Study on performance test methods and test rules of small complete set of domestic sewage treatment plant

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Abstract: This paper describes the test methods and corresponding test rules for the appearance, function, manufacturing, strength and tightness, safety, environmental protection, reliability, economy and generality of the small domestic sewage treatment plant, it can provide technical support for the quality improvement of small domestic sewage treatment plants in China.

1. Introduction
The treatment of rural domestic sewage is an important part of beautiful countryside construction and the improvement of rural living environment in China, which is directly related to the realization of the grand goal of China's ecological civilization construction and rural revitalization strategy. With the increase investment of state and local governments at all levels on rural sewage treatment facilities, small complete set of domestic sewage treatment plants with a variety of different treatment process, technical parameters and external dimensions have been widely popularized and applied and the level of standardization, serialization, integration and automation level has also been continuously promoted.

For corresponding technical standards, China is stepping up efforts to formulate standards for the treatment and discharge of rural domestic sewage, and for equipment product standards, performance testing method standards, and facilities operating effect evaluation standards of Rural sewage treatment plant are also in intensive development, the field of rural domestic sewage treatment of technical standards system is being established and will continue to refine. In 2020, China established the national standard for small complete set of domestic sewage treatment plant, in standard "small complete set of domestic sewage treatment plant" refers to "the combination process of biochemical method, biochemical method and physicochemical method, follow development and design principle of integration, modularity, and automation for the sewage purification treatment, and meet water quality standards of complete sets of equipment, mainly including bioreactor, process equipment, electrical control equipment, instrumentation and other major parts and pipes, cables, etc." Based on this definition, technical standard for small complete set of domestic sewage treatment plant is applicable to a single set of rated daily treatment volume not exceeding 1000m³/d and domestic sewage as raw water. The complete set of sewage treatment plant with raw water quality similar to domestic sewage can be implemented by reference.

The national standard of "small complete set of domestic sewage treatment plant" stipulates several technical requirements of small complete set of domestic sewage treatment plant, including appearance,
function, manufacturing, strength and tightness, safety, environmental protection, reliability, economic and versatility requirements. According to each technical requirement, it is very necessary to study and determine its test and inspection method for the effective implementation of the national standard "small complete sets of domestic sewage treatment plant".

2. Performance test methods of small complete set of domestic sewage treatment plant

2.1. Appearance inspection
The national standard "small complete sets of domestic sewage treatment plant" specifies the requirements of the shell surface, various protection, decorative coating, installation position of each appendage (parts), as well as pipeline layout and installation for small complete sets of domestic sewage treatment plant. In view of these requirements, we use visual inspection method to carry out appearance inspection on small complete sets of domestic sewage treatment plant. The specific inspection items include but not limited to the following aspects:

(1) Visual inspection to check the structure appearance is reasonable or not, the connection of each component should meet the design requirements.
(2) Visual test whether the coating is uniform, it should be free of wrinkles, adhesion particles, impurities and obvious brush marks and other defects.
(3) The specifications, quantity and installation position of each process equipment and valve inside of the complete set of equipment shall meet the design requirements.
(4) The electrical control cabinet shall be fixed and reliable, the paint layer shall be good and clean, the electrical components in the cabinet shall be complete and intact, all circuits should have correct installation position, firm fixation, and clear and well-marked, and conform to design requirements.
(5) The specification, quantity and installation position of each instrument in the complete plant shall meet the design requirements.
(6) Power cables and signal cables should be laid separately. All cables should meet the design requirements in specifications and layout, and be neatly arranged without mechanical damage.
(7) All marks shall be complete, correct and clear.
(8) Use a level instrument to measure the bioreactor, equipment room (box), main process equipment and process pipeline, and the horizontal and vertical directions should meet the design requirements.

2.2. Functional test
The national standard of "small complete set of domestic sewage treatment plant" covers the requirements of treatment effect, treatment capacity, aeration power, electrical function and automatic control function requirements of small complete sets of domestic sewage treatment plant. The test methods for these functional requirements are described below.

