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CODE OF PRACTICE

MAINTENANCE AND SERVICING
OF
SMALL WASTEWATER TREATMENT SYSTEMS
(PACKAGE PLANTS) UP TO 50 POPULATION
EQUIVALENTS (PE) AND
LARGER SYSTEMS UP TO 1000 PE.

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ISBN

Code of Practice

Maintenance and Servicing of Small Wastewater Treatment Systems (Package Plants) up to 50 population equivalent (pe) and larger systems up to 1000 pe.

1 Scope

The code of practice defines the ways in which small treatment plants should be serviced and maintained. It also sets out a training and certification scheme where service technicians can obtain a recognized national qualification.

1.1 The National Qualification is a broad based qualification that is aimed at all current experienced technicians of wastewater/sewage treatment plants to advance them all to a recognized level.

1.2 All participants and service companies need to pre-qualify (see Appendix A for details).

1.3 The code of practice seeks to be endorsed by the environmental regulators as the preferred methodology of servicing treatment plants up to 50 population equivalent (pe) and larger plants up to 1000pe.

2 References

2.1 Regulatory

2.1.1 England and Wales, Section H drainage regulations. Scotland, Section M.

2.1.2 Regulator consent (Environment Agency/Scottish Environment Protection Agency/ Department of Environment Northern Ireland)

2.2 Technical

2.2.1 Institution of electrical engineers- Regulations for Electrical Installations, 16th edition 1992, incorporating BS7671:2001, or latest edition

2.2.2 Health and Safety regulations

2.2.3 Pr EN 12566 -3 "small wastewater treatment systems up to 50 persons"

2.3 CE marking

Pr EN 12566 -3 sets out the minimum requirements for small package sewage treatment equipment less than 50 population equivalent. The transitional period for this standard is expected to expire by the end of July 2009; however, as there are no conflicting standards in the UK, there are no alternative routes for compliance with the performance requirements.

3 Definitions

3.1 Cesspools

A cesspool is an underground watertight container or tank without outflow (discharge) used for collecting domestic wastewater and for storing raw sewage, which is removed and disposed of by suction tanker (approved wastewater disposal companies only). The storage capacity for a cesspool should be sufficient for a least 45 days retention with a minimum volume of 18 cubic meters (BS6297: 2007).

Note: In Scotland the building regulations do not permit the use of cesspools.

3.2 Septic Tanks

Sealed sedimentation tank in which settled sludge is in immediate contact with the wastewater flowing through the tank, and the organic solids are partially decomposed by anaerobic bacterial action. The capacity of a septic tank is defined in BS 6297: 2007. BSEn12566- 1 and 4 cover the design of package and in situ built septic tanks.

3.3 Treatment Plants

A sewage or wastewater treatment plant is designed to treat raw effluent to a better and less polluting quality than a septic tank. Most treatment plants will have a secondary or biological treatment zone that removes the soluble polluting matter by the use of micro-organisms. Then a final section will settle out the solid particles.

Note: The selection and sizing of a treatment plant requires specialist advice to ensure it meets the needs of the site or application.

3.4 Soakaway or Drainage Field

Sub surface pit or other drainage arrangement prepared in permeable ground to which treated wastewater is fed and from which it soaks into the ground. The design and sizing of a soakaway is defined in BS 6297: 2007. TR EN12566 part 2 covers the design of sub surface irrigation systems.

Note: It is important that a percolation test is carried out before the soakaway is designed (TR EN12566 Part 2).

3.5 Direct Discharge to Water Course

Final Effluent Discharge Point – Point where the final effluent leaves the wastewater treatment plant and is discharged into the receiving water course i.e. ditch, stream etc.

3.6 Grease Removal/Management

3.6.1 Grease Trap: Structure or device for separation of grease, fat and oil or other floating material from wastewater.

3.6.2 Biological Dosing System: Device which doses a drain line periodically with a bacterial suspension to prevent/breakdown grease, fat and oil build up and stimulate treatment where a sewage/wastewater treatment plant is installed.

3.7 Pumping Station

A pumping station is a method of moving liquid to a higher point and or across a distance to a suitable discharge point. Either a chamber that has a pump or pumps situated within, or by another method such as drywell mounted pump(s) that suck as well as pump. Either crude or treated liquid can be pumped.

