



BIOvator™ Owner's Manual

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Table of contents

• Composting Basics & Mortality Composting	page 3
• BIOvator™ composting process	page 4
• Safety first	page 4
• Delivery, Placement and Adjustments	page 4-5
• First time loading instructions	page 6
• BIOvator™ options, dimensions, & daily capacity	page 7
• BIOvator™ Daily Operation Instructions	page 8 - 9
• Four key requirements for composting	page 9
• Daily recordings	page 9
• Storage and secondary treatment	page 9
• Static bins	page 10
• Maintenance	page 10 - 12
• Lightning strikes	page 12
• Basic trouble shooting	page 12
• Frequently asked questions	page 13 - 16
• Quick sheet (wall instructions)	page 17
• BIOvator™ Components and Technical Specifications	page 18 - 19
• Warranty	page 20

Composting Basics

Normal decay of any organic material occurs naturally, due to the action of micro-organisms. Some of these micro-organisms (bacteria and fungi) can live without air (anaerobic) and the rest (aerobic) need air to survive and carry out the decomposing of organic material.

General composting of organic matter is a method of speeding up the normal decay processes caused by bacteria and fungi. During this process, bacteria and fungi decompose organic material in a predominantly aerobic (with air) environment. These micro-organisms break down organic material into a stable mixture called compost. Brown to dark brown in color and odorless, compost is considered an ideal soil amendment.

Mortality Composting

In contrast to general composting, mortality composting takes place in both aerobic (with air) and anaerobic (without air) zones. The animal carcass (high in nitrogen, with high moisture content and near zero porosity) is placed into a mixture of bulking agent (high in carbon, very porous with moderate moisture content), creating an inconsistent mixture of materials. During this stage, called the primary stage, the carcass degrades through the action of anaerobic bacteria and micro-organisms, releasing fluids and gases which diffuse away from the carcass and enter the aerobic zone.

In the aerobic zone, aerobic bacteria and micro-organisms degrade the fluids and gases into carbon dioxide (CO₂) and moisture (H₂O). This action results in the emission of heat. The composting (complete transformation of the mixture, including the decomposed carcass which may include a few bones, into a neutral and odorless dark compost), must undergo a curing process to complete the transformation.

This curing process is called the secondary stage. Throughout the process, the compost is turned to allow the aerobic bacteria to finish their job. The composting is successfully completed when you can hold a handful of material and smell no foul odor in it, squeeze no moisture from it, and feel no heat coming out of it. This form of composting conserves the nutrients contained in dead animals, preserves the environment, and reduces odors and nuisance associated with storing or incinerating carcasses.

BIOvator™ COMPOSTING PROCESS

Besides the economic advantage the BIOvator™ offers, composting with the BIOvator™ is simple to manage. The BIOvator™ offers a continuous composting process throughout the year, and eliminates problems associated with outdoor composting.

Mortalities or organic waste are mixed with measured quantities of wood shavings and occasionally water. While anaerobic activities are underway inside carcasses, aerobic micro-organisms are also in action throughout the vessel, breaking all organic matter down into humus-like material that is consistent in quality and can be used as a soil-enhancing agent. Unlike outdoor composting, the BIOvator™ offers a highly controlled process, which accelerates the natural process of decaying. Regardless of outdoor conditions, the composting temperature inside the BIOvator™ is always higher than 100°F/38°C. Within a few weeks, the bulk of the composting process is finished inside the BIOvator™, and the operator can discharge and pile it up, or recycle it back with the addition of more mortalities and less wood shavings.

Safety First

People who manage on-site composting should use precautions, just as they would when working with any other soil amendment. Minimize direct contact. Always wear a mask when opening the BIOvator™ doors for inspection or loading. If discharged compost is dry, use a mask to minimize inhalation of particles during handling or spreading. (Good quality compost, however, should not be allowed to dry out to that extent.) People with asthma, allergies or serious health problems should not work with soil amendments.

Working with the BIOvator™ requires paying attention to the following:

- Driving system cover: The BIOvator™ comes with safety guards to all mechanical parts. Make sure the motor, gearboxes, pulleys, belts, chains and rollers are well covered.
- Loading of waste and shavings: If using a front-end loader, make sure not to hit the BIOvator™ or any part of its supporting structure.
- Opening of doors: Loading and inspection doors are heavy. Make sure you are standing on a solid and stable support while opening or closing these doors.

