



Orbital shaker-incubator ES-20/80C

Operating Manual

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1. About this edition of user instructions

1.1. The current edition of the user instructions applies to the following models and versions:

Model and name	Version
ES-20/80C , orbital shaker-incubator	V.1GD

1.2. Edition 1.03 – July of 2022

2. Safety precautions





Caution! Make sure you have fully read and understood the present Manual before using the equipment. Please pay special attention to sections marked by this symbol.



Caution! Hot surface! Incubator surface and inner camera may become very hot during use. Always use protective cotton gloves to install or remove samples when the temperature is set higher than 60°C.

2.1. Icons used on the unit and packaging

	CE marking, manufacturer affirms conformity with European health, safety, and environmental protection standards, see 10.1
	WEEE directive marking, see 10.1

2.2. General safety

- The protection provided can be ineffective if the operation of the appliance does not comply with the manufacturer's requirements.
- Save the unit from shocks and falling.
- After transportation, storage or in the case of condensation formation, and before connecting it to the electric circuit, keep the unit under room temperature for 2-3 hrs to dry out the unit. Without drying out, the operation of the unit may not comply with all safety requirements.
- Store and transport the unit at ambient temperatures between -20°C and +60°C and maximum relative humidity of 80%.
- Before using any cleaning or decontamination methods except those recommended by the manufacturer, check with the manufacturer that the proposed method will not damage the equipment.
- Do not make modifications in design of the unit.

2.3. Electrical safety

- Connect only to the mains with voltage corresponding to that on the serial number label.
- Do not plug the unit into an ungrounded power socket, and do not use an ungrounded extension lead.
- Ensure that the power plug is easily accessible during use.
- Disconnect the unit from the mains before moving.
- If liquid penetrates into the unit, disconnect it from the mains and have it checked by a repair and maintenance technician.
- Do not operate the unit in premises where condensation can form. Operating conditions of the unit are defined in the **Specifications** section.

2.4. During operation

- Make sure that all sample vessels are tightly sealed. Humidity caused by evaporation from unsealed vessels inside the incubator will damage the unit.
- Do not operate the unit in environments with aggressive or explosive chemical mixtures. Please contact manufacturer for possible operation of the unit in specific atmospheres.
- Do not incubate flammable, explosive or chemically active substances. If such substance is spilled inside the incubator, it must be cleaned with a moist cloth and a mild soap solution.
- Do not operate the unit if it is faulty or has been installed incorrectly.
- Do not use outside laboratory rooms.
- Do not place a load exceeding the maximum load value mentioned in the **Specifications** section of this manual.

2.5. Biological safety

- The user is responsible to carry out appropriate decontamination if hazardous material spills on or penetrates into the equipment.

3. General information

ES-20/80C shaker-incubator for biotechnological and pharmaceutical laboratories is a professional category equipment. The typical applications include – microbial and cell culture cultivation, protein expression, solubility studies, general mixing, as well as other various applications in the fields of biology and chemistry. The unit is equipped with a newly developed triple eccentric mechanism for platform motion that provides supreme balancing characteristics, superior reliability and quiet operation. The achieved stability of the unit during vigorous mixing allows for stacking installation of up to 3 units which enables to save space.

The new display and easy to use user interface provide a clear and intuitive control of parameters and allow data logging, storage and display over time. Additional features like out of balance sensor and automatic thermostat failure detection make this shaker-incubator an advanced and safe product. Bluetooth connectivity to PC allows for data management, data logging, parameter control and profiling in a dedicated software.

A combination of an electric heating element and a built-in heat-resistant brushless fan provides precise temperature distribution inside the chamber up to +80 °C. Cooling of the chamber is provided by additional Peltier modules allowing to cool until 12.5 °C below the ambient temperature. Additionally, an excellent sample temperature uniformity of ± 0.2 °C at 37 °C is achieved. The inner chamber is made of stainless steel. State-of-the-art motor, thermal insulation materials and parameter PID-control decrease the energy consumption and make the shaker-incubator highly energy efficient despite its relatively large size.

4. Getting started

- 4.1. **Unpacking.** Remove packing materials carefully and retain them for future shipment or storage of the unit. Examine the unit carefully for any damage incurred during transit. The warranty does not cover in-transit damage. Warranty covers only the units transported in the original package.



