The Plastic Pipes and Fittings Industry

Best Practice for effective jetting of sewer pipes

teppfa

the european **plastic pipes and fittings** association

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Cleaning and unblocking

All types of gravity drain and sewer systems require a regular cleaning regime to ensure achievement of efficient performance. A new European Standard for the management and control of these cleaning operations is currently being finalised: prEN 14654-1:2004 *Management and Control of Operations in Drains and Sewers – Part 1: Sewer Cleaning*.

This bulletin summarises recommended Best Practice for the effective use of pressurised jetting to clean and unblock sewer pipes while minimising risk of damage to the pipe system. *These principles apply to ALL pipe materials.*

A brief review of other cleaning methods is also included.

Choosing the right equipment

In one or two European countries, sewer cleaning is typically carried out using small portable rigs that employ low volumes of water at high pressure through small-bore (typically 1mm) nozzles.

However, there is increasing evidence from independent jetting tests *(see next page)* that **high** volume water at **low** pressures is a more effective way to achieve removal of obstructions and thorough cleansing of accumulated sediments from pipes – as well as for routine maintenance. These methods use larger bore (typically 2.8mm) nozzles.

Comparing techniques

When comparing these two jetting methods, the use of **high pressure/low volume** jetting has the following **disadvantages:**

- Much smaller active cleaning area
- Volume of water insufficient to carry debris to manhole for removal
- New blockage can form downstream of area being cleaned
- Significantly increased risk of damage to pipe wall, particularly if the pipeline is in poor condition

This may be contrasted with **low pressure/ high volume** jetting which has the following **benefits:**

- Cleaning of full pipe circumference
- Significantly increased hammer action of jet-head on blockages
  - A 2.8mm nozzle at 120 Bar is calculated to generate approximately 5 times the energy of a 1mm nozzle at 340 Bar
- Higher volume of water flushes debris to manhole for removal
- Minimal risk of damage to pipes

Although high pressure/low volume jetting is still common in the UK, the Water Research Centre's [WRc] *Sewer Jetting – Code of Practice* (published June 1997) actually recommends a maximum pressure of 130 Bar – particularly where the condition of the pipework concerned is unknown or known to be defective. This recognises the potentially dangerous consequences of employing high pressure jetting, risking serious damage to sewer pipelines, whatever the material, especially to those in poor condition.

These WRc recommendations are in line with similar industry guidance published elsewhere in Europe, including the Netherlands and Germany.

Conclusions from independent jetting tests

Assessing efficiency and impact

Inevitably, the question arises whether low pressures – not exceeding 120 Bar, for example – are capable of achieving the necessary cleaning efficiency for typical maintenance operations.

The efficiency and impact of jetting on the various pipe materials and constructions have been explored in a variety of independent tests over recent years. These studies have been conducted under controlled conditions in order to ensure that the testing can be fairly and consistently replicated. TEPPFA, through its member companies and organisations, has regularly taken a lead in the furthering of understanding through the commissioning of such research. One of these was conducted by Loughborough University in the UK.

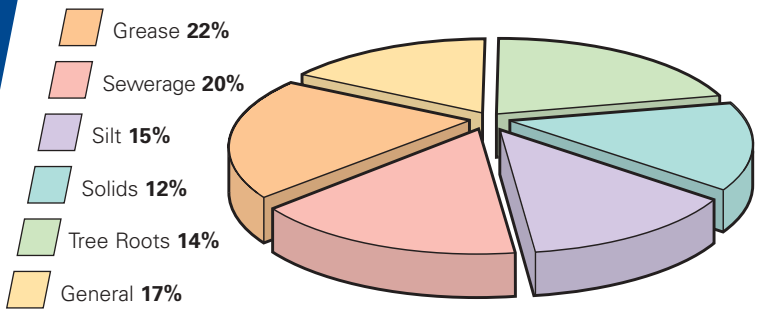
Blockage types

The Loughborough study firstly questioned jetting contractors in order to identify the various causes of blockages in sewer pipes and map the frequency with which these tended to occur.