Delivery & placement

- Unload and place BIOvator™
Use a crane for 430 and 442 models. (model specs & weights on page 7) Fork lift can be used for 308, 316 and 418 models.



- Place BIOvator™ on even stable surface. Place blocks/beams under support braces
Insure blocks are 6" minimum height



Adjustments (see part description on page #18)

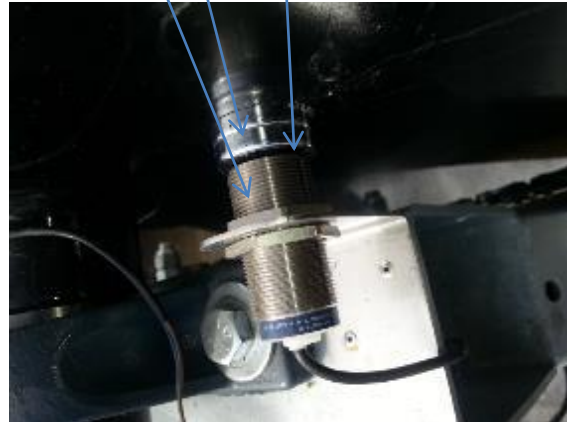
- Make sure all doors open and close freely, and that all bolts for hinges and locks are secured with the proper nuts and washers.
- Make sure all chains and rubber belts connecting the motor and gearboxes to the vessel are attached properly.
- Make sure the pillow block is secured to the vessel shaft.
- Make sure the nylon casters are placed properly inside the channels.
- Make sure the motor is connected to the correct power outlet.

- Adjust proximity switch to determine resting position

Prox switch access door



Prox switch; magnet (insure 1/8" gap)



Prox switch determines when the drum stops its rotation.

The picture below indicates ideal resting position in order to insure optimum loading position for daily mortalities.

Door hinge; shield flange



- Close all doors, turn power on, and observe rotations for at least 2 revolutions before loading for the first time.

- Adjust number of rotations per day using time clock
Pull out 1 peg for every 20 minute rotation



First time start up procedures

- Fill BIOvator™ with wood shavings
Insure that the unit is filled with carbon (wood shavings) both at the loading and discharge end of the BIOvator™
Adding a substrate such as broiler manure, or existing static compost can help to speed up the composting process.



Day 1 – 7 loading procedure

- Day 1 Load BIOvator™ with 50% of daily capacity
(See BIOvator™ model options, dimensions and daily capacity page 7)
Add small amount of water (10 gallons for model #442)
- Day 2 Set timer
- 308 = 2 rotations per day
 - 316 = 3 “
 - 418 = 3 “
 - 430 = 4 “
 - 442 = 4 “
- Day 3-7 Load BIOvator™ with 50% of daily capacity

Day 8

Once temperatures reach 50C or 120F, you can increase rotations to normal levels and increase loading to recommended daily levels

Number of rotations will depend on volume and quality of mortalities being added
Rotations per day

- 308 = min 1, mid 3, max 6
- 316 = min 2, mid 4, max 8
- 418 = min 4, mid 6, max 10
- 430 = min 4, mid 12, max 16
- 442 = min 6, mid 14, max 24

It will take 30 days for the 1st compost to come out of the BIOvator™.

BIOvator™ options, dimensions and daily capacity

Model #	Dimensions		Weight empty	Weight With Dead Stock	Daily Capacity Livestock
308 Standard	10' 6" Long 3' 2" Wide 4' High	320 cm Long 96.5 cm Wide 121.9 cm High	2000 lbs 907 kgs	4500 lbs 2014 kgs	60 lbs 27 kgs
316 Standard	18' 6" Long 3' 2" Wide	563.9 cm Long 96.5 cm Wide	3800 lbs 1725 kg	8,800 lbs 3993 kgs	120 lbs 55 kgs
	4' High	121.9 cm High			
418 Standard	22' Long 4' 2" Wide 5' High	670.6 cm Long 127 cm wide 152.4 cm High	5800 lbs 2631 kgs	13,300 lbs 6034 kgs	175 lbs 80 kgs
430 Standard	33' Long 4' 2" Wide 5' High	1005.8 cm Long 127 cm Wide 152.4 cm High	7600 lbs 3448 kgs	18,600 lbs 8439 kgs	350 lbs 160 kgs
442 Standard	45' Long 4' 2" Wide 5' High	1371.6 cm long 127 cm Wide 152.4 cm High	9900 lbs 4491 kgs	25000 lbs 11343 kgs	500 lbs 225 kgs
220 Volt					
220 Volt 50HZ					
Restriction cone					
Bone Screener					

As a rule of thumb, you may load the BIOvator™ with more than its daily capacity as long as weekly capacity is not exceeded.

