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Rural domestic sewage purification unit

农村生活污水净化装置

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Foreword

CMIF/TC 7 is in charge of this English translation. In case of any doubt about the contents of this English translation, the Chinese original shall be considered authoritative.

This document is drafted in accordance with the rules given in the GB/T 1.1-2020.

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Rural Domestic Sewage Purification unit

1 Scope

This document specifies the terms and definitions, model coding, technical requirements, testing methods, testing rules, marking, packaging, transport and storage of rural domestic sewage purification unit (abbreviated as purification unit).

This document is applicable to sewage purification devices which take rural domestic sewage as inlet water, adopt biological treatment technology with the processing capacity no more than 500 m³/d.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- GB/T 150.2 *Pressure vessels-Part 2: Materials*
- GB/T 825 *Eyebolts*
- GB/T 1184 *Geometrical tolerancing-Geometrical tolerance for features without individual tolerance indications*
- GB/T 1720 *Method of test for adhesion of paint films*
- GB 2894 *Safety signs and guideline for the use*
- GB/T 3768 *Acoustics-Determination of sound power levels and sound energy levels of noise sources using sound pressure-Survey method using an enveloping measurement surface over a reflecting plane*
- GB/T 4208 *Degrees of protection provided by enclosure (IP code)*
- GB/T 6920 *Water quality-Determination of pH value-Glass electrode method*
- GB/T 7251.1 *Low-voltage switchgear and control gear assemblies-Part 1: General rules*
- GB/T 11547 *Plastic-Methods of test for the determination of the effects of immersion in liquid chemicals*
- GB/T 11893 *Water quality-Determination of total phosphorus-Ammonium molybdate spectrophotometric method*
- GB/T 11901 *Water quality-Determination of suspended substance-Gravimetric method*
- GB/T 13306 *Plates*
- GB/T 13384 *General specifications for packing of mechanical and electrical product*
- GB/T 14394 *Computer software reliability and maintainability management*
- GB 19517 *National safety technical code for electric equipments*
- GB/T 23858 *Manhole cover*
- GB/T 25197 *Welded static non-pressurized thermoplastic tanks*
- GB/T 28742 *Sewage treatment equipment for prevention and treatment of water pollution*
- GB/T 31994 *The technical specifications for smart remote communication and control gateway*
- JB/T 5943 *Construction machinery—General specifications for welding parts*
- CJ/T 355 *Small complete equipment for domestic wastewater treatment*

- HJ/T 91 *Technical specifications requirements for monitoring of surface water and waste water*
- HJ/T 399 *Water quality-Determination of the chemical oxygen demand Fast digestion spectrophotometric method*
- HJ 505 *Water quality-Determination of biochemical oxygen demand after 5days (BOD₅) for dilution and seeding method*
- HJ 535 *Water quality-Determination of ammonia nitrogen-Nessler's reagent spectrophotometry*
- HJ 536 *Water quality-Determination of ammonia nitrogen-Salicylic acid spectrophotometry*
- HJ 537 *Water quality-Determination of ammonia nitrogen-Distillation-neutralization titration*
- HJ 636 *Water quality-Determination of total nitrogen-Alkaline potassium persulfate digestion UV spectrophotometric method*
- HJ 828 *Water quality-Determination of the chemical oxygen demand-Dichromate method*
- JC/T 658.1 *Glass fiber reinforced plastics water tanks-Part 1: SMC sectional water tanks*
- JC/T 658.2 *Glass fiber reinforced plastics water tanks-Part 2: Hand lay-up whole water tanks*
- SJ 20893 *Specification for acid pickling and passivation for stainless steel*