Note: Selection and sizing of the systems used requires specialist advice.

3.8 Flow Balancing

Balancing/Equalisation: Reduction in variations in flow, concentration, temperature etc, e.g. by a balancing tank. If a flow is balanced it will reduce the peak loads to the sewage/wastewater treatment plant, in many cases the treatment plant can then be reduced in size. However, the flows and site activities must be very carefully ascertained before sizing takes place.

Note: Application of flow balancing requires specialist advice.

3.9 Combined or Storm Flow

3.9.1 Combined Flow: Wastewater, plus infiltration (generally from cracked/leaking pipes, allowing ground water or surface water run off to enter the drain line) and storm flow.

3.9.2 Storm Flow: Run off from roofs, car parks, highways or any impermeable area.

3.10 Regulator Consent

Discharge Consent: Statutory approval to discharge final effluent, trade or industrial effluent, surface water or storm water to receiving watercourse.

4 Basic Product Knowledge

What service technicians and service companies should know: -

4.1 The basic theory of aerobic wastewater treatment.

4.2 Practical knowledge of poor effluents, grease, bio-mass (healthy or not) and why they occur.
4.3 Inhibition, overloading effects and problem resolution.
4.4 Practical problem solving for all types of plant and associated component failure.
For example: - Media blockages, disc blinding, mats fouling, pipe blocking, pump failure, compressor failure, control issues, all types of fault diagnosis.
4.5 Basic effluent test principles, BOD, Suspended Solids and Ammonia. Why they are important. Understand what affects them.
4.6 The reasons why sludge accumulates, the need to de-sludge and the correct method of de-sludging.
4.7 When a plant needs de-sludging and whether it has been done properly or not.
4.8 Basics of gravity drainage, surface water flows, balancing and pumping.

5 Final Effluent Measurement

What service technicians and service companies should know about/be aware of: -

5.1 The correct method of collecting and having a sample analysed.
5.2 Choosing the types of different analyses required subject to the consent and the nature of the situation:

5.2.1 If the system is failing then the appropriate elements need to be specified for analysis to provide a picture so a suitable correction program can be put together.
5.2.2 To check the equipment satisfies the consent.

5.3 Different types of sampling equipment and their uses/application.
5.4 Turbidity tube and how to use it.
5.5 Visual inspection of final effluent and giving informative comment on it.
5.6 Recording sample condition/photograph.
5.7 Ammonia and COD comparison test kits. Useful, not essential.

6 Regulator Consent

Service company to check and advise, where possible:

6.1 If the site has consent to discharge
6.2 In the Technician's opinion, if the system onsite is capable of meeting the consent?
6.3 The client in the situation of there being no consent informing them of their legal responsibility.
6.4 Client on obtaining discharge consent (where applicable)
6.5 Results of regulators analyses
6.6 Other analyses
6.7 The reason(s) for possible differences in final effluent quality, e.g. loading, plants ability to treat load presented

7 Health and Safety

7.1 Basic health and safety to be covered by the employer/service company.
7.2 Technicians need to consult a Doctor and to be vaccinated as recommended i.e. Hepatitis A, Polio, Typhoid, Tetanus, etc and carry vaccination awareness cards.
7.3 Technicians need to have valid confined space certificates and practice the requirement when entering designated confined spaces
7.4 Technicians need to have basic electrical safety knowledge.
7.5 Risk assessments will need to be completed for all types of treatment plants being serviced. Changing large components may require method statement.
7.6 Full personal protective equipment to be available and worn when appropriate.

