British Precast Drainage Association

Concrete Pipeline Systems

Sewer pipes and resistance to high-pressure water jetting

High pressure water jetting is the most commonly used technique for blockage clearance in drains and sewers. Following the publication of a new Manual for Drain & Sewer Cleaning, and amendments to standards such as EN 14654-3 and BS 5911, and industry standards such as the Design & Construction Guide (DCG) adoption code, a number of new requirements were introduced, and some previous restrictions have now been removed. This factsheet offers basic information on some of these new requirements and updates advice on the performance of different sewer pipe solutions.

Need for high pressure water jetting

Every year, Water Companies in England & Wales deal with up to 300,000 sewer blockages, costing water companies £100 million annually to clear them (Water UK, 2019). The damage from such blockages can be significant, in 2016/17 alone well over 5,000 properties and 30,000 private lands and gardens experienced flooding due to sewer blockage.

Sewer blockages and the rise of problems associated with fatbergs building up in sewer networks is not restricted to the UK. Fatbergs have attracted much media coverage in the last few years, with cases reported across Europe and North America. The main cause of such blockages is usually wipes and rags flushed down toilets and Fat, Oil & Grease (FOGs) disposed of through kitchen sinks. However, other elements such as pipe defects and poor sewer design can contribute to sewers' blockage.

High-pressure water jetting is the most commonly used technique to deal with sewers' blockage (WRc, 2020). Where jetting cannot be used due to accessibility, safety or availability of blow-back protection, other techniques such as rodding or rotary drain cleaning can be employed.

What causes sewer blockage?

Blockage in drains and sewers are caused by a combination of factors. In addition to consumers' behaviour, disposing of oils, wipes and other non-disposable items down toilets and kitchen sinks, drain and sewer defects can contribute to blockage. The Manual of Drain and Sewer Cleaning identifies a number of sewer-related factors:

- **Pipeline location, layout and shape:** All these factors can present different challenges that can lead to blockage.
- **Defects and deterioration:** Pipes with defects or deteriorated condition can experience blockage as well. Open and displaced joints can play a part in causing blockage. However, research in the US in the 1980s indicate that moderate and slight defects in joints do not affect flow (ACPA, 2014).
- **Other defects:** Defects in manhole design can lead to blockage. EN 16933-2 also identifies deformation, sagging or corrugations in pipes' profile as a factor which may cause problems with flow.

High pressure vs low pressure jetting

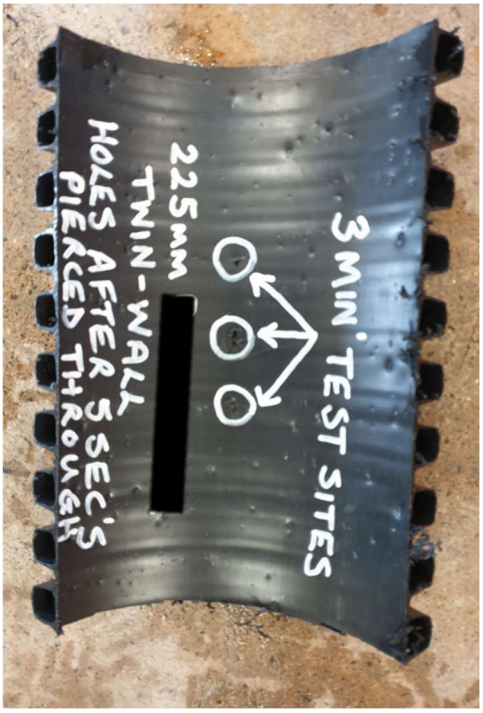
EN 14654 and the Manual of Drain and Sewer Cleaning (2020) identify two main families of units used for sewer jetting:

- High-flow rate machines at pressures 100-200 Bar (1500-3000 psi).
- Low-flow rate machines at pressures 200-350 Bar (3000 to 5000 psi).

However, the Manual of Drain & Sewer jetting notes that when it comes to blockages, jetting units of the high-pressure low-volume type are usually employed (WRc, 2020). A number of jetting contractors (such as Lanes for Drains) also refer to high-pressure jetting at 3,000 psi in their websites, or publications, as the typical method to deal with fatberg related blockages (Lanes for Drains, 2021). Low-flow jetting may be more suitable for regular cleaning operations where loose but settled deposits need to be removed.

