

ANQIP TECHNICAL SPECIFICATION

ETA 0905

BUILDING GREYWATER RECOVERY SYSTEMS (SPRAC)



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Note :

1. INTRODUCTION

This ANQIP Technical Specification (ETA) establishes technical criteria for the implementation of Building Greywater Recovery Systems (SPRAC), with a long retention period.

At the discretion of users, this Technical Specification may also be considered, in the applicable parts, for short retention period systems.

2. TERMS AND DEFINITIONS

Domestic wastewater

Domestic wastewater refers to effluents from sanitary installations, kitchens, washing clothes and similar uses.

Black water

Black water or fecal water is the water that comes from toilet and urinal flushes, that is, water that contains urine and/or feces.

Greywater

Greywater is domestic wastewater that does not contain black water. It generally comes from baths, showers, sinks, washing machines and kitchens.

Building greywater recovery systems (SPRAC)

A building system for the use of greywater allows this water to be reused in the building before final discharge, after appropriate treatment, in accordance with the quality required for its uses.

Water for reuse

Domestic wastewater with lower concentrations of pollutants can be considered for use. In residential buildings, this water generally comes from the discharges of bathtubs, showers and washbasins, but under certain conditions, discharges from washing machines or even wastewater from kitchens can also be considered.

Regenerated water

Greywater treated for use in the building, meeting the quality criteria established for its intended uses, is referred to as “regenerated water”.

Systems with long retention period

SPRAC with a long retention period generally correspond to recovery systems in buildings for collective use, where greywater comes from different users and where, after being collected and treated in a single location, it is equally distributed for use by different users.

Systems with short retention period

SPRAC with a short retention period generally correspond to simplified greywater use systems in single-family homes, generally with only one user or users from the same family.

Direct use in compact sanitary appliances

Some compact sanitary appliances (combination of washbasin and cistern, for example) allow direct use of greywater, with adequate simplified treatment. These appliances are not covered by this Technical Specification, but it is recommended that they be subject to technical-sanitary certification by ANQIP.

Acronyms

MAV – Maximum Admissible Value;

MRV – Maximum Recommended Value.

SPRAC Installer

Entity responsible for the supply, installation and start-up of the system. In the event that these procedures involve several entities, the installer is considered to be the last person involved and will represent, in terms of responsibilities in the process, all the other parties involved.

3. REGULATORY AND LEGISLATIVE FRAMEWORK

3.1. The design, installation and operation of SPRAC must comply with national and European harmonized standards and regulations applicable to these facilities or any of their components, including legislation on water quality.

3.2. With regard to the dimensioning of the drainage network, in particular, the provisions of the Portuguese General Regulation in force or the European Standards EN 12056-2 (System I or System IV) and EN 806-3 must be complied with, in the applicable parts. The design must minimize turbulence, taking into account the propensity for the formation of foam, as well as the stagnation of water.

3.3. SPRAC must also comply with applicable standards and regulations regarding noise and vibrations.

3.4. All SPRAC must be the subject of a project, the preparation of which must comply, in the applicable parts, with the requirements of Portuguese Order No. 255/2023, of August 7 , and subsequent updates.

3.5. In single-family systems with a short retention period, simpler regeneration and analytical procedures than those recommended in this ETA may be permitted, provided that they comply with applicable legislation and are under the responsibility of the owner

4. SYSTEM SECURITY AND CERTIFICATION PLAN

4.1. The design, installation and maintenance of SPRAC must only be carried out by duly qualified technicians and by companies with the necessary skills.

4.2. A Safety Plan must be drawn up, with an initial version being the responsibility of the installer, but periodically updated by the user. The Safety Plan must include, as a minimum, the following chapters:

1. Characterization of the installation;
2. Risk assessment;
3. Criteria for assessing the conformity of the quality of regenerated water (justifying any differences in relation to what is recommended in this ETA);
4. Procedures in case of breakdown or serious problem (Action Plan).

4.3. For technical and public health reasons, SPRAC must be certified under the terms of Technical Specification ANQIP ETA 0906, which requires prior assessment of the project, inspections of the work, a Safety Plan, a Maintenance Plan and a Maintenance Contract.

4.4. Suppliers of components that make up the SPRAC must provide adequate information about their products. Certification of the installation will be subject to the application of standardized products, whenever these are covered by Portuguese regulations or harmonized European standards.

