule. Typical fittings are tees, collars, saddles and special fibre-cement connection joints.

14 Embedment and backfilling

Backfilling of piping can be carried out in two phases :

— phase one involves partial backfilling before pressure testing (embedment) ;

— phase two involves completion of backfilling after pressure testing.

Complete backfilling can be carried out in a single operation prior to field pressure testing if so agreed between the pipeline installer and the pipeline designer. In either case, backfill shall be placed in a manner which ensures compaction. Where mechanical equipment is employed on the site, care shall be taken to avoid damage on the pipeline.

Where specified, tracer tapes shall be installed on the specified position for detection and/or warning and identification purposes.

The site engineer must approve the material used for backfilling. It is necessary to use select material see EN 1295-1. Material containing large stones or frozen lumps or harmful industrial wastes shall not be used.

14.1 Partial backfilling

Material used for partial backfilling shall be placed in the trench in a uniform manner, on each side of the pipe and over the whole width of the trench, in layers approximately 150 mm thick, carefully compacted under the pipe and at the sides in order to provide a good bedding free from cavities, and in conformity with the designer's specification see EN 1295-1.

Partial backfilling shall leave the joints exposed and rise at least 300 mm above pipes of diameters up to DN 200 and about 500 mm for larger diameters. In order to sensure good partial backfilling, mechanical shovels shall not be used for placing the backfilling in the trench. In general, if the excavated material is being used for backfill, the density and the moisture content of the compacted fill shall be as near equal as possible to that of the existing undisturbed soil it supports. If replacement materials are being used for backfill, they shall be compacted at their optimum moisture content to give the maximum density to the satisfaction of the site engineer.

14.2 Backfilling after pressure testing

When the tests have been completed satisfactorily, it is first necessary to backfill the joints which have been left exposed and then to complete the backfilling of the piping as a whole. For backfilling the joints, the instructions given in 14.1 shall be followed. To complete the backfilling, unless a fill of better quality is specified, use shall be made of materials which have been excavated from the trench and from which large stones have been removed. The trench shall on no account be used as a dump for waste and rubbish.

In completing the backfilling, the material shall be placed in layers approximately 300 mm thick, levelled and carefully compacted similar to the instruction given in 14.1 or in conformity with the designer's specification.

15 Working processes and recommended tools

Table 2 enclosed refers to currently known tools and methods. Other equally suitable tools may exist or could be developed in future. Therefore, the tables are not exclusive.

Table 2 — Recommended tools

	a) Cutting	b) Turning	c) Drilling. Cut outs
4.5.1 Diameter up to 600 mm	Handsaw (small diameters) Hand-operated lathe cutter Power-driven lathe cutter Jig saw (+ guiding device for diameter 350 mm to 600 mm) Chain cutter Hand-guided bandsaw Low speed circular saw	Hand-operated lathe Power-operated lathe	Handsaw Jig saw with carbide tipped blade Hand drill Power drill Hand-operated hole cutter Power-driven hole cutter with milling head Power drill with hardmetal bit
4.5.2 Diameter above 600 mm	Hand operated lathe cutter Power driven lathe cutter Chain cutter up to diameter 800 mm Hand-guided bandsaw Low speed circular saw	Hand-operated lathe Power-operated lathe	Jig saw with carbide tipped blade Power drill Hand-operated hole cutter Power-driven hole cutter with milling head Power drill with hardmetal bit

16 Tool specification

16.1 General recommendations

When working fibre-cement pipes with power driven equipment such as saws, jig saws and bandsaws, the fineness of the dust produced depends primarily on the geometry of the saw blade as well as on the blade speed (number of strokes, number of revolutions, etc.) of the machine.

With a machine operating at a high frequency together with a fine saw blade, an excessive amount of respirable fine dust produced due to the grinding action. Dust extraction is therefore mandatory.

With a coarse-toothed saw and a low frequency, a chip-cutting action takes place which produces mainly coarse du Under certain conditions, dust extraction is unnecessary.

