Operating & Maintenance Instructions FrostGuard Revolution R20, R25, R30

It's strictly forbidden to operate the FrostGuard if you haven't read this manual.

Year of construction: .....

Type: R20 / R25 / R30

Serial number: .....

This manual must be used according the European legislation. It must be considered as a part of the machine. The manual must be kept with the machine until the final dismantle as described in the European legislation. The purpose of this manual is to help use and maintain the FrostGuard safely.

The user manual must be kept by the owner or the user on a safe, dry and sun protected place on the working area. It must always be available to consult. When the manual is damaged, the user must ask Agrofrost for a new one.

Furthermore, Agrofrost SA has the right to change this publication and fulfil changes to the content without preannounce of such changes or rework.

POINTS OF ATTENTION IN THIS MANUAL

Hint:	to give suggestions and advice to ease certain tasks
Attention:	a remark with extra information to call your attention for possible problems
Warning:	to call your attention for avoiding danger

ABOUT THE USERS OF THE FROSTGUARD

- Required user characteristics.

Persons allowed to drive a tractor by law and familiar with the driving of a tractor may operate the FrostGuard. They must be at least 18 years old and be able of all their physical and psychical capacities. They must read this manual before using the FrostGuard.

Someone who **has not read** this manual cannot use the FrostGuard safely.

- The profile of the user.

This user manual is created for two main groups:
- The user / driver: the person who operates the FrostGuard
- The mechanical maintainer: the person who does the assembling, maintenance and repairs

Members of both groups have to read this manual attentively before using the FrostGuard and before doing any repairs or maintenance on the FrostGuard.

1 Introduction

1.1 INTENDED CONDITIONS OF USE OF THE FROSTGUARD

The FrostGuard is a rotating motor driven machine equipped with a powerful fan and a gas burning installation on the side.
It generates a lateral laminar flow of hot air to treat crops and trees with.
The FrostGuard may only be used outdoors where there is natural ventilation.
At the end of the season, the FrostGuard needs to be stored indoor with the propane bottles removed from the machine.
The propane bottles must be stored outside, according the prescriptions of the fire insurance company.

1.2 IMPROPER USE OF THE FROSTGUARD

The FrostGuard may not be used indoors or outdoors in a closed area without natural ventilation.

It is strictly prohibited to use the machine if not all safety requirements as described in Chapter 2, are complied.
The FrostGuard cannot be used, when one or more of the following parts are missing, loose, damaged or incomplete:

- Air outlet
- All the doors / side panels
- A fully loaded battery

Furthermore, it is strictly prohibited:

- **to use the FrostGuard on slopes with gradients of more than 20%;**
- to carry a charge of any kind in any circumstances on the machine;
- to transport persons or loads on the machine;
- to weld or to make any changes whatsoever on the original design of the FrostGuard.

1.3 POSITIONING THE FROSTGUARD IN THE ORCHARD, VINEYARD OR FIELD

Ask your dealer for the ideal setup of the machines. Or send a plan of your orchard/vineyard by e-mail to info@agrofrost.be . Agrofrost will send you back instructions for the ideal set up.

2 Safety

In this chapter, the FrostGuards most important safety aspects will be explained. It is essential that everybody who works with the FrostGuard reads attentively the contents of this chapter.
The most important safety and health risks related for using the FrostGuard are listed in paragraph 2.2. The FrostGuard is designed to reduce these risks as much as possible.
The safety precautions to be observed and to be taken by the FrostGuard user are listed in paragraph 2.3.
The safety advices for technicians come up in paragraphs 2.4 and the symbols found on the FrostGuard are clarified in paragraph 2.5.

2.1 IMPORTANT: NOT TO BE USED IN CLOSED AREAS

It is not allowed to use the FrostGuard in a closed area, because of three reasons:

- The burner consumes oxygen. Therefore, the supply of fresh air is very important.
- The engine produces carbon monoxide. This is an odorless, colorless, poisonous gas. Breathing carbon monoxide can cause nausea, fainting or death.
- If gas would escape because of a gas leak, it could create life threatening situations in a closed area because of the danger of explosions.

