It is vitally important that drainage systems are properly designed and installed to prevent any problems occurring at a later date. Robin Oakley provides an overview of the main areas to consider when undertaking this type of work.

The information in this article applies to solid wall PVCu plastic gravity drainage systems in BS nominal sizes 82, 110 and 160mm, but not necessarily to larger sizes used in civil engineering or to systems using clayware, stoneware or cast iron pipes. Drainage design should be in accordance with BS EN 752: 2008 Drains and sewers outside buildings, BS 5955 Part 6 Installation of PVCu pipework for gravity drains and sewers, and BS EN 1610: 1998 Construction and testing of drains and sewers. Drainage systems should also comply with the Building Regulations, Approved Document H, Draining and Waste Disposal 2002 (Amended 2010) in England and Wales, Building Standards 2013 in Scotland and the Building Regulations (Northern Ireland) 2012.


Storage of pipe and fittings
Pipes should be handled with care, especially in cold weather when their impact strength may be impaired. Don’t drag pipes along the ground as damage to a pipe’s outer surface can cause problems with jointing. Pipes should be stacked on a flat surface or in a pipe rack and should not be exposed to strong sunlight for long periods. Pipes should be stacked in separate stacks for each pipe size, but smaller pipes can be nested inside larger pipes if space is limited. Fittings should be kept in their packaging until required. Solvent cement and cleaning fluid should be stored in a cool place.

Layout
The drainage system layouts should be kept simple to minimise installation costs and to make the system easy to maintain. Foul drainage systems should be designed so that drains run in straight lines with bends, junctions and changes of direction designed to give the least resistance to flow with access via manholes, inspection chambers and rodding eyes. Connections to other drains and sewers should be made obliquely in the direction of flow.

Ventilation
The system should be ventilated by a flow of air with a ventilating pipe at the head of each drain. The pipe should be open at its termination. A vertical pipe that serves as a soil stack, but is not the head of a drain - e.g. serving

The author
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Drainage systems should be ventilated and designed to provide access points for inspection, testing and maintenance. Drains need an air admittance valve.

Carrying capacity of pipes
- PVCu pipes are susceptible to damage, particularly when used in basements or areas where there is a risk of frost. It is important that the ground is prepared correctly and that suitable bedding and backfill material is used. PVCU pipes can be laid directly on a fine-toothed saw. The chamber base should be installed on at least 100mm thickness of compacted 45:5 gravel or granular material to ensure that it is fully supported. Similar material should be placed around the riser during backfilling, and this should be compacted to a depth just below finished ground level.

Traditional manholes or inspection chambers
- PVCU pipes are susceptible to damage, particularly when used in basements or areas where there is a risk of frost. It is important that the ground is prepared correctly and that suitable bedding and backfill material is used. PVCU pipes can be laid directly on a fine-toothed saw. The chamber base should be installed on at least 100mm thickness of compacted 45:5 gravel or granular material to ensure that it is fully supported. Similar material should be placed around the riser during backfilling, and this should be compacted to a depth just below finished ground level.

Modern plastic drainage systems offer a range of standard components, which can be used to construct inspection chambers as an alternative to traditional brick manholes for more efficient access to the system. PVCU pipes can be laid directly on a fine-toothed saw. The chamber base should be installed on at least 100mm thickness of compacted 45:5 gravel or granular material to ensure that it is fully supported. Similar material should be placed around the riser during backfilling, and this should be compacted to a depth just below finished ground level.

Where pipes have to be laid underground, any hard core is formed. Where a drain passes through a wall, it should be sleeved or a sleeve should be built to take the weight of the wall above the sewer. Drain trenches should not be excavated lower than the foundations of nearby buildings unless action is also taken to prevent adverse effect on the foundations. If the drain trench is within 1m of the foundation, after laying the drain the trench should be filled with concrete up to the lowest level of the foundation. If the trench is more than 1m from the building the trench should be filled with concrete up to the lowest level of the building foundation equal to the distance from the building less 150mm.

Backflow prevention
- Backflow through small sewers can occur in extreme conditions, and where this is known to be a problem, fitting an anti-flood valve can be considered as a means of preventing backflow. Single-flap and double-flap versions of these valves are available, and they operate by the flap(s) opening to allow discharge under normal flow conditions, but in a flood situation the floodwater seals the flap(s) shut preventing backflow.

- The chamber should be fitted with a cast-iron cover and frame set in a concrete surrounding plinth. For chambers deeper than 12 metres and no greater than 4 metres, the clear opening should be reduced to 350mm to prevent human entry.

Connections to other materials
- When connecting PVCU pipe to other materials, it is necessary to use one of a range of purpose made adaptors for thin-wall claygate, slotted stoneware or cast iron. Sub waste connections from ground floor sanitary fittings should be made using either a spigot reducer or a socket reducer with a boss adaptor which can be used for any size up to 50mm.

Intermediate depths for shallower invert can be achieved by cutting the riser piece using a cast iron. Sub waste connections from ground floor sanitary fittings should be made using either a spigot reducer or a socket reducer with a boss adaptor which can be used for any size up to 50mm.

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