Technical Guidelines for Food Waste Recycling Projects in Housing Estates

Environmental Protection Department
Hong Kong SAR Government
AND
Hong Kong Productivity Council

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Technical Guidelines for Food Waste Recycling Projects

in Housing Estates

1. Introduction

Domestic food waste makes up a significant proportion of municipal solid waste. According to the report “Monitoring of Solid Waste in Hong Kong – Waste Statistics for 2011” published by Environmental Protection Department (EPD), around 9,000 tonnes of municipal solid waste is disposed of at landfills every day and domestic food waste takes up more than 2,500 tonnes, which is more than 28%.

As the amount of municipal solid waste has been increasing with the economic development over the past decades, we must adopt a more sustainable waste management strategy and hierarchy (Figure 1). The effective way is to reduce the waste from the source.

Figure 1.1 Waste Management Strategy and Hierarchy

The Waste Hierarchy

1 The EU’s Waste Framework Directive of 1975 introduced the term waste hierarchy as European waste policy. In 1989, it was formalised into a hierarchy of management options in the European Commission’s Community Strategy for Waste Management and further endorsed in the Commission’s review of this strategy in 1996.
Therefore, the most effective strategy for food waste management is avoidance and minimization of food waste. The next priority is to collect the inevitable food waste separately and recycle them into useful resources.

In view of this, the Environment and Conservation Fund (ECF) has launched a funding scheme known as “Food Waste Recycling Projects in Housing Estates” in July 2011, to encourage the source separation, collection and recycling of food waste from households.

ECF will provide funds to support housing estates for setting up on-site food waste treatment facilities, i.e. composters, and implement food waste collection and recovery programmes and related engagement activities. This funding scheme encourages the collaboration of housing estates and non-governmental organizations to organize education and promotional activities, so as to raise the awareness of food waste reduction and motivate them to actively participate in food waste recycling.

EPD has also commissioned the Hong Kong Productivity Council (HKPC), a professional and independent environmental consultant, to operate a help-desk service for the potential housing estate applicants and those government departments who participate in on-site food waste separation, collection and recycling pilot programme. The help-desk services include:

- Assisting in identification of a suitable site for installing the food waste treatment facility within the housing estate prior to formal application;
- Providing professional and technical advices to potential applicants or government departments who participate in on-site food waste separation, collection and recycling pilot programme during planning and implementation stages; and
- Conducting evaluation of performance, effectiveness and outcomes of the food waste recycling projects.

Hence, this Technical Guideline is jointly prepared by EPD and HKPC for the following parties:

- Housing Estates or Government Departments who intend to participate in the aforesaid project for their advanced preparation;
- Suppliers who are interested in supplying the food waste composting machines such that they can have better understanding to the requirement of food waste recycling in the scheme; and
- Anyone who is interested in conducting on-site recycling of source separated food waste for their reference.
For further enquiries to this Technical Guideline, please contact:
“Help-desk Service - Food Waste Recycling Projects in Housing Estates”
Tel: 2788 5598
Fax: 2788 5608
E-mail: hd-fwrs@hkpc.org
2. **Source Separation and Collection of Food Waste**

1. **Source of Food Waste**
   Food waste refers to all food that being discarded before, during and after its processing. All organic wastes produced in daily life including: (1) leftover food, such as rice, meat, vegetable, etc.; (2) uncooked food, such as meat and vegetables, etc.; (3) unwanted food, such as withered vegetables, peels of fruits, etc.; and (4) expired food, such as bread, biscuits, etc. are named as “food waste”.

   Residents should strive for avoiding and minimizing the generation of food waste first. Then, the inevitable food waste can be collected separately and be recycled into useful resources.

2. **Nature of Food Waste**
   Food waste contains a large proportion of organic matters, including carbohydrates, lipids, proteins, cellulose and hemicellulose. Among these components, carbohydrates, lipids and proteins take less time for decomposition, while cellulose and hemicellulose take longer time for decomposition. Food waste generally contains more than 85% of water. It easily decays, generates odour and attracts pests and it is the primary source of odour in domestic waste. It smells easily and causes nuisance even being kept in household for a short period of time. Therefore, food waste should be transferred to collection point every day to maintain household hygiene.

3. **Source Separation of Food Waste**
   Source separation of food waste is very important for the recycling of food waste. Improper source separation will affect the quality of compost or damage the food waste composting machine. The following table (Table 2.1) lists out some recyclable and non-recyclable food wastes. As the food waste composting machines have certain requirements on size of food waste granules, the food waste granules should be generally smaller than 50 mm. Therefore, residents should not put food waste that is larger than 50 mm (such as bones of pig, cow, chicken and duck) to the food waste container. These large food wastes can be crushed by bone crusher into smaller pieces or disposed of as usual household waste.
### Table 2.1: Recyclable and Non-recyclable Food Waste

<table>
<thead>
<tr>
<th>✓ Recyclable</th>
<th>× Non-recyclable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits: Fruits, fruit peels</td>
<td>Liquid: such as soup and juice</td>
</tr>
<tr>
<td>Vegetables: Vegetable leaves, roots and seeds, and peels of melon</td>
<td>Wood/ bamboo: Wooden chopsticks, toothpicks</td>
</tr>
<tr>
<td>Grains: Rice and other grain products</td>
<td>Cardboards: Paper packagings</td>
</tr>
<tr>
<td>Noodles: Noodles, bread and other wheat products</td>
<td>Metal Products</td>
</tr>
<tr>
<td>Beans: All kind of beans</td>
<td>Glass products</td>
</tr>
<tr>
<td>Meats: Raw or Cooked chicken, duck, fish and meats etc.</td>
<td>Plastic products: such as plastic bags, plastic table cloths and nylon ropes</td>
</tr>
<tr>
<td>Gardening: Floral, leaves and herbs</td>
<td>Household chemicals: such as detergents and insecticides</td>
</tr>
<tr>
<td>Residues: Residues of cane, tea leaves, Chinese medicines and coffee residual</td>
<td>Bones²</td>
</tr>
<tr>
<td>Snack: Biscuits</td>
<td>Seed of fruits: Seeds of mangoes and durians, etc.</td>
</tr>
<tr>
<td>Shells: Egg shells, shrimp shells, etc.</td>
<td>Hard shell: Conches, shell of crabs, etc.</td>
</tr>
<tr>
<td></td>
<td>Dense fibre: Peels and core of corns, dried leaves for grabbing dumplings</td>
</tr>
<tr>
<td></td>
<td>Others: Absorbent pads</td>
</tr>
</tbody>
</table>

² Bones of pig, cow, chicken and duck could not be recycled

4. Methods for Food Waste Collection

Participating housing estates should adopt a customized food waste collection plan according to their respective conditions and environment:

Method 1 - Individual household collection

Residents can use sealable food storage container (about 3-5 litres)³ for food waste collection. It should be labelled as a "Food Waste Container", with a label indicating...
the types of recyclables and non-recyclables, and the address\(^4\) of the participating household (Figure 2.1). Residents should only put “Recyclable Food Waste” into the container, and hand in to the designated collection point in the housing estate at designated time. Collection point is usually designated at the reception area/lobby of each building. If the “Food Waste Container” cannot be dropped off that day, it should be temporarily stored in the refrigerator to avoid odour generation. Residents should hand in the food waste as soon as possible following the collection timeslot.

![Image of a food waste container labeled as “Food Waste Container”]

The housing estate should inform participating residents the daily collection time and collection point(s). Residents should bring the filled food waste container to the collection point within the collection time and let the staff of the housing estate handle the container and food waste. Housing estate may provide clean/washed food waste container to exchange with the residents, and then weigh the food waste and record its weight\(^5\). In order to keep the delivery route clean, all food waste containers should be put into a large plastic container (around 50 litres) for transporting to the treatment facility. The containers could be washed and dried after the food waste is put into the composter for recycling.

\(^1\)Housing estates may provide the food waste container. Please check with the housing estates for details.

\(^2\)Address is needed for statistical analysis of food waste generation per household.

\(^3\)This step could be done in reception/lobby of each building or in centralized collection point.
Points to be noted when collecting food waste at home:

- Do not put “Non-recyclable food waste” into the container.
  Do source separation properly;

- Drain out liquid as much as possible until no liquid can be seen at the bottom of the container (Figure 2.2 is an improper case);

- For packaged food, remove packaging of expired food (e.g. expired bread from supermarket) before putting them into the container.

Figure 2.2  Food waste with excess liquid accumulated at the bottom

The whole food waste collection and recycling process is summarized as below:

Source Separation and Collection of Food Waste from Household  Centralized Collection Point in Housing Estate  Food Waste Composting

Method 2 – Centralized collection

Procedures of centralized collection are generally similar to the individual household collection method, except only one designated collection point would be arranged in centralized collection. Residents have to hand in the collected food waste to the single collection point for weighing and recording by an operator instantly (Figure 2.3). The food waste will then be put into food waste collection bin for further processing. Housing estates can either return a cleaned or used food waste container to the resident.