3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

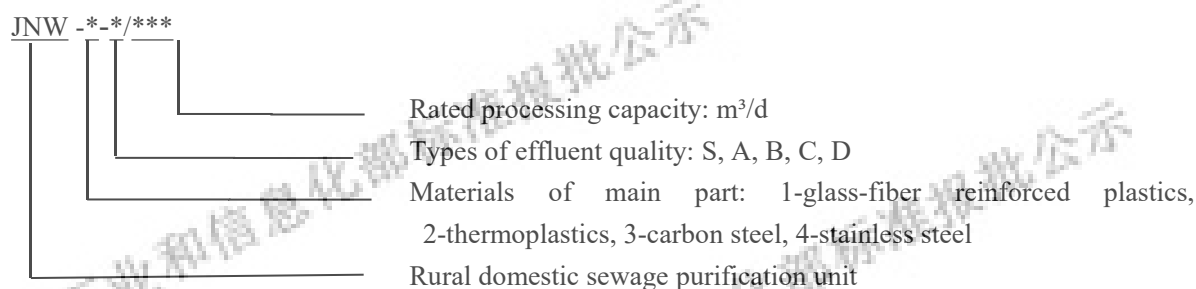
3.1

rural domestic sewage

sewage produced by rural residents' daily activities (mainly including flushing, washing and bathing, etc.)

4 Model Coding

The models of purification unit shall be composed of capital Chinese phonetic alphabets and Arabic numerals:



Example: JNW-1-A/20 represents: the main body adopts glass fiber reinforced plastic, the effluent quality is implemented as type A standard, and the rated treatment capacity is 20 m³/d.

5 Technical Requirements

5.1 Service conditions of the equipment

5.1.1 The daily accumulative water inflow shall be within the range of 40-110 % of the rated processing capacity of the purification unit.

5.1.2 For the rated processing capacity is not less than 5 m³/d, a regulating tank shall be set in front of the purification unit.

5.1.3 The influent water shall not contain pollutants (pesticides, insecticides, strong acids, strong alkalis, deodorants, chlorinators, heavy metals, petroleum, a large amount of animal and vegetable oils l (> 50 mg/L), etc.) that harm microorganisms, and influent water quality shall meet the requirements in Table 1.

Table 1 the inlet water condition (daily mean)

parameters	targeted value	units
pH	6-9	-
BOD ₅	45-150	mg/L
Chemical oxygen demand (COD)	150-500	mg/L
Suspended solids (SS)	100-300	mg/L
Ammonia nitrogen	≤45	mg/L
Total phosphorus	≤5	mg/L
Total nitrogen	≤50	mg/L
Water temperature	10-40	°C

5.2 Appearance requirements

5.2.1 The surface of the purification unit shall be uniform in color and no obvious scratches, impurities, cracks, defects and deformation. Surface coating for protection or decorate shall be homogeneous without defects, such as delamination and peeling.

5.2.2 The edge of the purification unit shall be smooth, uniform in thickness and no delamination.

5.2.3 The interface of each component of the purification unit shall be connected smoothly and glued uniform.

5.2.4 The signage of the purification unit shall be complete, correct and clear.

5.3 Materials requirements

5.3.1 Fiberglass reinforced plastics used in the main body of purification unit shall comply with the provisions of JC/T 658.1 and TC/T 658.2.

5.3.2 The thermoplastics used in the main body of purification unit shall comply with the provisions of GB/T 25197.

5.3.3 The carbon steel or stainless steel used in the main body of purification unit shall comply with the provisions of GB/T 150.2.

5.4 Manufacturing requirements

5.4.1 Dimensional deviation

The dimension of the purification unit shall comply with the design requirements. The undeclared tolerance shall comply with the provisions of GB/T 1184.

5.4.2 Strength and tightness

5.4.2.1 After full water test, the main body of purification unit shall be no obvious deformation or leakage.

5.4.2.2 After hydrostatic test, the internal baffles of purification unit shall be no obvious deformation or leakage.

5.4.2.3 After water and air pressure test, the internal pipes of purification unit shall be no obvious leakage.

5.4.2.4 After the loading strength test (The horizontal projection area of bearing area $\times 9 \text{ kN/m}^2$ is loaded on the main body of purification with the processing capacity $< 5 \text{ m}^3/\text{d}$. The horizontal projection area of bearing area $\times 16 \text{ kN/m}^2$ is loaded on the main body of purification with the processing capacity $\geq 5 \text{ m}^3/\text{d}$.), the main body of the underground purification unit shall be no obvious deformation, cracks or breakages.