Caution! Due to the high weight of the unit, its unpacking and installing must be carried out by two persons.



Caution! After transportation, storage or in the case of condensation formation, and before connecting it to the electric circuit, keep the unit under room temperature for 2-3 hrs to dry out the unit. Without drying out, the operation of the unit may not comply with all safety requirements.

- 4.2. **Complete set.** Package contents:

4.2.1. Standard set:

- ES-20/80C, Orbital shaker-incubator 1 pce.
- Power cable 1 pce.
- Spare fuse (inside fuse holder) 1 pce.
- Four screws and a hex driver 1 set
- USB drive with software and software manual 1 pce.
- Operating instructions, declaration of conformity 1 copy

4.2.2. Optional accessories:

- HSP-30/100 platform on request
- HSP-16/250 platform on request
- HSP-9/500 platform on request
- HSP-6/1000 platform on request
- PP-400 platform on request
- UP-168 universal platform on request
- HSC-50, HSC-100, HSC-250, HSC-500, HSC-1000 clamps for UP-168 on request
- TR-21/50 test tube rack for UP-168 on request
- TR-44/15 test tube rack for UP-168 on request
- USB Bluetooth adapter for PC on request
- Stacking kit for two units on request
- Stacking kit for three units on request



HSP-30/100



HSP-16/250



HSP-9/500



HSP-6/1000



PP-400



UP-168



SPML



TR-21/50



TR-44/15

4.3. Setup.



Note.

Ensure that the unit is placed on level horizontal surface, which is able to support its weight.



Note.

To stack two or three units, see the section **Stacking**.

- Place the unit on an even horizontal stable non-flammable surface 30 cm away from any flammable materials, clear 20 cm around the unit on all sides for ventilation.
- Level the unit on the surface by adjusting the threaded legs. Rotate the legs until the unit is stable, then secure the thread with a jam nut. The unit should stand on all 4 legs, vibrations should be absent.
- Remove the protective film from the display.
- Connect the power cable to the socket on the rear side of the unit and position it with easy access to the power switch and plug.

4.4. Platform installation.

4.4.1. Remove the silicon mat and unscrew four screws from the previous platform using a hex driver if a platform was present. Install and secure the new platform to the moving part of the base with four screws and replace the silicone mat.

4.4.2. **UP-168** platform. The platform can be outfitted with flask clamps or a test tube rack. Arrange the components symmetrically in relation to the centre of the platform. Fix them in place with screws included with components.

4.4.3. **SPML** strips for **UP-168**.

- Remove any obstructing clamps or racks.
- Degrease, clear and dry the platform as described in **9.3.1**.
- Remove protective plastic sheet from one side of the mat/strip and place it on the platform. Place up to three **SPML** strips symmetrically, in parallel to the longer edge.
- Remove the remaining protective sheet. Keep both sheets!

4.4.4. Maximum number of clamps or racks can be found in the table below.

FC-50	36
FC-100, FC-250	16
FC-500	8

FC-1000	4
SPML	3
TR-21/50, TR-44/15	2

5. Stacking



Note. The following section applies to the optional stacking kit, to use with 2 or 3 shaker-incubator units.

5.1. Stacking kit contains:

Component	Kit for 2 units	Kit for 3 units
Catalogue number	BS-0101670-OK	BS-0101670-PK
Side legs	–	2
Holder plate	4	8
Hex screw 6x16	16	40
Washer	16	40
Lock washer	16	40
Hex key	1	1

5.2. **Aquiring a kit.** To purchase the kit, contact Boeco or your local Boeco representative, with information from the section **Ordering information**.

5.3. Getting started.

5.3.1. Unpack the kit. Unpower the units and disconnect the power cables.

5.3.2. Prepare the working space. Ensure that the floor and the desk supports at least 150 kg_F/m² (for 2 units) or 200 kg_F/m² (for 3 units). Laminate or rubber flooring may reduce overall stability and are generally not recommended.

5.3.3. Position the units so that the access to the mains plugs, the sockets and the power switches is unobstructed.

5.4. Stacking two units (figure 2).

5.4.1. Set one unit atop the other.

5.4.2. Connect the units with four plates. A plate requires four screws, each with a washer and a lock washer on it (fig. 3). Fix the screws tightly.

