

Sewer Pipes and Resistance to Jetting

High pressure water jetting is the main method used to clean different types of sewers and drains. In 2001 a Sewers Jetting Code of Practice was produced by WRc. The code set a number of guidelines, requirements and specifications for use of high pressure jetting, however other standards are still being produced and used by the industry. This factsheet offers some basic information on the issue of sewers' water jetting.

Introduction: Need for High Pressure Jetting for Sewerage Systems

- Sewer blockages are a major cause of sewer flooding. In England and Wales, blockages cause 4,000 property flooding incidents each year. This is around 55% of sewer flooding incidents. The main practice usually used to clear sewer blockages is by employing high pressure (1500 to 5000 psi) water jetting. This is contrary to the practice in mainland Europe where a combination of high volume-low pressure jetting is employed. High pressure water jetting equipment is often used to clean drains and sewers on a regular basis and remove any blockages and sediments from them. However, it has been shown that high pressure water jets can cause damage to the fabric of drains and sewers, although it is normally limited in extent and can be difficult to detect. Uncontrolled jetting can affect the structural integrity, the leaktightness and serviceability of all types of sewers and drains.
- A few years ago, there was considerable pressure on plastic pipe manufacturers as a number of water companies were banning the use of their products because of alleged damage caused by high-powered water jet cleaning (Contract Journal, 1997). A House of Commons Select Committee report also referred to the problems associated with plastic pipes jetting. Today, up to three major water companies still have an effective ban on the vast majority of plastic sewer products.
- The Sewer Jetting Code of Practice was first published in 2001 and it provides guidance on good working practice when using high pressure water jetting equipment. The guidance offered should enable damage to the fabric of drains and sewers to be avoided. The Code also sets limitations for jetting pressure used for different types of sewer pipes, as demonstrated in the following table:



Figure 1. Need for limitations on water jetting.

Jetting Pressure (MAX)	Concrete	Clay	Plastic	Bricks/ Fibre
PSI	5000	5000	2600	1500
BAR	345	345	180	103

Table 1. Water jetting pressure maximum limits in the Water Jetting Code of Practice (WRc, 2005).

- However some water and wastewater companies have their own tougher requirements for maximum jetting pressures in their sewer networks. As shown in Table 2 (overleaf) three water companies (Thames Water, Anglian Water, and Southern Water²) specify that they require **higher** jetting pressure compliance than the Sewers Jetting Code of Practice figure.
- Whilst the material used to manufacture the sewer may have a jetting limit the job of the jetting contractor is to clear a blockage. If the blockage fails to clear, it has often been noted that the contractor will simply turn up the pressure until it clears. Prudence would therefore dictate using a material able to resist high powers of jetting, in this case a concrete pipe, rather than expecting a contractor to restrict the pressure used in jetting operations.

¹ Latest version of the code was published in 2005.

² For sewer plastic pipeline systems with sizes 150 to 300 mm.

Maximum Jetting Pressure allowed for Plastic Pipes psi (BAR)	Anglian Water	Northumbrian	Severn Trent	United Utilities
	4000 (276)	2600 (180)	2600 (180)	2600 (180)
	South West	Yorkshire	Thames	Scottish
	2600 (180)	2600 (180)	4000 (276)	2600 (180)
	Welsh Water	Wessex Water	Southern Water	
	2600 (180)	2600 (180)	2600 (180) – 4000 (276)	

Table 2. Water jetting maximum pressure limits for plastic sewer pipes, Sewers for Adoption (2006).

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- As shown in Table 2, concrete and clay pipes (with >5000 psi pressure resistance) should not have any problems with the restrictions imposed by all water companies. Tests conducted by CPSA show that concrete pipes can actually take much higher jetting pressure exceeding 6,000 psi.
- It should be noted that the problem with jetting is not only restricted to the Code. The current national standard for sewer plastic pipes WIS 4-35-01 offers details on a high pressure jetting testing regime for plastic pipeline systems. Plastic sewer pipes are to be tested under a jetting pressure not exceeding 2600 psi – leaving no margin of safety for the product. This point was raised a number of times by CPSA since the publication of the standard in 1999.
- More worryingly, the new sewer plastic pipe standards EN 14654: 2005 and EN 13476: 2007 set a lower maximum jetting pressure of 120 Bar (around 1740 psi). The pressure limit was based on studies at Loughborough University and the Danish Technology Institute (the latter research was commissioned by TEPPFA). TEPPFA claims that lower jetting pressure is better and can avoid problems associated with higher pressure, including: “*significantly increased risk of damage to pipe wall, particularly if the pipeline is in poor condition*” (TEPPFA, 2006).
- Plastic pipes’ vulnerability to jetting damage (compared to concrete and clay pipes) may be an area of debate. There are a number of possibilities why there is a vulnerability problem – however the magnitude of these possibilities will differ from one type of thermoplastic pipe to another:
 1. Plastic pipe wall thickness: Minimum wall thicknesses for different plastic sewer pipeline systems have been reduced considerably in the last 40 years (see Figures 2 and 3). It is not clear what led the plastic industry to make such reductions. One reason may be advances in reinforcing admixtures used in plastic products, so justifying such decrease in wall thicknesses. However another reason may be cost reductions. It may be that the reduction in wall thickness has contributed to the jetting damage problems witnessed by the industry.