5.4.3 Anticorrosive

5.4.3.1 When the fiberglass reinforced plastics or thermoplastics is used in the main body of purification unit, there shall be no obvious variation after soaking in 10 % H_2SO_4 and 10 % NaOH respectively for 96 h.

5.4.3.2 When the stainless steel is used, stainless steel shall be treated by pickling and passivation. And the quality shall comply with the provisions of SJ 20893.

5.4.3.3 When the carbon steel is used, the total thickness of dried paint film shall be in the range of 240-260 μm (The position directly connecting with water) and 160-200 μm (Others).

5.4.4 Filler

The used filler with the specific surface area $> 300 \text{ m}^2/\text{m}^3$ shall be corrosion resistance, free of clogging, and easily to install and clean.

5.4.5 Check hole cover

5.4.5.1 The surface of check hole cover shall be smooth and no defects (such as cracks, breakages, rough edges, burrs, holes),

5.4.5.2 The surface of check hole cover shall design the slip-resistance function.

5.4.5.3 To ensure the safety, the lock hook or safety protective net shall be designed at the external or internal lightweight check hole cover

5.4.5.4 The check hole cover of the underground purification unit shall be in accordance with the requirements given in GB/T 23858.

5.4.6 Air supply equipment

The air supply equipment shall be provided with enclosure. And the surface temperature of the enclosure shall not exceed $70 \text{ }^\circ\text{C}$ (On the basis of $30 \text{ }^\circ\text{C}$ ambient temperature)

5.4.7 Electric control cabinet

5.4.7.1 The design of the electric control cabinet shall be in accordance with the requirements given in GB/T 7251.1.

5.4.7.2 The protection level of the electric control cabinet shall not be lower than IP54 requirement given in GB/T 4208.

5.4.7.3 The welding of the electric control cabinet shall be firm. The welding line shall be smooth and uniform, but not exist the undesirable phenomenon (sealing-off, welding-missed joint, weld penetration, cracks, undercut, pores, etc.). It is needed to remove the coating, welding slag and slag-splashing. The manufacturing and acceptance of the weld assembly shall comply with the provisions of JB/T 5943.

5.4.7.4 The electric control cabinet's surface shall be treated properly or coated the appropriate corrosion resistance coating. The coating on the outer surface shall be even in color and no defects (sags, bubble, serious chromatism, correction marks and the defects affecting the decorative and protective performance, etc.). The coating on the inner surface shall be uniform in color and no defects (sags, bubble, etc.). The adhesive force of the spraying coating shall not be lower than level 4.

5.4.8 Gateway

5.4.8.1 The gateway shall be designed in accordance with the requirements given in GB/T 31994.

5.4.8.2 The data collection, processing, storage, transmission shall be able to support the collection and remote transmission of electrical energy data, device status data, measurement data, the signal of equipment warning, gateway disconnection, power failure warning, the controlling and operating of the sites and equipment (Including the operations of telecontrol, synchronization, teleregulation, artificial number, planning curve reception, lockout and unlocking).

5.4.9 Management platform

5.4.9.1 The management platform shall be able to transmit the data collected by the gateway reliably and securely. The collected data can include videos, graphics, water quality, flow, equipment status, which can be displayed by the data model. The management platform shall be provided with the customized UPS power to avoid the database offline and the loss of data in the case of sudden power failure.

5.4.9.2 The reliability and maintainability of the management platform shall comply with the provisions of GB/T 14394.

5.5 Performance requirements

5.5.1 The effluent quality treated by the purification unit shall meet the design requirements of the purification device and the main indicators are given in Table 2.