5.5. Stacking three units.

5.5.1. Base unit (figure 4):

5.5.2. Attach the left and the right legs to the base unit. A leg requires four screws, each with a washer and a lock washer on it (fig. 3). Fix the screws tightly.

5.5.3. Regulate the rubber parts of the legs so that the base unit is stable and level.

5.5.4. Middle unit (figure 5):

5.5.5. Set the middle unit atop of the base unit.

5.5.6. Connect the units with four plates. A plate requires four screws, each with a washer and a lock washer on it (fig. 3). Fix the screws tightly.

5.5.7. Top unit (figure 6):

5.5.8. Set the top unit atop of the middle unit.

5.5.9. Connect the units with four plates. A plate requires four screws, each with a washer and a lock washer on it (fig. 3). Fix the screws tightly.

5.6. Connect the power cables to the units and to grounded mains sockets.

5.7. **Maintenance.** Check the screw fixation and unit stack stability once a month.

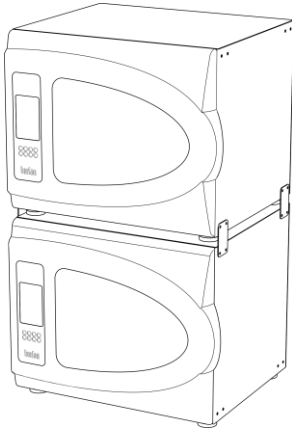


Figure 2. Stacking two units

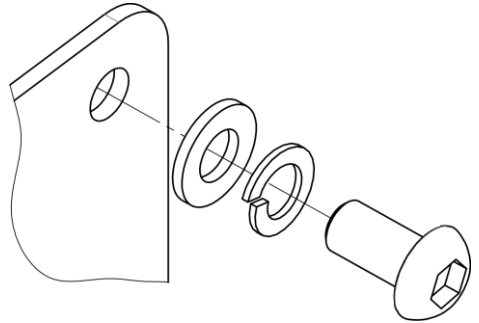


Figure 3. Washers on the screw

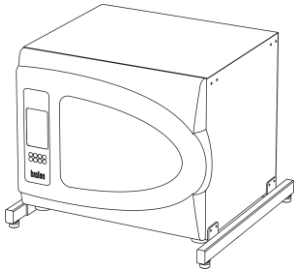


Figure 4. Stacking three units, base level

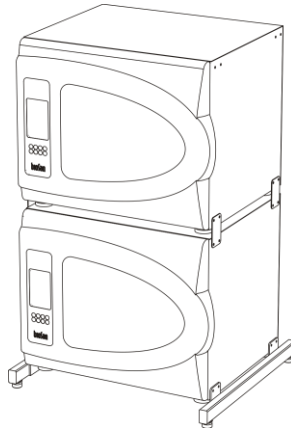


Figure 5. Stacking three units, middle level

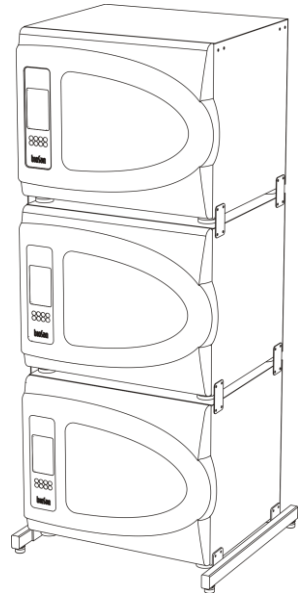


Figure 6. Stacking three units, top level

6. Operation



Caution! After transportation, storage or in the case of condensation formation, and before connecting it to the electric circuit, keep the unit under room temperature for 2-3 hrs to dry out the unit. Without drying out, the operation of the unit may not comply with all safety requirements.

