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UK Water Industry

SPECIFICATION FOR TYPE 1 PACKAGE PUMPING STATIONS COMPRISING A PUMPING ASSEMBLY INSTALLED IN A DRY CHAMBER AND INTENDED TO SERVE MORE THAN ONE PROPERTY

FOREWORD

This specification does not purport to include all the necessary provisions of a contract and users are responsible for its correct application. Compliance with this specification does not itself confer immunity from legal obligations.

This specification calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to the technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Reference to a European Standard, British Standard, Water Industry Specification or any other specification applies equally to any equivalent specification.

Information contained in this specification is given in good faith. Neither Water UK nor the members of its Standards Board can accept any responsibility for actions taken as a result.

It has been assumed in the drafting of this specification that the execution of its provisions is entrusted to appropriately qualified and experienced people, for whose guidance it has been prepared.

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This document has been prepared by the Water UK Standards Board. The latest version of this document can be downloaded from: http://www.wis-ign.org. Technical queries should be addressed to the Standards Board via Brian Spark Technical Secretary to the Board, Water UK, 1 Queen Anne's Gate, London, SW1H 9BT or e-mail brian.spark@ntlworld.com telephone +44 (0) 1480 351865 fax+44 (0) 1480 351865

1. SCOPE

This specification gives requirements for package wastewater pumping stations, installed in a separate chamber no more than 4 m deep and intended to serve 2 properties or more, where the flow is pumped by a duty pump unit, with a power rating of 7.5 kW or less, fitted to a sealed collection tank and where there is an identical standby pump unit.

Figure 1.1 shows a general example of a pumping station layout for the kind of pumping station covered by this specification.

This specification covers only Type 1 pumping stations, which have an incoming peak design flow, when calculated in accordance with Sewers for Adoption 7 Ed. Clause B.5.1, of less than or equal to 0.25 litres per second (typically 5 dwellings or less).

This specification covers the whole package pumping station including; the pumping assembly (collection tank, pump units and valves), chamber, electrical equipment, controls, telemetry and kiosk.

2. DEFINITIONS

For the purposes of this specification, the following definitions apply:

2.1 Chamber – the structure that the package pumping station is installed in.

2.2 Check (Reflux) valve – a valve that prevents backflow of wastewater from the discharge pipework.

2.3 Domestic wastewater – water discharged from kitchens, laundry rooms, lavatories, bathrooms, toilets and similar facilities.

2.4 Collection tank – unpressurized part of the package pumping station where the incoming wastewater is stored prior to lifting.

2.5 Electrical assembly – low voltage switchgear and controlgear assembly, i.e. the control panel.

2.6 Pumping assembly – comprising the collection tank, pump units, valves and level detection equipment.

2.7 Pump unit – mechanical component of a pumping station which pumps the wastewater out of the collection tank to a higher level.