8 Recommended Basic Equipment

8.1 Manhole lifting keys, cabinet keys and manufacturer/site specific access keys
8.2 General mechanical and electrical tools for changing components and making on site repairs
8.3 Regularly replaced components/parts: -

Floats – Differential, single acting
Air filters – various types and manufacturers
Fuses – range of sizes and types
Pipework – solvent weld, fittings and glues
Flexible pipe work – various sizes, hose tails, jubilee clips/wide bolt clamps
Electrical components such as MCB's, contactors, change over relays
Any manufacturer specific parts as required

8.4 Testing equipment - multimeter and insulation tester
8.5 Turbidity Tube, sample bottles and sampling device
8.6 Core tube sampler
8.7 First Aid box
8.8 Pressure washer and various fittings, hose pipe and a supply of water if possible
8.9 Camera (Disposable or/and Digital, very useful not essential)
8.10 Generator (Useful not essential)
8.11 Manufacturer's spares plus miscellaneous parts, fuses etc.
8.12 230V Submersible pump or portable site pump
8.13 Personal sanitation device i.e. handwashing unit preferably with hot water supply (Van fitted unit such as Teal or equivalent)

9 Servicing Schedules/Intervals

To system manufacturer's specification, see current versions available on all manufacturers' web-sites. In the absence of any recommendations the following guidelines may apply:

9.1 Domestic residences up to 50 pe. a minimum of twice per annum.

9.2 Commercial applications at least four times per year, site conditions dependent.

9.3 Levels of service to be offered based on commercial considerations and the requirements of each treatment plant manufacturer.

A possible structure of service could be: -

- Gold – Fully Comprehensive
- Silver – Regular maintenance and general wear items
- Bronze – Parts and labour only

10 De-sludging/Suction Tanker Visits

10.1 Follow the manufacturer's recommended desludging intervals as defined in the O & M manual. In the absence of other recommendations the following intervals are suggested:-

10.1.1 Septic Tanks - Annually (subject to loading)

10.1.2 Sewage/Wastewater Treatment Plants – Domestic – twice each year (subject to loading and consent requirements)

10.1.3 Commercial –Quarterly (subject to loading, possibly more frequently)

10.2 On inspection the service technician may change the emptying intervals if required, because of high/low loadings or seasonal variations, but only if required for the safe operation of the equipment.

10.3 Responsible Waste Contractors (desludging companies) will audit their services and assure a competent and reliable standard. They should provide feedback on the state of the system and equipment if the visit is not supervised by an Accredited Service Engineer who will have successfully completed the British Water course for Package Sewage Treatment Plant Maintenance. Currently, not all service providers are effective in supervising de-sludging to ensure correct and proper methodology is adhered to or problem identification carried out.

10.4 The responsibility of organising de-sludging should be agreed with the client or included within the service contract.

10.5 De-sludging, irrespective of plant type or manufacturer, should be the removal of the crust then the settled sludge, clearing any deleterious material throughout the system including accumulated sludges. Jetwashing through out the sewage/wastewater treatment plant as required and in accordance with the manufactures instructions.

10.6 Moving logically through the system generally from Primary Zone, Biozone Zone to Humus/Final Settlement and to include both primary or final effluent pumping stations if they are part of the system.

10.7 All service technicians should be aware of correct and proper methods of de-sludging and a general idea of the governing legislation.

10.8 Re-primed/filled as soon as possible after emptying, especially in wet conditions where a local water table is close to tank installation depth.

10.9 Technicians and service providers to advise access for optimum distance for de-sludging.

10.10 Maximum distances for a standard vacuum tanker: -
75m horizontally, 9m vertically (measured from the base of the tank to the top of the stack pipe of the suction tanker).

11 Manufacturers O & M (Operational & Maintenance) Manual

11.1 Compliance to manufacturer's instruction is essential for plant performance. See latest versions on their web-sites.
11.2 Advice on basic operational Do's and Don'ts, especially by householder.
11.3 Consequences of grease and toxic substances entering the plant.

12 Use of Correct Replacement Parts

12.1 Any company not using proprietary parts invalidates warranty and plant performance.
12.2 Manufacturers to set up with OEMs to supply to their specification.
12.3 A service company may loose certification if they use other than non-approved parts, especially if parts fitted compromise plant performance.

13 Quality Assurance

13.1 To meet minimum standards: ISO9001:2000 and ISO14001. If however a service company does not have these standards then they can be part of a similar system of an approved treatment plant manufacturer who has the required standards.
13.2 All service companies must keep a competent persons register and training records.
13.3 Plant manufacturers can carry out auditing at random of associated service companies who have their type approval.
13.4 Records to be maintained regarding the operation, performance and equipment condition of the treatment plant. Details may be reported to the manufacturer of the treatment plant.
13.5 If a product complaint occurs this will instigate an investigation by the service provider and if necessary referred to the appropriate treatment plant manufacturer. Records should be maintained in accordance with the quality assurance system.
13.6 All training certificates require re-validating every 3 years.
13.7 Manufacturer's product updates to be regularly reviewed.