Figure 2.3  Operator is weighing the food waste and recording its weight during collection

The following should be noted by the housing estate during collection of food waste:

- Operators should remove the non-recyclables from the collected food waste, and
drain the excessive liquid from food waste as much as possible.

> 120 litres waste collection bin (Figure 2.4) can be used for centralized food waste collection. For health and safety reason, collectors should avoid overfilling the food waste collection bin. When the food waste collection bin is about half way full, it should be transferred to the treatment facility for treatment.

> The centralized collection point should be located at ventilated and shaded area to avoid direct sunlight which may increase the temperature and induce fermentation that generates odour in the food waste collection bin. Housing estate can set up a dedicated storage area in garbage room for temporary storage of food waste which will be sent to composting machine.

> The food waste collection bin should be equipped with wheels to cater for easy transport.

> The food waste collection bin should also be labelled for identification.

> The housing estate should clean the centralized collection point regularly to maintain environmental hygiene and avoid animals and pests.

> The housing estate should transfer the food waste from the centralized collection point to the on-site treatment facility every day. Leaving food waste overnight may possibly create hygiene problem.
Technical Guidelines for Food Waste Recycling Projects in Housing Estates (January 2016)

- Container volume can be about 120 litres
- Should have a cover for preventing odour leakage
- Better with wheels for easy transportation
- Screen should be in place at the bottom to sieve excessive liquid
- Should be labelled as “Food Waste Container”
- Should be equipped with a stop valve at the bottom of the container to drain away excessive liquid

Figure 2.4 Food Waste Container
5. Frequently asked questions about Food Waste Collection

Based on the past experience of food waste collection from the participating housing estates, the following problems often occur at the beginning of food waste collection:

- Use of plastic bags to contain collected food waste (see figure 2.5, 2.6);
- Collection container contains large amount of liquid (see figure 2.7, 2.8);
- Large fruit peels and shells (see figure 2.9, 2.10);
- Large bone type of food waste (see figure 2.11); and
- Large quantity of fruit and high-fiber food waste (see figure 2.12).
For the above cases, housing estates will need to sort out the non-recyclable food waste from the recyclable food waste so as not to affect the operation of food waste composter. Therefore, before the start of the food waste collection, housing estates should hire green groups or other organizations to conduct educational activities to introduce the recyclable and non-recyclable types of food waste.

3. **Principle of Food Waste Composting**

1. **Principal of Composting**

Composting is a process that organic matters are converted to humus matters, which are beneficial to plants. It makes use of fermentation and microbial bio-degradation under
controlled conditions.

Modern composting technology basically employs aerobic composting due to more thorough decomposition, shorter operating cycle and less odour generated. Therefore, aerobic composting is adopted for most on-site food waste processing facilities in Hong Kong.

Composting can be divided into four stages, which are: mesophilic stage, thermophilic stage, cooling stage and curing stage.

First Stage: Mesophilic Stage
Fungi and bacteria start to decompose organic matters while heat is generated in the process and temperature of the compost is raised. They grow and reproduce by the nutrients released from the process and multiply significantly. When temperature exceeds 40°C, the thermophilic stage starts.

Second Stage: Thermophilic Stage
The compost temperature will keep on increasing. The high temperature will inhibit activity of fungi, and the decomposition process is taken over by thermophilic actinomycetes. At this stage, the temperature can exceed 60°C. Large molecules such as sugar, starch, fat and protein will be decomposed under high temperature. As ammonia will be generated during the decomposition of protein, pH value will increase to become alkaline. The rate of decomposition will slow down as organic matters are being consumed. The composting process then proceeds to cooling stage.

Third Stage: Cooling Stage
The temperature of the compost will be decreased as the rate of decomposition slows down. When the temperature drops to around 40°C, fungi are reactivated and will decompose the remaining fibres.

Final Stage: Curing Stage
The organic matters are fully decomposed and the products after decomposition will become stable humus and humic acid. This process is called curing or maturation. When the compost is mature, it becomes dark brown in colour and has a special odour. The compost is ready to be mixed up with soil for use.

2. Conditions to be Controlled During the Composting Process
In composting process, some conditions are needed to be controlled in order to facilitate the process. Those conditions are discussed below:

Oxygen: In aerobic composting, microbes need sufficient oxygen for metabolism and reproduction. In general, 8% or more of oxygen is required.

Moisture: The microbes also require sufficient moisture for growth and reproduction. The moisture level during composting should be maintained between 50 to 60%.

Carbon-to-Nitrogen Ratio (C/N ratio): Microbes are the important decomposers during the composting process. They decompose carbon and nitrogen compounds in organic matters for growth and reproduction. The optimum range for Carbon-to-Nitrogen Ratio in composting should be around 20 to 30:1.

Temperature: Suitable temperature helps to increase the metabolic rate of microbes. It also enhances the rate of decomposition of organic matters and kills pathogens. The suitable temperature should be maintained between 50-60°C.

pH value: pH value will vary with the fermentation time and temperature in the composting process. Therefore, pH value can be used as an indicator to assess the composting condition. In general, the optimal composting rate can be achieved at the pH value between 7.8 - 8.5.

3. Points to be Noted in the Process of Food Waste Composting

“Water”, “air” and “time” are three critical factors in food waste composting. The following points should be noted to help food waste composting more smoothly:

(a). Sufficient time have to be provided as organic matters decomposition have to go through complicated process together with the function of various micro-organisms.

(b). If water content in the food waste is not well controlled, it will affect the processes of composting. Therefore, water contents should be well controlled to avoid odour generation and also maintain a good hygiene and environment.

(c). Good ventilation can ensure enough provision of oxygen for proper decomposition. Poor ventilation would lead to anaerobic decomposition and poor removal of moisture, which generates rotten smell.
4. **Effectiveness and Application of Compost Products**

Compost can provide nutrients for the growth of plants. The nutrient contents vary according to the ingredients of food waste and the conditions under which the composting operation is carried out as mentioned in Section 2 of Chapter 3. Besides, compost can also improve soil properties. Effectiveness and application of compost products to soil are briefly described as follows:

1. **Effectiveness of compost products to soil**

   Compost can enhance soil properties in the following three perspectives:

   (i) **Improving physical properties of soil**
   
   - Improve soil structure: Compost can loosen soil, whereas the organic matters can facilitate the production of polysaccharide by microbes, which helps to form soil particles and improve soil structure.
   - Enhance ventilation in soil: More oxygen can be supplied to the root system and the diffusion of carbon dioxide can also be enhanced with improved soil structure.
   - Enhance water retention in soil: Composts can help to retain water, or change the soil structure so that capability of water retention is enhanced.
   - Increase soil temperature: More heat could be absorbed by darker soil mixed with compost, hence warming up the soil.

   (ii) **Improving chemical properties of soil**
   
   - Supply minerals and energy to vegetation: Inorganic matters (e.g. nitrogen, phosphorus, potassium, etc.), organic nutrients (e.g. amino acids and carbohydrates) and carbon dioxide would be released during decomposition. These are essential components for vegetation to carry out photosynthesis.
   - Enhance the ability to store nutrients: Nutrients can be attached on the organic surface of the compost and can be easily absorbed by plants.

   (iii) **Improving biological properties of soil**
   
   - Supply nutrients and energy to microbes: Addition of organic matters could help microbes to speed up decomposition process, and hence supply organic matters for vegetation.
   - Supply nutrients to beneficial microbes and inhibit the growth of harmful microbes.
2. Advantages of using compost products
Comparing to chemical fertilizers, the nutrient contents in compost are more balanced. Since the rate of compost decomposition is slower, it takes longer time for the nutrients to be released in soil. Therefore, the effect of compost is more long-lasting than chemical fertilizers. Moreover, compost can improve physical, chemical and biological properties of soil while chemical fertilizers cannot.

3. Application of compost
The application method of compost product is similar to that of commercial fertilizers. Proper application could provide appropriate amount of nutrients for plant growth. Fertilization management could ensure sufficient nutrients in the soil for vegetation. Application quantity and location of fertilization should be inter-related with soil property, plantation property and growing stage of plantation.

Compost products recovered from food waste contains various nutrients composition. Hence, testing should be carried out before its application in order to understand its nutrient contents. The applications of compost products are listed as follow for housing estates’ reference:
- Compost can be applied for landscaping in housing estate;
- Compost can be distributed to participating households for gardening; and
- Compost can also be used as filtering material for bio-filter to remove odour by its physical adsorption properties and microbial decomposition ability.