- 6.1. Connect the unit to a grounded power socket. Set the **Power** switch on the rear panel to position **I** (on).
- 6.2. The display turns on. From top to bottom, display shows:
 - Current date and time;
 - Actual and set temperatures;
 - Actual RPM, set RPM and timer;
 - Status bar;
 - Context buttons, corresponding to unmarked keys below the display.
- 6.2.1. Below the display:
 - Four unmarked keys, corresponding to context buttons on the display;
 - The **Select**, **▲**, **▼** and **Run Stop** keys.
- 6.3. **Setting the parameters.** Press the **Select** key to select the parameter to change. Use the **▲** and **▼** keys to adjust the parameter. Pressing the key for longer than 2 s increases changing speed. Press the **Select** key again to select the next parameter. Changes are saved automatically.
 - 6.3.1. **Setting temperature.** Temperature starts changing according to set value. Increment is 0.1°C. Values can be changed anytime.
 - 6.3.2. **Setting speed (RPM).** Increment is 10 RPM. Speed can be adjusted anytime.
 - 6.3.3. **Setting time.** Time is set separately for hours and minutes, with increment of 1 minute.
- 6.4. **Program execution.**
 - 6.4.1. When the actual temperature in the incubator reaches set values, open the door and place samples on the platform.



Caution! Place the samples symmetrically in relation to the center of the platform to avoid imbalance errors.



Caution! Do not fill the vessels inside the incubator. Please make sure that all vessels are tightly sealed. Humidity caused by evaporation from unsealed vessels inside the incubator will damage the unit!

- 6.4.2. Press the **Run Stop** key. The platform will start rotating and the timer indicator will start counting the time interval.



Caution! If the speed is set to zero, pressing the **Run Stop** key will start the timer, but the platform will not move.

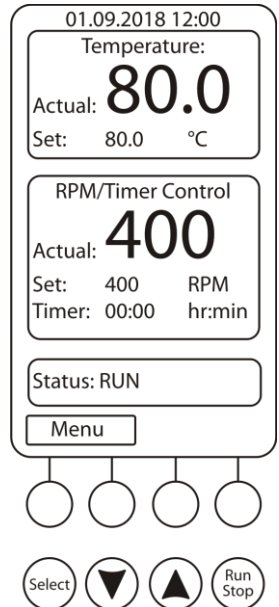


Figure 7. Control panel

- 6.5. After finishing the program (after the set time elapses), the platform motion stops and the status bar shows STOP accompanied by the repetitive sound signal. Press any key to stop the signal.



Caution! The chamber heating can only be stopped manually by reducing the temperature.

- 6.6. If the time is not set (set time is 00:00), the **Run Stop** key will start continuous operation of the unit until the **Run Stop** key is pressed again.
- 6.7. The platform motion can be stopped at any time by pressing the **Run Stop** key. In this case, the program realisation and the platform motion will stop and the timer will switch into the STOP mode saving previously set time. Press the **Run Stop** key to restart the operation with the same time and speed. Additionally, if the door is opened the platform will stop; after closing the door, platform will reinitiate motion automatically.
- 6.8. **Incubator menu.** The **Menu** button opens incubator's menu. Use **▲** and **▼** buttons to navigate and **Enter** button to select. While browsing in the menu, select the topmost **Quit** option in order to return from sub-menu to menu.
- 6.8.1. **Incubator ID.** Option **GetID** shows the serial number and name of the incubator and its Bluetooth module MAC address, as well as remote PC Bluetooth module MAC address.
- 6.8.2. **Date & Time.** To set date and time in this submenu, press **Enter** button to select the parameter, then **▲** and **▼** buttons to change the value and **Enter** button to confirm changes.
- 6.8.3. **Service.** This submenu has following options: **Current Errors** and **Settings**.
- 6.8.3.1 **Current Errors.** This option allows user to view and reset the list of active errors.
- 6.8.3.2 **Settings.** This option has two suboptions available – **Alarm Setting** and **Start mode**.
- **Alarm Setting.** User can set the alarm settings based on values of temperature and RPM. All alarms are working on the following principle, temperature taken as an example:
If $T_{act} < T_{thr,low}$ or $T_{act} > T_{thr,high}$ for t_{delay} minutes, then an alarm will be triggered.
Where T_{act} is the actual temperature inside the incubator, $T_{thr,low}$ is the lower threshold limit value, $T_{thr,high}$ is the higher threshold limit value and t_{delay} is the time delay in minutes. Time delay is used in order to avoid false triggering of the alarms.
RPM alarm is operated using the same principle.
 - **Start Mode.** User can change the acceleration mode of the unit. In **Start Mode Slow** the unit picks up speed gently to reduce the possibility of spilling. In **Start Mode Fast** the unit rapidly gains speed and set RPM rate.
- 6.8.4. **Active Alarms.** This option allows user to view and reset the list of active alarms.
- 6.8.5. **Data Logger.** Data logger features following options: View Plot T(t), View Plot RPM(t), View Plot T(t)+RPM(t), Clear log, Logger on/off.
- 6.8.5.1 All View Plot options use the same interface. Use **Left** and **Right** buttons to move the plot along the x axis. Use **Up** and **Down** buttons to move the plot along the y axis. Use **<-xx->** button to choose the x axis navigational scale. Available scales are 15 minutes, 1 hour, 1 day, 1 week and 1 month.
- 6.8.5.2 **Clear Log** button clears the logger's data.
- 6.8.5.3 **Logger On/Off** button toggles the automatic logging of the data.
- 6.8.5.4 **Available memory indicator.** When the data logger uses up all available memory, it begins overwriting data from beginning. 100% of memory is used up in approximately 1 month.
- 6.9. At the end of operation, set the **Power** switch in position O (off). Disconnect the power cable from electric circuit.