BIOvator™ Daily Operational Instructions

Before using the BIOvator™:

*PUSH **RED BUTTON** into the OFF POSITION*



- 1) Record daily temperatures (should range between 38C – 65C or 100F – 150F)
- 2) Determine and record daily mortality weights.
- 3) Open loading doors, remove center bridge



- 4) Add one bag of fresh shavings for each 250 lbs. of mortalities.
(Sow Farms should add 25% more shavings when adding afterbirth.)
- 7) Place mortalities into BIOvator™.
- 8) Put ½ the previous days compost back into the BIOvator™ as recycle. **(Optional)**

9) Before starting **BIOvator™** make sure:

- Loading door gaskets and door frames are clean.
- Loading door bridge is set back in place.
- All doors are closed, all ratchet straps tightened, and handles are in locked position.

10) Pull out **RED Button** and make sure selector switch is in Auto.

Note: If the temperatures drop for more than two days you should check the moisture and add fresh shavings, or if very dry, add water. 99.9% of the time the unit needs fresh shavings because it is too wet.

****Make Sure Doors are Closed and Ratcheted before Starting Biovator**

Four Key Requirements for Composting

- 1) Nitrogen = animal mortalities, manure, food waste, etc.
- 2) Carbon = pine shavings, paper, wood chips, etc
- 3) Air = rotations of **BIOvator™** provide additional air
- 4) Water = Animal carcasses provide most of the needed water in the **BIOvator™**

Daily Recordings

- 1) Check & record daily temperatures, should range from 38C – 65C or 100F – 150F
- 2) Use manual temp. probe to verify and calibrate gauges on **BIOvator™**

Storage and Secondary (optional) Treatment

- 1) Place half the composted product coming out of the **BIOvator™** back into the unit as recycled product. **(optional)**
- 2) Put all bones back into the **BIOvator™** for complete composting.
- 3) Place compost out of the **BIOvator™** into one of the static bins for secondary treatment and storage.
- 4) Storage/Static bins may need water added to keep moisture and temperatures at the optimum range of 55C+ or 130F+

Static Bins

Use static bins for any mortality that does not fit into BIOvator™ due to high spikes and catastrophic losses.

- 1) Place a 18" layer of compost and fresh shavings on floor.
- 2) Place mortalities. Cover with 12" compost and fresh shavings.
- 3) Continue to place mortalities in layers and cover with 12" **(Optional)** compost and fresh shavings as needed.
- 4) Monitor temps with probe. Add water if product is too dry.
- 5) Static bin should be recycled back into BIOvator™ when mortality spike has ended or moved to another bin.

Maintenance

- 1) Check straps and hooks for wear and operation



- 2) Lubricate chains every 6 months with quality chain lube



3) Check viewing glass on gear box for oil and inspect for leaks.



4) Clean door gaskets and door jams daily before closing



5) Keep ratchets sprayed weekly so they operate easily



6) Check rollers for wear



- 7) Insure BIOvator™ base remains level. Check regularly and adjust when needed.



****CAUTION****

Lightning strikes, power surges or low power sources may cause damage to the control box, orange fuse, proximity switch, or motor.

Basic Troubleshooting

- 1) If temperatures are dropping, check the moisture. Add fresh shavings at all doors if unit appears wet.
- 2) If the BIOvator™ does not rotate, check power supply, check orange fuse inside control box.
- 3) If the BIOvator™ does not stop at the correct position, check proximity switch and the magnet on the drum. The magnet may have moved or the proximity switch may not be working. If the proximity switch becomes loose, it may push and move the magnet.

Frequently asked questions

Q. How do we insure bones are completely composted?

A. Some bones, such as large skulls, teeth, or ball joints, may not be fully composted in the same short time as flesh and muscles. The BIOvator™ has an optional bone screener attachment that prevents the bones from exiting with the compost. Bones carry on to their own discharge pile. It is estimated that some of the bones may take up to 3 months to break down and disappear. If longer periods of time are noticed to break down these bones, look for reasons the process is being slowed. Many times it is due to not enough shavings in the system. (see picture below)



Q. How do we insure odor is minimized?

A. Odor should not be generated in a correctly managed BIOvator™. The presence of odor is an indication of one, some, or all of the following conditions: excessive load at the front part of the vessel, too low or high moisture content, or lack of adequate shavings covering the carcasses. Odor can also be noticed if partially decaying carcasses are added to the compost. Odor is more noticeable when opening the loading doors, inspection doors or the discharge opening. It is unlikely to notice such odor outside the BIOvator™, unless doors have been kept open for long periods of time and conditions inside the BIOvator™ have been mismanaged.