2.2 SAFETY AND HEALTH RISKS: RESIDUAL RISK

The residual safety- and health risks related to parts of the FrostGuard are being mentioned below together with a series of measures that are taken to keep these residual risks as little as possible.

- Presence of propane gas (= combustible)
  - Risk of explosion in closed space has been averted by use of safety components and the explicit ban on indoor use.
  - The design of the FrostGuard also reduces the risk of the presence of accumulated gas. If the FrostGuard is working with all the cover plates present, the inlet air stream will flow throughout the FrostGuard and carries any possible accumulated gas through the fan before ignition has started.
  - Various safety components are built in the gas installation. The suppliers of these components ensure that have been inspected by an official inspection service.
  - Ignition of the gas is built in and works from a distance. The user ignites the machine in a safe way from a safe position.
  - An electric valve is built in. It stays only open automatically when the burner is working. If the flame goes out, the valve will close immediately.
  - When the energy supply is cut off, the machine cannot function, because the pilot will have gone out.

- Presence of propane under pressure.

There are 2 pressure regulators for pressure relief.
  - The first one is sealed and reduces the incoming pressure to 0,8 bar. There is no need to alter the preset value.
  - The second regulator is used to adjust the air temperature.

- Presence of high temperatures
  - At the ignition on the inlet of the burner: the ignition is entirely shielded from contact with the user by the isolated inlet. There's no chance for contact with the ignition flames.
  - At the outlet of the fan: when the machine is working, the flow of the air prevents touching the inside of the outlet of the fan. When the user stops working with the machine, he must leave the ventilator running for **at least 2 minutes**, so the additional outlet of the fan can cool sufficiently (30°C). There is a thermometer and a warning pictogram on the outlet of the machine. So the user can check the temperature before he starts to store the outlet. However, there is no shielding to prevent the user to touch the fan outlet of the machine.

- Uncontrolled use of the FrostGuard
  - The use of control panels simplifies and secures the operation of the FrostGuard. Explanation is given in chapter 5.
  - There are 4 heat sensors incorporated, all at the outlet of the fan.

a. One heat sensor will shut down the machine when the temperature exceeds 150 °C.
b. One heat sensor is connected to the temperature gauge to show the working temperature.
c. One heat sensor will activate the alarm when the working temperature exceeds 120 °C.
d. One heat sensor will activate the alarm when the working temperature drops below 50 °C.

- Presence of rotating parts
  - Covering the exhaust pipe isn't possible because this exhaust is needed for applying a laminar air flow. Because of this, there is an extra sensor that controls if the exit pipe is mounted.
  - R20 an R25 models: When the exit pipe is not mounted, the engine will not start. If the exit pipe is taken away during operation, the engine will stop immediately.

EXTRA WARNINGS:
DO NOT PUT YOUR HANDS IN THE EXHAUST FAN

- Dangerous situations involving third parties
  - A fixed safety zone of 30 meters around the FrostGuard must be observed: no other people but the user may be in that safety zone.

When disconnecting the propane supply to the burner, for any reason, always keep the machine running for another 3 minutes to remove any amassed gas and to cool down the heat sensors of the electric valve.
Only after the electric valve has closed automatically other people may enter the safety zone.

2.3 SAFETY PRECAUTIONS

Before use

First read attentively the instructions in the manuals of both the FrostGuard. The user has to be acquainted with operating the controls of the machine.

- The guards must all be in their place. The FrostGuard cannot be used, when one or more of the guards are missing, loose, damaged or incomplete.
- Check the propane connections for leaks with the leak spray.