Low speed circular saws with milling action produce coarse chips and do not require dust extraction.

The type of machinery is assessed by the following formulae :

$$d = \frac{va}{k}$$

$k = Hf$ for reciprocating movement

$k = wR = 2\pi Rf$ for radial movement

where

d ist the calculated chip thickness, in millimetres ;

v is the rate of feed, in millimetres per minute ;

k is the speed of the cutting teeth, in millimetres per minute ;

a is the tooth spacing in millimetres ;

H is the length of stroke, in millimetres ;

R ist the radius of circular saw blade, in millimetres ;

f is the frequency (number of strokes or revolutions), in revolutions: 1/min ;

w is the angular velocity, in revolutions per minute.

When working without dust extraction, the feed rate shall be chosen that the required chip thickness is reached under normal operating conditions. For a given saw blade, the feed rate depends principally on the shearing force as well as the thickness and the properties of the material being cut.

For various reasons, a certain proportion of fine dust will be produced even when operating with a thick chip. For this reason, the required thickness of chip lies considerably above the dimensions of respirable dust particles.

The working process with a rotating saw blade is exactly the same as that of the working stroke of a machine with a reciprocating motion. However, on the return stroke a grinding effect occurs which produces fine dust. The proportion of fine dust produced during the working stroke shall therefore be reduced, that is, coarser chips shall be produced, in order to maintain a similar average dust concentration. Less fine dust is produced on the return stroke when using thick saw blades because of the reduced surface pressure.

The cooling air for a jig saw is often so directed that the fine dust falling from the saw blade is blown away. This sort of air flow is not permissible for the working of fibre-cement pipes.

The fine dust produced when a jig saw works with a grinding action shall be removed by means of concentrated suction apparatus.

Empirical criteria for working with or without dust extraction.

Saws with rotating blades :

$d > 100$ µm extraction usually not required ;

$d < 50$ µm extraction required ;

$50 < d < 100$ µm extraction not required for occasional use, extraction required for continuous use.

Saws with reciprocating blades :

$d > 200$ µm extraction usually not required ;

$d < 100$ µm extraction required ;

$100 < d < 200$ µm extraction not required for occasional use, extraction required for continuous use.

16.2 Lathe cutter, lathe, hole cutter

These tools work by means of a rotating hardmetal chisel (or even two for a hole cutter) fixed on a turning frame.

16.2.1 Lathe cutter

The lathe cutter, completely assembled, can be pushed over the pipe, or can be assembled around the pipe in the trench. The pipe is cut by a hardmetal chisel, which rotates around the pipe. Closer adjustments of the chisel can be made by hand or automatically with a screw nut. Lathe cutters are available with manual turning handles or optional power drive.

This operation produces coarse dust because of the low frequency. Dust extraction is unnecessary.

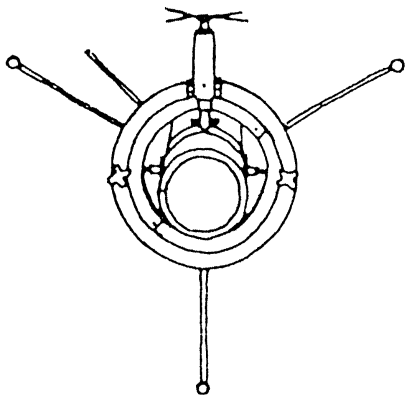


Figure 7 — Lathe cutter

16.2.2 Lathe

The lathe used to end-trim and re-machine rough pipe barrels to the necessary end profiles consists of an adjustable self-aligning arbor inserted into the pipe bore, a screw-fed turning frame, blades and manual turning handles or an optional power drive.

This operation produces coarse dust because of the low frequency. Dust extraction is not necessary.