14 Documentation and Record Keeping

14.1 End users, i.e. householders, should also be encouraged to keep records of service visits and de-sludging volumes to help with satisfying the Regulator's requirements.
14.2 Servicing companies shall keep records of all work carried out.

14.3 Service companies/technicians should retain current Waste Carrier details and all Duty of Care Waste Consignment Notes as required by current UK Environmental Law, when they arrange waste/de-sludging contracts.

14.4 Service companies/technicians should keep copies of Regulator Consent Certificates where available.

15 Bibliography

Burks, B.D. and Minnis, M.M. (1994) "Onsite Wastewater Treatment Systems" (Hogarth House)

Tchobanoglons, G.; Burton, F.L.; Stensel, H.D. (2003) "Wastewater Engineering: Treatment and Re-use – Metcalf and Eddy" (McGraw Hill)

Simpson, J.R. (1972) "Wastewater Treatment for Small Communities" (Process Biochem)

Appendix A

Pre-Qualification

The Company

1 Commercial

1.1 Quality assurance to IS0001:2000 and ISO14001or similar
1.2 Financial: Bank and 2 trade references or similar
1.3 Insurance: Public Liability (£2.0M) and Employer's liability in the event of pollution.
1.4 Service area they are prepared to cover: usually at least a county
1.5 When carrying waste: Registered Waste Carrier Broker
1.6 At least one reference (preferably 2/3) from members of British Water

2 Systems

2.1 Plan for all routine servicing activities
2.2 Record keeping of service visits, action taken and equipment/system inventory.
2.3 Training records for the service technician(s)
2.4 Health & Safety training and activity log
2.5 Equipment test certificate register

3 Technical background of employees

Either

3.1 Qualified by experience i.e. can demonstrate knowledge of treatment plants and pumping systems and how they operate and familiar with most of the tools and techniques used to service treatment plants and pumping systems in accordance with the British Water Code of Practice.

Or

3.2 A minimum of 12 months experience working under the supervision of a qualified technician (British Water Accredited Service Engineer)
3.3 Attended a training course by at least one of the members of British Water who manufacture small package treatment plants less than 50 PE.

4 Technical knowledge and competence of maintenance staff

4.1 Ideally have successfully completed the British Water Course for Package Sewage Treatment Plant Maintenance and be in possession of a valid certificate or can demonstrate understanding of this British Water Code of Practice and substantiate the knowledge which can be summarised as:-
4.1.1 Understanding of treatment plants and how they operate
4.1.2 Knowledge of fault findings process and M&E related issues and practical problem solving techniques

4.1.3 Confined space trained for use as necessary
4.1.4 Demonstrate knowledge of customer care

4.2 Level of experience in the industry

4.3 Practical hands on experience

4.4 Driving license

4.5 Understand the main types of sewage/wastewater treatment plant and their maintenance requirements.

4.11 Training and development program that is overseen by the servicing company or British Water member of manufacturers

Appendix B
Glossary

Activated sludge	Aerated wastewater with a suspended biomass
Aerobic	Condition where oxygen is present
Ammonia	Should be called ammoniacal nitrogen
BOD	**Biochemical oxygen demand**: the amount of dissolved oxygen consumed by microbial activity over usually a 5-day test at 20° C (BOD)
Biofilm	A film of biomass or microbial cells attached to a surface usually submerged
BAF	**Biological Aerated Filter** that contains a submerged medium of a high surface area which is aerated. The excess biomass is cleaned or back-washed by some method
BF	**Biological filter** or trickling filter. This is usually a circular tank filled with media and a distribution system dispersing wastewater over the media
Cesspool	An underground watertight tank without outflow used for collecting domestic wastewater. It is a watertight vessel that stores the raw sewage until collected by a tanker
COD	**Chemical Oxygen Demand** is the amount of oxygen consumed by the chemical oxidation of the matter present in the wastewater sample
Crust	Accumulated material that collects on top of the primary liquor and which is removed when the system is de-sludged
Desludging	Method of removing by suction tanker the accumulated crust, sludge and deleterious material. Sludge removal reduces BOD loading
DWF	**Dry Weather Flow** is the average daily flow received by the wastewater plant in a day to have originated directly from the premise connected to the plant.

