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English Version

## Drain and sewer systems outside buildings - Management and control of activities - Part 3: Drain and sewer cleaning

Réseaux d'évacuation et d'assainissement à l'extérieur des bâtiments - Gestion et contrôle des activités opérationnelles - Partie 3: Curage des branchements et des collecteurs

Entwässerungssysteme außerhalb von Gebäuden - Management und Überwachung von Maßnahmen - Teil 3: Kanalreinigung

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**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

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## **European foreword**

This document (FprEN 14654-3:2020) has been prepared by Technical Committee CEN/TC 165 “Wastewater Engineering”, the secretariat of which is held by DIN.

This document is currently submitted to the formal vote.

This document will supersede EN 14654-1:2014.

The changes to the text in this document are largely editorial and relate to the separation of the duplicated text.

EN 14654 consists of the following parts, under the general title *Drain and sewer systems outside buildings — Management and control of activities*:

- *Part 1: General*
- *Part 2: Rehabilitation*
- *Part 3: Drain and sewer cleaning (the present document)*
- *Part 4: Control of inputs from users*

Other parts, dealing with other activities, may be added later.

In drafting this part of EN 14654, account has been taken of other available standards, in particular EN 752, *Drain and sewer systems outside buildings*” and EN 13508 *Investigation and assessment of drain and sewer systems outside buildings*”.

## 1 Scope

This document establishes requirements for the management and control of activities in drain and sewer systems outside buildings and specifies requirements for development and implementation of work programmes, and the selection of techniques.

This document covers the management and control of drain and sewer cleaning.

It is applicable to drain and sewer systems from the point where wastewater leaves a building, roof drainage system, or paved area, to the point where it is discharged into a wastewater treatment plant or receiving water body.

Drains and sewers below buildings are included provided that they do not form part of the drainage system of the building.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 752, *Drain and sewer systems outside buildings - Sewer system management*

EN 1829-1, *High pressure water jet machines - Safety requirements - Part 1: Machines*

EN 1829-2, *High-pressure water jet machines - Safety requirements - Part 2: Hoses, hose lines and connectors*

EN 13508-1:2012, *Investigation and assessment of drain and sewer systems outside buildings - Part 1: General Requirements*

FprEN 14654-1:2020 *Drain and sewer systems outside buildings — Management and control of activities — Part 1: General*

EN 16323:2014, *Glossary of wastewater engineering terms*

### **3 Terms and definitions**

For the purposes of this document, the terms and definitions given in EN 16323:2014, FprEN 14654-1:2020 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

NOTE: Certain key definitions from EN 16323:2014 have been repeated below for clarity. The following additional terms used in this European Standard are defined in EN 16323:2014.

- drain
- foul wastewater
- sewer
- sewer system
- receiving water body
- surface receiving water body
- wastewater treatment plant

#### **3.1 General**

##### **3.1.1**

##### **cleaning activities**

removal or partial removal of settled deposits, attached deposits, roots and other obstacles from a drain or sewer system

##### **3.1.2**

##### **degree of cleaning**

extent to which complete removal of deposits is achieved

##### **3.1.3**

##### **removal**

extraction of deposits after collecting at the working area or the intentional use of the flow in the drain or sewer to carry the re-entrained solids to a specified point of extraction

##### **3.1.4**

##### **self-cleansing**

ability of the flow in a drain or sewer to carry away solid particles which would otherwise be deposited in the pipe

[SOURCE: EN 16323:2014, 2.2.1.13]

##### **3.1.5**

##### **supernatant liquor**

liquor in a tank lying above the deposited solids

[SOURCE: EN 16323:2014, 2.1.2.16]

### **3.1.6**

#### **wastewater**

water composed of any combination of water discharged from domestic, industrial or commercial premises, surface run-off and accidentally any sewer infiltration water

[SOURCE: EN 16323:2014, 2.3.10.65]

## **3.2 Deposits**

### **3.2.1**

#### **attached deposits**

material attached to the wall of elements of the drain or sewer system by physical or chemical bonding

### **3.2.2**

#### **settled deposits**

material deposited by gravity in the invert or benching of elements of the drain or sewer system

## **3.3 Cleaning techniques**

### **3.3.1**

#### **cleaning ball**

spherical device, having an indented surface, designed to be carried through a drain or sewer by the flow to facilitate removal of sediments