Table 2 The discharge limits of the main indicators of effluent quality (daily mean)

NO.	items	units	The effluent water's grade requirements				
			Type-S	Type-A	Type-B	Type-C	Type-D
1	pH	-	6~9				
2	BOD ₅	mg/L	≤6	≤10	≤20	≤20	≤30
3	COD	mg/L	≤30	≤50	≤60	≤60	≤100
4	SS	mg/L	≤10	≤10	≤20	≤20	≤30
5	Total phosphorus	mg/L	≤0.3	≤0.5	≤1	≤2	≤3
6	Ammonia nitrogen	mg/L	≤3 (5)	≤5 (8)	≤8 (15)	≤8 (15)	≤25 (30)
7	Total nitrogen	mg/L	≤15	≤15	≤20	-	-

Note: when the water temperature is > 12 °C or ≤ 12 °C, the controlling indicator shall comply with the brackets' outside or inside value, respectively.

5.5.2 The purification unit shall be capable of withstanding sustained impact by the daily cumulative flow of 110 % of the rated processing capacity.

5.5.3 The purification unit ($\geq 5 \text{ m}^3/\text{d}$) shall be capable of withstanding impact by the instantaneous flow rate of 110 % of the rated processing capacity's instantaneous value.

5.5.4 The purification unit ($< 5 \text{ m}^3/\text{d}$) shall be capable of withstanding impact by the instantaneous flow rate of 200 % of the rated processing capacity's instantaneous value.

5.5.5 The purification unit shall operate normally at low temperature (10-12 °C).

5.6 Safety requirements

5.6.1 The electrical safety of the purification unit shall comply with the provisions of GB 19517.

5.6.2 The purification unit shall affix clear safety warning signs at the prominently position. And the warning signs shall comply with the provisions of GB 2894.

5.6.3 The sound level of the noise generated by the normally operated purification unit shall not be greater than 75 dB (A).

5.6.4 Other safety requirements and measurements shall comply with the provisions of GB/T 28742.

5.7 Other requirements

It is advisable to set up the metallic lifting ring to facilitate handling and installation. The quantity and strength of the lifting ring shall be in accordance with the integral lifting requirements of the purification unit and the requirements given in GB/T 825.

6 Testing Methods

6.1 Visual inspection

Use visual inspection to inspect the surface and signs of the purification unit.

6.2 Materials inspection

Check out the quality certificate of the materials.

6.3 Manufacturing quality inspection

6.3.1 Dimensional deviation

Use standard measuring implement to measure the dimension.

6.3.2 Strength and tightness

6.3.2.1 The full water test of the main body of purification unit

The full water test carries out the test of bioreactor according to CJ/T 355.

6.3.2.2 Hydrostatic test of the internal baffles of purification unit

From the top opening, water is firstly injected into the purification unit on a rigidly horizontal platform. Then inspect whether the equipment's internal baffle is leaking, transforming or damaging after keeping stationary for 10 min. And the test shall be carried out on the other side of the baffle in the same way.

6.3.2.3 The water and air pressure tests of the internal pipes of purification unit

The hydrostatic test of water piping system and air pressure test of air piping system shall be carried out according to CJ/T 355.

6.3.2.4 The loading strength test of the main body of the underground purification unit

Place the purification unit on a rigidly horizontal platform and load bearing evenly from the above. Inspect whether the unit is damaged.

6.3.3 Anticorrosive

6.3.3.1 The corrosion prevention performance of glass-fiber reinforced plastics and thermoplastics shall be carried out according to GB/T 11547.

6.3.3.2 The appearance and the passivating film's adhesive force of stainless steel shall be carried out according to SJ 20893.

6.3.3.3 The total thickness of the coating dry film is measured by the paint film thickness gauge.

6.3.4 Filler

Check out the quality certificate of the filler.

6.3.5 Check hole cover

6.3.5.1 Use visual inspection to inspect the surface of the inspection cover.

6.3.5.2 Check out the quality certificate of the inspection cover.

6.3.6 Air supply equipment

The temperature is measured by the infrared thermometer.

6.3.7 Electric control cabinet

6.3.7.1 The protection grade of the electric control cabinet shall be carried out according to GB 4208.

6.3.7.2 The appearance, dimension and quality of the weldment shall be inspected according to JB/T 5943 by visual inspection and general gauges.