2.8 Rising main – a sewer through which wastewater is pumped.

2.9 Type test – test to demonstrate conformity to this standard.

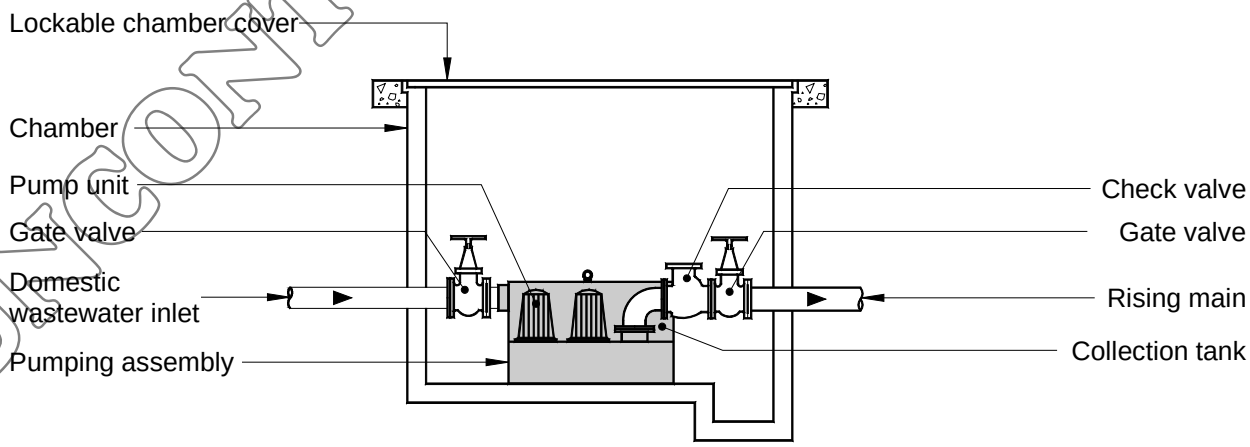

Figure 1.1 – Example layout of a pumping station covered by this specification

3. HAZARDOUS AREAS

3.1 Parts of a wastewater pumping station can be hazardous zones in accordance with the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR). Consideration of such zones and measures taken to manage them shall be in accordance with Sewers for Adoption 7 Ed. Section D.6.2.

4. PUMPING ASSEMBLY

4.1 General

4.1.1 Plant and equipment shall be reliable, efficient and capable of operating between the manufacturer's recommended service intervals without attention or inspection (apart from the necessity to clear pump unit blockages should these arise).

4.1.2 Pumping units shall be capable of pumping wastewater including all the solid matter usually contained in domestic wastewater.

4.1.3 Pumping units shall be designed in such a way that solid matter does not accumulate.

4.1.4 The free passage in the pumping unit at any point between the wastewater inlet into the pumping unit and the pump unit outlet or valves shall be in accordance with Table 4.1 for solids handling performance details.

Nominal bore of outlet (mm)	Diameter of solid sphere able to be passed (mm)
	Type 1 Pumping Stations
80	60
> 80 but ≤100	65
> 100 but ≤ 125	90
> 125 but ≤ 175	120

Table 4.1 – Solids Handling Performance

4.1.5 The minimum internal diameter of the rising main shall be 80 mm.

4.1.6 The dimensions of inlet, discharge and ventilating connections shall allow the use of standard pipe sizes. Pipework immediately outside the pumping station shall have flexible connections, to allow for ground movement and shall withstand 1.5 times the maximum operating pressure without leaking.

4.1.7 The package pumping station shall be provided with clearly-identified, permanent, corrosion-resistant lifting points, located to give a safe, balanced lift. The lifting points shall be designed for lifting the entire pumping assembly out of the chamber.

4.2 Hydraulic design

4.2.1 The peak design flow rate coming in to the pumping station will be specified by the customer and shall be in accordance with Sewers for Adoption 7 Ed. Clause B.5.1.

4.2.2 The design flow rate of each pump unit in foul pumping stations shall be at least the maximum of:

a) half the peak design flow rate (see Clause 4.2.1); and

b) the flow rate required to achieve a minimum flow velocity of 0.75 m/s in the rising main.

4.2.3 The maximum flow velocity in the rising main shall be 1.8 m/s under normal operating conditions (at the pump unit design flow rate).

4.2.4 The pumping station design static head for the design flow shall be based on the mid-point of the duty pump unit stop and start levels in the collection tank. Calculations shall be provided to confirm capacities of the pumping station based on the hydraulic design.

4.2.5 The pumping station shall be provided with an ultrasonic level control system. Four level set points shall be set in the collection tank. These shall be a 'snore' level, a pump unit stop level, a duty pump unit start level and a standby pump unit start level. These levels shall be selected to ensure that:

a) the pump units operate safely and effectively in accordance with the pump unit manufacturer's instructions (e.g. the pump

units do not exhibit damaging cavitation, vibration or airlocking or create damaging surface vortices);

b) if the collection tank is a hazardous area, the pump units do not contravene any DSEAR requirements (see Clause 3.1); the pump unit manufacturer shall be consulted to this end;

c) the number of pump unit starts per hour is not more than 15 when operating under normal conditions (at the pump unit design flow rate);

d) where possible, the pump unit run time is not less than 60 seconds;

e) the combined retention time of wastewater in the collection tank and the rising main is not more than 6 hours (to prevent septicity occurring);

f) the stop level is as low as possible, without compromising the effective operation of the pump unit. This shall be the level used for automatic control and shall be set at a point where the pump unit has adequate submergence (to prevent air ingestion due to vorticity) and adequate NPSH(a) to suppress damaging cavitation;

g) the high level backup float switch in the collection tank is not routinely activated (i.e. the standby pump unit start level shall be a minimum of 100 mm below the high level backup float switch in the collection tank); and

h) the standby pump unit start level is a minimum of 150 mm above the duty pump unit start level.