2.2.1. Inspection of treatment effect
(1) we should ensure that small set of sewage treatment plant in water day cumulative flow is between 70% of the nominal and max daily inflow, the instantaneous inflow is between 70% of the rated water quantity and the maximum water quantity, the concentration of organic matter, nitrogen, phosphorus and other major pollutants in the inflow is 60% ~ 100% of the limit of raw water quality, and, the operation test is carried out on the small complete set of domestic sewage treatment plant with the inflow temperature 10°C ~ 25°C to verify its treatment effect.
(2) The duration of the operation test shall not be less than 2 months (excluding the time of process commissioning).
(3) During the operation test, according to the regulation in HJ 91.1 "sewage monitoring technology standard", manual monitor water quality and water quality for small sets of actual water sewage treatment plant, water samples are got by manual or automatic sampling. If sampling is done manually, it is advisable to use equal time mixed water samples with sampling frequency at least once every 2h. and take 24h mixed samples, then calculate according to the daily mean value. The time interval and quantity of water quality sampling can be performed by referring to Table 1. The analysis method of
each control project shall be implemented in accordance with the provisions of GB/T 31962 "Water Quality Standard for Sewage Discharge into Urban Sewer" and GB 18918 "Pollutant Discharge Standard for Urban Sewage Treatment Plant". All the control projects are qualified if the compliance rate reaches 90% or above.

(4) The water source online monitoring system including automatic water quality sampler, automatic chemical oxygen demand (CODCr) water quality analyzer, automatic ammonia nitrogen (NH3-N) water quality analyzer, automatic total phosphorus (TP) water quality analyzer, and automatic total nitrogen (TN) water quality analyzer should be adopted to automatically monitor the effluent water quality of the complete set of plant.

(5) The operation test should be carried out to test the treatment effect under special influent conditions such as water quantity and water quality impact load, low temperature and low C/N ratio.

Table 1 Water quality sampling time interval and sampling quantity requirements in operation test

| No. | Control project               | Maximum sampling interval | Minimum number of samples | Compliance rate requirements |
|-----|------------------------------|----------------------------|---------------------------|-----------------------------|
| 1   | pH                           | 24h 24h                    | 60qty 60qty               | ≥90%                        |
| 2   | Chroma                       | 24h 24h                    | 60 qty 60qty              | ≥90%                        |
| 3   | Suspended solids (SS)        | 24h 24h                    | 60 qty 60qty              | ≥90%                        |
| 4   | Chemical oxygen demand (COD) | 24h 24h                    | 60 qty 60qty              | ≥90%                        |
| 5   | 5 days Biochemical oxygen demand (BODs) | 3d 3d | 20 qty 20qty | ≥90% |
| 6   | Ammonia nitrogen             | 24h 24h                    | 60 qty 60qty              | ≥90%                        |
| 7   | Total nitrogen (TN)          | 24h 24h                    | 60 qty 60qty              | ≥90%                        |
| 8   | Total phosphorus (TP)        | 24h 24h                    | 60qty 60qty               | ≥90%                        |
| 9   | Anionic surfactants          | 7d 7d                      | 8qty 8qty                 | ≥90%                        |
| 10  | Animal and plant oil         | 7d 7d                      | 8qty 8qty                 | ≥90%                        |
| 11  | Petroleum                    | 7d 7d                      | 8qty 8qty                 | ≥90%                        |
| 12  | Number of fecal coliforms    | 7d 7d                      | 8qty 8qty                 | ≥90%                        |

Note 1: During the test period, the daily water volume shall not be less than 80% in the range of 80% ~ 100% of the rated daily treated water volume;

Note 2: During the test period, the concentration of organic matter, nitrogen, phosphorus and other major pollutants in the influent during the test shall not be less than 80% if the concentration is 80% ~ 100% of the limit value of raw water quality.

2.2.2 Treatment capacity measurement. (1) During the operation test, if the small set of domestic sewage treatment equipment water quality is in line with the treatment effect of the premise, use meter with precision level of not less than 2.5 to measure instantaneous outflow of complete sets of plants, (unit: m3/h), and daily handling water volume (unit: m3 / d), keep the measure duration and operation test the same duration, it is qualified to reach 95% or more of the rated treat water volume and daily volume, respectively.
(2) If the automatic sewage flowmeter has been installed in the small complete set of domestic sewage treatment plant, and has passed the verification or acceptance of the metering department, the flow value of the flowmeter can be used. If the automatic sewage flowmeter is not installed in the small complete set of domestic sewage treatment plant, the flowmeter should be installed on the outlet pipe of the small complete set of domestic sewage treatment plant, and the installation method should meet the requirements of the flowmeter for measurement accuracy and precision.