6.3.7.3 The paint coating, plastic spraying and cladding on the inner and outer surfaces of the electronic control cabinet shall be inspected by visual inspection. And the adhesion force of the coating shall be measured according to GB/T 1720.

6.3.8 Gateway

The gateway shall be inspected according to GB/T 31994.

6.3.9 Management platform

The reliability and maintainability of the management platform shall be tested by code inspection, code walkthrough and static analysis.

6.4 Performance inspection

6.4.1 Water quality testing method: The test quality assurance and control, the test data collecting, organizing and processing should be carried out according to HJ/T 91. The test methods of water quality are given in Table 3.

Table 3 The test methods of water quality

Test indicators	Test methods
Biochemical oxygen demand (BOD ₅)	<i>Water quality-Determination of biochemical oxygen demand after 5 days (BOD₅) for dilution and seeding method (HJ 505)</i>
Chemical oxygen demand (COD)	<i>Water quality-Determination of the chemical oxygen demand-Dichromate method (HJ 828) or Water quality-Determination of the chemical oxygen demand-Fast digestion-spectrophotometric method (HJ/T 399)</i>
Ammonia nitrogen	<i>Water quality-Determination of ammonia nitrogen-Nessler's reagent spectrophotometry (HJ 535) or Water quality-Determination of ammonia nitrogen-Salicylic acid spectrophotometry (HJ 536) or Water quality-Determination of ammonia nitrogen-Distillation-neutralization titration (HJ 537)</i>

Total phosphorus (TP)	<i>Water quality-Determination of total phosphorus-Ammonium molybdate spectrophotometric method (GB/T 11893)</i>
Suspended solids (SS)	<i>Water quality-Determination of suspended substance-Gravimetric method (GB/T 11901)</i>
Total nitrogen (TN)	<i>Water quality-Determination of total nitrogen-Alkaline potassium persulfate digestion UV spectrophotometric method (HJ 636)</i>
pH	<i>Water quality-Determination of pH value-Glass electrode method (GB/T 6920)</i>

6.4.2 Basic test

Test condition: The inlet water temperature is 18-40 °C, the inlet water quality comply with the requirements listed in 5.1.3, and the water inflow is adjusted to 100 % of the designed value.

Test method: Continuously monitoring the effluent water quality of the purification unit for 2 months and analyzing the water quality (daily mean) of the collected inlet and outlet water sample at least once a week.

6.4.3 Impact resistance tests

6.4.3.1 Continuous impact test

Test condition: The inlet water temperature is 18-40 °C, the inlet water quality comply with the requirements listed in 5.1.3, and the water inflow is adjusted to 110 % of the designed value.

Test method: Keeping the unit continuously running 24 h in 7 days and analyzing the water quality (daily mean) of the collected inlet and outlet water sample daily.

6.4.3.2 Instantaneous impact test ($\geq 5\text{m}^3/\text{d}$):

Test condition: The inlet water temperature is 18-40 °C, the instantaneous water inflow is adjusted to 110 % of the designed value at 7:00-8:00, 12:00-13:00 and 17:00-18:00.

Test method: Continuously running for 1 week and analyzing the water quality (daily mean) of the collected inlet and outlet water sample daily.

6.4.3.3 Instantaneous impact test ($< 5\text{m}^3/\text{d}$)

Test condition: The inlet water temperature is 18-40 °C, the instantaneous water inflow is adjusted to 200 % of the designed value at 7:00-8:00, 12:00-13:00 and 17:00-18:00.

Test method: Continuously running for 1 week and analyzing the water quality (daily mean) of the collected inlet and outlet water sample daily.

6.4.4 Processing capacity test at low temperature: Continuously running for 1 week at 10-12 °C of the inlet water temperature and analyzing the water quality (daily mean) of the collected inlet and outlet water sample daily.

6.4.5 The effluent water quality indicator: When the inlet water quality complies with the requirements of 5.1.3, and the effluent water quality indicators of the purification unit comply with the requirements listed in Table 2, it shall be deemed qualified as the indicators comply with the standards.