4.3 Collection tank layout

4.3.1 The incoming flow shall be controlled (e.g. by an inlet baffle plate or by a drop tube) such that any residual turbulence shall not adversely affect the accuracy of the level control instruments.

4.3.2 The design of the collection tank and the sewer inlet arrangement shall ensure the following:

a) the formation of free surface and submerged vortices is avoided;

b) flow is presented to the pump units in accordance with the pump manufacturers recommendations and without excessive pre-swirl (no greater than 5^{o}) or air entrainment; and

c) the collection tank is materially self cleansing in terms of grit, solids and positive buoyancy material, see Clause 8.1.7.

4.3.3 The base of the collection tank shall be profiled to ensure the collection tank is self cleansing.

4.3.4 Excluding inlet, outlet and venting openings, collection tanks shall be watertight according to testing requirements, see Clause 8.1.2.

4.4. Pump units

4.4.1 The pumping assembly shall incorporate 2 identical pump units arranged in a duty/standby configuration.

4.4.2 Macerator pump units shall not be used in the pumping assembly.

4.4.3 Pump units shall comply with the requirements of Sewers for Adoption 7 Ed. Clauses F.2.2 to F.2.4 with respect to Type 1 pumping stations.

4.5 Valves and Pipework

4.5.1 The pumping assembly shall incorporate the following:

a) one gate valve mounted horizontally in the pump unit outlet pipework and arranged to isolate the pumping unit from the rising main; and

b) one check (reflux) valve per pump unit mounted horizontally in the pump unit outlet pipework upstream of the gate valve and arranged to prevent mass flow reversal under normal operating conditions;

4.5.2 Valves shall comply with the requirements of Sewers for Adoption 7 Ed. F.4.

4.5.3 Where iron and steel pipework is used, corrosion protection shall generally comply with the requirements specified within the Water Industry Mechanical Electrical Specification (WIMES) 4.01 – Paints and Polymeric Coatings for Corrosion Protection.

4.6 Marking

4.6.1 The pumping unit shall be clearly marked with the following information:

a) design flow rate and maximum flow rate;

b) operating head and maximum head rating;

c) power requirements;

d) weight of pumping assembly (when full of wastewater);

e) weight of individual pump units; and

f) external dimensions of the pumping assembly.

5. CHAMBER

5.1 General

5.1.1 A separate chamber shall be provided to house the package pumping station.

5.1.2 The chamber shall be of such dimensions to allow access to all equipment for maintenance, removal and replacement.

5.1.3 The chamber base shall have a sump hole to collect any ingress of water (or wastewater spillages) and discharge it into the rising main, via a non return valve and isolation valve, by means of a hand operated pump.

5.1.4 Cable ducts shall be provided to route cables underground in accordance with Sewers for Adoption 7 Ed. Clause F3.4.4.

5.1.5 Where the collection tank cannot be vented through the upstream sewer system, ventilation shall be provided in accordance with one of the following methods:

a) the installation of a stack with a minimum diameter of 75 mm and a minimum height of 4 m with a galvanized mild steel mesh at the top;

b) if the pumping station is to be installed inside a secure compound, then either holes/slots drilled in the chequer plate before galvanizing, or the use of open mesh flooring made from galvanized steel, may be permitted if suitable measures are taken to prevent surface water run off from entering the chamber; or

c) an air inlet/outlet vent shall be provided and positioned at least 3 m from the kiosk/building housing the electrical equipment and a minimum of 15 m from any habitable building.

5.1.6 The selection of the method of venting, see Clause 5.1.5, shall take into account the risk of odour nuisance and any DSEAR requirements (see Clause 3.1).

5.2 Chamber structural design

5.2.1 All chambers shall withstand all necessary loads in accordance with BS EN 1990 including the following loads:

a) internal hydrostatic pressure;

b) external hydrostatic pressure from groundwater up to the finished ground level;

c) external ground pressure; and

d) external imposed loads.

5.2.2 The chamber shall incorporate fixing devices to prevent rotation or floatation of the empty structures when subject to groundwater pressure up to the finished ground level.

5.2.3 Where pipes pass through the wall of a structure, flexible joints and rocker pipes shall be provided on the connecting pipework to accommodate differential movement.

5.3 Access to chamber

5.3.1 Where the chamber is less than 1.5 m deep, openings in access covers shall span the whole chamber top.

5.3.2 Where the chamber is between 1.5 m and 3 m deep, openings in access covers shall be large enough for the pumping assembly to be lifted easily and safely out of the chamber for above-ground inspection, maintenance or replacement.