2.2.3. Aeration functional test. For small complete set of domestic sewage treatment plant, proceed water test, start the gas supply equipment, do aeration per the internal need of aeration device in main body, test level shall ensure aerator or air diffusion device submerged depth of not less than 30 cm, test duration shall be not less than 20 min, check each part aeration condition, the aeration amount of each part reaches the design value and the aeration is uniform.

2.2.4. Electrical function test. Open the power of the electric control cabinet of small complete sets of domestic sewage treatment plant for operation test. The button, indicator light and other electrical components can operate, move and display correctly, and all electrical equipment and instruments can work normally as qualified.

2.2.5. Automatic control functional testing. During the clean water test, process debugging or operation test, test whether the small complete set of domestic sewage treatment plant can operate unattended under the program control state, and whether the feedback instructions and actions can be correctly executed.

2.3. Manufacturing quality inspection

2.3.1. Material inspection. For the small complete set of domestic sewage treatment plant made of carbon steel or stainless steel, proceed sampling, or obtaining device main body with sample materials. Inspect the material chemical composition in accordance with methods in GB/T 700 "carbon structural steel", GB/T 1591 "high strength low alloy structural steel, GB/T 4171" weather resistance structural steel" or GB/T 20878 stainless steel and heat resistant steel-grades and chemical composition", it’s qualified if the inspection result meet material and design requirements.

2.3.2. Corrosion resistance test. For the small complete set of domestic sewage treatment plant construction made of carbon steel and the anticorrosive coatings for surface treatment, follow provisions of GB/T 37361 "the act of film thickness-measurement of ultrasonic thickness gauge", GB/T 9286 “Paints and varnishes- film cross test” to the detect the film thickness and film adhesion, comply with the design requirements for qualified. For the small complete set of domestic sewage treatment plant whose main body is made of carbon steel in whole or part of structure and whose surface is treated by FRP, the high voltage test shall be conducted in accordance with the provisions of GB/T 7991.6 "Test Method for Glass Lined Lying Part 6: High Voltage Test", and the test shall be qualified if it meets the design requirements.

2.3.3. Dimensional inspection. (1) For linear dimension, use vernier caliper with 1mm precision; The wall thickness was measured with a vernier caliper or micrometer with an accuracy of 0.02mm, straightness can be measured with straight ruler, graduated steel ruler, etc., such as scale ruler measurements are available, and the flatness can be measured in multiple directions on the measured surface with a knife edge ruler and a feeler gauge. The parallelism can be measured with a flat plate, a measuring frame with a dial gauge or a level ruler, or a high-precision laser measuring system can also be used.

(2) The linear size in each direction should be measured at least 3 times, three different measurement points should be selected on the surface of different thickness of the device body for the wall thickness,
and at least three measured positions should be selected on the device body for the straightness, flatness and parallelism, and the maximum value of all above should be taken as the approximate value of error.

(3) when do full water test for the main body made of the plastic, the effective volume is measured in accordance with the method specified in CJ/T 489 "Plastic septic tank".

(4) Measure the plane position, elevation, elevation difference, levelness and verticality of water pump, aeration equipment, mixing equipment and other process equipment as well as pipeline.

2.4. Strength and tightness test

2.4.1. Load test of the main body of the plant. After the main body of the outdoor buried small complete set of domestic sewage treatment plant is completed, proceed the load test according to the method stipulated in CJ/T 489 "Plastic Septic Tank", and it is qualified that there is no crack or crack after the pressure disappears.

2.4.2. Impact resistance test of the main body of the device.
(1) After the main body of the small complete set of domestic sewage treatment plant made of FRP structure material is completed, the impact strength test is conducted according to the method specified in CJ/T 409 Technical Requirements for FRP Septic Tanks, and the impact surface of the steel ball without crack is qualified.

(2) After the main body of the small complete set of domestic sewage treatment plant with plastic structure material is completed, the impact performance test shall be conducted according to the method specified in CJ/T 489 "Plastic Septic Tank", and the surface of the impact of the drop weight shall be qualified if there is no rupture or damage.