### **3.3.2**

#### **combined jetting**

simultaneous use of high-pressure water jetting equipment together with a suction action, to remove obstructions or sediments from drains or sewers

[SOURCE: EN 16323:2014, 2.2.1.10]

### **3.3.3**

#### **flushing**

use of a temporary and substantially increased flow to facilitate the removal of obstructions or sediments from drains or sewers

[SOURCE: EN 16323:2014, 2.2.1.16]

### **3.3.4**

#### **jetting**

use of water under defined conditions of pressure, through a nozzle

[SOURCE: EN 16323:2014, 2.2.1.18]

### **3.3.5**

#### **rodding**

use of appropriate device on the end of flexible rods to facilitate the removal of obstructions (or sediments) from drains or sewers

[SOURCE: EN 16323:2014, 2.2.1.11]

**3.3.6**

**scouring plate**

device used to clean a drain or sewer by concentrating the flow into a small cross section thereby increasing the flow velocity

**3.3.7**

**winching**

use of a device pulled through a drain or sewer to facilitate removal of sediments (or obstructions)

[SOURCE: EN 16323:2014, 2.2.1.12]

**4 General**

Cleaning activities in drains and sewers can be carried out pro-actively, to prevent problems occurring or to clean a drain or sewer before particular operations (e.g. an inspection or renovation work) or reactively in response to problems that have occurred.

The requirements for pro-active cleaning can be identified through a rehabilitation plan, a maintenance plan involving periodic monitoring or as part of an integrated sewer system management plan in accordance with EN 752. Consideration shall also be given to the feasibility of preventing deposition of sediments for example by rehabilitation of the sewer.

This document applies the process described in EN 14654-1 for implementing cleaning activities in the integrated drain and sewer system management plan. This document shall be used in conjunction with EN 14654-1.

**5 Integrated sewer system management planning**

**5.1 Introduction**

Cleaning activities are one aspect of the maintenance plan, as part of an integrated sewer system management plan. A maintenance plan dealing with cleaning activities should be in place for the drain and sewer system prior to carrying out major programmes of sewer cleaning. However, this is not always possible if works are required urgently (e.g. in response to a sewer failure).

**5.2 Cleaning aims**

The principal aims of carrying out cleaning work can include:

- a) Pro-active cleaning
  - 1) to ensure that the performance of the drain or sewer system is acceptable;
  - 2) to prolong the operational life and maintain the value of the asset;
  - 3) to control septicity to reduce associated odour, health and potential corrosion problems;
  - 4) to limit polluting discharges into receiving water bodies;
  - 5) to enable inspection or renovation of the drain or sewer system;
  - 6) to optimize the effectiveness of key components of the system at critical times (e.g. prior to heavy rain seasons, busy periods in tourist sites);
  - 7) to facilitate inspection.



- b) Reactive cleaning
  - 1) to restore the flow (e.g. by removing a blockage)
  - 2) to restore the function of the drain or sewer system;
  - 3) to reduce septicity and odour problems (e.g. by removing sediments)

The nature of the aim can determine the degree of cleaning necessary.

## **6 Preparation of the cleaning programme**

### **6.1 Introduction**

The cleaning programme defines the approach to be taken to cleaning in each drain or sewer, either specifically or as part of a group of drains or sewers. The cleaning programme defines a series of projects, in line with the integrated sewer system management plan, to ensure that the drain and sewer system meets the performance requirements.

### **6.2 Review of the cleaning activities planning**

A review should be undertaken of the cleaning aspects of the operations and maintenance plan within the integrated sewer system management plan.

### **6.3 Investigation**

#### **6.3.1 Introduction**

The location of the sections of drains and sewers where proactive cleaning is to be carried out and the assessment of the cleaning frequencies shall be based on:

- a) an understanding of the characteristics and structural condition of the drain and sewer system;
- b) an analysis of its performance;
- c) a review of the available information which may include the performance of similar systems elsewhere.

The different sections of the sewer shall be described according to the information collected in order to optimize the cleaning programme.

The scope of the investigations necessary to produce the cleaning programme will depend on the extent of the investigations carried out during the preparation of the integrated sewer system management plan and on the characteristics of the individual systems.