EA/SEPA/EHS	Environmental Regulators (Environment Agency/Scottish Environment Protection Agency/ Environment and Heritage Service Northern Ireland)
Eutrophication	This is the enrichment of a water course or body by nutrients mainly phosphates and nitrates that usually leads to deterioration in the water quality especially bacterial, algal and/or plant growth
Full flow to treatment	The maximum flow a wastewater plant can treat and is usually expressed as a maximum flow for a set number of hours not repeated more that twice a day
Humus tank	A settlement tank that follows secondary treatment
Mixed liquor	The mixture of microbial solids and wastewater present in activated sludge aeration vessels
Organic loading	The amount of BOD present in the wastewater expressed as grams or kilograms per day
Package treatment plant	A self-contained sewage treatment plant that is manufactured in a factory and transported to site for installation. It can be more that one module
Per capita volume and loads	The wastewater volume in litres per person per day with the organic and ammonia load expressed in grams
Population equivalent (pe)	The notional value equivalent to a domestic resident usually used for comparisons or sizing a treatment plant which receives some non-domestic wastewater
Reedbed	A gravel bed with reeds planted to provide some form of additional treatment
RBC	**Rotating biological contactor** is a treatment plant that has discs that rotate in but which are not completely submerged in the settled effluent. The biological treatment takes place on the discs

Septic tank	A compartmentalised settling tank that provides a limited amount of anaerobic digestion
Sequencing batch reactor (SBR)	A treatment process that undergoes a filling, aeration (bio-mass and wastewater treatment), settlement and discharge phases
Submerged aerated filter (SAF)	A fixed film treatment process in which the media that is submerged in the effluent and a mechanical device introduces oxygen

Appendix C

Audit Procedure for Failing Plants (APFP)

Introduction

The procedure is only to be used in the following circumstances:

A) No maintenance has taken place on a plant and it is in very poor condition.
B) Plant has been badly neglected or abused.
C) The effluent quality is very poor.
D) There are sufficient concerns about the site and the way the plant is being operated.

General Notes

Forms contained within this appendix illustrate how the necessary information required to make a detailed appraisal of a failing packaged sewage treatment plant should be recorded.

Relevant information can be obtained from a variety of different sources such as contract files, product brochures and operation and maintenance manuals. More detailed plant and site information can be acquired through discussions with the plant owner and during a site visit. However, only data that is readily available should be recorded and it is not expected that the service engineer should spend time searching for information i.e. if the customer does not know what consent they have then nothing can be entered for this or if the customer is out or unavailable. The engineer should use reasonable endeavours to fill in as much of the form as is possible.

All APFP documents should be sent to the end user with a covering letter and a record kept by servicing company. Also, a note must be kept to record whether the end user has complied, or not, with the advice given by the servicing company. If no action is taken by the end user, then a reminder letter must be sent by the servicing company. Plant manufacturers to randomly check compliance of APFP forms that apply to their plants.

Sheet 1

- Obtain plant details, e.g. name and type of system and all the relevant details of the treatment stages used within the system.
- Obtain the original design loadings and compare with the actual site data.
- Check and note discharge consent and compare with the sample results obtained from the Regulator and any site investigations.

Sheet 2

- Inspect the structural integrity of the system on site including manhole covers used and the plant internals.
- Check the general installation of the plant, including ventilation, levels and electrical connections.
- Inspect the mechanical / electrical items on site for correct operation (e.g. motors, blowers and pumps).

- Carry out a simple process evaluation through the treatment stages of the plant as relevant to plant or system design e.g. dissolved oxygen and temperature readings, biomass conditions and flow measurement. (Where ever possible and appropriate)
- Obtain samples from throughout the treatment stages of the plant. Have them analyzed to help identify the cause of the problem.

Sheet 3

- Identify any actions required or recommendations to improve the system performance.