Of these, two of the more problematic causes were selected to be the subject of simulated clearing tests using jetting:

- **Grease/fat:** full bore blockage of solidified fat and disposable nappies
  - Consistent with typical in-service operational blockages
- **Solids:** one-third bore partial blockage of cured concrete
  - Simulating residual builders' waste left in the pipe invert after installation
  - Primarily encountered pre-commissioning of newly-installed pipes *(see NOTE)*

Causes of sewer pipe blockages: views of UK jetting contractors



Testing of plastic pipes

Test work in the UK, and general practice throughout Europe, has demonstrated that, in practice, a pressure of 120 Bar is sufficient for all plastics and other pipe materials. This will remove blockages likely to occur in service, while debris is carried to the manhole by high water volume.

Plastic pipe materials (PVC-U, Polypropylene and Polyethylene), in solid and structured wall construction types, were included in extensive laboratory testing in a TEPPFA-commissioned programme conducted by the Danish Technological Institute (DTI). New plastic pipes, as well as those which had been in service for several years, were subjected to 120 Bar water pressures with a 2.8mm nozzle over 50 cycles without any damage to the pipe. This was as specified in **prCEN/TR 14920** *Jetting resistance of drain and sewer pipes – Moving jet test method.*

Clearing tests

The pressure required to remove these blockages was measured for new pipes in the main material types:

	BLOCKAGE REMOVAL	
	GREASE	SOLIDS
Solid and Structured Wall Plastic *Pressure required…*	70 bar	70-110 bar
Clay *Pressure required…*	70-105 bar	*Required pressure levels may also damage pipeline.*
Concrete *Pressure required…*	105 bar	*Replacement would be recommended (see NOTE)*

NOTE: *Can be dependent on concrete mix and cure time. In clay and concrete sewers, the longer the curing period, the more likely that the concrete will have bonded with the pipe wall, requiring greater jetting power to achieve removal. Cured concrete does not adhere to plastic in this way, and so its removal requires less jetting pressure.*

In the tests on rigid (clay and concrete) pipes, pressures needed to remove such blockages significantly exceeded the ***maximum*** *jetting pressure recommended in the WRc Jetting Code of Practice (130 Bar). Such high pressure jetting could cause damage to the pipe wall. In practice, therefore, if CCTV surveys detect such blockages in rigid pipework, and concrete debris has been allowed to cure, re-excavation and replacement of affected pipes would be necessary.*

Supplementary techniques

Other cleaning methods

In most situations, low pressure/high volume water jetting, in accordance with the recommended best practice (see overleaf) is generally sufficient for the removal of blockages and efficient cleaning of sewer pipes – whatever their material or construction.

However, for any sewer from time to time, certain other cleaning techniques may also be required, in addition to jetting, to help deal with specific situations. These include:

Cleaning ball*

A spherical device, slightly smaller than the sewer pipe bore, which is passed down through the sewer. Its fluted surface creates localised turbulence and increased flow velocity adjacent to the pipe wall as it passes. This loosens, and helps release, deposited sediments.

Flushing*

Placing a dam or flushing valve at the upstream end of the pipe section to be cleaned in order temporarily to interrupt the flow through the sewer pipe and create flow volume build-up. When this is released, the temporary substantially-increased flow removes obstructions and loose deposits from the pipe.

Rodding*

Using a tool on the end of a flexible rod that is pushed (via a suitable access point) through a sewer pipe to remove blockages. Typically only suitable for pipes up to 250mm nominal diameter that are no more than 2m below ground.

Winching*

Using a tool that is pulled on a cable through a sewer pipe between adjacent manholes to help remove obstructions or sediments. The tool is typically bucket-shaped or as appropriate to the nature of the deposits. In order to minimise the risk of damage to the pipe wall, the procedure begins with a small-sized tool/bucket. This may be subsequently increased in size up to the maximum for the size of pipe concerned. A cleaning pass through the pipe is usually made in both directions.

**NOTE: These techniques are all included in BS EN 752-7:1998 Drain and sewer systems outside buildings. Maintenance and operations.*

ALSO USED

Root cutters

Mechanical tools to remove roots that have penetrated into a sewer pipe through cracks or displaced joints. Tools may be cutters or rotating chains. However, these carry a high risk of severe damage to the pipeline and will only provide a temporary solution because the roots will grow back. Only replacement of the affected section of the pipeline and/or removal of the trees concerned can provide a long-term solution.