#### **6.3.2 Review of previous investigations**

A review should be undertaken of the information available. The review should include:

- a) inventory data
  - 1) type of effluent (foul wastewater, surface water, combined sewage or specific effluents);
  - 2) sewer characteristics (shape, size, slope, depth, material, etc.), presence and characteristics of combined sewer overflows and other ancillaries;

- 3) characteristics of the location of the sewer (e.g. aquifer protection zones, ground water level, trees, proximity of receiving water bodies);
- b) condition information from inspection reports (e.g. visual inspection reports, CCTV reports, sediment measurements);
- c) data on flows from measurements or the results of hydraulic models;
- d) records of past cleaning (e.g. location of areas of persistent operational problems, working space and access constraints, effectiveness of previous techniques, personnel input and costs); and
- e) performance data (e.g. sewer flooding, sewer blockages, collapses, odours, septicity problems, premature operation of combined sewer overflows, etc.).

### **6.3.3 Further investigations**

Where there is insufficient information available to plan the cleaning programme, a programme of investigations shall be carried out to obtain the necessary information.

An example report form is given in Annex A.

Examples of investigations can include:

- a) further inspection in parts of the system where the original assessment was based only on sample inspections;
- b) use of an appropriate sewer flow simulation model;
- c) more detailed studies of the impact of any discharges on receiving water bodies.

Details of investigation techniques for drains and sewers are described in EN 13508-1:2012.

### **6.4 Assessment**

The assessment should identify the location of those components of the drains and sewer system where proactive or reactive cleaning is to be carried out. This shall be based on:

- a) effects of the deposits on the performance of the system;
- b) sources of such deposits;
- c) typology of the drain or sewer;
- d) nature of the effluent.

The performance of the drain or sewer systems shall be assessed in accordance with EN 13508-1:2012, Clause 6, using the results of the investigation (see 6.3). The assessments carried out during the preparation of the integrated sewer system management plan should be reviewed and updated in the light of any new information identified during the investigations. The performance at each planning horizon shall be compared to the performance requirements to identify the need for cleaning.

Where inspection is used to determine the current levels of sediment, the effect of the movement of sediment in dunes, leaving some parts of the pipe clear while other localized parts of the sewer have significant deposits, should be considered. However, localized sediments may also indicate the presence of an obstacle.

The typology of drains and sewers can be identified as:

- type 1: drains and sewers which are self-cleansing, where proactive cleaning is exceptional;
- type 2: drains and sewers which are not completely self-cleansing, where proactive cleaning could be beneficial, the cleaning frequencies depending on the rate of sediment accumulation;
- type 3: drains and sewers with localized problems, which require frequent cleaning.

The typology can change over time.

Other elements of the sewer system, for example sewer connections, gullies, silt traps, inverted siphons, pumping stations, rising mains and vacuum systems also require cleaning.

NOTE: Information on pumping stations, rising mains and vacuum systems are given in EN 16932 parts 1 to 3

## **6.5 Development of the programme**

### **6.5.1 Introduction**

A cleaning programme shall:

- a) identify optimum frequencies for pro-active cleaning operations;
- b) maintain or reduce the number of reactive cleaning operations to an acceptable level.

### **6.5.2 Specification of objectives**

The cleaning objectives should be established in accordance with the cleaning aim. These should be expressed as a performance requirement, for example:

- a) to remove settled and/or attached deposits to a prescribed amount (for example remove completely or to a maximum depth);
- b) to restore the flow capacity in a pipe to the design capacity;
- c) to limit the build-up of sediments to a prescribed level;
- d) to limit the deposits to existing levels (maintaining a balance in the sediment movement);
- e) to limit the build-up of deposits so that sewer flooding is limited to prescribed frequencies;
- f) to remove sufficient deposits to avoid blockages;
- g) to remove sufficient sediments to allow an inspection to take place or to facilitate renovation or repair;
- h) to remove bio-films (for example from rising mains to reduce septicity, or from heat exchangers).

### **6.5.3 Developing options**

There are a number of possible cleaning approaches, including:

- a) periodic cleaning (cleaning according to fixed time intervals);
- b) monitored periodic cleaning (cleaning according to time interval, the subsequent time interval is updated according to the depth of deposits prior to previous cleaning);

## **FprEN 14654-3:2020 (E)**

- c) planned inspection (by CCTV or other technique) and cleaning (inspection at intervals in order to determine when deposits have reached a threshold level for cleaning);
- d) specific cleaning before other works such as CCTV inspection, rehabilitation operations, etc.;
- e) reactive cleaning - in those sections of drains and sewers which are normally self-cleansing;
- f) action to control discharge of unsuitable materials into the drain or sewer system (see FprEN 14654-4:2020).