Compost could be used as soil conditioner for improving soil texture by mixing with soil. The principle, method and dosage of the use of compost is recommended as follows:
1. Principle of fertilization
   The principle of fertilization is to provide the soil with matters for biological decomposition in order to increase or maintain its fertility and biological activity. Thus, fertilization management should reduce the loss of nutrients from the soil, and to avoid the accumulation of heavy metals and other pollutants.
2. Use as farming basal
   Compost mainly improve the physical, chemical and biological properties of the soil, which are mostly slow-release fertilizer. As such, as a farming basal,
it can improve the soil condition prior to the future growth of vegetation. Basal application could be done during plowing by mixing soil and compost evenly in a recommended ratio of 5 to 10 kg compost per meter square of field.

3. **Use for garden ornamentals**
Compost and soil (the volume ratio of compost: soil should be around 1:10. Soil should include sand, mud and gravel, but not weeds, sticky mud, chemical pollutants, and other hazardous materials) should be mixed before use. This way could enhance the decomposition of compost and effect of application. If the compost is not mature enough, it should be used after mixing with soil, otherwise root damage or poor root development may occur. In general, ditching or burrowing can be adopted. The compost should be covered with soil after application, or plowed into the soil after spreading evenly on the soil.

4. **Use for top dressing**
There are various application methods for top dressing: 1) adding compost around the root of the plant, 2) diluting the compost with water, and spraying the solution on the plant or onto the soil surface for absorption by the root.

5. **Use for domestic pot planting**
It is recommended to use compost: soil at a ratio of 1:20 – 1:30 as the nutrient requirement of potted plants is less.

Before applying the compost in farming, users should know the compost composition and make sure the heavy metals concentrations do not exceed the limits as a safety measure. According to users’ experience, the amount of compost, soil condition and nutrients required by different species of plants are various. Hence, the application dosage of compost would not be the same and pilot tests have to be conducted before mass application.

4. **Reminders for the use of compost**
   i. Immature compost with depleted nitrogen content produces organic acids and creates an anaerobic condition that will damage plant roots. In order to ensure compost is thoroughly mature, the simplest way is to avoid removing compost from the system too early. Composting should take at least 14 days before being discharged from the composter. For further test of the maturity, seed germination index test can be used. The testing procedures are stated as below:
      - Mix compost with distilled water in a weight ratio of 1:5 to become a
mixture (i.e. 100 mg of compost: 500 mg distilled water) by shaking it for 30 minutes;

- Use 10 ml of the filtered mixture to cultivate 10 cress / lettuce seeds;
- Comparing the result with a controlled experiment using distilled water for cultivation only, if 60% of the seeds can germinate, the compost is mature.

ii. Immature compost products should be placed in a ventilated container for further composting according to supplier’s instruction. The container should not be sealed for better ventilation.

iii. In general, compost can be applied to plants every one to two months. Housing estate can adjust the quantity and frequency of application according to the plant species and their growing conditions.

iv. Compost is more suitable to be applied in well-developed and mature parterre. Normal dosage for mature vegetation may be excessive to immature vegetation, and cause damage to its root. It is recommended to test the proper dosage for application in mature parterre, and then apply a diluted one on immature vegetation.

6 Referring to Chapter 1 of Guidance Notes for the General Specification for Civil Engineering Works (2006 edition) and general comments from users

7 Referring to the application guideline of compost and general comments from users of Agriculture, Fisheries and Conservation Department
5. **Technical Specifications of the Composter Systems and Requirements of the Contractors**

The composter system provided by suppliers shall include: 1) a chamber for composting; 2) an odour removal system; 3) an electrical and automatic control; and 4) a working platform that facilitates putting food waste into the composter or electrical lifting device. The daily treatment capacity of the composter system provided by suppliers shall not be less than 50 to 100 kg of food waste, and should be able to recover the food waste into useful compost products. The composter system provided by suppliers should at least meet the following requirements:

**General Requirements of the Composter System**

1. The composter system should be suitable to be installed in outdoor and humid environment, it shall be made with rust-proof material such as stainless steel 304 or higher grade, and the electrical power control panel should also be rust-proofed and water-proofed.

   [Item 2 is for the composter system installed in outdoor environment]

2. If the composter system is installed in outdoor environment, awning shall be installed to facilitate operation during raining.

3. Apart from the feeding of food waste into the enclosed chamber and the discharge of compost from it, the operation of the composter system shall be fully automatic.

   [Item 4 is for motorized bin lifting device]

4. If the composter has a motorized bin lifting device, it shall be capable to lift up the weight not less than 150 kg and the food waste will not be spilled out from the device while feeding the food waste into the enclosed chamber of the composter system.

   [Item 5 is for manual food waste feeding]

5. For manual food waste feeding, stainless steel working platform with stairs shall be provided as part of the composter system if the feeding inlet is over 1.2 metres above ground. The working platform surface shall be of the checker plate type for slippery prevention and the platform shall be capable of supporting the weight of at least one adult worker.

6. The composter system in operation shall not induce noise nuisance.

7. The composter system shall be able to turn the source separated food waste to useful compost in solid powder forms. It shall not produce waste matters that have to be
disposed of at landfills.

8. The composter system shall not convert source separated food waste into liquid compost (except condensate) and discharge to the sewers to avoid increasing the loading to the sewage treatment system.

9. Supplier of the composter system should present the supporting laboratory testing reports for the supplied composter system that could produce compost meeting the standards as tabulated below (Table 5.1).

### Table 5.1

<table>
<thead>
<tr>
<th>Compost Maturity</th>
<th>The compost product must pass one of the tests from Group A AND one of the tests from Group B:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
</tr>
<tr>
<td></td>
<td>1. Ammonia concentration ≤ 700 mg/kg dw</td>
</tr>
<tr>
<td></td>
<td>2. Ammonium : nitrate ratio ≤ 3</td>
</tr>
<tr>
<td></td>
<td>3. Volatile organic acids concentration ≤ 500 ppm dw</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
</tr>
<tr>
<td></td>
<td>1. Carbon : Nitrogen ratio ≤ 25</td>
</tr>
<tr>
<td></td>
<td>2. Oxygen consumption rate ≤ 0.4 g O₂/kg TS/hr</td>
</tr>
<tr>
<td></td>
<td>3. Carbon dioxide release rate ≤ 2 g C/kg VS/day</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Compost Quality</th>
<th>Chemical and physical properties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pH 5.5 – 8.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Salmonella sp. ≤ 3 MPN/4g</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
<td>≤ 1,000 MPN/g</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seed Germination Index</th>
<th>Dilution: wet weight ratio of 1 part compost product to 5 parts water, while seed germination index ≥ 60%</th>
</tr>
</thead>
</table>

Note: Testing methods could be referred to the Compost and Soil Conditioner Quality Standards (2005) established by the Hong Kong Organic Resources Centre.

### Requirements for the Enclosed Chamber of Composter System for Fermentation

10. The enclosed chamber for fermentation should be made with rust-proofed material such as stainless steel 304 or higher grade.

11. The enclosed chamber shall consist of inlet for feeding of food waste (inlet) and outlet (outlet) for treated matter discharge. Doors with seal gasket and security
lock or motorized or electrical interlocking device (e.g. reed switch) shall be provided to enclose the inlet and outlet openings.

12. The composter system shall be designed and sized such that the retention period of food waste inside the enclosed chamber will be at least 14 days before the treated matter is being discharged or removed from the chamber.

13. The enclosed chamber should be coated with insulation material to reduce heat loss to the surroundings.

Requirements of the Odour Removal Device

14. The odour treatment equipment in a composter system shall be based on mechanism of activated carbon adsorption and/or biofiltration. It shall be designed to effectively remove the odour arising from food waste fermentation inside the enclosed chamber. The odour treatment system (made of activated carbon filter and/or biofilter) shall have hydrogen sulphide and ammonia removal efficiency not less than 80% and 90% respectively. The Supplier shall provide laboratory report or manufacturer testing documents to prove that the food waste composter system can comply with the above requirements for preventing odour problem.

Requirements of the Power Supply, Control and Safety

15. The electricity power control shall comprise panel with emergency switch for stopping the composter system operation, and also equip with other electricity protection system in accordance with the legislative requirements in Hong Kong, such as Code of Practice for the Electricity (Wiring) Regulations. It requires: 1) the layout and the wiring of the control circuit should be tidily completed and easy for maintenance; 2) workable devices, such as short circuit protection, overload protection and over-current should be equipped; 3) devices such as short circuit protection, overload protection and over-current protection must be matched with the loading of the equipment; and 4) clearly label the indication lamp, display panel instrument and operation buttons.

16. If the composter system is installed in outdoor or humid environment, the electricity power control including the electrical wiring and switches shall be water-proofed.

17. The composter system shall be equipped with heating and temperature controlling provisions and be designed so to ensure the fermentation temperature of food waste inside the enclosed chambers be maintained at around 50 to 60 degree Celsius. The system shall also include display panel at a conspicuous location that shows the temperature measured inside the enclosed chamber.
18. Temperature set point(s) should be provided for temperature control so that the composter system shall be turned on at the preset temperature. The heater shall be able to stop heating automatically when the fermentation temperature is higher than the preset temperature.