5.3.3 Where the chamber is greater than 3 m deep, openings in access covers shall be no smaller than 600 x 600 mm for man-entry and large enough for the pumping assembly to be lifted easily and safely out of the chamber for above-ground inspection, maintenance or replacement.

5.3.4 Covers shall have the following features:

a) covers shall be lockable and fabricated from galvanized steel, finished flush with the cover slab and provide a non-slip surface;

b) hinged covers are normally preferred. The hinged cover shall incorporate a facility for securing a recessed padlock and each lid shall have assistance to ensure a lifting effort not exceeding 25 kgF;

c) if hinged covers are not provided, the weight of each cover shall not exceed 35 kg;

d) in a closed position, the cover shall withstand the appropriate FACTA (Fabrication Access Covers Trade Association) class loading based on the risk of traffic loading. As a minimum the cover shall withstand a 5 tonne static wheel load in accordance with FACTA class B loading;

e) for chambers greater than 1.5 m deep, a hinged safety grid in two sections shall be provided below the cover and be capable of withstanding a 250 kg load;

f) provision shall be made within the frame to enable the main cover to be closed whilst cables are still attached to a pumping assembly that has been removed from the chamber;

g) the cover frame shall provide facilities for demountable handrailing which can be erected prior to any maintenance on the pumps being undertaken. Depending on the Site conditions, the handrail can be fixed permanently but with removable sections to allow pump removal. Chains shall not be used for handrails; and

h) the barriers shall withstand an impact load of 125 kg from a height of 1.85 m through a footprint of 400 mm. Safety barriers shall be capable of being released to allow access to the equipment from all sides. The stanchion sockets within the frame shall be flush with the concrete slab and be sealed to prevent debris entering when not in use.

5.3.5 Access to below ground chambers deeper than 600 mm, but no deeper than 1.5 m, shall be by plastic encapsulated steel double step rungs conforming to BS EN 13101.

5.3.6 Access to below ground chambers deeper than 1.5 m shall be by a ladder, not made from aluminium, conforming to BS EN 14396.

6. KIOSK

6.1 General

6.1.1 The kiosk shall, as a minimum, enclose the following equipment:

a) the Electricity Distribution Network Operator's supply and metering equipment;

b) the Electrical Assembly;

c) the telemetry outstation (which may be incorporated in the Electrical Assembly);

d) a kiosk heating and lighting system; and

e) a RCD switched 240 V socket.

6.2 Kiosk construction

6.2.1 The kiosk shall be of a non 'walk-in' design with an open base and a one-piece roof that slopes to its rear.

6.2.2 The walls and doors of the kiosk shall be constructed from GRP encapsulated, marine grade plywood panels with a minimum thickness of 18 mm. Panels shall be joined together using stainless steel bolts and any gaps between panels sealed with a non-biodegradable mastic sealer. The edges of the kiosk doors and door frames shall be stiffened by encapsulated steel sections.

6.2.3 Where necessary, to support the control panel and all associated equipment, either:

a) the rear wall of the kiosk shall be stiffened by encapsulated steel sections; or

b) a suitably-sized, 18 mm thick, varnished, marine quality, plywood backboard, complying with the requirements of BS 1088-1, shall be fitted to the rear internal wall of the kiosk.

6.2.4 Where option a) above is selected in clause 6.2.3 above, a suitably-sized, 18 mm thick, varnished, marine grade, plywood backboard shall also be fitted to the rear internal wall of the kiosk to accommodate the Electricity Distribution Network Operator's incoming supply and metering equipment.

6.2.5 The walls of the kiosk shall have turned bottom flanges, suitably drilled to accommodate the bolts for securing the kiosk to a 100 mm rebate in the plinth. The bolt-holes shall be reinforced with 5 mm thick, galvanized steel plates, encapsulated within the bottom flanges.

6.2.6 The quality of kiosk construction shall ensure the following:

a) the thermal transmittance of the kiosk shall not exceed 1.5 W/m^2K;

b) the fire resistance (retention of stability, integrity and insulation) of the kiosk shall be Class 2 in accordance with BS 476: Part 7, when tested in accordance with BS 476: Parts 20 to 23 for a period of over half an hour; and

c) the kiosk shall be rated IP55 (minimum) or an equivalent.