Where frequent cleaning is required, or where the consequences of sediment accumulation are severe, consideration should be given to the feasibility of carrying out rehabilitation works to prevent the accumulation of sediments.

### **6.5.4 Assess feasibility of solutions**

In addition to the factors specified in FprEN 14654-1:2020, 6.5.4, the assessment should consider whether the options developed would increase the capacity of the sewer system.

### **6.5.5 Select optimum solution**

The optimum solution should be selected in accordance with FprEN 14654-1:2020, 6.5.5. As well as the costs, the relative benefits of each option should also be taken into account.

### **6.5.6 Producing the programme**

In addition to the information specified in FprEN 14654-1:2020, 6.5.6, the programme should specify:

- a) location and length of the sewers to be cleaned or inspected;
- b) nature of the deposits anticipated to be removed (for example intruding roots, sediments, obstacles).

## **7 Preparation of the project specification**

### **7.1 Introduction**

A cleaning specification defines in detail the cleaning work to be carried out in a group of drains or sewers. The specification should be in accordance with the approach defined in the cleaning programme.

### **7.2 Review of the project description and project objectives**

The review should be carried out in accordance with FprEN 14654-1:2020, 7.2, and should include an assessment as to whether there have been any changes to the information identified during the preparation of the cleaning programme.

### **7.3 Investigation**

An investigation should be carried out to determine the following:

- a) extent of the deposits or obstructions, including deposits in lateral connections to the sewer;
- b) nature of the deposits expected (e.g. grease, sand);
- c) whether the deposits are the cause (wholly or partially) of any reported performance problems;

- d) amount of deposits which need to be removed to restore acceptable performance having regard to the likely rate of re-deposition following cleaning;
- e) structural condition of the drain or sewer and the type of material;
- f) other information that could affect the feasibility of sewer cleaning work.

The investigation should be carried out using the existing data available. Further investigation can be necessary.

#### **7.4 Assessment**

The assessment shall be carried out in accordance with FprEN 14654-1:2020, 7.4.

#### **7.5 Drafting the project specification**

##### **7.5.1 Introduction**

In accordance with FprEN 14654-1:2020, 7.5, the drafting of the project specification involves the following stages: prepare potential solutions, assess feasibility of solutions, select optimal solutions, detailed design of optimal solution.

##### **7.5.2 Prepare potential solutions**

Solutions should be developed for the pipeline sections and other components to be cleaned and the amount of deposits that need to be removed. The feasibility of these solutions should be evaluated taking into account:

- a) nature of the deposits or obstacles to be removed;
- b) size of the drain or sewer;
- c) range of water depths and the flow regimes within the drain or sewer;
- d) restrictions on the access, including:
  - 1) traffic restrictions, traffic safety and safe working space,
  - 2) availability of suitable manholes or inspection chambers,
  - 3) size of the equipment and the available working space,
  - 4) need for off-road vehicles and their suitability to the site conditions,
  - 5) weight of the vehicle and the risk of the damage to the drain or sewer,
  - 6) land ownership;
- e) structural condition and the type of material of the drain or sewer and its susceptibility to deterioration due to damage through cleaning;
- f) extent to which they meet the cleaning aims;
- g) risk the sewer cleaning method will contribute to early operation of combined sewer overflows or sewer flooding;
- h) effectiveness of techniques used previously;

- i) personnel input and costs.

### **7.5.3 Assess feasibility of solutions**

The feasibility of each solution should be assessed taking account of a variety of factors, including:

- a) likely improvement on the performance of the system and if that is temporary, the likely duration of the improvement;
- b) any external constraints (e.g. restrictions on the disruption to traffic).

### **7.5.4 Select optimal solution**

Where more than one solution is feasible, the optimal solution shall be selected in accordance with FprEN 14654-1:2020, 7.5.4.

### **7.5.5 Detailed design of optimal solution**

After selection of the optimal solution further detailed design work should be carried out if appropriate (e.g. providing access, temporary flow management, operating pressure of jetting).

### **7.5.6 Prepare project specification**

For the selected option, a description of the works shall be produced to provide all the information necessary for the cleaning activities.