19. All the rotating devices that may cause injuries to the operators should be sealed or sheltered, or adopting other safety measures to avoid contact by the operator.

20. If particulates or dust is found in the composting process, the composter system should be equipped with particulates or dust trap or filtering device to prevent inhalation by the operators.

**Other Requirements on Composter**

21. The contractor shall supply, deliver and install the composter system at the premises chosen by the housing estates.

22. The contractor shall provide all necessary insurance covering for works related to the delivery and installation of the composter system.

23. The contractor shall perform functional tests for the installed composter system. The functional test shall include at least test of the emergency switch, test of the motor drive for mixing / conveyance inside the enclosed chamber, test of the odour treatment equipment blower or exhaust fan, and test for the motorized bin lifting device (if provided).

24. The contractor shall rent the composter system to the housing estate for food waste recycling for a period of 24 months. The commencement date of rental contract should be fixed on the day when all the functional tests of the installed composter system are successfully completed.

25. The contractor shall provide user operation and maintenance manuals with drawings within one week from delivery of the composter system to the premises chosen by the housing estate.

26. The contractor shall provide half-day training to 2 staff and 2 workers of the housing estate covering the operation, checking and maintenance aspects relating to the composter system within two weeks from the delivery of the composter system.

27. After commencement of the composter system operation and upon request from the procured housing estates, the contractor shall make odour measurement to verify whether the odour treatment equipment could meet with the equipment requirement standards and effective in abating odour nuisance. The contractor shall provide a technical report on the result of such verification, the removal efficiency of the odour
treatment equipment and other incidents that may cause excessive odour events within 2 months after commencement of the rental of the composter system.

28. During the rental period of the composter system, the contractor shall carry out regular checking and maintenance (including the odour treatment equipment) and also provide consumables and spare parts necessary for the proper operation of the composter system. The contractor shall also provide advice and guides to resolve any operational or maintenance problems of the composting system.

29. During regular maintenance / cleaning of composting chamber, the contractor should remove: 1) particulates / dust that is trapped inside the ventilation system of the composter system; and 2) debris trapped inside composter, e.g. plastic bags, nuts, hard shells, tough fibre, etc.

30. Upon completion of the rental period, the contractor shall decommission and remove the composter system away from the premises if no arrangement has been made with the housing estate for renewing the rental period or purchasing the composter system.

Requirements of the Contractors
The contractors shall provide a layout design in the quotation to show the space for the composter system required, including the space needed and location for: 1) installation dimensions of the composter system and its operation buffer zone; 2) storage area for compost products; and 3) cleansing area for food waste containers and other equipment, etc.

The contractors shall submit the following documents to the help-desk service provider before supply, delivery and installation of composter system to the housing estates. Besides, EPD would require the help-desk service provider to conduct on-site testing to the installed composter system. Hence, the contractors shall make every effort to provide assistance in these procedures.

1) Specifications of the delivered system would be cross-checked and verified with the specifications submitted with the quotation. Proper record should be kept. Specifications include:
   - Dimensions of composter;
   - Space requirement for motorized bin lifting device (if provided), product output and walkway;
   - Electrical power requirement, and electric check meter;
   - Whether odour removal device is included; and
   - Other minor works items: shelter, ventilation, water supply and drainage, etc.
2) Operation and maintenance manual shall include the following items:
   i. Safety precautions
   ii. Installation location, electricity or other requirements
   iii. Recyclable and non-recyclable materials for the system
   iv. Operation of the system, including but not limited to, start-up, shut-down, normal operation, etc.
   v. Consumables (e.g. bulking agents, microbes) required, and service life of Odour Removal Unit and the refill quantity
   vi. System information:
      - Description of the process /principle of the machine /information of Odour Removal Unit
      - Technical specifications /major equipment schedule including the materials used in Odour Removal Unit
      - Power requirements
      - Descriptions of display, indicators and alarm signals
   vii. Maintenance and warranty guides
   viii. Troubleshooting guideline
   ix. Recommendation for the compost’s application and dosage needed

3) System testing and commissioning
   Testing and commissioning (T&C) should be conducted after the system has been delivered and installed. T&C records should be properly kept. Testing and commissioning should include:
   i. Functional test
      To ensure the system and individual devices/ components function properly, including rotation of mixer / rotating drum, rotation direction, heating device, air supply and exhaust system, etc.
   ii. Power test
      - Installation of power supply
      - Insulation test of individual device (MΩ)
      - Information of individual devices
      - Operating current measurement for individual devices (A)
      - List of protection devices of individual equipment (such as circuit breaker, fuse, overload device, etc.)

The contractors shall submit the above records as stated in 1), 2) and 3) to the Help-desk Service for Food Waste Recycling Projects in Housing Estates within 1 month after
installation. The records shall be sent by email at hd-fwrs@hkpc.org or mail to Help-desk for Food Waste Recycling Projects in Housing Estates, Environmental Management Division, HKPC Building, 78 Tat Chee Avenue, Kowloon.

During testing and commissioning period, details checking, functional testing, electrical safety testing for each individual equipment should be conducted and recorded. The contractors can make reference to “Testing Record for the Food Waste Composter System” in Appendix 3.

Guideline of Quotation Submission for Renting the Composter System to Housing Estate for Food Waste Recycling

Quotation should include the following submissions:
1) Completed appendix on proposed composter system technology
2) Completed rental price list for 24 months rental period*
3) Catalogue and layout design of the proposed composter system, including technical specifications data and information
4) Delivery and installation schedule
5) Proposal on purchasing the composter system after the completion of 24 months rental period

*The quoted rental price shall cover all the necessary costs for the supply, transport, installation, testing, training, rental, reporting, maintenance service, decommission and removal of the composter system as specified in the specification of “Provision of Composting System for Food Waste Recycling in Housing Estate”.
## Appendix : Proposed Composter System Technology

<table>
<thead>
<tr>
<th><strong>1. Information of Composter Equipment</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Manufacturer</td>
</tr>
<tr>
<td>b. Country of Manufacture</td>
</tr>
<tr>
<td>c. Model / Type (Solid powder forms or others)</td>
</tr>
<tr>
<td>d. Capacity (kg/day)</td>
</tr>
<tr>
<td>e. Dimension : L x W x D (meter)</td>
</tr>
<tr>
<td>f. Weight (kg)</td>
</tr>
<tr>
<td>g. Casing Material / Material of Fermentation Chamber</td>
</tr>
<tr>
<td>h. Power supply: V / Phase / Hz</td>
</tr>
<tr>
<td>i. Power (kW)</td>
</tr>
<tr>
<td>j. Current (amps)</td>
</tr>
<tr>
<td>k. Type of Odour Treatment</td>
</tr>
<tr>
<td>* laboratory report or manufacturer testing documents showing the removal efficiency of hydrogen sulfide (%) **</td>
</tr>
<tr>
<td>* laboratory report or manufacturer testing documents showing the removal efficiency of ammonia (%) **</td>
</tr>
<tr>
<td>l. Safety equipment</td>
</tr>
<tr>
<td>m. Other Accessories</td>
</tr>
<tr>
<td>n. Consumable Requirements (e.g. bacteria, bulking agents, activated carbon etc)**</td>
</tr>
<tr>
<td>o. Retention period of food waste inside the fermentation chamber of Composter System (day)</td>
</tr>
<tr>
<td>p. Fermentation temperature of food waste inside the enclosed chamber (degree Celsius)</td>
</tr>
<tr>
<td>q. Physical State of Compost</td>
</tr>
<tr>
<td>r. Laboratory testing reports showing the compost sample meet the standards at Table 5.1*</td>
</tr>
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<td></td>
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</tbody>
</table>
2. **Electrical Lifting Device (If this device is provided)**

<p>| | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>a.</td>
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<tr>
<td>b.</td>
<td>Country of Manufacture</td>
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<tr>
<td>c.</td>
<td>Model number</td>
</tr>
<tr>
<td>d.</td>
<td>Dimension: L x W x D (meter)</td>
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<tr>
<td>e.</td>
<td>Weight (kg)</td>
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<td>g.</td>
<td>Power (kW)</td>
</tr>
<tr>
<td>h.</td>
<td>Current (amps)</td>
</tr>
<tr>
<td>i.</td>
<td>Lifting capacity (kg)</td>
</tr>
<tr>
<td>j.</td>
<td>Safety equipment</td>
</tr>
</tbody>
</table>

3. **Composter System, Electrical Lifting Device (If this device is provided) and other Equipment layout plan**

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>a.</td>
<td>Location and dimensions of the composter system and its operation buffer zone: L x W x D (meter)</td>
</tr>
<tr>
<td>b.</td>
<td>Storage area for compost products: L x W x D (meter)</td>
</tr>
<tr>
<td>c.</td>
<td>Cleansing area for food waste containers, sewage discharge point, and other equipment etc</td>
</tr>
<tr>
<td>d.</td>
<td>Location and dimensions of the Electrical Lifting Device and its operation buffer zone: L x W x D (meter)</td>
</tr>
</tbody>
</table>

* Laboratory testing report / manufacturer testing document, design layout should be submitted with quotation for evaluation

** Please delete as appropriate
Guideance for Maintenance Service to Composting System

Maintenance Services and Response to Fault Calls

1. During the Contract period, the Contractor shall carry out regular maintenance service of the Composter and the odour treatment system including quarterly / half-yearly * inspections to ensure the normal and proper operation of the Composter. Maintenance service includes labour and material costs of spare parts and consumables (including microbes, bulking agents, replacement of odour removal filter; and containers for compost product whichever is the applicable) necessary for the proper operation of the Composter system. The Contractor shall also provide advice and guides to resolve any operational or maintenance problems about the Composter. The Contractor should provide clear instructions to the Property Management Corporate (PMC) to carry out the daily inspection to the Composter.