However, it should be noted that not all types of sewer pipes can take the same magnitude of water jetting pressure. EN 14654 warns that the maximum water pressure applied "*will vary according to the pipe material, the condition of the pipe and type of nozzle*".

Additional elements identified by the Manual of Drain & Sewer Cleaning include the status and condition of the sewer and certainty over the type of pipe material. Pipes made of different materials have differing levels of resistance to jetting, the Manual of Drain & Sewer Cleaning warns specifically against jetting damage to specific types of pipe materials, such as plastic and pitch fibre pipes, where damage in the form of small holes may occur and may be undetectable by CCTV. Tests by BPDA reveal that it could take as little as 3-5 seconds of jetting at high-pressure for some plastic pipe walls to fail.



Pipe material type and resistance to jetting

Resistance to cleaning and jetting pressure is included in most pipeline product standards. The main standard for components used in drains and sewers, EN 476, stresses that product standards need to provide justifying statements in regard to sewerage components resistance to cleaning operations. The WRc manual sets limitations on maximum jetting pressures for different pipe materials used in sewers. These are included in Table 1.

Jetting pressure	Concrete	Clay	Plastic	Bricks/ fibre
PSI	5,000	5,000	2,600	1,500
BAR	345	345	180	103

Table 1. Table 1: Water jetting pressure maximum limits (WRc, 2020).

Clay pipes standard, EN 295, currently includes a high-pressure water jetting test to ensure that all pipes can offer the same level of performance when blockage is experienced and that fatbergs caused by wipes, rags and FOG will not severely damage the pipe.

The British concrete pipe industry is adopting a similar high-pressure moving and stationary nozzle test, which is expected to be included in BS 5911. The current advice for both clay and concrete pipes is a maximum jetting pressure of 4,000 to 5,000 psi.

Advice on plastic pipe jetting resistance is not straightforward or clear as the national method to test the resistance to jetting for plastic sewer pipes (detailed in WIS 4-35-01) is based on a maximum jetting pressure of 180 BAR (2,600 psi). However, that test method is only applicable to plastic pipes ≤ DN300. The main European standard (EN 13476-1) suggests that only low pressure, increased volume, water jetting should be employed. The European standard advises that a range between 1014 and 1554 psi should be sufficient to remove blockage.

This does not necessarily mean that all plastic pipes are designed to withstand jetting pressures between 1554 or 2600 psi only. A number of plastic pipe systems available in the UK report higher jetting pressure resistance.

What does the new sewers adoption standard say?

Earlier versions of the sewers' adoption guidance (Sewers for Adoption) used to offer addendums that would allow Water Companies to impose their own requirements. A number of Water Companies used to impose a minimum water jetting pressure of 4,000 psi for all pipes used in their sewer systems, removing the risk associated with damage during high-pressure jetting blockage clearance.

However, this requirement has been dropped in the latest Design & Construction Guide (DCG) adoption code. It is now the responsibility of cleaning contractors to manage the risk of pipe damage due to high-pressure water jetting during cleaning operations.

BPDA continues to believe that a margin of safety should be added to current plastic pipe standards bringing the current maximum water jetting pressure to 4000 psi (276 Bar) to limit the risk of damage and enable more efficient removal of sewers' blockage.

References

- **ACPA** (2012) *Manning's n Values History of Research - Design Data 10.* ©American Concrete Pipe Association, 2014. Link: https://www.concretepipe.org/wp-content/uploads/2014/09/DD_10.pdf
- **Lanes for Drains** (2020) *Fatberg removal and cleaning*. Lanes for Drains website: https://www.lanesfordrains.co.uk/commercial/services/fat-oils-and-grease-disposal/fatberg-removal-cleaning/
- **Water UK** (2019) *Fine to Flush - a major new development in the fight against fatbergs.* Link: https://www.water.org.uk/news-item/fine-to-flush-a-major-new-development-in-the-fight-against-fatbergs/
- **WRc** (2020) *Manual of Drain and Sewer Cleaning*. ©WRc, 2020.

For product information, please contact BPDA members

British Precast Drainage Association (BPDA)
The Old Rectory, Main Street, Glenfield, LE3 5DG
Tel: 0116 232 5170
email@precastdrainage.co.uk
www.precastdrainage.co.uk

Marshalls CPM
Tel: 01179 814 500

F P McCann
Tel: 01530 240 000

Stanton Bonna Concrete
Tel: 01159 441 448