The information provided in the project specification can include:

- a) objective of the cleaning;
- b) location and extent of the section to be cleaned (e.g. drawing);
- c) location of the access points (e.g. manholes or inspection chambers) and the distance between them;
- d) restrictions on access to the site of the manhole or inspection chamber (e.g. traffic restrictions, the need for off road vehicles, land ownership etc.);
- e) restriction on access into or within the manhole or inspection chamber (e.g. the need for special lifting equipment or diameter of the manhole or inspection chamber);
- f) depth of the manhole or inspection chamber;
- g) type of deposits expected;
- h) size of the drain or sewer;
- i) known hazards (including hazards from trade effluents, drop pipes, automatic flushing devices etc.);
- j) the water depth and flows in the drain or sewer in various conditions;
- k) environmental restrictions such as noise, odours, etc.;
- l) whether there is danger of a direct spill from the sewer into a receiving water body;
- m) traffic management requirements;

- n) restrictions on working methods;
- o) restrictions on temporary stopping where this could cause sewer flooding or pollution;
- p) the locations of pumping installations or other structures which could be adversely affected by cleaning operations;
- q) whether and where deposits are to be removed from the drain or sewer;
- r) restrictions on the disposal of deposits and supernatant liquor (see FprEN 14654-1:2020, 8.7);
- s) water supply points (location, the nature of that supply and number);
- t) welfare facilities required on site for the use of operatives engaged on the cleaning works;
- u) information available in relation to the waste material to be removed by the cleaning work;
- v) anticipated volumes of material, if known, to be removed as part of the cleaning operation;
- w) public safety issues that could arise from the works.

## **7.6 Performance indicators**

### **7.6.1 Introduction**

Performance indicators should be selected in accordance with FprEN 14654-1:2020, 7.6.

### **7.6.2 Indicators for the assessment of the work quality**

The results required either immediately after cleaning has taken place, or on a continuing basis, shall be clearly described in the specification, to ensure that the cleaning objectives are achieved.

Performance indicators should be selected in relation to each of the cleaning objectives.

Examples of indicators can include:

- a) re-establishing free flow following reactive cleaning;
- b) number of complaints concerning odours, blockages, sewer flooding or pollution from a sewer length after pro-active cleaning;
- c) measurement of sediment depths at a sample of sections which were cleaned;
- d) percentage of sediment depth compared to the diameter of the drain.

### **7.6.3 Indicators for the assessment of the effectiveness of the project or programme**

Examples of indicators can include:

- a) percentage of the total length of drain or sewer cleaned pro-actively per year;
- b) percentage of the total length of drain or sewer cleaned reactively per year;
- c) number of emergency cleaning operations carried out per kilometre of sewer each year;
- d) number of complaints concerning odours, blockages, sewer flooding or pollution from a sewer length after pro-active cleaning;

- e) volume or weight of sediments removed per kilometre of sewer cleaned.

## **8 Implementation of projects**

### **8.1 Introduction**

The cleaning work should generally be carried out in such a manner that coarse material and debris is not allowed to discharge into the downstream sewer system. In some cases, it is possible to remove deposits at the wastewater treatment plant or other appropriate location. Deposits shall be removed from the drain or sewer system.

Where all the drains or sewers in an area are being cleaned, work should generally start with those sewers near the head of the system and continue downstream.

Where a supply of water is required, measures shall be taken to avoid contamination of any drinking water supply and to avoid unacceptable impact of the pressure supplied to other users. Where high pressure water jetting cleaning techniques are to be employed, the use of equipment capable of recycling the supernatant liquor decanted from the deposits removed should be considered. In addition, the use of non-potable water sources should also be considered.

Where unexpected pollutants are found, the cleaning work should be stopped, and arrangements made to avoid dispersing the pollution. The employer will be informed to agree what to do next.

Information on drain and sewer cleaning techniques is given in Annex B.