6.4.6 Qualification determination: When the overall water quality is up to standard rate of 90% after the basic test, impact resistance test and low temperature treatment capacity test, the purification unit shall be determined qualification.

6.5 Safety tests

6.5.1 Electrical safety of the unit shall be tested according to GB 19517.

6.5.2 The warning signs shall be inspected by using the visual inspection.

6.5.3 When the purification unit is in normal operation, its noise sound pressure shall be measured according to GB/T 3768.

6.5.4 Other safety requirements and measurements shall be inspected according to GB/T 28742.

6.6 General tests

The strength of the lifting ring shall be tested according to GB/T 28742.

7 Inspection Rules

7.1 Inspection classification

The inspections are divided into delivery inspection and type inspection.

7.2 Delivery inspection

7.2.1 The delivery inspection shall be made for each purification unit. The inspection items and methods shall be performed in accordance with the requirements listed in Table 4.

7.2.2 Judgement rule: When the delivery inspection items of the product comply with all the requirements, it shall be judged as qualified product. When the inspection items can't meet the requirements, the repair is allowed. However, when the product still can't comply with all the requirements, the product shall be judged as unqualified product.

Table 4 Inspection items

NO.	Items	Delivery inspection	Type inspection	Requirements	Testing methods	
1	Appearance	√	√	5.2	6.1	
2	materials	√	√	5.3	6.2	
3	Manufacturing quality	Dimensional deviation	√	√	5.4.1	6.3.1
4		Strength and sealing	√	√	5.4.2	6.3.2
5		Corrosion prevention	√	√	5.4.3	6.3.3
6		Filler	√	√	5.4.4	6.3.4

7		Inspection cover	√	√	5.4.5	6.3.5
8		Air supply equipment	--	√	5.4.6	6.3.6
9		Electric control cabinet	--	√	5.4.7	6.3.7
10		Gateway	--	√	5.4.8	6.3.8
11		Management platform	--	√	5.4.9	6.3.9
12		Performance	--	√	5.5	6.4
13		Safety	--	√	5.6	6.5
14		Other inspection	--	√	5.7	6.6

Note: The items in the table marked with “√” indicate to be inspected in delivery inspection and type inspection.

7.3 Type inspection

Type inspection shall be carried out under any of the following conditions:

- a) Trail-manufacture new products, modification of existing products, trail-manufacture and finalizing the design and identification of the products produced in the transferred factory.
- b) The products' performance is affected by the changes of product structure, producing process and main raw materials.
- c) Resuming production after a long shutdown.
- d) The normally mass-produced products shall be inspected every four years.
- e) The big difference is existed between the results of the delivery inspection and that of last type inspection.
- f) The type inspection is proposed by the market supervision and administration departments.

7.3.1 The test items and test methods of type inspection shall comply with the requirements in Table 4.

8 Marking, Packaging, Transport and Storage

8.1 Marking

8.1.1 The nameplate shall be fixed on the obvious and flat position of each unit and in accordance with the requirements in GB/T 13306. The nameplates shall be marked with at least the following contents:

- a) unit's name and model
- b) product's serial number
- c) basic technical parameters
- d) manufacturer's name

8.1.2 The signs of the prevention of electric shock and ground connection shall be set up on the electrical equipment of the purification unit.

8.2 Packaging

8.2.1 When packaged, it shall be clean and tidy. And the joints, pipe orifices and flanges shall be sealed.

8.2.2 All the instruments shall be protected before packaging.

8.2.3 The packaging shall be suitable for long distance transportation and in accordance with the requirements given in GB/T 13384.

8.3 Transport

During transportation, the damage owing to crushing is strictly prohibited. The integrity of unit shall be guaranteed. And the corrosive chemicals shall not be transported simultaneously.

8.4 Storage

8.4.1 The warehouse shall be clean, dry and with sufficient fire protection measures.

8.4.2 When the ambient temperature is lower than 4 °C, the warehouse shall be equipped with heat preservation measures.

8.4.3 The electrical part and instrument shall be dustproof, waterproof and dampproof.