2. During regular maintenance /cleaning of the Composter chamber, the Contractor should remove: 1) particulates/ dust that is trapped inside the ventilation system of the Composter system; and 2) debris trapped inside the Composter such as plastic bags, nuts, hard shells, tough fibres, etc.

3. The Contractor shall initiate immediate rectification actions to eliminate the defect within 36 hours and to complete the rectification action within 60 hours after receiving the notification (Verbal followed by written notification) of the defect or faulty operation of the Composter from the Representative of (Housing Estate) with no additional service charge except otherwise stated.

Handling of Complaints

4. The Contractors shall initiate immediate investigation within 48 hours after receiving the notification (verbal followed by written notification) of complaint against the operation or performance of the Composter and to implement necessary improvement measures upon identification of the problem.

5. The Contractor shall provide the Representative of (Housing Estate) within two (2) weeks after the notification of complaint a written report on the investigation result and the necessary improvement measures implemented /recommended measures for rectification of the problems to address the complaint, if justified.
### Quality of Compost Product

6. The Composter system shall be able to turn the source separated food waste to useful compost in solid powder forms that are safe to use and comply with the following standards for pathogens:

- Salmonella sp. ≤ 3 MPN/4g
- E. Coli ≤ 1000 MPN/g

(Note: testing methods should follow those specified in Compost and Soil Conditioner Quality Standards 2005 established by the Hong Kong Organic Resources Centre.)

It shall not produce waste matters that have to be disposed of at landfills.

* Delete the inappropriate

### Inspection of Electrical Composter

The safety and reliability of Electrical Composter cannot be ensured unless it has received regular inspections. Regular inspections are particularly important because they provide a useful means of detecting potential hazards which could contribute to accidents. Regular inspections can also forewarn the owner of necessary preventive maintenance or repair, the lack of which can lead to serious deterioration of the lifting appliance and expensive replacement or repair charges.

An inspection means a visual and physical checking usually supplemented by a functional check to examine the states of individual items of Electrical Composter. The purpose of an inspection is to find out whether there is any item having abnormal wear and tear, malfunction, unusual noise, and excessive vibration, etc. If necessary, arrangements should be made for remedial actions such as repair or replacement of the defective parts and components.

The key elements of regular inspection are:

- Frequency and coverage of inspection; and
- Reporting by competent person.

(i) Frequency and coverage of inspection

**Daily or monthly inspection**

Visual checking should be made daily / monthly by Property Management Corporate and the inspection should be as broad as possible. Every electrical composter has its own specifications;
professional advice from the supplier should be sought before determining the inspection items.

In general, the inspection should cover but not limited to the following. If there are any signals of failure you have found, please inform the supplier for repair immediately.

- **Safety function of the device:**
  - Emergency stop for stopping the operation of the whole system
  - Mixer inside the fermentation chamber will be stopped when inlet lid opens; and
  - Mixer inside the fermentation chamber will be stopped when outlet lid opens.

- **Unusual noise and excessive vibration of the mechanical parts during the operation.** In the occurrence of the above observations, the following items should be inspected:
  - The mixer inside the fermentation chamber (forward and backward);
  - The rotating fermentation chamber;
  - The air blower and extraction fan; and
  - The bin lifting device.

### Regular Inspection

In many cases, manufacturers require regular inspections such as quarterly / half yearly inspections. These inspections are intended to determine the need for repair or replacement of parts as required maintaining the appliances in serviceable condition insofar as safety is concerned. Property Management Corporate should consult the supplier for the professional advice.

In general on top of the above mentioned inspection items, regular inspection should cover but not limited to the following:

- Electrical heating elements;
- Mixer inside the fermentation chamber;
- The screen (or filter) in between the fermentation chamber and the extraction fan;
- Connection pipe between the extraction fan and the activated carbon filter / biofilter; and
- The activated carbon filter / biofilter.

### Thorough Examination (Annual Inspection)

The objective of ‘Thorough Examination’ is to ensure that the electrical composter so examined is of good mechanical and electrical condition in according to the manufacturer's instructions. The examination should be carried out at least once every year by competent person and it shall be carried out as carefully as the conditions permit so as to arrive at a reliable conclusion as to the safety of the parts examined. On top of the above mentioned inspection items, the though
examination should cover but not limited to electrical testing and examination. Electrical testing and examination should according to the legislative requirements in Hong Kong, such as Code of Practice for the Electricity (Wiring) Regulations.

**Reporting by competent person**

A competent examiner should keep an examination log sheet to note down the function of safety devices, electrical particulars and the state of working condition of the electrical composter undergone thorough examination. Any deficiencies or abnormal conditions detected during the thorough examination should be entered in the log sheet. The owner of the electrical composter should be informed of the findings for immediate attention or repair.
6. **Site Requirements and Reminders for Food Waste Composting System Installation in Housing Estate**

Before choosing the installation location of the composting system (together with the deodorizing system), housing estate should have a thorough understanding in the process of food waste recycling, the operating procedures of food waste composting machine, general problems that may arise during composting, and the condition of the housing estate. The installation location for composting system can be indoor area (such as central garbage room) or outdoor area which is spacious and would not affect residents. Awning is recommended to be installed for better operation if the composter system is installed outdoor. When selecting the site for the composting system, the following factors can be considered:

1. **Space for installation**
   
   Other than the composting machine, the designated space for the composting system should be large enough to accommodate: (1) temporary storage for daily collected food waste; (2) bulking agents such as fallen leaves (if necessary); (3) immature compost (recommended to store it for 21 days before use); (4) storage of mature compost for use; (5) access around the composter system (if necessary); and (6) space for operation of the composter system, such as: a) weighing and recording of the collected food waste, b) washing food waste containers and other equipment, and c) sorting out non-recyclables or compost products larger than 50 mm, etc. The space required depends on different brand, model and capacity. In general, it requires 200 to 300 square feet of space for installation of a 100 kg/day composter system. Actual space requirement should be recommended by equipment suppliers.

   Housing estates can also consider to locate items (3) and (4) as mentioned above in another locations.

2. **The composter system should be installed away from residential areas (Figure 6.1) to reduce nuisance to residents.**

   If the system is installed indoors (e.g. centralized garbage collection room), ventilation system should be installed to enhance air exchange in the room. The exhaust outlet should be away from pedestrians. Figure 6.1 Exhaust outlet should be away from residents or pedestrians.
residents. If it is installed in outdoor area, wind direction should be considered to ensure proper ventilation.

3. Water supply and sewage system
Water supply and sewerage system should be in place for cleansing purpose and avoiding pests or rats. If the housing estate has to provide cleansing service of the food waste containers to residents, cleansing equipment should be prepared. Sewage discharge should be connected to the Government sewer, or sewage treatment plant in the housing estate.

4. Food waste collection method (please refer to Section 4 of Chapter 2).

5. Food waste collection time, transporting path and handling procedure of late disposal of food waste by participants after the collection time.

6. Hygiene of collection point and transporting path.

7. There is smell in the process of composting. The degree of its nuisance depends on the operation of the food waste collection and recycling by the housing estate and the effectiveness of the odour removal system of the composter system. Please refer to Chapter 7 for details.

8. As most of the food waste composter systems are installed in the garbage rooms after they are built, housing estates need to consider the operation buffer zone of composter system, cleansing issues and whether the position of garbage room exhaust may pose nuisance to the residents and the public.

The main purpose of this project is to encourage residents to avoid and minimize food waste generation and recycle the inevitable food waste into useful resources. Hence, the installation location should have the least impact to the daily living of the residents.
7. **Principle of Odour Generation and Deodourisation for Food Waste Composting System**

Food waste converted compost is rich in organic matters, including carbohydrates, fats, proteins, cellulose, hemicellulose, lignin, etc. Decomposition of organic waste would produce substances like polypeptide, amino acids, organic acids, etc. Under anaerobic condition, odour would be generated, which consists of hydrogen sulphide, volatile ammonia, mercaptans, short chain fatty acids and other metabolites.