5. QUANTITY AND QUALITY OF GREYWATER

5.1. Water balance

5.1.1. The quantity of greywater produced may vary considerably depending on the sanitary habits and standard of living of families. In the absence of specific studies, in new or refurbished buildings where devices of the minimum water efficiency class “A” of the ANQIP labelling scheme have been installed, the average water consumption may be estimated at around 110 l/(inhab.*day) and the production of greywater at around 70 l/(inhab.*day) (Table 1).

The scenario set out in the table takes into account the reuse of greywater from the kitchen. If only the reuse of greywater from the bathrooms is taken into account, the figures should be adjusted accordingly.

5.1.2. The information on the water balance in residential buildings presented in Table 1 can be adapted for non-residential buildings, through a case study.

Table 1 - Water balance in residential buildings with efficient devices (average values in litres per inhabitant and per day)

Nature of water used	Water uses	Wastewater produced	Water destination
55 litres of drinking water	43 litres for shower, bathtubs and wash basins	73 litres of greywater	55 litres of regenerated greywater for reuse
	12 litres for kitchen		
55 litres of regenerated water	5 litres for cleaning	32 litres of blackwater	18 litres of greywater discharged
	13 litres for the washing machine		32 litres of blackwater discharged
	32 litres for flushing toilets	-	5 litres infiltrated into the ground
	5 litres for garden watering		

5.2. Composition of greywater

5.2.1. The substances present in the water generally come from personal hygiene products, detergents, hair, skin, dandruff particles and, possibly, dirt from clothes, and are easily biodegradable. Due to this biodegradability, treatment cannot be delayed too much, as this may trigger decomposition processes involving sulphates and unpleasant odours.

5.2.2 In general, water from showers and bathtubs is not very polluted. Water from washing machines tends to have a higher pollutant load and water from the kitchen (sink and dishwasher) is even higher.

Values may vary depending on the quality of the public water supply or on treatments carried out in the building network (for example, a higher concentration of nitrates in the general network or the addition of polyphosphates in the building installation to prevent corrosion of the pipes). Relatively high phosphate concentrations may result from dishwashing detergents.

5.2.4. Microbiological studies carried out on water from bathtubs, showers and washbasins revealed levels of total and fecal coliforms (*E. coli*) that were much lower

than those found in total domestic wastewater. In washing machine effluents, bacterial concentrations depend on the washing temperature.

5.3. Uses and quality requirements for regenerated water

5.3.1 General considerations

5.3.1.1. According to current knowledge, it is considered that regenerated water can be used for flushing toilets, washing clothes, watering gardens and cleaning, after appropriate treatment. The quality is considered adequate when, in periodic analytical controls, no parameter exceeds the specific MAV, indicated below, with the tolerances indicated in Table 2 being admissible for some parameters.

Table 2 – Tolerances in relation to MAV

Parameter	Tolerance towards MAV
<i>Legionella spp.</i>	1 logarithmic unit
Fecal coliforms (<i>Escherichia coli</i>)	1 logarithmic unit
Total suspended solids	75% of MAV
Turbidity	100% of MAV

5.3.1.2. SPRAC must be equipped with sampling points before and after treatment.

5.3.1.3. The user of the regenerated water is responsible for preventing deterioration of its quality between the treatment and use sites.

5.3.1.4. For treatment surpluses, discharge into the public network, infiltration into the soil or direct release into water lines may be considered, among other alternatives, under the conditions in item 5.3.7.

5.3.1.5. In general, the use of flowmeters in SPRAC is not recommended, given the operating conditions of these devices.

5.3.2. Flushing toilets

For flushing toilets, the requirements of Table 3 must be taken into account, where the values for *faecal streptococci* and *faecal coliforms* are defined as in the quality standards for inland bathing water (good quality), in accordance with national legislation and

applicable European directives. Additional safety measures must also be considered, such as the placement of warnings stating that the toilet lid must be closed when flushing.

Table 3 - Quality requirements for flushing toilets

Parameter	MAV	MRV
Total coliforms	-	10 ³ CFU/100 ml
Fecal streptococci (<i>Enterococci</i>)	-	100 CFU/100 ml
Fecal coliforms (<i>Escherichia coli</i>)	10 CFU/100 ml	-
Turbidity	5 UNT	2 UNT
pH	6.0 to 9.0	-
Ammoniacal nitrogen	10 mgNH ₄ /l	-
CBO ₅	25 mg/l O ₂	-
Residual chlorine (*)	2 mg/l	0.5 mg/l

(*) When chlorine is used in the greywater regeneration process

5.3.4. Washing clothes

The requirements indicated in Table 4 apply to washing clothes, which must be carried out at temperatures not lower than 55 °C.