During use

- When the machine is activated, make sure that no other people come within the safety zone, being 30 meters around the machine. Keep children away from the machine. Do not let them without supervision if they could come within the safety zone, being 10 meters around the machine.
- Remain within hearing distance when the machine is working. The acoustic alarm could go off, indicating that there is need for intervention.
- Do not let the machine work without all the cover plates: it is important for the cooling of the engine that all the plates are in place.
- Beware of the fact that the entire machine is rotating. Therefore, don't come to close. You might influence the working of the machine.
- Always keep the engine running at a stable pace (full throttle). When the number of revs lowers, the exhaust temperature will rise sharply. The guards on the exhausts will also heat up, which results in potential danger of burns.
- If the flame should go out for any reason during operation, it must not be lit immediately. **First, the ventilator must run for minimally 2 more minutes**, so the heat sensors can cool down and the electric valve will close automatically.

When changing the propane bottles and ending operation

- Always close the propane bottles after use, and before changing them on the machine.
- Use leak spray to check the connections of the propane cylinders for leaks.

2.4 SAFETY ADVICE ON MAINTENANCE, REPAIRS AND STORAGE

- All screws and nuts must be tightened firmly, to keep the machine safe and in optimal condition.
- The FrostGuard must be stored inside, but not with the propane bottles on it. Store the FrostGuard horizontally in a dry place.
- Always use genuine spare parts. Using non-genuine spare parts can enhance the chances of damage, even if they fit on the machine.
- Replace damaged warning and instruction stickers.
- All the flexible propane hoses must be replaced every 5 years.

2.5 EXPLANATION PICTOGRAMS

FLAMMABLE MATERIALS

CAUTION - DANGER

HOT SURFACE

MOVING PARTS

FIRE: OPEN FLAMES AND SMOKING PROHIBITED

3 Transport and Storage

3.1 TRANSPORT

- When you want to transport the machine by road, you need to fix the machine firmly onto the transportation vehicle.
- If it is necessary to hoist the FrostGuard, you can buy a set of liftings eyes that can be mounted on the machine.
- When you transport the machine towards the field, the FrostGuard can be moved with a tractor that is equipped with a forklift. The forks of the forklift should support the main frame.
- Do not drive faster than 5 km/hour during transport in the field.

Only R20 and R25: before transporting the machine, you must block it into "TRANSPORT POSITION". To do so, put the handle at the bottom up to disengage the rotation and turn the machine into position. Take out the exit pipe and replace the cover plate on the fan's exit. **Do not turn the machine by hand when the rotation is still engaged.**

3.2 STORAGE

During the season

During the period of use, you can leave the FrostGuard standing in the field for a while. The FrostGuard is protected against all weather conditions.

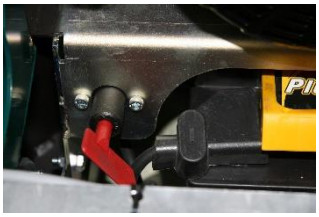
After the season

Make sure that the FrostGuard is cleaned as described in chapter 7.
Store the FrostGuard in a covered, dry place and horizontally, even when storing it for a short while.
Store the FrostGuard in a place where you don't need to cover it, because underneath a cover arises condensation. In this way, the risk of absorbing moisture by insulation incorporated in the machine is avoided.

The propane bottles must be removed every time the machine is stored indoor.
The propane bottles or tanks must be stored outdoor, according to the prescriptions of the fire insurance company.

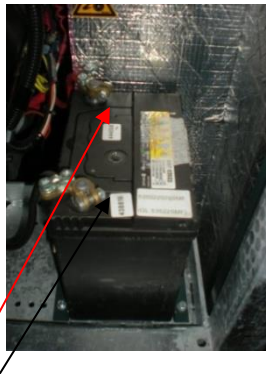
When you store the FrostGuard during summer and autumn, it is better that you take the battery out of the FrostGuard. You can use it elsewhere or you can use a trickle charger to keep it in the best condition.

Before taking out the battery, switch the Battery Cut Off Switch to "OFF".



To take out the battery, you just need to unscrew the battery connectors.
First disconnect the negative pole with the black wire, then the other one.

To install the battery again, you can't connect this in a wrong way, because one of the connectors is slightly bigger than the other.
Reconnect the positive pole and the red wire first.