Odour is a special air pollutant that would be easily noticed due to the nuisance it causes. The unpleasant smell would be interpreted as a potential threat to health. Hence, odour would lead to human’s natural respond of disgust and sense of exclusion. People would have different degree of reaction to various types and intensity of odour. In general, odour would lead to mild nausea, nausea, vomiting, dizziness, headache, cough and other symptoms.

Hence, the odour generated from aerobic composting process can be controlled through controlling the aerobic conditions in the fermentation chamber and removing it by deodourisation equipment/technology.

The aerobic condition in the fermentation chamber can be controlled by: (1) oxygen concentration; (2) temperature; and (3) moisture content of compost. Under aerobic condition, aerobic microbes will reproduce rapidly and carry out decomposition of the food waste. At this stage, odourous gases such as ammonia and hydrogen sulphide are minimized.

1) Oxygen concentration: The aerobic condition in the fermentation chamber can be controlled by appropriate mixing, exhausting or forced air supply. These three modes of operation facilitate food waste to be decomposed rapidly and reduce the generation of odour.

2) Temperature: There is usually a heating system in composter system for maintaining temperature of composting process.

3) Moisture content of compost: Compost with high moisture content would be more compact, reducing the air movement inside the compost and hence generating odour under anaerobic condition. Operators should drain as much water from food waste as possible before putting them into composter system to reduce the
fluctuation of humidity inside the fermentation chamber. If the fermentation chamber is too humid, bulking agents like sawdust could be added. The function of bulking agents include: (1) increasing porosity of compost particles; (2) reducing humidity of fermentation chamber; and (3) adjusting the C/N ratio of composting mixture and facilitating the reproduction of microbes with proper amount of bulking agents added.

To remove odour by deodourisation equipment / technology, odourous gas is extracted by exhaust fan from the fermentation chamber, then it is treated through deodourising equipment before being discharged into the environment. As the fermentation condition has higher temperature and humidity than the external environment, water vapour in the exhaust gas would be condensed when the exhaust gas is cooled down through the pipe. With immediate attachment of condensed water on the deodourising agents, the effectiveness and efficiency of the deodourisation system would be reduced. Hence, it is recommended to dehydrate the exhaust gas before letting the gas pass through the deodourising system. The deodourising equipment that are currently available on the market include, but not limited to, the following:

1. **Biofilter**
   Biofilter is a fixed biofilm treatment method. It makes use of the microbes that attached on the porous filter surface to decompose volatile organic compounds (VOCs) in the exhaust gas to carbon dioxide and water. Optimum microbial activity can be achieved by controlling various factors such as filter's temperature, humidity, pH value which speeds up the reaction and enhance odour removal efficiency. After decomposition, carbon dioxide produced will leave the system with air flow and the effused water will be discharged or recycled.

   The nature of biofilter is the key factor for the survival of microbes. It should have large surface area and high porosity, good air flow channeling, high hydrophilicity, good moisture retention, high compressive strength, resistance to densification, and can provide nutrients to microbes (such as C, N, P, K, etc.). Typical biofilter is made of ingredients including compost, bark and wood chips that are mixed in a suitable ratio. In general, the service life of biofilter is 1 to 2 years.

2. **Activated carbon filter**
   Activated carbon filter removes odour by either adsorbing odour gases physically or combining with odour gases chemically. In general, saturated activated carbon can be regenerated for reuse. Activated carbon filter can effectively remove odour gases
generated from organic matters, including fatty acids, thiols, phenols, hydrocarbons, etc. In general, activated carbon can only remove VOCs of low concentration (<10 ~ 50 ppm).

The suitable operating temperature for activated carbon filter should be maintained below 40°C in order to achieve a good performance. If the exhaust gas contains large amount of moisture or impurities, it will adhere on the surface of the activated carbon and reduce the effectiveness of adsorption. Therefore, removal of these interfering substances is necessary. Saturated activated carbon can be regenerated by steam or nitrogen to desorb the adsorbed organic matters. The efficiency of desorption depends on the methods used, but all methods will increase the total treatment cost. In general, activated carbon should be replaced every half year or every year. Extra solid waste is generated in such replacement.

8 Appropriate bulking agents, such as leaves, carbon granules, straws, saw dust or wood chips
8. **Points to Note on Using Food Waste Composting Machine and Potential Impacts on Environment**

The followings should be checked when using food waste composting machine:

1. Are the power supply and food waste composting machine properly connected?
2. Is the operating temperature of the food waste composting machine normal?
3. Is source separation properly done (such as separation of bones or other large size food waste from food waste to be recycled)?
4. Does the food waste contain too much water content?

Food waste composting machine may cause impacts on the environment or have some abnormal situations during operation. The followings are the possible causes and corresponding solutions. If problems persist, suppliers should be contacted for technical support.

<table>
<thead>
<tr>
<th>Possible Abnormal Situations / Impacts on the Environment</th>
<th>Possible Causes</th>
<th>Corresponding Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor compost quality</td>
<td>Excessive foreign objects</td>
<td>Pick up the foreign objects manually or add a filtering equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strengthen the promotion on source separation</td>
</tr>
<tr>
<td>Slow decomposition of food waste</td>
<td>Vent being blocked</td>
<td>Clean the blocked vent</td>
</tr>
<tr>
<td></td>
<td>Too much food waste input</td>
<td>Reduce the input amount of food waste to the composting machine</td>
</tr>
</tbody>
</table>
### Potential Incidents of Composter System

There are two types of incidents that possibly happen in composter system: 1) mechanical failure of composter; and 2) improper operation leading to failure of composter. The potential incidents of failure are listed as follows:

#### Mechanical Failure of Composter
- Improper wiring of the main power, making the equipment to rotate in wrong direction;
- Detaching of agitation system which damaging the fermentation chamber;
- Exhaust duct of odour treatment system too long, leading to ineffective emission of exhaust; and
- Heating system could not stop heating at the preset temperature and over-heating the compost.

#### Improper Operation Leading to Failure of Composter
- Excessive water is put into the composter system, making the fermentation chamber

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<table>
<thead>
<tr>
<th>Odour</th>
<th>Insufficient air</th>
<th>Reduce the input amount of food waste to the composting machine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Extend the aeration time⁹</td>
</tr>
<tr>
<td>High moisture content in food waste</td>
<td>Source removal of excessive water</td>
<td>Add dry bulking agent</td>
</tr>
<tr>
<td>Materials inside chamber are closely packed</td>
<td>Add dry and large bulking agent</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ammonia smell</th>
<th>Low carbon to nitrogen ratio</th>
<th>Increase the proportion of carbon, such as straw, saw dust, wood chips or dried leaves, tea or coffee grounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flies</td>
<td>Poor environmental hygiene</td>
<td>Remove liquid dripped from food waste composting machine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Keep the environment clean</td>
</tr>
</tbody>
</table>

⁹Fine tuning by suppliers maybe required.
too humid and generate malodor;

- Food waste containing non-recyclables are put into the composter, such as plastic bags, lighters, etc.; and
- Excessively large food waste is put into the composter, such as bones, stones of fruit, peel of durian, etc.
- No regular clearing of the residual in the fermentation chamber, such as plastic string, fiber, etc.
- No removal of stagnant water in the odour treatment system; and
- No regular replacement of activated carbon and cleansing filter.

Therefore, the contractors, participating households and property management companies have to devote and collaborate with each other to make the food waste collection and recycling a success.
9. **Frequently Asked Questions**