6.2.7 Alternative forms of kiosk construction to GRP encapsulated marine grade plywood may be used in locations subject to vandalism (as advised by local police) or EMC emission/immunity problems.

6.2.8 The doors of the kiosk shall be fitted with vandal-proof, stainless steel hinges and self-latching stays to restrain the doors in the fully-open position (minimum opening angle of 90 degrees). One door shall have stainless steel shoot bolts at the top and bottom.

6.2.9 Unless planning conditions dictate otherwise, the preferred exterior colour of the kiosk shall be BS 4800 14C 39 (Dark Green).

6.2.10 The preferred interior colour of the kiosk shall be BS 4800 00E 55 (White).

6.2.11 Suitably-sized weather-proof and vermin-proof ventilation grilles, with fly screens, shall be fitted at low level on one side of the kiosk and at high level on the opposite side of the kiosk to ensure cross-ventilation. Consideration shall be given to the equipment being installed within the kiosk to minimise heat or humidity generated by that equipment. Ventilation shall be sufficient to restrict the temperature in the kiosk, under all weather conditions, to a maximum of 40 ^oC at any one time, and to an average of 35 ^oC over 24 hours.

6.2.12 A separate compartment shall be provided within the main kiosk construction, with separate external access from the rest of the kiosk, for the regional electricity supplier's meter, fuses etc. and bulk head light.

6.2.13 The kiosk doors shall be fitted with a multipoint locking system with hasp and staple. The hasp and staple shall be at least 90 mm long horizontally, 30 mm wide vertically and be suitable for a 30 mm padlock as a minimum.

6.2.14 An A4 sized slot with a clear front shall be fitted to the kiosk for information to be displayed by the user of the pumping station.

6.2.15 Where specified by the client, the kiosk should meet the required security rating in accordance with the Loss Prevention Certification Board Standard 1175.

6.3 Kiosk mounting arrangements

6.3.1 The kiosk shall be mounted 150 mm above the finished ground level on a concrete plinth. The

plinth shall extend a minimum of 125 mm beyond the kiosk walls and have chamfered edges.

6.3.2 The surface of the plinth shall be sufficiently level to ensure that the kiosk will seat correctly on the plinth and that the kiosk doors will open and close without any fouling or forcing.

6.3.3 All fasteners and shims required to secure the kiosk to the plinth shall be manufactured from stainless steel. The fasteners shall be stainless steel expanding bolt type complete with large washers to prevent damage to the GRP flange. They shall be located at suitable intervals to prevent flange distortion.

6.3.4 The bottom flange of the kiosk and plinth shall be sealed with a suitable mastic sealant to prevent water ingress.

7. ELECTRICAL EQUIPMENT

7.1 General

7.1.1 The electrical equipment shall comprise:

a) an incoming power supply;

b) the electrical assembly, incorporating the incomer, motor starters, control circuit supplies, common control equipment and interface for connection to telemetry outstation;

c) the pumping station electrical installation, incorporating all electrical components, equipment and cabling outside the electrical assembly, and the pumping station earthing and bonding system;

d) instruments associated with the pumping station including the ultrasonic transducer head, float switches and flowmeter (if required); and

e) a telemetry outstation (if not provided within the electrical assembly) with appropriate communications connection (for example, GSM, PSTN, radio link etc.).

7.1.2 The electrical equipment listed in clause 7.1.1 above shall comply with the relevant requirements for Type 1 pumping stations in Sewers for Adoption 7 Ed. F3.

7.2 Electrical assembly

7.2.1 A Form 2 sub-division type 1 Electrical Assembly, complying with the requirements of Sewers for Adoption 7 Ed. F.3, may be provided subject to an appropriate risk assessment, see Sewers for Adoption 7 Ed. F.3.3.1.2. Otherwise, the form of separation of the Electrical Assembly shall be Form 4a, sub-division type 1, complying with the requirements of Sewers for Adoption 7 Ed. F.3.

7.3 Control philosophy

7.3.1 The pumping station shall be designed to operate in the following modes:

a) Automatic mode – in this mode of operation the control system shall operate the pumping station automatically, without need for manual intervention; and

b) Manual mode – in this mode of operation, the control system is overridden and the operator can operate the pump units manually via the pushbutton switches mounted on the door of the electrical assembly.