7. Specifications

The unit is designed for operation in cold rooms and closed laboratory rooms at ambient temperature from +4°C to +40°C in a non-condensing atmosphere and maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C.

Grant is committed to a continuous programme of improvement and reserves the right to alter design and specifications of the equipment without additional notice.

7.1. Temperature specification

Setting range	+4°C ... +80°C (increment 0.1°C)
Control range	12.5°C below ambient ... +80°C
Uniformity ¹	±0.2°C
Control accuracy ¹	±0.1°C
Heat up time to +80°C inside the chamber	70 min

7.2. General specification

Speed control range.....	50 - 400 RPM (increment 10 RPM)
Digital time setting	1 min - 96 hrs (increment 1 min) / non-stop
Maximum continuous operation time.....	30 days



Note. Recommended interval between prolonged operations – not less than 8 hours

Maximum load	10.6 kg
Orbit	20 mm
Display	TFT LCD
Data transfer.....	Bluetooth
Dimensions	620x620x510 mm
Dimensions of the inner chamber.....	460x350x400 mm
Stacking.....	up to 3 units ²
Operating voltage/ power consumption	230 V, 50/60 Hz / 810 W (3.7 A)
Weight, accurate within ±10%.....	50 kg

Table 1. Recommended maximum speed for UP-168 platform with fully loaded TR-21/50 or TR-44/15, depending on the set angle.

Set angle	Speed, in RPM			
	200	250	350	400
0°	OK			
15°	OK			
30°	OK			
45°	OK			Not recommended
60°	OK		Not recommended	
75°	OK	Not recommended		

¹ Data for samples, at 37°C and 240 RPM

² Only with the stacking kit installed. Base side-mounted leg parts are required for third level stacking

8. Ordering information

8.1. Models and versions available:

Model	Version	Description
ES-20/80C	V.1GD	230 V, 50/60 Hz, no platforms

8.2. To inquire about or order the optional accessories, contact Grant or your local Grant representative.

8.2.1. Optional accessories for **ES-20/80C**:

Model	Description
HSP-30/100	Platform with clamps for 30 flasks of 100 ml
HSP-16/250	Platform with clamps for 16 flasks of 250 ml
HSP-9/500	Platform with clamps for 9 flasks of 500 ml
HSP-6/1000	Platform with clamps for 6 flasks of 1000 ml
PP-400	Flat platform with non-slip silicone mat. Working dimensions 360x400 mm
UP-168	Universal platform for different flasks
HSC-50	Clamp for 50 ml flask for UP-168 platform (ø 50 mm)
HSC-100	Clamp for 100 ml flask for UP-168 platform (ø 65 mm)
HSC-250	Clamp for 250 ml flask for UP-168 platform (ø 85 mm)
HSC-500	Clamp for 500 ml flask for UP-168 platform (ø 105 mm)
HSC-1000	Clamp for 1000 ml flask for UP-168 platform (ø 130 mm)
SPML	Set of 3 double-sided adhesive strips for UP-168, 390x80x3 mm
TR-21/50	Variable angle test tube rack for 21 tubes of 50 ml for UP-168 platform
TR-44/15	Variable angle test tube rack for 44 tubes of 15 ml for UP-168 platform
	Bluetooth adapter
	Stacking kit for two units
	Stacking kit for three units