<table>
<thead>
<tr>
<th></th>
<th>How to find a suitable location for the installation of food waste composting machine?</th>
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<tbody>
<tr>
<td>Answer:</td>
<td>When looking for a location to install the composting machine, the housing estate may consider the central garbage room or other common outdoor areas with sufficient spaces. The seven factors listed in Chapter 6 of this Guideline should be considered. Housing estate should spare enough space for the food waste composting machine as well as space for storage of compost or other equipment.</td>
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<thead>
<tr>
<th></th>
<th>How can housing estates use compost practically?</th>
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<tbody>
<tr>
<td>Answer:</td>
<td>Compost can supply rich nutrients to plants. They can be applied to plants in the housing estate gardens for landscaping or given to residents for domestic planting.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th></th>
<th>What should the housing estate do if they could not consume all the compost generated?</th>
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<tbody>
<tr>
<td>Answer:</td>
<td>Housing estates should study Chapter 4 of this Guideline and understand the application and dosage of compost, and amount needed by the housing estate. This Scheme recommends on-site application of compost in the housing estate in order to benefit participating households and reduce other impact in transportation. Housing estates could offer their excessive compost to nearby schools or organic farms. Comprehensive record with the name of recipient organisations and amount of compost should be kept. Housing estates MUST NOT dispose of any compost product at landfills.</td>
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<tr>
<th></th>
<th>How should housing estate handle food waste of larger sizes (such as bones)?</th>
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<tbody>
<tr>
<td>Answer:</td>
<td>Housing estate should educate participating households to separate food waste of larger sizes (such as bones) from other food waste for treatment because larger food waste will affect the quality of compost recycled or damage the composting equipment. Such larger waste can be discarded as usual municipal solid waste.</td>
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<tr>
<td>5.</td>
<td>Will odour be produced during the operation of the food waste composting machine? Does it have any impacts on the residents?</td>
</tr>
<tr>
<td>Answer:</td>
<td>When the food waste composting machine is operating, odour may be generated. Though food waste composting machine is equipped with deodourisation system, odour is still likely to be generated occasionally. Therefore, choosing a suitable place for installing the food waste composting machine is very important. A place with good ventilation and appropriate location of exhaust outlet can help to minimise impact on residents.</td>
</tr>
<tr>
<td>6.</td>
<td>How should the housing estate choose an appropriate supplier for food waste composting machine?</td>
</tr>
<tr>
<td>Answer:</td>
<td>The housing estate should first refer to the technical requirements stated in Chapter 5 of this Guideline and check if the supplier’s equipment meets all the requirements. Housing estate should choose the capacity of food waste composting machine based on number of participating residents. Moreover, the supplier must be able to prove the compost produced from their machine meets the standards stated in Table 5.1 or the Environment and Conservation Fund may not allow the reimbursement of the expenditures for renting the food waste composting machine.</td>
</tr>
<tr>
<td>7.</td>
<td>Where can I find information for suitable food waste composting machines?</td>
</tr>
<tr>
<td>Answer:</td>
<td>You can refer to this website for the information of food waste composting machines: <a href="https://www.wastereduction.gov.hk/en/workplace/electriccomposters.htm">https://www.wastereduction.gov.hk/en/workplace/electriccomposters.htm</a></td>
</tr>
<tr>
<td>8.</td>
<td>Where can a list of green groups, NGOs or other suitable organizations be found if applicant housing estate wishes to engage such groups for promotional or education activities?</td>
</tr>
<tr>
<td>Answer:</td>
<td>Applicant housing estate can refer to the EPD webpage below. Please note that not all the green groups / NGOs are listed and the webpage is for reference purpose only. Green groups / NGOs listed on EPD webpage: <a href="http://www.epd.gov.hk/epd/english/links/local/link_greengroups.html">http://www.epd.gov.hk/epd/english/links/local/link_greengroups.html</a></td>
</tr>
</tbody>
</table>
9. **When is the deadline for the application of funding?**

**Answer:** There is no deadline for the funding application. The ECF has earmarked $50 million for the funding scheme and the Waste Recovery Projects Vetting Sub-Committee will approve applications in accordance with the vetting procedures until the earmarked fund is exhausted.

10. **If the housing estate has already installed food waste composting machines, can they still apply for the funding?**

**Answer:** Yes, they can still apply for the funding. However, they must state the information related to the existing food waste composting machines in the application form clearly for the Vetting Sub-committee’s consideration. (The application form should include daily capacity of the existing food waste composting machines, form of fertilizer produced, year of commencement of operation, brand name, name of supplier, and indicate whether the food waste composting machines is purchased or being rented.)

11. **Can a housing estate apply for more than one composter system to meet the needs and scale of the housing estate?**

**Answer:** According to the Guide to Application - Food Waste Recycling Projects in Housing Estates, each application can only apply for not more than one composter system. Large scale housing estate could consider practicing rotation of households’ participation, such as changing participating households every 3 months. If there are several phases in a housing estate while each of them has an independent Owners’ Corporation, the individual phase can apply the Scheme separately.

12. **Can the housing estate continue to use the composter system after the 24 months of ECF’s subsidizing period?**

**Answer:** After the 24-month lease period of the composter system, the housing estate could apply further funding from the ECF to buy off the composter system.
13. What is the funding limit?

**Answer:** The actual subsidised amount depends on various factors such as the capacity of the food waste composting machines rented, the number of participating households and the types or frequencies of promotional or education activities, etc. Applicants should refer to “Level of Funding Support” in Appendix A of the Guide to Application. For application exceeded HK$2,000,000, it will be considered by the Environment and Conservation Fund Committee.

<table>
<thead>
<tr>
<th>14.</th>
<th>Does the government provide resources for promotion and education about Food Waste Recycling Projects in Housing Estates?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Answer:</strong></td>
<td>Exhibition display panels are available from the EPD for participating housing estates to borrow (Waste Recovery Projects Vetting Sub-committee Secretariat, Tel: 2835 2305). The EPD has also produced leaflets with 5 languages versions, namely Chinese, English, Tagalog, Indonesian and Thai, for housing estates to distribute. These leaflets can be obtained from the EPD, Waste Recovery Projects Vetting Sub-committee Secretariat or Help-Desk Service for Food Waste Recycling Projects in Housing Estates.</td>
</tr>
</tbody>
</table>

---

10 *This FAQs section will be updated from time to time. Please visit the website for “Help-desk for Food Waste Recycling Projects in Housing Estates” for the latest information.*
10. **Advice for Successful Applicants**

Successful applicants for “Food Waste Recycling Projects in Housing Estate” are required to submit the following document regularly:

- 2. “Composting Equipment Operation Record” in Appendix 1;
- 3. “Report Form for Food Waste Recycling Projects in Housing Estates” in Appendix 2; and

The “Composting Equipment Operation Record” in Appendix 1 enables the operator to understand the equipment’s operating conditions and help to solve problems encountered. “Report Form for Food Waste Recycling Projects in Housing Estates” in Appendix 2 can assist the EPD to assess the effectiveness of this Scheme.

The schedule for report submission is stated as below:

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>First 6 months</td>
<td>Report once a month</td>
<td></td>
<td>Report every 6 months</td>
</tr>
<tr>
<td>After 6 months</td>
<td>Report once a month</td>
<td>Report every 3 months</td>
<td></td>
</tr>
</tbody>
</table>

“Financial Report” of The Environment and Conservation Fund can be downloaded at the following link. Please note that this report should be submitted to Waste Recovery Projects Vetting Sub-committee Secretariat.


Secretariat, Environment and Conservation Fund
Waste Recovery Projects Vetting Sub-committee
E-mail: wrp@epd.gov.hk
Fax: 2827 8138
Mailing address:
5/F Southorn Centre,
130 Hennessy Road,
Wan Chai, Hong Kong

Details on submission of Appendices 1 and 2 are listed below.

E-mail：hd-fwrs@hkpc.org
Fax：2788 5608
Mailing address：
“Help-desk for Food Waste Recycling Projects in Housing Estates”
Environmental Management Division
Hong Kong Productivity Council
HKPC Building,
78 Tat Chee Avenue,
Kowloon, Hong Kong
Appendix 1

Composting Machine Operation Record
## Composting Machine Operation Record

<table>
<thead>
<tr>
<th>Week (Sunday to Monday)</th>
<th>Date (DD/MM YY)</th>
<th>Name of Operator</th>
<th>No. of participating households</th>
<th>Feed-in time</th>
<th>Net Weight of Food Waste Input (kg)</th>
<th>Additional Material Input (e.g. Bulking Agent) (kg)</th>
<th>Temperature Inside the Chamber (°C)</th>
<th>Weight of Compost Output (kg)</th>
<th>Supplementary Information (e.g. materials with its quantity, any abnormal conditions.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td>Household</td>
<td>Other (if any)</td>
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</tbody>
</table>

**Total**

**rice/**
## Composting Machine Operation Record

### Name of Housing Estate:

### Date (DD/MM/YY):

### Name of Operator:

<table>
<thead>
<tr>
<th>Week (Sunday to Monday)</th>
<th>Date (DD/MM/YY)</th>
<th>No. of participating households</th>
<th>Feed-in time</th>
<th>Net Weight of Food Waste Input (kg)</th>
<th>Additional Material Input (e.g. Bulking Agent) (kg)</th>
<th>Temperature Inside the Chamber (°C)</th>
<th>Weight of Compost Output (kg)</th>
<th>Supplementary information (e.g. materials with its quantity, any abnormal conditions.)</th>
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</thead>
<tbody>
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<td></td>
<td></td>
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<td></td>
<td>Household</td>
<td>Other (if any)</td>
<td>Total</td>
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</tr>
</tbody>
</table>

### Total

- Household
- Other
- Total

- Total Food Waste Input (kg)
- Average Food Waste Input per day (kg)

- Total Compost Output (kg)

### Other Source of Food Waste:

1. 
2. 

### Remark:

Please submit this operation record to the Help-Desk of Food Waste Recycling Projects in Housing Estates on or before 15th day of each month by fax.: 2788 5608 or email: hd-fwrs.hkpc.org to Mr. Chan for record and data analysis.
Appendix 2

Report Form for Food Waste Recycling Projects in Housing Estate
Report Form for Food Waste Recycling Projects in Housing Estates

This report form should be submitted to the Help-Desk for Food Waste Recycling Projects in Housing Estates. For the schedule of submission, please refer to the website or Chapter 10 of the Technical Guideline.