Monitoring the compost temperature is a good check to avoid odor. Temperatures that are too low or do not increase after loading indicate a problem with the process and forewarn of impending odor.

Q. How do we minimize Flies, Insects, Vermin and Scavengers

A. Due to the complete confinement of the compost mixture inside the BIOvator™, scavengers and vermin do not exist. The heat produced combined with the turning of the BIOvator™ also prevents development of insect larvae or maggots. The continuous addition of dry shavings and recycled compost reduces the wet conditions required for egg laying.

Flies may appear around the BIOvator™ during hot weather if doors are left open. Odor is generated due to lack of shavings, or fluid is leaking from openings. If the latter is noticed, check the loading and inspection door

Q. Does the composting action continue during winter months in cold climate areas?

A. If started during summer or early winter (not later than November), composting would continue during the winter months, provided thicker layers of woodchips are added on top of the carcasses. Auxiliary heat may be required when starting a BIOvator™ during colder winter months.

Q. Does it smell around the BIOvator™?

A. When properly managed and when carcasses inside the BIOvator™ are totally covered with enough wood shavings, the odors should sufficiently suppressed or absorbed. Using insufficient bulking material (less than 6" cover at any time) is the single greatest factor causing odors in and around the facility

Q. Is cutting/dismembering required for large carcasses?

A. No. However, if facility managers wish to speed up the process and have the means to do it, they may put a few holes or cuts in the carcasses. It should be noted large carcasses (180-270 kgs or 400-600 lbs) would take longer to decompose than smaller ones.

Q. What about diseases and pathogens?

A. The high compost temperatures, cover of sawdust and full enclosure of the BIOvator™ are sufficient to eradicate pathogens commonly associated with livestock production survival.

Q. What are other sources of carbon sources can be used?

A. Any granular organic material with high carbon content can work. Long fibrous material, such as hay or cornstalks, may be used but they will need to be chopped into smaller particle sizes and because they are so bulky, you may need to re-stock the system more often. Common carbon sources like wood shavings, rice hulls or flax chives have been proven to work well in most settings.

Q. Does composting fail?

A. If not managed properly, compost may not heat enough particularly in wintertime, and may produce odors in summer. Composting is a biological process that depends on providing nutrients and an environment favorable for bacterial decomposition. Common mistakes are:

- Failure to provide enough shavings (or bulking material) inside the BIOvator™ to provide for the bio-filter and to maintain an appropriate carbon source for the system to operate over time
- Overloading the BIOvator™ and creating a large anaerobic mass

Q. How can I tell when compost is cured?

A. If steam is emitting from the discharged pile, it is not fully cured. You may leave it in the pile for more time, or recycle it back into the BIOvator™. Once the pile temperature is down to ambient temperature and compost color is dark brown, it is cured.

Q. How large a carcass can be put in the BIOvator™?

A. Mature sows and boars over 207 kgs or 600 lbs can be loaded in the BIOvator™. Expect longer composting time for larger carcasses

Q. Are there any additives that can be used to speed up composting?

A. Composting experiments using various inoculants have been conducted but little or no advantage was found

Q. How do I add moisture?

A. The best way to uniformly distribute the water is to use a garden hose with a sprinkle/spray head. Adding water with a pail would cause some parts to be very wet and others to remain dry. Be careful not to over water and create anaerobic conditions.

Q. Can finished compost be used as a full substitute for fresh shavings in the BIOvator™?

A. Experience to date indicates that up to 50% of the fresh shavings requirement may be substituted with finished compost. The long-term viability of the process cannot be maintained if fresh shavings are not added, because the source of carbon would eventually be exhausted. Advantages of recycling finished compost include: less fresh shavings required, active bacteria and heat are available in the finished compost, less finished compost to haul for spreading and speeding up the disappearance of bones.