2.4.3. Full water test or hydraulic test of the main body of the plant.
(1) After the main body of the small complete set of domestic sewage treatment plant is completed, the inlet and outlet are closed. For the non-closed water tank (pitcher), the water is injected into the tank (pitcher) to the height of the overflow nozzle, and the water level is maintained for 24h. If the whole tank (pitcher) body doesn’t have deformation, seepage or leakage, it is qualified; For closed water tank (pitcher), the test pressure last 10min, if pressure does not drop, and without penetration and leakage, it’s qualified. The test pressure should meet the design requirements.

(2) For the main body of the small complete set of domestic sewage treatment plant with internal baffle, we should proceed water test or hydraulic test on both sides of each baffle respectively, and both sides are qualified for no deformation or pressure drop, no penetration and no leakage.

2.4.4. Hydro test or water filling test for water and drug piping system.
(1) For pressure pipeline (including valves and other accessories) mediums in small complete sets of domestic sewage treatment plant are water or pharmaceutical, hydraulic test should be done. The test pressure is 1.5 times of the working pressure, but not less than 0.6Mpa. The metal and composite pipe piping system is observed under the test pressure for 10min. The pressure drop should not be greater than 0.02Mpa, and then the pressure is reduced to the working pressure for inspection and there should be no penetration and no leakage. The pressure of the plastic pipe piping system shall be stabilized for 1h under the test pressure, and the pressure drop shall not exceed 0.05Mpa. Then the pressure shall be stabilized for 2h under the condition of 1.15 times of the working pressure, and the pressure drop shall not exceed 0.03Mpa. The joints of the system shall be checked without leakage and abnormal deformation.

(2) Non-pressure pipes (including valves and other accessories) with water as the internal medium of small complete sets of domestic sewage treatment plants should do irrigation tested. The irrigation height should not be lower than the corresponding submerged water depth of the pipes at the highest liquid level of the complete sets of plants. If the pipes and interfaces have no leakage for 1h, it is qualified.
2.4.5. Air pressure test of gas piping system. The test pressure should be 1.15 times of the design pressure, and the pressure should be gradually and slowly increased during the test. When the pressure rises to 50% of the test pressure, if no abnormality or leakage is found, continue increasing pressure by 10% of the test pressure step by step, and the pressure should be stabilized for 3 min at each stage until the test pressure. The pressure should be stabilized for 10 min under the test pressure, and then the pressure should be reduced to the design pressure. The pressure stop time should be determined according to the needs of leak detection work. To the foaming agent inspection does not leak for qualified.

2.5. Electrical safety test

2.5.1. Enclosure protection level test. The protection level of electrical control cabinet is verified according to the method specified in GB/T 4208 "Degrees of protection provided by enclosure (IP Code)".

2.5.2. Insulation resistance test. Use 500 V 00 MΩ or larger megohmmeter for measurement, during measurement, ensure that electrical cabinet shell and motor shell connected with reliable grounding device, primary circuit of the components should be in the off state, the environment temperature is 5 °C to 40 °C, relative humidity should not be higher than 80%, the insulation resistance of measuring part that satisfy the requirements of table 2 is qualified.

| No. | Measuring locations                                                                 | Insulation resistance requirement |
|-----|-------------------------------------------------------------------------------------|-----------------------------------|
| 1   | The main power \(^a\) circuit breaker is interphase, each phase line of the total power supply, grounding bus, and the motor winding and the motor shell | ≥0.5                              |
| 2   | Secondary circuit \(^b\) and grounding bus                                           | ≥1                                |

\(^a\) Refers to the total power supply of the electrical control cabinet;
\(^b\) Primary circuit’s monitoring, regulation, protection circuit function and the corresponding components.

2.5.3. Dielectric performance test. After the insulation resistance test is completed, the dielectric performance test of the electrical control cabinet shall be carried out according to the method specified in GB 7251.1 "Low voltage switchgear and control equipment -- Part 1: General Rules", and the test shall be deemed qualified if it meets the requirements in GB 7251.1.

2.5.4. Protection circuit validity test

(1) According to the method specified in GB 7251.1 "Low Voltage Switchgear and Control Equipment -- Part 1: General Rules", the electrical control cabinet shall be tested for the effectiveness of the protection circuit using a resistance measuring instrument that is capable of at least 10 A AC or DC current output. This current is passed between each exposed conductive part and the terminals of the external protective conductor of the main power supply inlet line. Resistance that is not more than 0.1 Ω is qualified.