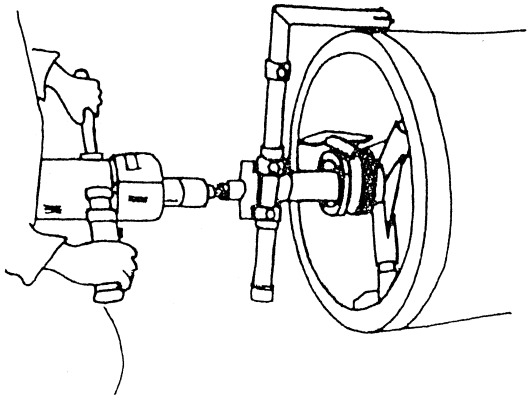


Figure 8 — Lathe

16.2.3 Hole cutter

The hole cutter consists of a turning frame and two chisels, manual turning handles or optional power drive. The turning frame is affixed in the pipe barrel

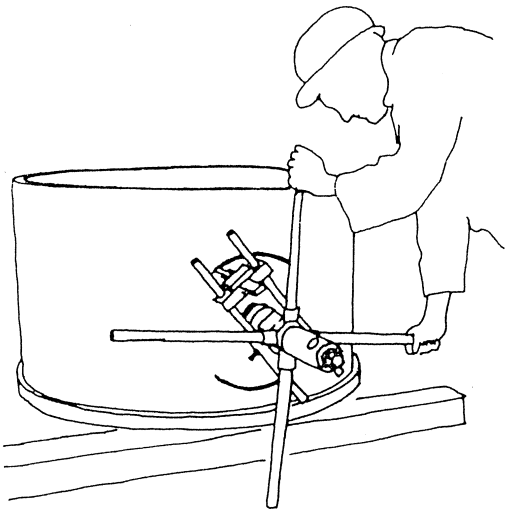


Figure 9 — Hole cutter

This operation at a low frequency produces coarse dust. Dust extraction is unnecessary.

16.3 Jig saw

The large jig saw for cutting pipes up to DN 600 consists of a driving engine of approximately 700 W or more and hardmetal toothed saw blade of a length up to 1 m. For stability reasons, this cutting unit needs a guiding and holding device to cut pipes with diameters exceeding DN 350.

Low frequency and wide tooth spacing produce coarse dust. Dust extraction is not necessary if the calculated chip thickness satisfies the following condition : $d > 200$ µm

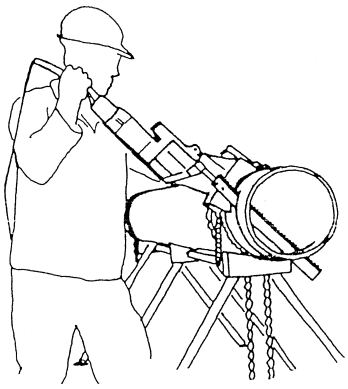


Figure 10 — Jig saw

16.4 Low speed circular saw

The low speed circular saw is powered by a motor of 330 W and has a speed of 250 revolutions per minute. The blade diameter is of about 115 mm and tipped with hardmetal teeth.

The low speed circular saw does not require dust extraction.

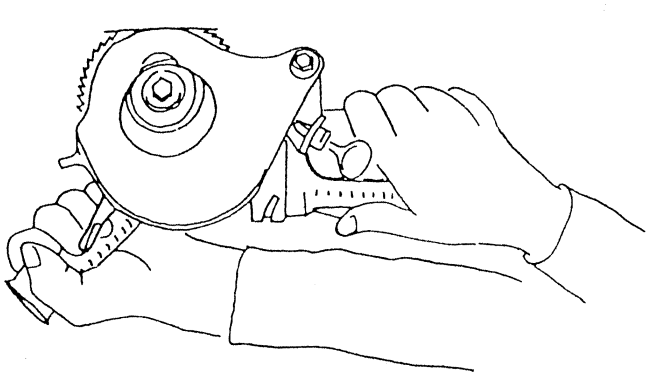


Figure 11 — Low speed circular saw

16.5 Chain cutter

Chain cutters operate by means of cutting wheels, mounted on a chain wrapped around the pipe barrel. Hydraulic pressure, applied by means of a remote electric or manually operated pump, simultaneously squeezes the cutting wheels into the pipe-wall until the material shears along the squeezing line. Because of the shearing process, cutting with the chain is practically dust-free and no chip thickness need to be calculated.