5.3.5. Washing vehicles and floors

The values indicated in Table 4 can also be considered for washing vehicles and floors, additionally considering, in this case, the MAV indicated in Table 5 for *Legionella pneumophila*, if applicable.

5.3.6. Watering private gardens

For watering private gardens, the requirements indicated in Table 5 must be met, without the need to add chemical products.

5.3.7. Infiltration into soil or direct discharge into water lines

Infiltration into the soil or direct discharge into water lines requires approval from the respective River Basin Administration, in accordance with current legislation, whether the water is regenerated or not.

Table 4 - Quality requirements for laundry washing

Parameter	MAV	MRV
Total coliforms	10 CFU/100 ml	
Fecal streptococci (<i>Enterococci</i>)	Not detected	-
Fecal coliforms (<i>Escherichia coli</i>)	Not detected	-
<i>Pseudomonas aeruginosa</i>	-	1 CFU/ml
Total suspended solids	-	10 mg/l
Turbidity	5 UNT	2 UNT
pH	6.0 to 9.0	-
Residual chlorine (*)	2 mg/l	0.5 mg/l

(*) When chlorine is used in the greywater regeneration process

Table 5 - Quality requirements for irrigation of private gardens

Parameter	MAV	MRV
<i>Legionella spp.</i> (*)	-	10 CFU/100 ml
Total coliforms	10 CFU /100 ml(*)	10 ³ CFU /100 ml
Fecal streptococci (<i>Enterococci</i>)	Not detected(*)	100 CFU/100 ml
Fecal coliforms (<i>Escherichia coli</i>)	10 CFU/100 ml or not detected(*)	-
Enteric parasites		1 egg/ 10 l
Suspended solids	10 mg/l	-
Turbidity	5 UNT	2 UNT
pH	-	6.0 to 9.0
Residual chlorine (**)	0.5 mg/l	-
CBO ₅	10 mg/l O ₂	-
Ammoniacal nitrogen	10 mg NH ₄ ⁺ /l	-
Total nitrogen	15 mg N/l	-
Total phosphorus	5 mg P/l	-

(*) When there is a risk of aerosol formation (sprayers, sprinklers, nebulizers, etc.)

(**) When chlorine is used in the greywater regeneration process

5.4. Analysis methods and periodicity

5.4.1. Analyses must be carried out immediately downstream of treatment, and must be carried out using sensors that allow continuous monitoring in buildings used collectively and with a long retention period. Continuous monitoring may be dispensed with in family-scale installations.

5.4.2. Installations with continuous monitoring must have a calibrated controller with an alarm system, which will be activated when it is found that any of the monitored

parameters is outside the limit indicated in Tables 3 to 6, with the tolerances indicated in Table 2. The controller must also automatically suspend operation when the non-compliance situation persists for more than 24 hours.

5.4.3. Analyses not performed automatically “in situ” must be carried out by an accredited laboratory. For reference analysis methods of the parameters referred to in this Specification, those indicated in Portuguese legislation on water quality must be considered, with the minimum number of successive analyses being defined in Table 6.

5.4.4. The installer shall be responsible for analyses of the start-up phase or those resulting from shutdowns of the installation caused by problems detected during the warranty period. Compliance must refer to the parameters indicated in Tables 3, 4 and/or 5, depending on the uses, without considering the tolerances indicated in Table 2.

5.4.5. The start-up phase must have a minimum duration of six weeks and is only considered complete when, for each parameter with MAV indication, compliance is observed for a period of six weeks or, if no continuous monitoring system is installed, within N_1 successive analyses (Table 6). The last analysis must also include the parameters for which only the MRV is indicated. The type and number (N_1) of analyses referred to in Table 6 may be changed in duly justified situations. The first analysis at this stage must only be carried out two weeks after the start-up of the installation and N_1 analyses must not be carried out at intervals of less than seven days.

5.4.6. After a period of prolonged shutdown or detection of a serious problem in the installation, its operation may only be restored after checking compliance in all parameters for two weeks continuously or in N_2 successive analyses (Table 6). The type and number (N_2) of analyses referred to in Table 6 may be changed in duly justified situations.