(2) The resistance measuring instrument is used to measure the resistance between the shell of other electrical components and the grounding bus of the electrical control cabinet. Resistance to no more than 4 Ω qualified.

2.6. Pollution monitoring

2.6.1. Air pollutant monitoring

During the operation test, when the small complete set of domestic sewage treatment plant is in normal operation, the concentration of air pollutants discharged by the complete set of domestic sewage treatment plant shall be measured in accordance with the provisions of GB 18918 "Pollutant Discharge..."
Standard for Urban Sewage Treatment Plant". The monitoring times shall be at least 3 times, and all the monitoring results shall be qualified in accordance with the provisions of Table 3.

Table 3 Maximum permissible concentration of air pollutant emission

| Pollutant item | Unit: g/m³ |
|----------------|------------|
| ammonia        | ≤1.5       |
| Hydrogen sulfide| ≤0.06     |
| Ozone concentration | ≤20        |
| methane (maximum volume concentration %) | ≤1 |

2.6.2. Noise monitoring
During the operation test, when a small set of sewage treatment plant during normal operation, we should proceed noise sound pressure level measurement of complete sets of equipment according to the provisions of GB 12348 "standard of environmental noise at boundary of industrial enterprises discharge", and minimum monitor times is three, all the monitoring results shall be respectively in accordance with national standard “Small complete set of domestic sewage treatment plant” in different processing capabilities and achieve the noise sound pressure level of demand that is deemed to be qualified.

2.7. Reliability test
During the operation test of small complete set of domestic sewage treatment plant, do overall outage record and statistics, and calculate the mean time between failures (MTBF), if the result is in line with the mean time between failures (MTBF) in the national standard “Small complete set of domestic sewage treatment plant” that is not be less than 1000 hours, it’s qualified.

2.8. Determination of energy consumption and sludge consumption

2.8.1. Measurement of electricity consumption per unit sewage. During the operation test, proceed records and statistics of daily consumption and water processing for small complete set of domestic sewage treatment plant, thus calculate the unit water consumption, in the national standard “Small complete set of domestic sewage treatment plant”, the power consumption per unit sewage in the normal operation is not larger than 120% of the upper limit provided by the manufacturer as qualified.

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\text{Power consumption per unit sewage (kW·h/m³) = cumulative power consumption of the complete set during the operation test (kW·h) ÷ cumulative water treatment of the complete set during the operation test (m³)}
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2.8.2. Determination of drug consumption per unit sewage. During the operation test, proceed records and statistics of daily drug consumption and water processing for small complete set of domestic sewage treatment plant, thus calculate drug consumption per unit of sewage, in the national standard “Small complete set of domestic sewage treatment plant”, the drug consumption (including dephosphorization agent, carbon source, disinfectant, functional bacteria, membrane cleaning agent and other agents) per unit sewage in the normal operation is not larger than 120% of the upper limit provided by the manufacturer as qualified.

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\text{Drug consumption per unit sewage (kg/m³) = cumulative drug consumption of the complete set during the operation test (kg) ÷ cumulative water treatment of the complete set during the operation test (m³)}
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2.8.3. Determination of sludge production per unit sewage. During the operation test, proceed records and statistics of daily amount of sludge production and water processing for small complete set of domestic sewage treatment plant, thus calculate drug consumption per unit of sludge production, in the national standard “Small complete set of domestic sewage treatment plant”, the sludge production (including residual sludge, chemical sludge etc. all sludge) per unit sewage in the normal operation is not larger than 120% of the upper limit provided by the manufacturer as qualified.
Unit sewage sludge production (kg/m$^3$) = cumulative sludge production (kg) of the complete set during the operation test ÷ cumulative water treatment (m$^3$) of the complete set during the operation test.

3. Inspection rules for small complete sets of domestic sewage treatment plant

The inspection of small complete sets of domestic sewage treatment plant is divided into factory inspection and type inspection.