SAFETY NOTE: Personnel entry to sewer systems is not generally recommended.

*If necessary, all Health & Safety regulations must be observed. If the **flushing** technique is used, it is especially important to ensure that no personnel are present in sewers downstream.*

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Recommended Best Practice for jetting

To achieve efficient cleaning and unblocking of any sewer pipes – whether manufactured from plastic, clay or concrete – the following Best Practice principles are recommended:

Personnel

- Jetting equipment should only be used by trained personnel

Preparatory

- Evaluate, as far as possible, the nature and condition of the sewer to be cleaned, including
  - Material type and size
  - Structural condition
  - Operational condition: flow performance and nature of deposits/blockage(s)
- Evaluate the associated Health & Safety factors – particularly in relation to regulations concerning personnel entry into confined spaces

Jetting equipment

- Use low pressure/high volume jetting
- AVOID high pressure/low volume cleaning techniques
- Select nozzle size appropriate to jetting equipment and size of pipe

Jetting pressure/flow rate *(see table)*

- Maximum pressure at nozzle: 120 Bar

  NOTE: 60 Bar is typically sufficient to remove soft debris. 80-120 Bar may be required for the removal of more substantial build-up of material
- See TABLE for
  - Maximum flow rates for jetting hose sizes
  - Guidance on pressure drop between pump and nozzle per 10m of hose
- Recommended draw-back speed: 6-12m per minute

After jetting

- Review the operational condition of the cleaned pipe
- If jetting was used to clear a blockage, use CCTV to investigate the possible cause of the blockage which had to be cleared
  - Was it due to structural problems/defects (e.g. cracking or collapse)?
- Report accordingly, and record any information which may be useful for future maintenance or refurbishment works

Pressure drop (bar) per 10 metres of hose

	HOSE SIZE nominal bore			
FLOW RATE (l/min)	12mm (1/2")	20mm (3/4")	25mm (1")	32mm (1 1/4")
25	0.5	-	-	-
50	2.8	0.1	-	-
80	7.0	0.7	-	-
100	n/a	1.1	-	-
120	n/a	1.6	-	-
140	n/a	2.2	-	-
150	n/a	2.5	0.8	-
180	n/a	4.4	1.2	-
200	n/a	n/a	1.5	-
250	n/a	n/a	2.3	0.7
300	n/a	n/a	3.4	1.0
350	n/a	n/a	n/a	1.3
400	n/a	n/a	n/a	1.8
450	n/a	n/a	n/a	2.3
Recommended Maximum flow (l/min)	80	180	310	500

NOTE: Quoted pressure drop figures are approximate – for guidance only

KEY: l/min = litres per minute
"-" = negligible pressure drop
n/a = not applicable (exceeds recommended maximum flow rate for hose size)

SOURCE: Danish Technical Institute

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TEPPFA

The voice of the Plastic Pipes and Fittings Industry in Europe

TEPPFA represents and acts for the interests of over 200 manufacturers of plastic pipes and fittings and their respective national trade associations across Europe. Members account for around € 10 billion turnover with about 30,000 employees.

The Association brings a unique fund of experience and expertise to all Community consultations about the plastic pipes industry.

TEPPFA is active in three principal areas:

Health, Safety and the Environment

Providing strong leadership on environmental issues. Using members' collective technical expertise to provide balanced, authoritative expressions of the industry's vision and concerns about plastics and the environment:

- Exchanging and communicating knowledge and expertise
- Promoting best practice (e.g. collection and recycling schemes)
- Maintaining an informed and balanced source of information

Certification and Standardisation

Providing a centre for members' technical excellence and internationally recognised expertise:

- Formulating and proposing European standards
- Promoting third party quality certification of plastic pipe systems
- Supporting international recognition of test results between countries
- Representing the industry at the European Commission and CEN

Promotion

Proactively addressing current issues and driving industry change:

- Research plastic pipe systems' performance in existing and innovative applications
- Commissioning independent testing and performance auditing against other materials
- Disseminating information and test results to the industry and the wider public