Special Note:
If the customer does not have consent to discharge then they need to be informed that a consent to discharge is required unless the Regulator has specifically written to confirm that it is not required. However, in England and Wales this doesn't always apply to domestic properties producing <5m3/day.

Plant Details Address:	Date of Visit: Contact Name: Contact Tel:	
Definition of Problem:		
Plant Name and Type:		
Primary Treatment Type (e.g. cylindrical, spherical, integral): Dimensions / Volume: Desludge Interval (No. of days):		
Secondary Treatment Type (e.g. RBC, SAF, SBR): No. of Stages: Dimensions/volume:		
Final Clarification Type (e.g. integral, separate): Dimensions / Volume: Desludge Interval (No. of days):		
Tertiary Treatment Type (e.g. sand filter, UV, nitrify): Details: Dimensions / Volume:		
Plant Loadings Population Equivalent [p.e.]: Organic Load [gBOD_5/d]: Hydraulic Load [L/d]: Ammonia Load [gNH_4-N/d]:	**Design**	**Actual**
Discharge Consent [BOD:SS:NH_4-N:Oils & Greases]:		
General Notes / Remarks		

Structural Inspection
(e.g. manhole covers/lids, plant internals)

Installation Inspection
(e.g. plant, ventilation, electrical)

Mechanical / Electrical Inspection
(e.g. pumps, blowers, electrical internals)

Process Inspection
(DO/temperature readings, conditions of biomass, final effluent quality, flow measurement)

Sampling/Measurement
(e.g. inlet, settled sewage, final effluent)

Remarks/Actions/Recommendations

Engineer…….. Certificate number……..……
Service company:……...……..

Appendix D

British Water course for Packaged Sewage Treatment Plant Maintenance

Rationale
There are a large number of small sewage treatment plants of differing designs and ages across the country. The Environment Agency (EA) in England & Wales, SEPA in Scotland and EHS in Northern Ireland are showing increasing concern about the potential amount of pollution these plants could cause.

One of the primary ways of preventing this pollution is to ensure the plant is properly and correctly maintained.

British Water has been working closely with the environmental regulators to develop a training and accreditation scheme for service engineers. The regulators regard this as an important factor in the prevention of pollution.

Aims and Objectives of training course
The overall aim is to ensure that the service engineer has a thorough understanding of the types, theory and operation of small sewage treatment plant.

Objectives - at the end of the course the service engineer will be able to:

- Describe the different types of small sewage treatment plant
- Describe the differences between fixed film and activated sludge type plants
- Describe the operation of the different types of plant
- Understand the causes of common faults and know how to rectify them
- Understand the different types of consents
- Understand the causes and effects of pollution
- Describe the importance of the measured parameters
- Complete the audit form for failing plant
- Understand the values and calculations used in the design code of practice Flows and Loads 2

Accreditation
The training course is supported by a questionnaire which is independently assessed. Success in the questionnaire leads to accreditation, and the issue of the 'Qualified Service Engineer' certificate and identity card. Accreditation is valid for three years, and illustrates that the engineer is skilled in servicing small sewage treatment plant. The regulators will recognise the importance of such a system in the prevention of pollution.

The Accredited Service Engineers' details will be posted in a dedicated section of the British Water web site. The section will be searchable by name, company, post code or other criteria

The course content is as follows:

1. Introduction
    - **1.1** Background to the course
    - **1.2** Regulations
2. Treatment processes – Overview
    - **2.1** Fixed Film
    - **2.2** Suspended Growth
3. Packaged plants in detail
4. Pumps (short section)
5. Fault finding
6. Case Studies
7. Health & Safety
    - **7.1** Precautions
    - **7.2** Electrical
    - **7.3** Confined space
8. Sampling and Testing
9. Knowledge assessment (Test)

The course management is as follows:
The course material consists of an extensive series of PowerPoint slides, case study information and a comprehensive set of course notes.

British Water subcontracts the provision of the training course to an established training provider who provides the 2-day course, carries out the examination, marks the assessments and issues British Water with a list of successful candidates.

British Water issues successful candidates with an Accredited Service Engineer certificate, a plastic photo identity registration card and enters the person's details on the register and the BW website. The accreditation is personal to the engineer.