### **8.2 Select cleaning method**

When selecting the cleaning method and equipment the following considerations should be taken into account:

- a) nature of the deposits or obstacles to be removed;
- b) shape, size and depth of the drain or sewer;
- c) range of water depths and the flow regimes within the drain and sewer;
- d) distance from the manhole or inspection chamber to the furthest point to be cleaned;
- e) restrictions on the access to the manhole or inspection chamber, including traffic restrictions, the need for off-road vehicles, land ownership;
- f) whether access is available from the downstream manhole or inspection chamber;
- g) whether the access from the manhole or inspection chamber to the furthest point to be cleaned is only through plain (straight) pipe or whether it is through bends or an interceptor trap;
- h) type of material used in the construction of the drain or sewer and its susceptibility to damage through cleaning;
- i) structural condition of the drain or sewer and its susceptibility to deterioration due to damage through cleaning;
- j) environmental criteria such as noise, odours, the risk of discharge to the environment, etc.
- k) effectiveness of techniques used previously;
- l) personnel input and costs;



Further information on the different cleaning techniques available is given in Annex B “Drain and sewer cleaning techniques”

### **8.3 Health and safety**

The works shall be carried out in accordance with FprEN 14654-1:2020, 8.9. High-pressure water jetting machines shall comply with the requirements of EN 1829-1 and EN 1829-2.

The main part of the sewer cleaning operations comprises work on drains and sewers, often in confined spaces and in public traffic areas. In addition, there can be hazards related to the specific cleaning method.

The contractor shall identify the health and safety risks associated with the proposed cleaning works and provide the necessary mitigation of those risks.

### **8.4 Environmental impact**

The environmental impacts of sewer cleaning activities considered shall include the following:

- a) impact on surface receiving water bodies or groundwater:
  - pollution of groundwater by accidental discharge of polluting agents;
  - discharge of wastewater from the site;
  - discharge of polluted or sediment laden surface water from the site.
- b) impact on site:
  - contamination by spray or spillage;
  - impact of vehicles used for cleaning.
- c) impact on air:
  - emission of gas and polluting particles by site equipment;
  - dust generated by the work;
  - toxic emissions (e.g. Volatile Organic Carbons);
  - odour and aerosols.
- d) impact of noise:
  - noise emissions from site equipment.
- e) impact of site waste:
  - sorting of site waste;
  - handling of deposits removed;
  - procedure for handling and disposal of contaminated soil and waste materials.
- f) social impact:

## **FprEN 14654-3:2020 (E)**

- tidiness and cleanliness on public or private property;
- restrictions on access to property;
- ecological damage.

### **8.5 Cleaning report**

The contractor shall submit a report to the client on completion of the work in accordance with FprEN 14654-1:2020, 8.11. This shall include the following:

- a) location, date and time of the work;
- b) name of the contractor and the operative;
- c) estimate of the state of the sewer before the work commenced;
- d) cleaning techniques used;
- e) type and amount of deposits removed;
- f) documentation of the waste management arrangements for the deposits removed (the Waste Framework Directive (Directive 2008/98/EC [3]) can apply); and
- g) information concerning the state of the sewer after cleaning.

An example of a cleaning report form is included in Annex A.

## **9 Measurement of conformity**

### **9.1 Measuring conformity with the project specification**

The measurement of conformity shall be in accordance with FprEN 14654-1:2020, Clause 9. Examples of methods for measuring conformity with the contract include the following:

- a) visual inspection of sediment depths at manholes or inspection chambers;
- b) visual inspection of the sediment in the drains or sewers, directly or by CCTV see EN 13508-1:2012, 5.8.3;
- c) visual inspection of the sewer where tree roots or other specific obstacles are being removed.
- d) sonar inspection of the drain or sewer.

The specification shall state whether these are to be applied on all locations or to a sample. Where sampling is to be used, the sampling method and the method of statistical analysis shall be described.

### **9.2 Non-conformities**

When non-conformities are found, these should be dealt with in accordance with FprEN 14654-1:2020, 9.2.

## **10 Review of plan and programme**

A review of the cleaning plan and programme shall be carried out by the evaluation of general quality indicators and efficiency indicators for the applied strategy, using for example the reporting data from reactive or pro-active cleaning operations as statistical parameters.

Examples of general and efficiency indicators are given in 7.6.3.

The review of the cleaning plan can lead to the improvement of the former strategy or the determining of a new strategy, and, thus, provides feedback for continuous improvement.

The cleaning strategy should be specified with consideration of operational experience and should be continuously reviewed and updated with information from earlier cleaning.

**Annex A**  
(informative)

**Example of cleaning report form**

SEWER CLEANING DAILY REPORT FORM

Sheet ., of ..