Chain cutter are particularly recommended for autoclaved pipes. The use for non-autoclaved pipes is limited due to the poor quality of the cut.

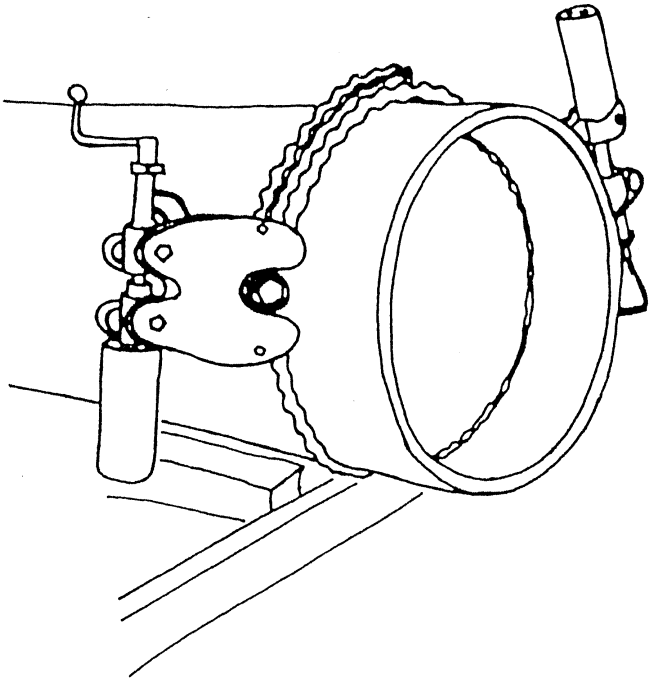


Figure 12 — Chain cutter

16.6 Abrasive discs

Water flushed rotary abrasive disc cutters are permissible for cutting pipes provided that those involved in the operation wear suitable respiratory protective equipment and impervious protective clothing.

17 Dust extraction equipment

17.1 Characteristics

To achieve the general goals of this European Standard, certain tools need related dust-extraction units. A vacuum cleaner is usually defined by the following characteristics :

Suction

— vacuum (bar) ;

— air volume (cubic metres per hour) ;

— cross-section, hose connection muffs ;

— cross-section, extraction hoses.

Separation

Number of separation steps

Filter medium

— material ;

— surface (square metres) ;

— surface load (cubic metre of air per square metre of filter per hour) ;

— separation degree (%).

Method of collection of the separated dust capacity (bag, container).

Protective facilities

Tool shall be only operated together with vacuum cleaner efficiency survey.

Cleaning facility for filter.

Electric supply

Mass

As there is no mathematical law to support the choice of the most compatible vacuum equipment, the following data and recommendations based upon experience shall be observed as guidelines.

17.2 Recommendations

It is the tool and its dust emission in both volume and content which determine the choice to be made.

Different usage criteria shall be taken into account.

Suction

As for handiness, hoses and extraction hoods usually have a small cross-section and therefore a high vacuum power is required exceeding 0,15 bar in most cases.

Separation

The concentration in the clean air flow shall not exceed 0,2 f/ml. It is recommended that a two-step separation process be applied :

a) for coarse and fine dust ;

b) for finest dust (absolute filters).

The air flow shall not exceed 120 m^3 of air per hour per square metre of filter surface (cubic metres per hour per square metre).

Diffusion of dust shall be avoided during and after emptying the vacuum cleaner; dust shall be emptied into bags which may be sealed.

The dust storage capacity shall correspond to at least half a shift and if possible to a whole shift.