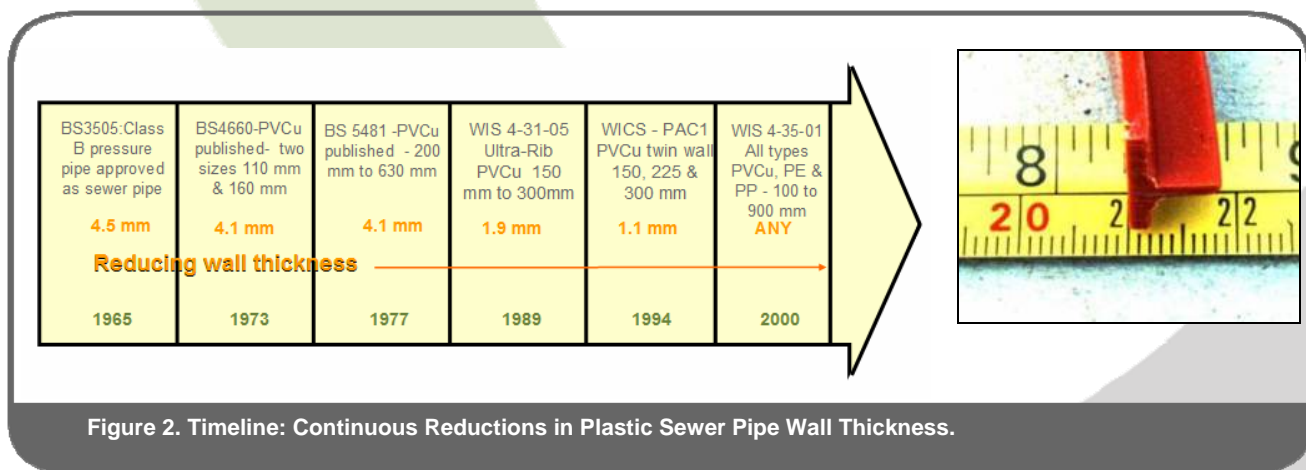


Figure 2. Timeline: Continuous Reductions in Plastic Sewer Pipe Wall Thickness.

2. **Plastics pipe wall resistance to shattering and penetration:** The University of East London did some research on structured wall plastic sewer pipes in the 1990s investigating thin structured wall plastic pipes' resistance to damage (Lawrence *et al*, 1998). A number of commercially available plastic pipe types were subjected to a number of puncture tests (adapted from ISO 6603) and the results showed levels in variance in resistance to puncture – especially in two PVC-U samples manufactured using the same specification and manufacturing technology (with variation levels reaching 78 to 88%). The study even noted that the irregularity in performance varied from segment to segment leading to questions about consistency in the quality of products made using the technology – this astonishing level of product inconsistency may have caused the problem with specific plastic pipes weak resistance to jetting (see Figure 4).

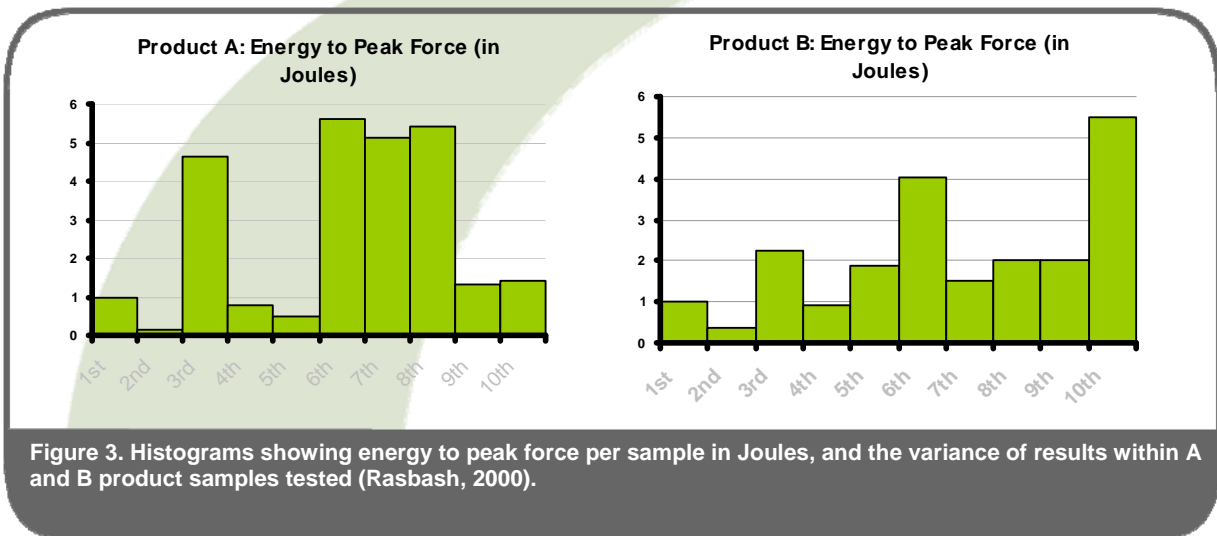


Figure 3. Histograms showing energy to peak force per sample in Joules, and the variance of results within A and B product samples tested (Rasbash, 2000).

- There will certainly be more developments in the area of pressure water jetting. Notwithstanding the clear maximum of 5000 psi on rigid sewer pipeline systems, there are claims from concrete pipe manufacturers that their products can easily undertake more water jetting pressure. With considerable differences between some water company requirements (2600 to 4000 psi), Code of practice requirements of 2600 psi, and European standards requirements of 1740 psi, it is still not clear what the appropriate maximum jetting pressure for plastic sewer pipeline products should be.
- The huge difference in jetting requirements from 5000 psi down through 2600 psi to 1500 psi is confusing and can cause immense difficulties to jetting contractors operating in areas where the material of a pipeline system cannot be positively identified.
- **CPSA** sees that a margin of safety should be added to the current WIS 4-35-01 testing jetting pressure – bringing the current maximum water jetting testing pressure to 4000 psi (276 Bar).

References:

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- **Water UK** (2006) Sewers for Adoption – A Design and Construction Guide to Developers. 6th Ed. Published by WRc plc, Swindon – on behalf of Water UK.

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