3.1. The factory inspection

Each small complete set of domestic sewage treatment plant shall be inspected. The inspection items include: appearance, water quality, processing power, aeration function, electrical, automatic control functions, chemical analysis, corrosion performance, size, load test, impact test, the device main body full water test and hydro test, water and drug piping system hydro test or irrigation test, air pressure test of gas piping system, ingress protection level, insulation resistance, dielectric properties, circuit protection effectiveness test, atmospheric pollutants and noise, mean time between failures, Unit sewage power consumption, unit sewage drug consumption, unit sewage sludge production etc., and its test method shall be in line with the provisions of 2.1-2.8. The specific determination rules are as follows: if there is any unqualified item, the unqualified item shall be re-inspected; if it is still unqualified, it shall be judged as unqualified product.

3.2. Type inspection

Type inspection of small complete sets of domestic sewage treatment plants should be carried out under the following circumstances:

(1) Product finalization and identification;
(2) The performance of the product is affected by the change of sewage treatment process, key design parameters, internal structure or major components;
(3) For normal production, carry out every four years;
(4) When production is stopped for more than three years and production is resumed;
(5) There is a big difference between the factory inspection result and the last type inspection result;
(6) When the national quality supervision agency puts forward the requirement for inspection.

Type inspection is proceeded on one or two random samples taken from the factory inspection qualified complete sets of equipment, inspection items include: appearance, aeration function, electrical function, anti-corrosive performance, size, or the device main body full water test and hydro test, water and drug piping system hydro test or irrigation test, air pressure test of gas piping system, insulation resistance, validity test of protection circuit, etc. The test method shall be implemented in accordance with the corresponding provisions of 2.1-2.5. The specific determination rules are: if the water quality test is not qualified, it is judged as unqualified products. If any one of the other inspection items fails, double sampling should be taken to re-check all the inspection items. If still fails, it will be judged as unqualified product.

4. Conclusion

(1) In recent years, the improvement of quality and efficiency of sewage treatment has become an important demand for the development of urban sewage treatment industry. The transformation from the initial upgrading and transformation of sewage treatment plants to the whole-system improvement of quality and efficiency of pipe network, pumping station and plant station has been conducted. Small complete set of domestic sewage treatment plant performance test methods stipulated requirements in the technical standards “small complete set of domestic sewage treatment plant”, including appearance, function, manufacture, strength and tightness, security, environmental protection, reliability, economy and versatility requirements, clear specifies its various performance test method, enhances the small set of sewage treatment plant, technologies, processes, coordination and operability of standards.

(2) In January 2021, the National Development and Reform Commission, the Ministry of Science and Technology, the Ministry of Industry and Information Technology and other ten departments jointly
issued the “Guiding Opinions on the Promotion of Wastewater Resource Utilization”, which made arrangements for the comprehensive promotion of wastewater resource utilization. The overall goal is proposed: by 2025, the national sewage collection efficiency will be significantly improved, the sewage treatment capacity of counties and cities will basically meet the needs of local economic and social development, and the sewage treatment in sensitive areas will basically be upgraded. The research on performance testing methods of small sets of domestic sewage treatment plants can provide technical support for the overall planning and coordinated promotion of the construction of sewage treatment facilities and recycled water utilization facilities, and make positive contributions to the improvement of the level of sewage resource utilization.

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References
[1] HJ 91.1 Technical Code for sewage monitoring
[2] GB/T 31962 Wastewater quality standards for discharge to municipal sewers
[3] GB 18918 Discharge standard of pollutants for municipal waste-water treatment plant
[4] GB/T 700 Carbon structural steels
[5] GB/T 1591 High strength low alloy structural steels
[6] GB/T 4171 Atmospheric corrosion resisting structural steel
[7] GB/T 20878 Stainless and heat-resisting steels - Designation and chemical composition
[8] GB/T 37361 Determination of the film thickness—Ultrasonic thickness gauge method
[9] GB/T 9286 Paints and varnishes--Cross cut test for films
[10] GB/T 7991.6 Test method of vitreous and porcelain enamels—Part 6 High voltage test
[11] CJ/T 489 Plastic Septic tank
[12] CJ/T 409 Technical requirements for glass reinforced plastic septic tanks
[13] GB/T 4208 Degrees of protection provide by enclosure (IP code)
[14] GB 7251.1 Low-voltage switchgear and controlgear assemblies Part 1: Guidelines
[15] GB 12348 Emission standard for industrial enterprises noise at boundary