Q. What about maggots?

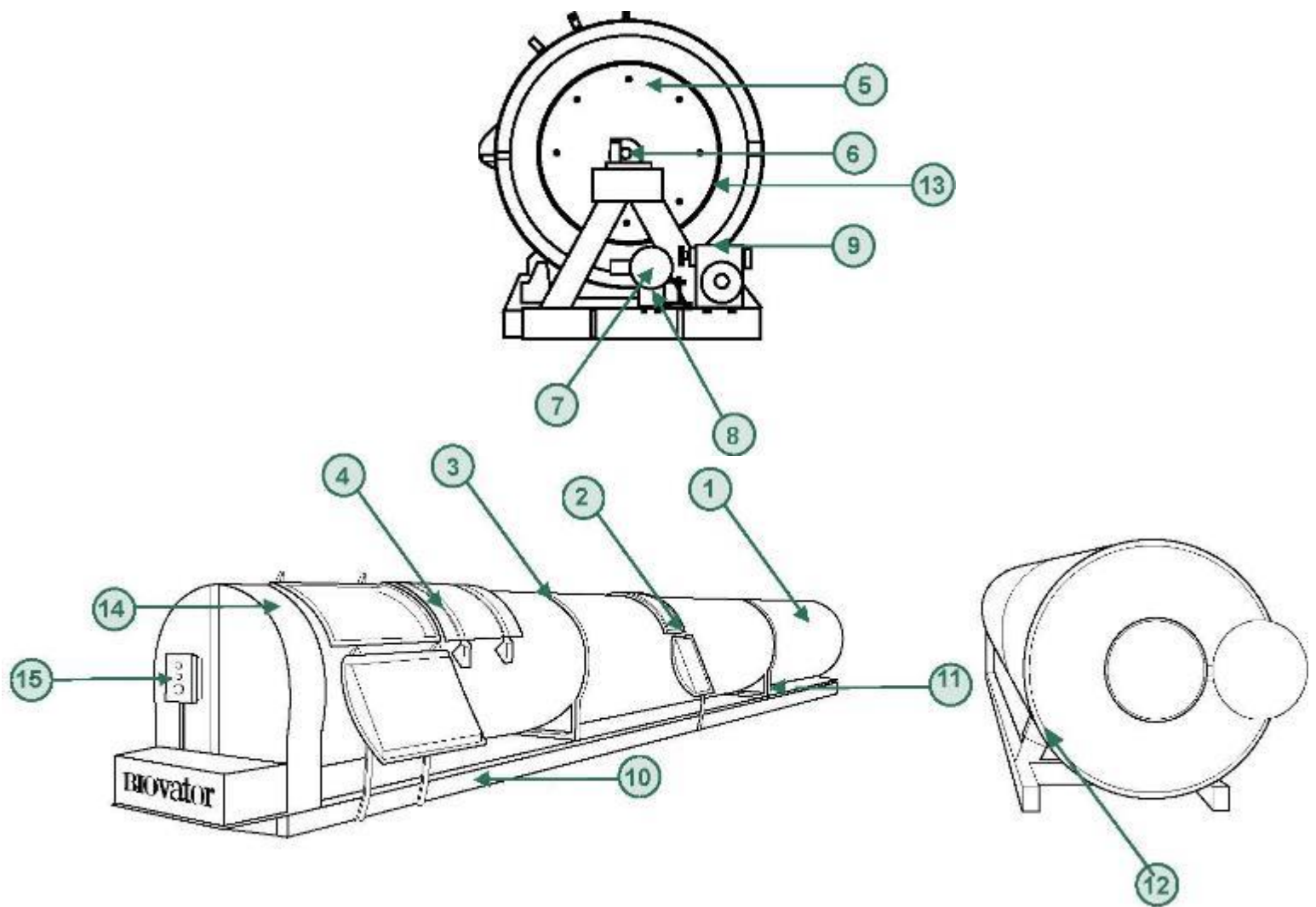
A. Generally, all kinds of earthworms are beneficial for composting. Large-sized maggots are particularly beneficial for composting. The maggots to be concerned with are the small, pale-colored housefly larvae, which may present a public health problem. Usually, the main cause for harmful larvae is lack of shavings inside the BIOvator™ or leakage of fluids. Therefore, it is good practice to maintain a sufficient cover of shavings on top of the carcasses and eliminate any leakage.

Q. Can the BIOvator™ be set right on the ground?

A. Yes, the BIOvator™ may be set on gravel or concrete pads. We recommend a minimum of 6" wooden blocks or beams be placed under frame supports.