Contractor:

Date:

Operative:

Time of arrival

Site:

Time of departure

Location	Start manhole Ref	Finish manhole Ref	Sewer length m	Sewer size mm	Sewer type	Technique used	Depth of deposits before mm	Type of deposits	Depth of deposits after mm	Length cleaned m	Direction of cleaning [Upstream or Downstream]	Waste management Reference	Comments

## **Annex B** (informative)

### **Drain and sewer cleaning techniques**

#### **B.1 General**

Techniques for cleaning drains and sewers include the following. This list is not exhaustive. Work on sewers is potentially hazardous, and health and safety should also be considered (see 6.3).

#### **B.2 Jetting**

This technique can be used for removal of obstacles, and settled and attached deposits. Work should be carried out wherever possible from a downstream manhole or inspection chamber. Pressures should be limited to avoid damage to the fabric of the pipe. Maximum safe working pressures to avoid damage will vary according to the material of the pipe, the condition of the pipe and the type of nozzle.

Water jetting units can be broadly classified on the basis of the pressure used and the rate of water delivered. Typically, there are two families of jetting units; the first using lower pressures and delivering higher flow rates of water, the second using higher pressures delivering lower flow rates of water. Experience is needed to select the most appropriate unit.

Care should be taken when introducing the nozzle into the pipe as the nozzle can cause impact damage to the pipe when the pressure is started. The nozzle should be kept moving at all times in order to limit the potential for damage to the fabric of the drain or sewer. The rewind rate of the jetting hose for sediment removal should be typically 100 mm/s to 200 mm/s.

The nozzle should be selected which:

- is appropriate for the nature of the deposits being removed;
- minimizes the risk of damage to the fabric of the drain or sewer;
- maximizes the effectiveness of removal of the deposits.

Where water for cleaning is taken from the public supply, national or local regulations can apply.

#### **B.3 Jetting with suction**

Combined water jetting delivering higher flow rates of water with suction to remove deposits from the sewer.

Where this equipment is incorporated in a single vehicle this is termed combined jetting. This combination sometimes includes re-circulation of water allowing higher flow rates of water to be used.

This technique can be used for removal of settled or attached deposits.

## **B.4 Winching**

This involves pulling a tool by means of a cable between two adjacent manholes. Measures should also be taken to minimize the risk of damage to the drain or sewer system. The type of the tool selected should relate to the nature of the deposits. The size of the initial tool selected should generally be small. The size of tool should then be increased successively to the maximum for the size of pipe. The tension on the cable should be monitored for any undue force. The direction of working is generally two-way.

## **B.5 Rodding**

This involves pushing a tool through a drain or sewer on the end of a flexible rod. It is generally only suitable for pipes less than DN 250 and less than 2 m deep and for removal of blockages. The type of tool selected should relate to the nature of the deposits. Total removal of debris from the drain or sewer line is not generally possible and some material is likely to remain in the line. In addition, some debris may also pass into the downstream system.

## **B.6 Remote controlled equipment**

A variety of remotely controlled equipment is available including:

- chain flails;
- mechanical root cutters;
- robotic controlled high-pressure water cutters.

The equipment chosen should be appropriate for the type of deposits being removed and the pipe material.

## **B.7 Flushing**

Flushing involves temporarily or permanently placing a gate dam, a flushing valve, or a storage chamber upstream of the section to be cleaned in order to retain a significant volume which is then released to create a large wave. Depending on circumstances, several waves are generated.

This is suitable for cleaning loose deposits in sewers. The loosened deposits are generally retained in the drain or sewer system.

Care should be taken to ensure that there are no personnel in the sewers downstream.

## **B.8 Cleaning balls/scouring plates**

In this technique, a gate or ball slightly smaller than the size of the drain or sewer is allowed to move down the drain or sewer. The increased flow velocity as the flow passes the moving obstruction loosens the sediments and moves them downstream. Cleaning balls are generally fluted to maximize the localized turbulence to release the deposits. It is not generally possible to remove the loosened deposits from the sewer.

## **B.9 Manual or mechanical excavation**

Manual or mechanical excavation is also possible in larger drains or sewers, and is generally used where other techniques of cleaning are not practicable. Due to the potential health and safety risks, the use of techniques involving operations personnel entering the sewer should be minimized.

Mechanical excavation can be using small excavators or purpose made vehicles that push or sweep the sediments forward to a collection point. Where mechanical excavation is used, the equipment should be protected to minimize the risk of explosions.

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