7.3.2 The pumping station control system shall allow for auto reset in the event of a power failure.

7.3.3 The pump units shall be operated in response to the level of effluent in the collection tank.

7.3.4 An ultrasonic level control system shall be provided together with a back-up float switch in accordance with Sewers for Adoption 7 Ed. F.3.

7.3.5 A separate high level float switch shall be provided.

7.3.6 The relays within the ultrasonic level control shall be configured to achieve the following pump unit control philosophy based on the four level set points given in Clause 4.2.5:

a) level rising through ‘snore’ level – no action;

b) level rising through duty/standby pump unit stop level – no action;

c) level rising through duty pump unit start level – start duty pump unit;

d) level rising through standby pump unit start level – stop duty pump unit and start standby pump unit;

e) level falling through standby pump unit start level – no action;

f) level falling through duty pump unit start level – no action;

g) level falling through duty/standby pump unit stop level – stop duty pump unit if duty pump unit running or stop standby pump unit if standby pump unit running;

h) Level falling through 'snore' level – inhibit both pump units.

7.3.7 The ultrasonic level controller shall have a facility to provide sequential rotation of pump units, to sequentially rotate the pump unit duty/standby status each time all pump units are stopped to ensure equal pump unit usage, as well as allowing individual pumps to be operated.

7.3.8 The ultrasonic level controller shall be configured to initiate a collection tank cleaning ('snore') cycle at least once a week. The 'snore' level shall be chosen to be as low as possible without affecting the safe/effective operation of the pump units; the pump unit manufacturer shall be consulted to this end.

7.3.9 The ultrasonic level controller shall be configured so that the collection tank level readings are displayed in the kiosk, and if required transmitted via telemetry.

7.3.10 The ultrasonic level controller shall be configured so that the 'zero level' reading in the collection tank corresponds to the 'snore' level i.e. the level below which the pump units cannot pump anymore.

7.4 Telemetry

7.4.1 Telemetry shall be provided for the pumping station.

7.4.2 Provision shall be made for telemetry by provision of suitable inputs and outputs for the following functions:

a) pump unit running (for each pump unit);
b) pump unit tripped (for each pump unit);
c) pump unit available/not available (for each pump unit);
d) motor overtemperature;
e) remote common fault reset;
f) mains power from DNO fail;
g) high collection tank alarm;
h) high high collection tank alarm;
i) back-up float switch operating;
j) maintenance in progress;
k) level control fail;
l) emergency overflow operating* (see note);
m) telemetry battery low; and
n) telemetry fail;

*only required where there is an emergency overflow where this is provided on a replacement pumping station.

7.4.3 Telemetry shall comply with the requirements of Sewers for Adoption 7 Ed. Clause F.3.3.9 and Tables F.3 to F.6.

8. TESTING

8.1 Type test requirements

8.1.1 General

8.1.1.1 The requirements in this section shall be met before compliance with this specification can be claimed. If there is a change in design, in material and/or in the production method other than routine in-process adjustments and extensions to the product range it will be necessary to ensure that the conditions of this specification are still satisfied.

8.1.1.2 The pump units shall be tested at the manufacturer's premises to Grade 1 of BS EN ISO 9906 to demonstrate that they are capable of achieving the specified design duty. Type-test curves are acceptable for verification of performance.

8.1.1.3 Characteristic curves of pump total differential head, pump efficiency, pump power input and driver power input versus flow rate shall be provided before the pump units are delivered to Site.

8.1.2 Internal water pressure test

An internal water pressure test shall be carried out in accordance with EN 12050 Part 1 Clause 8.3.1. If there is no visible leakage from the pumping station during the test, it shall be considered to have passed the test.

8.1.3 Discharge pipe connection test

A discharge pipe connection test shall be carried out in accordance with EN 12050 Part 1 Clause 8.3.2. If there is no visible leakage of water from the discharge pipe during the test, it shall be considered to have passed the test.

8.1.4 Pumping station effectiveness test

The pumping station effectiveness shall be tested in accordance with EN 12050 Part 1 Clauses 8.4 and 8.5. If the pumping station does not suffer any breakdown during the entire test, it shall be considered to have passed the test.

8.1.5 Non-return valve functional test

Functional testing for non-return valves used in wastewater pumping stations shall be carried out in accordance with EN 12050-4, clause 8.2. If the non-return valve is operational after testing, it shall be considered to have passed the test.

