7 COMMISSIONING OF SYSTEMS

7.1 GENERAL

7.1.1 Scope

1 This Part specifies the requirements for the testing and cleaning of drainage installations.

2 Related Sections and parts are as follows:

This Section

Part 1..... General
Part 2..... Internal Drainage Works
Part 3..... External Drainage Works
Part 4..... Trenches for Drainage Pipework
Part 6..... Surface Water drainage

Section 1 General

7.1.2 System Description

1 Inspections and tests should be made during the installation of the discharge system as the work proceeds, to ensure that the pipework is properly secured and clear of obstructing debris and superfluous matter and that all work which is to be concealed is free from defects before it is finally enclosed.

2 Prefabricated units should be tested at the works or place of fabrication, and inspected on delivery at the Site.

7.1.3 Submittals

1 The Contractor shall prepare a detailed testing and inspection programme and submit it to the Engineer for approval. This programme shall identify each item to be tested, the type of test to be performed and the date and time of the test.

2 The Contractor shall prepare test and inspection record sheets for all tests and inspections undertaken. The format of the test record sheets shall be to the approval of the Engineer. On successful completion of a test/inspection, the test record sheet shall be signed and stamped by all the Contractor and the Engineer. The Engineer shall retain the original test record sheet.

7.1.4 Connection to Existing Mains

1 Connection to existing mains shall not take place until all tests and inspections have been successfully completed and the system has been cleaned.

7.2 CLEANSING OF PIPES, MANHOLES AND CHAMBERS

7.2.1 General

1 On completion, the discharge system should be meticulously inspected to ensure that the requirements of the Contract Documentation have been observed.

2 The Contractor shall ensure that no cement droppings, rubble or other objects are left in or on the pipes and that no jointing material projects into the pipe bore.

3 Manholes and chambers shall be thoroughly cleansed to remove all deleterious matter, without such matter being passed forward to existing mains.

4 Sanitary appliances shall be thoroughly cleansed. Any chromium plated or other metallic surfaces forming part sanitary appliances that exposed to view shall be polished.

5 All parts of the Works included in this Section shall be maintained in a clean and serviceable condition by the Contractor until completion of the Contract.

7.3 TESTING

7.3.1 General

1 The Contractor shall notify the Engineer at least two clear working days prior to his intention to test a section of pipeline.

2 Items failing any test shall be corrected immediately and re-tested before further work proceeds.

3 Unless otherwise stated in the Project Documentation, the Contractor is responsible for providing materials and apparatus required for testing purposes and for their removal and proper disposal on completion at testing.

7.4 TESTING AND INSPECTION EXTERNAL DRAINAGE PIPELINES

7.4.1 General

1 Unless otherwise agreed by the Engineer, both interim and final test shall be undertaken on each section of the Works. The Contractor shall note that the satisfactory completion of an interim test does not constitute a final test.

2 Non-pressure pipelines laid in trenches shall be tested after they are jointed and before any concreting or backfilling is commenced, other than such as may be necessary for structural stability whilst under test.

3 The pipelines shall be tested by means of an air or water test or by a visual or closed circuit television (CCTV) examination, in lengths determined by the course of construction.

4 A further test shall be carried out after the backfilling is complete.

7.4.2 Inspection

1 Visual inspection shall be carried out before backfilling in order to detect faults in construction or material not shown up under test but which could lead to premature failure. A careful record shall be kept of such inspections.

2 On external pipelines, the following shall be visually inspected:

(a) pipe bed
(b) pipe line and level
(c) joints
(d) pipe protective coating
(e) any pipeline appurtenance.

3 Trenches shall be inspected to ensure that the excavation is to the correct depth to guard against mechanical damage due to traffic loading.

4 No part of the pipe trench shall be backfilled until the above are performed to the satisfaction of the Engineer.

7.4.3 Water Test

1 The test pressure for external drainage pipelines up to and including 750 mm nominal bore shall be not less than 1.2m head of water above the pipe soffit or groundwater level, whichever is the higher at the highest point, and not greater than 6m head at the lowest point of the section. Steeply graded pipelines shall be tested in stages in cases where the maximum head, as stated above, would be exceeded if the whole section where tested in one length.

The pipeline shall be filled with water and a minimum period of 2 hours shall be allowed for absorption after which water shall be added from a measuring vessel at intervals of 5 minutes and the quantity required to maintain the original water level noted. Unless otherwise specified, the length of pipeline shall be accepted if the quantity of water added over a 30 minute period is less than 0.5 litre per linear metre per metre of nominal bore. This relationship in equation format, with water added measured in litres, can be written as follows:

Maximum volume of water added over a 30 minute period = 0.5 x L x D

Where: L = pipe diameter (m)
D = Length of test section (m)

7.4.4 Air Test

1 Non-pressure pipelines to be air tested shall have air pumped in by suitable means until a pressure of 100 mm head of water is indicated in a U-tube connected to the system. The pipeline shall be accepted if the air pressure remains above 75 mm head of water after a period of 5 minutes without further pumping following a period for stabilisation. Failure to pass the test shall not preclude acceptance of the pipeline if a successful water test, ordered by the Engineer, can subsequently be carried out in accordance with Clause 7.3.3.

7.4.5 CCTV Inspection

1 Where internal inspection of pipelines by CCTV is required, the Contractor shall provide all necessary equipment, including suitable covered accommodation for viewing the monitor screen, together with personnel experienced in the operation of the equipment and interpretation of results.