Please note that this report form will be made available for public access.

Name of Housing Estate: ___________________ Record Date (DD/MM/YYYY): _____________

The General Information and Project Schedule only need to be filled in ONCE for the first time submission or updating of information

<table>
<thead>
<tr>
<th>General Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
</tr>
<tr>
<td>Number of Household</td>
</tr>
<tr>
<td>Contact Person</td>
</tr>
<tr>
<td>Contact Phone Number</td>
</tr>
<tr>
<td>E-mail</td>
</tr>
<tr>
<td>Food Waste Composting Machine</td>
</tr>
<tr>
<td>Brand / Model</td>
</tr>
<tr>
<td>Location of Installation (e.g. garbage room)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commencement Date</td>
</tr>
<tr>
<td>Original</td>
</tr>
</tbody>
</table>

If the project was delayed, please specify the reason(s):

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________  

Change of project scope, details, participating blocks, etc. (if yes, please specify changes and reasons)

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________  

Appendix 2
### A. Information on Composting System’s Operation

<table>
<thead>
<tr>
<th>Month</th>
<th>Electricity Consumption</th>
<th>Total Food Waste Recycled per Month</th>
<th>Total Compost Generated per Month</th>
<th>Compost Quality, Attached with Analysis Data (if any)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kWh</td>
<td>kg</td>
<td>kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kWh</td>
<td>kg</td>
<td>kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kWh</td>
<td>kg</td>
<td>kg</td>
<td></td>
</tr>
</tbody>
</table>

### B. Application of Compost

Please briefly describe the use of compost in your housing estate: (For example, landscaping in the housing estate / giving out to residents / donation\(^1\) / others\(^2\))

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>kg</td>
</tr>
<tr>
<td>2.</td>
<td>kg</td>
</tr>
<tr>
<td>3.</td>
<td>kg</td>
</tr>
</tbody>
</table>

1Please keep the recipient organization(s) record  
2Please list out the purpose of use

If the compost is used in landscaping of housing estate, please provide the following information:

1. Total area of the landscaping: ____________________ m\(^2\)
2. Area for application of compost: ____________________ m\(^2\)
3. Method of application of compost
   - Applying directly on the soil surface
   - Mixing with soil before application, at a ratio: ______________________
4. Frequency of application (weekly / monthly or others) : ______________________
5. Please list out the effect on the landscaping area after applying compost on it

### C. Household Participation Rate and Education Activities

<table>
<thead>
<tr>
<th>Month</th>
<th>Number of Participating Household</th>
<th>Participating Percentage (Number of Participating Household / Total Households × 100%)</th>
<th>Number of Days that Housing Estate Collect Food Waste</th>
<th>Number of Days that Food Waste is Actually Collected from Residents</th>
<th>Participating Day Percentage (Number of Days that Housing Estate Collect Food Waste / Number of Days that Food Waste is Actually Collected from Residents × 100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>%</td>
<td></td>
<td>%</td>
<td></td>
</tr>
</tbody>
</table>
If there are any promotions or education activities related to the food waste or other waste recycling held in the estate this month, please specify below:

<table>
<thead>
<tr>
<th>Date / Holding Period</th>
<th>Location</th>
<th>Type of Activities *</th>
<th>Education / Promotional Activities (e.g. lectures/ workshops)</th>
<th>No. of Participants / Households</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Food Waste /Other Waste</td>
<td></td>
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<tr>
<td></td>
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<td>Food Waste/Other Waste</td>
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<td>Food Waste/Other Waste</td>
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<tr>
<td></td>
<td></td>
<td>Food Waste/Other Waste</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Delete as appropriate

Note: Please attach a copy of news clips, publicity materials, leaflets or photos related to the activities above, if any. Also, please specify the types and numbers of publicity or printed materials.

Are any of the education / promotional activities delayed? □ Yes □ No
If yes, please specify the reasons:

Please briefly describe the education / promotional activities planned to be held before the submission of the next report:

D. Household Awareness to Waste Reduction and Waste Separation

<table>
<thead>
<tr>
<th>Has the amount of other waste (such as paper, plastic, metal) collected increased comparing with the previous report?</th>
<th>□ Increased, approximately_______%</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Decreased, approximately_______%</td>
<td>□ No change</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Has the household’s awareness towards waste reduction and waste source separation increased comparing with the previous report?</th>
<th>□ Increased</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Decreased</td>
<td>□ No change</td>
</tr>
</tbody>
</table>
### E. Other Comments

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did the selected site for Food Waste Composting System cause any nuisance to residents? (For example, nuisance from odour? Inconvenience caused by compost storage? Or other impacts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes, please describe the situation and remedial measures:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the centralized food waste collection point convenient enough for residents to dispose food waste? (For example, not enough collection points, collection points / time is not convenient for residents, low household participation rate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If no, please describe the situation and remedial measures (if any):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is it convenient enough for operators to transfer food waste from centralized food waste collection point to the composting facility?</td>
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</tr>
<tr>
<td>If no, please describe the situation and remedial measures (if any):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any unusual materials discovered in food waste collected?</td>
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<tr>
<td>If yes, please describe the frequency, situation and remedial measures (if any):</td>
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</tr>
<tr>
<td>Any difficulties encountered when using the composting machine? (For example, lack of technical support from supplier, difficulties in operating the composting machine such as odour, machine failure, compost cannot fulfill the technical requirement)</td>
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<tr>
<td>If yes, please describe the situation and remedial measures (if any):</td>
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<td></td>
</tr>
<tr>
<td>Any problems encountered in implementing this project? (For example, difficulties in promotion)</td>
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</tr>
<tr>
<td>If yes, please describe the situation and remedial measures (if any):</td>
<td></td>
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</tr>
</tbody>
</table>

Please briefly conclude the progress and impact of this project in this month/these three months

_____________________________________________________________________________________

Comments on Food Waste Recycling Project in Housing Estates (if any)
_____________________________________________________________________________________

<table>
<thead>
<tr>
<th>Applicant Housing Estate</th>
<th>Date of Report:</th>
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<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td>Reporting Person:</td>
<td>Position in Organization:</td>
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</tr>
<tr>
<td>Signature:</td>
<td>Official Chop of Organization:</td>
</tr>
</tbody>
</table>

The End
Appendix 3

Composter Testing Record
## Composter Testing Record

Name of Housing Estate: ___________________________  Date: ________________

### Electrical composter (Composter) safety / functional test

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main power connection</td>
<td>Correct / Incorrect</td>
</tr>
<tr>
<td>Emergency stop for the composter</td>
<td>Function / Non-function</td>
</tr>
<tr>
<td>Agitation system inside the composter will stop when the input door of the enclosed chamber is opened</td>
<td>Yes / No / N/A</td>
</tr>
<tr>
<td>Agitation system inside the composter will stop when the output door of the enclosed chamber is opened</td>
<td>Yes / No / N/A</td>
</tr>
<tr>
<td>Rotation of the agitation system of the composter (Forward / Backward)</td>
<td>Function / Non-function / N/A</td>
</tr>
<tr>
<td>Rotation of the enclosed chamber</td>
<td>Function / Non-function / N/A</td>
</tr>
<tr>
<td>Rotation of the output screw</td>
<td>Function / Non-function / N/A</td>
</tr>
<tr>
<td>Operation of the heating element</td>
<td>Function / Non-function</td>
</tr>
<tr>
<td>Heating element will On and Off at the desired set point</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Operation of the air supply fan</td>
<td>Function / Non-function / N/A</td>
</tr>
<tr>
<td>Operation of the exhaust fan</td>
<td>Function / Non-function</td>
</tr>
<tr>
<td>Operation of the motorized bin lifting device</td>
<td>Function / Non-function / N/A</td>
</tr>
</tbody>
</table>

N/A : Not applicable

### Insulation test for the equipment of the composter

<table>
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<tbody>
<tr>
<td>Main power source</td>
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<tr>
<td>Motor for the agitation system</td>
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<tr>
<td>Motor for the rotating chamber</td>
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<tr>
<td>Motor for the bin lifting device</td>
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</table>

### Name plate of the equipment of the composter

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Power (kW)</th>
<th>Phase (Φ)</th>
<th>Voltage (V)</th>
<th>Frequency (Hz)</th>
<th>Ampere (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor of the agitation system</td>
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<tr>
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### Composter Testing Record

Name of Housing Estate: ________________________________ Date: __________________

<table>
<thead>
<tr>
<th>Running current of the equipment of the composter (A)</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>Protective component and setting value</th>
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<tbody>
<tr>
<td>Main power source</td>
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Remarks:

__________________________________________________________________________

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