5.4.7. The values indicated in Table 6, in the current operation column, correspond to the frequency of the analyses to be carried out (N_3), when there is no continuous monitoring system. If a deviation greater than that indicated in Table 2 is detected in any of the parameters, the installation must be reviewed and the analysis for that parameter repeated within a maximum period of 15 days (confirmation analysis). If the deviation persists, the procedure must be repeated with the same frequency. If compliance is not achieved in all the parameters after two successive confirmation analyses, or over a period of two weeks in the case of continuous monitoring, it must be considered that there is a serious problem and the operation of the installation must be suspended to detect and correct the anomalies.

5.4.8. The obligation to record analytical results obtained during the current operating period must be included in the installation maintenance contract.

5.4.9. The Security Plan may impose more restrictive procedures than those indicated in item 5.4.7, or, in the case of simple installations on a single-family scale, less restrictive procedures.

Table 6 – Number of successive analyses that comply in the different phases of the SPRAC

Parameter to analyze	Start-up period (value N_1)	After prolonged downtime or detection of a serious problem (value N_2)	Current exploration (value N_3)
<i>Legionella spp.</i>	2	1	Semi-annual (*)
Fecal streptococci (<i>Enterococci</i>)	3	2	Monthly
Fecal coliforms (<i>Escherichia coli</i>)	3	2	Monthly
<i>Pseudomonas aeruginosa</i>	2	1	Semi-annual
pH	2	2	Monthly
CBO ₅	2	2	Monthly
Suspended solids	2	2	Monthly
Turbidity	2	2	Monthly
Ammoniacal nitrogen	2	2	Monthly
Total nitrogen	2	1	Semi-annual
Total phosphorus	2	1	Semi-annual
Residual chlorine (**)	2	1	Monthly

(*) A mandatory sample in the summer

(**) When chlorine is used in the greywater regeneration process

5.4.10. If the regenerated water presents changes in color or transparency, floating debris , surface oil films or foam, the procedure referred to in 5.4.7 must be followed.

5.4.11. During the start-up period and during the period of restoration of the installation's operation after a prolonged shutdown, the regenerated water must be discharged, with the devices being supplied with water from the mains.

5.4.12. In systems with continuous monitoring, the controller must alert to the need to automatically trigger the discharge of regenerated water in situations where this is required in this ETA, switching to supplying the devices with water from the network in these situations, if these operations are not carried out automatically.

6. DESIGN OF SPRAC AND TECHNICAL REQUIREMENTS

6.1. General

6.1.1 As a rule, the need for regenerated water in residential buildings is less than the available quantity of greywater, so it is not necessary to use and treat all of it, but only the less polluted effluents, such as those from the shower, bath and washbasin.

6.1.2. An alternative water supply to the SPRAC (supply) must be provided, with water from the mains or other sources that have a quality suitable for the intended uses. When the minimum level of regenerated water is reached in the reservoir, the supply device will start, introducing the strictly necessary quantity of water into the system. In current operation, the operation should preferably be automatic and in the last stage of treatment.

6.1.3. The alternative power supply must also be able to be activated manually in the situations of operational shutdown provided for in this ETA.

6.1.4. The supply solution to be adopted must ensure compliance with applicable national legislation and Community standards, in particular standard EN 1717 (for risk class 5), and must ensure that cross-connections are impossible.

6.1. 5. The system must be designed so that it is possible to supply the entire building network from the public network, should it be necessary to take the SPRAC out of service. It must also be possible to completely empty the network of regenerated water from one or more purge points.

6.2. Building installations

6.2.1. The dimensioning of the supply pipes with regenerated water must be done in a similar way to the dimensioning of the drinking water network and for identical comfort levels.

6.2.2. Regenerated water networks, including accessory elements, must be clearly differentiated from drinking water networks, and it is suggested that purple piping or colored adhesive tape be used, preferably with the warnings “Non-potable network”, “Non-potable water”, “Regenerated water” or equivalent, and the condition of these marks or warnings must be checked periodically.

6.2.3. Indoor or outdoor irrigation or washing devices supplied with regenerated water must be marked with warnings similar to those indicated in 6.2.2 and/or appropriate symbols (Annex 1). The respective taps must be fitted with removable handles (safety key) to prevent inappropriate use.

6.2.4. Adequate ventilation of treatment spaces must be ensured.

6.2.5. Some components of greywater, such as hair, for example, can cause operational problems, so pipes and fittings that are in contact with greywater must be designed to reduce their retention.

6.3. Reservoirs and electromechanical equipment

6.3.1. All mechanical equipment, such as pumps, motorised valves, filters and other units, shall be easily accessible to allow maintenance, repair or cleaning. This is particularly important if kitchen waste is connected to the system, given the potential for high concentrations of grease.