Protection

The current supply shall be devised so that the tool may only be switched on if the vacuum cleaner is also in operation.

The pressure drop across the filter shall be indicated by a manometer in order to clean the filter as soon as there is a 20 % decrease of efficiency.

It shall also reveal the presence of holes in the filter by indicating pressure drops.

The combined current consumption of tool and vacuum cleaner shall not exceed the electric supply on-site.

Extra wirings shall be avoided as leading to the non use of the vacuum cleaner.

For ease of manipulation, the reasonable mass acceptable shall be under 20 kg.

17.3 Cleaning and disposal of the waste

Arrangements shall be made for the cleaning of personnel and equipment. Waste material such as off-cuts, turnings and dust shall be disposed of in accordance with national regulations.

Annex A
(informative)

A-deviations

National deviations due to regulations, the alteration of which is for the time being outside the competence of the CEN member. In the relevant CEN countries these A-deviations are valid instead of the provisions of the European Standard until they have been removed.

National Deviations type A, with regard this European standard, which falls under Directive 90/531/CEE, have been requested by Germany, Denmark, Norway and Sweden. The references of their national regulations are the following :

GERMANY

Order relating to prohibitions and limitations on the putting into circulation of dangerous substances, preparations and products under the terms of the law concerning chemicals (Chemikalien-Verbotsverordnung) of October 14, 1993 BGBI 1993 Part 1, page 1720.

Order for the protection against dangerous substances (Gefahrstoffverordnung) of October 26, 1993 BGBI 1993 Part 1, page 1783.

DEUTSCHLAND

Verordnung über Verbote und Beschränkungen des Inverkehrbringens gefährlicher Stoffe, Zubereitungen und Erzeugnisse nach dem Chemikaliengesetz (Chemikalien-Verbotsver-ordnung vom 14. Oktober 19993 BGBI 19993 Teil 1 S. 1720.

Verordnung zum Schutz vor gefährlichen Stoffen (Gefahrstoffverordnung) vom 26. Oktober 1993 BGBI 19993 Teil 1 S. 1783.

ALLEMAGNE

Arrêté relatif aux interdictions et limitations de la mise en circulation des matières, préparations et produits dangereux, en vertu de la loi sur les produits chimiques (Chemikalien-Verbotsverordnung) du 14 octobre 19993 BGBI 1993 partie 1, page 1720.

Arrêté pour la protection contre les matières dangereuses (Gefahrstoffverordnung) du 26 octobre 1993 BGBI 1993 partie 1, page 1783.

DENMARK

Ministry of Labour

Order No. 1182 dated December 1992

On the performance of work

Ministry of Labour

Order No. 1017 dated 15 December 1993

On the safe organization of building sites and similar workplaces according to law on working environment

Order on the use of asbestos

(Order No. 660 of 24 September 1986)

orders to amend the order on asbestos

(Order No. 139 of 23 March 1987)

(Order No. 984 of 11 December 1992)

According to this Order, the use of AT products is not allowed in Denmark

NOTE 1 Related to § 4.3.1, 4.3.2 and 4.3.3

DS 475 : 1993 : code of practice for trenching for underground pipes and cables

DS 475/Til1 : Annex A to code of practice for trenching for underground pipes and cables

NOTE 2 Related to § 8.3.

DÄNEMARK

Ordnung Nr. 1182 von Dezember 1992

betreffs der Arbeitsausführung

Arbeitsamt

Ordnung Nr. 1017 vom 15. Dezember 1992

betreffs der sicheren Organisation von Baustellen und ähnlichen Arbeitsplätzen laut des Gesetzes über die Arbeitsumwelt.

Ordnung betreffs des Einsatzes von Asbest

Ordnung Nr. 660 vom 24. September 1986

Ordnungen zur Abänderung von der Ordnung über Asbest

Ordnung Nr. 139 vom 23. März 1987

Ordnung Nr. 984 vom 11. Dezember 1992

Laut dieser Ordnung wird der Einsatz von AT-Art Faserzementrohren in Dänemark verboten.