Quick sheet (wall instructions)

- 1) Record daily temperatures and loading weights
- 2) Before opening doors, push **RED** button to shut off **BIOvator™**
- 3) Open loading doors and remove center bridge
- 4) Add mortalities
- 5) Add fresh wood shavings – 1 bag (3 compressed cubic ft) for every 113 kgs or 250 lbs of mortalities
(If you are adding afterbirth, add 25% extra wood shavings)
- 6) Add same amount of finished compost as fresh shavings **(optional)**
- 7) Before starting **BIOvator™** make sure
 - Loading door gasket and door frames are clean
 - Loading door bridge is back in place
 - All doors are closed
 - Ratchet straps are tightened down and handles are in locked position
- 8) Pull **RED** button and make sure the selector switch is in Auto position
- 9) If temperatures start to drop for two or three days you should add more fresh wood shavings



1	Steel drum Spiral welded	Mild Steel ¼" thick Two part epoxy coated (SS option available)	8' long 3' dia	16' long 3' dia	18' long 4' dia	30' long 4' dia	42' long 4' dia
2	Inspection door	17 ½" X 24" opening SS 304 construction Foam insulated Nitrile seal 1 ¾" X ¾" Ratchet type locking device	No door	No door	No door	1 door	2 door (1 vented)
3	Steel channel	6"X10.5 lbs per foot Welded to the drum Hot dipped galvanize	1 channel	1 channel	1 channel	2 channels	3 channels
4	Loading door	24" X 90" opening 2 (doors) SS 304 construction Foam insulated Nitrile seal 1 ¾" X ¾" Ratchet type locking device	1 door	1 door	2 doors	2 door	2 doors
5	Steel sprocket	Bolted to the center of the loading end of the rotary vessel	Fit #100 chain 70 teeth	Fit #100 chain 70 teeth	Fit #100 chain 89 teeth	Fit #100 chain 89 teeth	Fit #100 chain 89 teeth
6	Pillow block		HCP211-32 for 2" shaft	HCP211-32 for 2" shaft	HCP211-32 for 2" shaft	HCP211-32 for 2" shaft	HCP211-32 for 2" shaft
7	Electric motor	110 volts single phase Baldor farm duty motor (220V/3 phase options available)	1 HP 1725 RPM 60 HZ (50 HZ option available)	1 HP 1725 RPM 60 HZ (50 HZ option available)	1 HP 1725 RPM 60 HZ (50 HZ option available)	1 HP 1725 RPM 60 HZ (50 HZ option available)	1 HP 1725 RPM 60 HZ (50 HZ option available)
8	Speed reducer	60:1 Synthetic gear box oil	Frame #80	Frame #80	Frame #80	Frame #80	Frame #80
9	Speed reducer	60:1 Synthetic gear box oil	Frame #80	Frame #80	Frame #120	Frame #120	Frame #120
10	Steel frame	Hot dipped galvanized	4" X 4" X .188 thick tubing	4" X 4" X .188 thick tubing	4" X 6" X .188 thick tubing	4" X 6" X .188 thick tubing	4" X 6" X .188 thick tubing
11	Nylon roller with sealed rings	6" dia X 3" wide ¾" bore, 5,500 lb capacity each	2	2	2	4	6
12	Foam insulation	1 ½"-2" thick spray-on insulation R-8, Cover with SS 304 liner	1	1	1	1	1
13	Chain	Heavy duty roller chain	#100	#100	#100	#100	#100
14	Drive guard	All SS 304	1	1	1	1	1
15	Control box (220V available)	EEMAC 4X Fibreglass enclosure, 120VAC 1 phase, 24 hour automated time switch with proximity switch de-activation	1	1	1	1	1



BIOvator™

LIMITED WARRANTY CERTIFICATE

SAVE THIS CERTIFICATE.

If your unit needs servicing, contact a qualified dealer or sales representative. When requesting service, please have the model and serial number from the unit readily available. If your dealer needs assistance, Nioex Systems is available to provide support.

Fill in the installation date and model and serial numbers of the unit in the space provided below and retain this Limited Warranty for your files.

GENERAL TERMS

The term of this Limited Warranty is one (1) year on workmanship, two (2) years on motor and gearboxes, five (5) years pro-rated on inner **mild** steel barrel against perforation due to corrosion in normal use and ten (10) years pro-rated on inner **stainless** steel barrel against perforation due to corrosion in normal use. The use of acid material will cancel this warranty. All drive components are under warranty from the manufacturer. The warranty commences on the date the unit was invoiced to the customer as shown on the customer invoice.

Installation Date _____

Model No. _____ Serial No. _____