9. Guarantee and service

- 9.1. **Guarantee.** When used in laboratory conditions and according to these working instructions, this product is guaranteed for TWO YEARS (excluding items mentioned in **8.2**) against faulty materials or workmanship.
- 9.2. **Service.** There are no user-serviceable parts inside the unit. For all maintenance and repairs (except as defined below) return to our service department in the UK or in other countries, our distributor.
- 9.2.1. If a stacking kit is used, check the screw fixation and unit stack stability once a month. See section **5. Stacking** for additional information.
- 9.2.2. Frequently check condensation accumulation in the condensation tray (fig. 8), discard if necessary.
- 9.3. **Cleaning and disinfection.**
- 9.3.1. Use mild soap and water with a soft cloth or sponge for cleaning the exterior. Rinse remaining washing solution with distilled water. Wipe dry the excess water with clean, soft cloth or sponge.
- 9.3.2. To disinfect the plastic and metal parts, use 75% ethanol or DNA/RNA removing solution (e.g., Grant PDS-250). After disinfecting it is necessary to wipe the surfaces dry.
- 9.3.3. The platforms are autoclavable (120°C, 20 min).
- 9.4. **Fuse replacement.** Disconnect the power cable from the mains. Disconnect the power cable from the socket on the rear of the unit. Open the fuse holder, located near the socket (fig. 9). Check and replace with a correct fuse if necessary, see table below:

Model & version	Fuse ¹
ES-20/80C V.1GD (230 V)	M 4 A

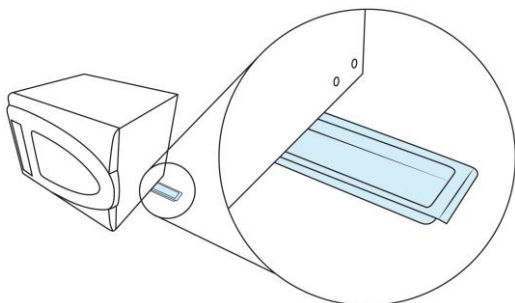


Figure 8. Condensation tray

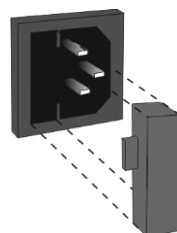


Figure 9. Fuse holder

¹ Fuse type M - time lag Medium

10. Compliance

EU Declaration of Conformity

All the products covered by this Manual comply with the requirements of the EU harmonised legislation verified using the following standards

Low Voltage Directive (2014/35/EC) for Electrical safety.	LVS EN 61010 Part 1 LVS EN 61010 Part 2-010 LVS EN 61010 Part 2-051
EMC directive (2014/30/EC) for Electromagnetic compatibility	LVS EN 61326-1
RoHS Directive (Directive 2011/65/EC including 2015/863) for Hazardous substances	LVS EN 50581

UK Declaration of Conformity

All the products covered by this Manual comply with the requirements of UK statutory requirements verified using the following standards.

Electrical Equipment (Safety) Regulations 2016	BS EN 61010 Part 1 BS EN 61010 Part 2-010 BS EN 61010 Part 2-051
Electromagnetic Compatibility Regulations 2016	BS EN 61326-1
The Restriction of the Use of Certain Substances in Electrical and Electronic equipment Regulations 2012	BS EN 50581

Waste Electrical and Electronic Equipment (WEEE)



All the products covered by this Manual are marked with the crossed-out wheeled bin symbol indicating they must not be disposed of with unsorted waste. Safe recycling of WEEE helps conserve natural resources and protect human health.

Grant Instruments complies fully with the UK Waste Electrical & Electronic Equipment (WEEE) regulations 2013. We are a member of the B2B compliance scheme (Scheme Approval Number WEE/MP3338PT/SCH), which handle our WEEE obligations on our behalf. Grant Instruments have been issued with a unique registration number by the Environmental Agency, this reference number is WEE/GA0048TZ.

For information regarding WEEE collections in the UK please contact our B2B Compliance Scheme directly on 01691 676 124 or www.b2bcompliance.org.uk

In the EU, Grant Instruments complies with WEEE Directive 2012/19/EU. Contact your local equipment supplier for WEEE collections.

REACH Regulations

This product does not contain any Substances of Very High Concern (SVHCs) at greater than 0.1% that have to be identified in accordance with Regulation (EC) No 1907/2006 and therefore does not have an entry in the SCIP database.

Grant-bio

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