Anmerkung 1 Betrifft § 4.3.1, 4.3.2 und 4.3.3

DS 475 : 1993 : Praktische Verhaltensregeln für die Verlegung von Erd-Rohrleitungen und Kabeln.

DS 475/Til.1 : Anhang A zu den praktischen Verhaltensregeln für die Verlegung von Erd-Rohrleitungen und Kabeln.

Anmerkung 2 Betrifft § 8.3.

DANEMARK

Ministère du travail

Arrêté N° 1182 de décembre 1992

Sur les performances au travail

Ministère du travail

Arrêté N° 1017 du 15 décembre 1993

Sur la sécurité de l'organisation du travail sur chantier et dans les lieux de travail similaires, conformément à la loi sur l'environnement professionnel.

Arrêté sur l'utilisation de l'amiante

(Arrêté N° 660 du 24 septembre 1986)

Arrêtés qui amendent l'arrêté sur l'amiante

(Arrêté N° 139 du 23 mars 1987)

(Arrêté N° 984 du 11 décembre 1992)

Cet arrêté stipule que l'utilisation des produits AT est interdite au Danemark

NOTE 1 correspondant aux § 4.3.1, 4.3.2 et 4.3.3

DS 475 : 1993 : code of practice for trenching for underground pipes and cables

DS 475/Til1 : Annex A to code of practice for trenching for underground pipes and cables

NOTE 2 correspondant au § 8.3.

NORWAY

(Forskrifter om asbest)

Ministry of local government

Regulation on asbestos

Order of 16 August 1991

Pursuant to law of 4 February 1977 n° 4, on labour protection and working environment.

Pursuant to law of 11 June 1976 n° 76, on product control.

NORWEGEN

(Forskrifter om asbest)

Ministerium für regionale Verwaltung

Regelung über Asbest

Verordnung vom 16. August 1991

Nach dem Gesetz Nr 4 über den Personalschutz und das Arbeitsumfeld vom 4. Februar 1977.

Nach dem Gesetz Nr 76 über die Erzeugniskontrolle vom 11. Juni 1976.

NORVEGE

(Forskrifter om asbest)

Ministère de l'administration régionale

Réglementation sur l'amiante

Décret du 16 Août 1991

Conformément à la loi du 4 février 1977 n° 4, sur la protection du personnel et l'environnement du travail.

Conformément à la loi du 11 Juin 1976 n°76, sur le contrôle des produits.

SWEDEN

(Föreskrifter om asbest)

National Swedish Board of Occupational Safety and Health.

Ordinance AFS 1992:2, concerning asbestos.

SCHWEDEN

(Föreskrifter om asbest)

Nationaler schwedischer Rat für Berufssicherheit und Gesundheit.

Beschluβ AFS 1992:2 über Asbest.

SUEDE

(Föreskrifter om asbest)

Conseil national Suédois pour la sécurité professionnelle et la Santé.

Ordonnance AFS 1992:2, concernant l'amiante.

NETHERLANDS

Order relating to prohibitions and limitations to the processing, treatment and storage of abestos or abestos-containing products.

Asbestbesluit Arbeidsomstandighedenwet (Stb. 1988, 560), modified Stb. 1993, 136 (5 maart 1993), last modification Stb. 1994, 562.

NIEDERLANDE

Verordnung über Verbote und Beschränkungen für die Verarbeitung, Behandlung und Lagerung von Asbest oder Asbestprodukten.

Asbestbesluit Arbeidsomstandighedenwet (Stb. 1988, 560), abgeändert Stb. 1993, 136 (5 maart 1993), letzte Abänderung Stb. 1994, 562

PAYS BAS

Arrêté relatif aux interdictions et limitations en matière de transformation, traitement et stockage de l'amiante ou de produits contenant de l'amiante.