2 The intensity of illumination within the pipe and the rate of draw of the camera shall be such as to allow a proper examination of the inside of the pipe. Provision shall be made for the movement of the camera to be stopped and its position recorded and for permanent photographs to be taken at any point requested by the Engineer.

7.4.6 Infiltration

1 External drainage pipelines shall be tested for infiltration after backfilling. All inlets to the system shall be effectively closed, and any residual flow shall be deemed to be infiltration.

2 The pipeline shall be accepted as satisfactory if the infiltration, including infiltration into manholes, in 30 minutes does not exceed 0.5 litre per linear metre per metre of nominal bore. This relationship in equation format, with water infiltration measured in litres, can be written as follows:

Maximum volume of infiltration over a 30 minute period = 0.5 x L x D

Where: L = pipe diameter (m)
D = Length of test section (m)

3 Notwithstanding the satisfactory completion of the above test, if there is any discernible flow of water entering the pipeline at a point which can be located either by visual or CCTV inspection, the Contractor shall take such measures as are necessary to stop such infiltration.

7.5 TESTING AND INSPECTION INTERNAL DRAINAGE PIPELINES

7.5.1 Air Test

1 The water seals of all sanitary appliances should be fully charged and test plugs or bags inserted into the open ends of the pipework to be tested.

2 To ensure that there is a satisfactory air seal at the base of the stack, or at the lowest plug or bag in the stack if only a section of the pipework is to be tested, a small quantity of water sufficient to cover the plug or bag can be allowed to enter the system.

3 One of the remaining test plugs should be fitted with a tee piece, with a cock on each branch, one branch being connected by means of a flexible tube to a manometer. Alternatively, a flexible tube from a tee piece fitted with cocks on its other tow branches can be passed through the water seal of a sanitary appliance. Any water trapped in this tube should be removed and then a manometer can be connected to one of the branches as described above.

4 Air shall be pumped into the system through the other branch of the tee piece until a pressure equal to 38 mm water gauge is obtained. The air inlet cock is then closed and pressure in the system should remain constant for a period of not less than 3 min.

7.5.2 Leak Location

1 The use of smoke to detect leaks shall only be permitted if approved in writing by the Engineer. A smoke producing machine may be used which will introduce smoke under pressure into the defective pipework. Leakage may be observed as the smoke escapes. Smoke cartridges containing special chemicals should be used with caution, taking care that the ignited cartridge is not in direct contact with the pipework and that the products of combustion do not have a harmful effect upon the materials used for the drainage system. Smoke testing of plastics pipework or systems with rubber jointing components is not permitted.

2 With the pipework subjected to an internal pressure using the smoke machine or air test method, a soap solution can be applied to the pipes and joints. Leakage can be detected by the formation of bubbles.

7.5.3 Water test

1 There is not justification for a water test to be applied to the whole of the plumbing system. The part of the system mainly at risk is that below the lowest sanitary appliance and this may be tested by inserting a test plug in the lower end of the pipe and filling the pipe with water up to the flood level of the lowest sanitary appliance, provided that the static head does not exceed 6 m.

7.6 TESTING OF SANITARY APPLIANCES

7.6.1 General

1 To ensure that adequate water seals are retained during peak working conditions the tests described below should be carried out. After each test a minimum of 25 mm of water seal should be retained in every trap.

2 Each test should be repeated at least three times, the trap or traps being recharged before each test. The maximum loss of seal in any one test, measured by a dip stick or small diameter transparent tube, should be taken as the significant result.

7.6.2 Self-Siphonage and Induced Siphonage in Branch Discharge Pipes

1 To test for the effect of self-siphonage the appliance should be filled to overflowing level and discharged by removing the plug; WC pans should be flushed. The seal remaining in the trap should be measured when the discharge has finished.

2 Ranges of appliances, connected to a common discharge pipe, should also be tested for induced siphonage in a similar way. The number of appliances which should be discharged together is given in Table 6.1. The seal remaining in all the traps should be measured at the end of the discharge. Only those appliances included in Table 6.1 shall be tested under simultaneous discharge conditions.

Table 6.1
Number of Sanitary Appliances to be Discharged for Performance Testing

Number of appliances of each kind on the stack	Number of appliances to be discharged simultaneously	
	WC	Wash Basin
1 to 9	1	1
10 to 18	1	2
19 to 26	2	2
27 to 52	2	3
53 to 78	3	4
79 to 100	3	5

7.6.3 Induced Siphonage and Back Pressure in Discharge Stacks

1 A selection of appliances connected to the stack should be discharged simultaneously and the trap and seal losses due to positive or negative pressures in the stack should be noted. These selected appliances should normally be close to the top of the stack and on adjacent floors, as this gives the worst pressure conditions. Table 6.1 shows the number of appliances which should be discharged simultaneously. Only those appliances included in Table 6.1 shall be tested under simultaneous discharge conditions.

7.7 TESTING OF DRAINAGE STRUCTURES

7.7.1 Manholes and Chambers

1 Manholes and chambers shall be tested for infiltration after backfilling. Where appropriate, they shall be inspected for water tightness before placing cover slabs.

2 Manholes and chambers shall be substantially water tight, with no identifiable flow of water penetrating the structure. Manholes and chambers which are not substantially water tight shall be corrected immediately.

END OF PART