8.1.6 Ultrasonic level control test

8.1.6.1 The ultrasonic level control shall be tested when the pumping station is positioned and connected on a test rig in the same way as intended on Site.

8.1.6.2 The collection tank shall be filled with water, through the inlet pipe of the pumping station, according to a predetermined test flow cycle so that the water level in the collection tank can be calculated from any point in time during the test cycle.

8.1.6.3 The test flow cycle shall be carried out at the design flow rate, at half the design flow rate and at quarter the design flow rate.

8.1.6.4 The on and off levels for the ultrasonic level control shall be set at least 50 mm apart. The on/off levels and the test flow cycle shall allow the ultrasonic level control to turn on and off at least 2 times each during the test flow cycle.

8.1.6.5 If the ultrasonic level controls switch on and off within 25 mm of the set on and off levels respectively, during the whole test flow cycle period, then it shall be considered to have passed the test.

8.1.7 Self cleansing test

8.1.7.1 The self cleansing test shall be carried out when the pumping station is positioned and connected on a test rig in the same way as intended on Site.

8.1.7.2 The collection tank shall be filled with a suspension made up of equal amounts of bentonite and graded quartz sand in water. The graded quartz sand used in this test shall have first passed through a 2 mm sieve. The concentration of the suspension shall be 500 grams per litre.

8.1.7.3 The collection tank shall be filled with the suspension at the design flow rate until the collection tank is half full.

8.1.7.4 The solution in the collection tank shall be left to settle for 4 hours.

8.1.7.5 The collection tank shall be emptied using the pumping station's pump unit.

8.1.7.6 Clauses 8.1.7.3 to 8.1.7.5 shall be repeated 100 times.

8.1.7.7 If, at the end of test, the depth of the sediment in the collection tank is less than 10% of the difference between the pump unit inlet and the base of the collection tank, then it shall be considered to have passed the test.

8.2 Commission test requirements

8.2.1 Quality control (QC) tests shall be carried out on each installed packaged pumping station or as otherwise agreed with the purchaser.

8.2.2 The pump units shall be tested on Site to ensure that they are capable of delivering the design flow rate under all possible operating conditions, without cavitation or excessive noise/vibration. To this end, hydraulic drop tests shall be carried out by the Developer in the presence of the Undertaker to verify the theoretical performance of each pump unit. The results of these tests shall be recorded and

placed in the Pumping Station O & M Manuals. The accuracy of the drop test shall be within +/- 7% on head and flow. The accuracy of flow meter readings (where fitted) shall be demonstrated by comparing them to the drop test results.

8.2.3 After installation, the collection tank shall be checked for signs of: stagnation, vortices, pre-swirl and accumulation of solids.

9. REFERENCES

This specification makes reference to the latest edition of the following publications (except where otherwise indicated) including all addenda and revisions.

British Standards

BS 476-7 Method of test to determine the classification of the surface spread of flame of products.

BS 476-20 Method for determination of the fire resistance of elements of construction (general principals).

BS 476-21 Method for determination of the fire resistance of loadbearing elements of construction.

BS 476-22 Method for determination of the fire resistance of non-loadbearing elements of construction (general principals).

BS 476-23 Method for determination of the contribution of components to the fire resistance of a structure.

BS 4800 Schedule of paint colours for building purposes.

European Standards

EN 752 Drain and sewer systems outside buildings.

EN 1990 Basis of structural design.

EN 12050-1 Wastewater lifting plants for buildings and sites – Principles of construction and testing.

EN 12050-4 Wastewater lifting plants for buildings and sites – Principles of construction and testing – Part 4: Non-return valves for faecal-free wastewater and wastewater containing faecal matter.

EN 13101 Steps for underground man entry chambers. Requirements, marking, testing and evaluation of conformity.

EN 14396 Fixed ladders for manholes.

EN ISO 9906 Rotodynamic pumps – Hydraulic performance acceptance tests – Grades 1 and 2.

Other references

Dangerous Substances and Explosive Atmospheres Regulations 2002

Lifting Operations and Lifting Equipment Regulations (LOLER)

Sewers for Adoption 7th Edition Water UK/WRc 2012 ISBN 978 1 898920 65 6

Water Industry Mechanical Electrical Specification (WIMES) 3.04 – Low Voltage Electrical Specification for Package Plant

Water Industry Mechanical Electrical Specification (WIMES) 4.01 – Paints and Polymeric Coatings for Corrosion Protection