6.3.2. One of the functions of reservoirs is to compensate for the time lag between the inflow of greywater and its consumption, but they can also have some influence on the quality of the regenerated water. Their volume depends on the habits of the users, the building, and the processing time.

6.3.3. Since, as a rule, there is a balance between the production of greywater and the need for regenerated water, the reserve volume (before or after treatment) should not be greater than the average daily consumption.

6.3.4. Tanks must be opaque or protected from sunlight in order to prevent the possible development of algae.

6.3.5. Reservoirs and other components of the system must prevent the release of odours and, if possible, be ventilated separately from the other areas of the building. They must also be made of suitable material, taking into account the chemical characteristics of greywater.

6.3.6. Tanks must be structurally suitable for their location, expected temperature variations and anticipated loads.

6.3.7. Tanks must have an access opening that allows for proper inspection and maintenance.

6.3.8. Reservoirs, when located outdoors, must respect a minimum distance of 1.5 meters from buildings and 3 meters from any trees or plants that develop a significant root system, unless root barriers are installed.

6.3.9. Surface discharges (*overflow*) must be provided with a siphon and, if necessary, a non-return device and/or protection against the entry of small animals.

6.3.10. Pumping installations must comply with current regulations, respect the noise levels established by law and be protected from heat, cold or rain, in a ventilated location. Pumps for greywater must be suitable for the physical and chemical characteristics of this water, in particular the solid matter it may contain.

6.3. 11. The following complementary measures are recommended:

- a) Protection of electrical circuits by grounding;
- b) Installation of sensors to indicate system parameters (water levels, pressure, etc.);
- c) Installation of warning systems for system failures or the need for refueling or replacements;
- d) Installation of control systems that avoid excessive storage periods.

6.3.12. As a rule, greywater recovery systems with a long retention period must incorporate a monitoring and control unit.

6.3.13. In addition to the requirements previously referred to in this ETA, monitoring and control units, where applicable, must also:

- a) alert the user/operator when a consumable needs to be replenished or replaced;
- b) ensure that treated greywater is not stored for an excessive period;
- c) in the event of a system failure: alert the user to this fact through a visible or audible warning;
- d) Communicate with the centralized management system, when provided for in the building program.

7. TREATMENT

7.1. Technologies

There are several water treatment technologies that can be used to regenerate greywater, with preference being given to those that do not require the addition of chemicals, those that require little energy and those that are economical to maintain. These include:

- a) Biological treatment systems;
- b) Membrane technology;
- c) Combined technologies.

If, together with the reduction of organic matter, there is also a microbiological reduction (which can happen with membranes, for example), a specific disinfection step may not be necessary.

8. INSPECTION, MAINTENANCE AND COMMISSIONING

8.1. The SPRAP installer is responsible for providing the final screens of the executed system, the Maintenance Plan and the analytical bulletins relating to the analyses carried out during the start-up period.

8.2. Inspections must be carried out in accordance with the manufacturer's and installer's instructions. Not only the operation of the SPRAC components must be checked, but also its overall operation.

8.3. There must be a maintenance plan and a maintenance contract with an installer or entity accredited or with competence recognized by ANQIP for this purpose, the presentation of which will be mandatory for the purposes of Certification of the SPRAC installation.

8.4. Before commissioning, in addition to the analytical control reviewed in this Specification, the SPRAC must be subject to the following tests:

- a) Watertightness of the system's networks and components, in accordance with the Portuguese General Regulation;
- b) Operation of electrical and mechanical equipment.

8.5. The installer must prepare a commissioning form, proving that the system is operational, which must be delivered to the owner of the installation.

8.6. As referred to in 5.4.8, a record must be made of all testing, maintenance and repair operations of the installation, as well as of the analyses carried out, which must be kept for a minimum period of 5 years and made available to ANQIP whenever requested, in particular for the purposes of renewing the installation's certification.

ANNEX 1

MODEL OF NOTICE TO BE PLACED NEAR WATERING OR WASHING DEVICES SUPPLIED BY REGENERATED WATER



RECOMMENDED COLORS : red (RAL 3000), purple (RAL 3004) or intermediate colors (RAL 3001 to RAL 3003).

RECOMMENDED DIMENSIONS: 10 cm x 15 cm, with smaller dimensions permitted when justified by the available space.

NOTE: The space below the phrase “Do not drink” (*não beber*) can be used to place the name or logo of the equipment supplier and/or installer.