Asbestbesluit Arbeidsomstandighedenwet (Stb. 1988, 560), modifié Stb. 1993, 136 (5 maart 1993), dernière modification Stb. 1994, 562

CZECH REPUBLIC

In accordance with Decree N° 76/1990 Coll. Issued by the Ministry of Health and Social Affairs – of the chief Hygienist of Czech Socialist Republic which modifies and amends the Directive of the Ministry of Health and Social Affairs – of the chief Hygienist of Czech Socialist Republic N° 64/1984 Coll. – "Directive on hygienic principles for working with chemical carcinogenes" - the use of products containing asbestos is restricted (see 11a, 11b of the Decree N° 76/1990 Coll.)

TSCHECHISCHE REPUBLIK

In Anwendung des durch das Ministerium für Gesundheitswesen und soziale Angelegenheiten – vom Oberhygieniker der sozialistischen tschechischen Republik herausgegebenenen und die Richtlinie des Ministeriums für Gesundheitswesen und soziale Angelegenheiten Nr 64/1984 Coll – vom Oberhygieniker der sozialistischen tschechischen Republik. – « Richtlinie über die hygienischen Grundsätze für die Arbeit mit chemischen Karzinogenen » – abändernden und ändernden - Erlasses Nr 76/1990 wird die Anwendung von Asbest enthaltenden Produkten beschränkt (siehe 11a, 11b des Erlasses Nr 76/1990 Coll).

REPUBLIQUE TCHEQUE

Conformément au décret n° 76/1990 Coll. pris par le Ministère de la santé publique et des affaires sociales – du responsable des questions d'hygiène de la République socialiste tchèque, modifiant et amendant la Directive du Ministère de la santé publique et des affaires sociales n° 64/1984 Coll. – du responsable des questions d'hygiène de la République socialiste tchèque– « Directive relative aux principes d'hygiène à appliquer pour travailler avec des carcinogènes chimiques » - l'utilisation de produits contenant de l'amiante est limitée (voir 11a, 11b du décret n° 76/1990 Coll).

SWITZERLAND

Stoffverordnung Nr. 814.013 vom 9.6.1986 über umweltgefährdende Stoffe.

In accordance with above mentioned regulation, the use of abestos is not allowed in Switzerland.

SCHWEIZ

Stoffverordnung Nr. 814.013 vom 9.6.1986 über umweltgefährdende Stoffe.

Die Verwendung von Asbest ist laut o.g. Stoffverordnung in der Schweiz nicht erlaubt.

SUISSE

Ordonnance n°814.013 du 9.6.1986 sur les substances dangereuses pour l'environnement. L'utilisation de l'amiante est interdite en Suisse suivant l'ordonnance ci-dessus.

FRANCE

- Order N° 96-1133 of December 24, 1996 relative to the prohibition of asbestos, in conformity with the Labour Code and the consumer code.

In accordance with the order, it is forbidden to manufacture, import, put on the market, export, sell all types of asbestos fibres or products containing those fibres.

FRANCE

- Décret N° 96-1133 du 24 décembre 1996 relatif à l'interdiction de l'amiante, pris en application du code du travail et du code de la consommation.

Conformément à ce décret, la fabrication, l'importation, la mise sur le marché national, l'exportation, la détention en vue de la vente, l'offre, la vente et la cession à quelque titre que ce soit de toutes les variétés de fibres d'amiante et de tout produit en contenant sont interdites.

FRANKREICH

In Anwendung des kollektiven Arbeitsrechts und der Konsumgesetz-gebung erlassene Vorordnung Nr 96-113 vom 24 Dezember 1996 über des Asbestverbot.

Erlass vom 24. Dezember 1996 über das Erklärungsformular zwecks Abweichungen vom Asbestverbot.

Gemäss dieser Verordnung ist es verboten asbesthaltiger Stoffe einführen, herstellen und verkaufen.

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