Positive pole (red wire)

Negative pole (black wire)

4 First use and preparation

Mount all the pieces that are delivered separately.
The FrostGuard can be equipped with different systems for the propane bottles.
Every system is delivered with its own mounting instructions. Follow these instructions.

<u>R20 + R25:</u> Pay special attention to the swivel connection at the top of the FrostGuard in case you do not use the 4 bottle holders that are mounted on the machine. The flexible propane hose that comes from the propane tank needs to be high enough above this point because the FrostGuard is turning around. By turning around, it could get stuck if the hose is not installed high enough.

4.1 FIRST USE

You need to install the FrostGuard properly. Make sure it is placed in its best possible position: parallel or as close as possible to parallel with the terrain, if the slope is not more than 15%. Otherwise, you must level out the machine until the angle is not more than 15%.
For obtaining the best results, it needs to be levelled with its surroundings as well: for the best results the air needs to travel close to the ground over a distance of ± 50 to 60 meter.
Make sure everything is tested in advance: use the leak spray to test the propane connections.
Check if the battery is connected.

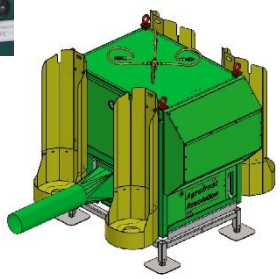
Supply enough spare propane bottles. Make sure that these are within easy reach, so changing them can be done as quickly as possible. Put the necessary tool out as well: a 28 mm open end spanner. (In some countries, the open end spanner maybe of a different size as 28 mm)

After connecting the gas hoses, check the gas connections with the leak spray.

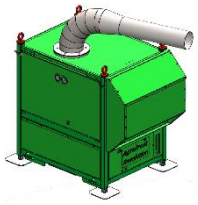
4.2 SET UP THE FROSTGUARD WITH 4 GAS CYLINDER HOLDERS ON THE MACHINE.

On all models, it's possible to mount 4 bottle holders for the propane bottles.

- Put the cylinders in the holders and fix them with the straps.
- Connect all the cylinders to the gas hoses.
- After connecting the gas hoses, check the propane connections with the leak spray.
- You need to use them all together, otherwise the cylinders will freeze. (open all the valves)
- Make sure there is enough propane to last all night. **(consumption = 10 kg / h)**



4.3 SET UP THE FROSTGUARD WITH CONTAINER FOR 5 OR 6 GAS CYLINDERS.

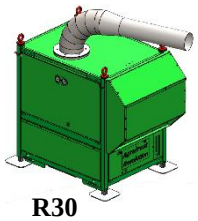


+

The R30 can also be delivered with a container for 5 or 6 gas cylinders.

- Put the cylinders in the container and fix them with the straps.
- Connect all the cylinders to the gas hoses.
- Make sure to connect the heating pipe to the container, otherwise the cylinders will freeze.
- After connecting the gas hoses, check the gas connections with the leak spray.
- You need to use the gas cylinders all together, otherwise the cylinders will freeze.
- Make sure there is enough gas to last all night.

4.4 SET UP THE FROSTGUARD WITH SUPPORT FOR 5 OR 10 GAS CYLINDERS – ONLY R30



R30

Support for 10 cylinders

If you mount the support, make sure to fix the square tube, on which the bottles are posed, on the correct height. There are 2 possibilities. Mount the tube in the lowest position, so the air stream can pass above the bottles and make sure to mount the tube with the holes upwards, otherwise the bottles are not heated and will freeze.

Always place 5 gas cylinders of the support and use them all together. Make sure there is enough gas to last all night. After connecting the gas hoses, check the gas connections with the leak spray.

To prevent the gas cylinders from freezing, the gas cylinders must be heated with the exhaust gases of the engine. To do so, connect the flexible exhaust tube to the support of the gas cylinders. The main tube that supports the gas cylinders has 5 holes, one for each gas cylinders, where the hot air exits. It's important to place the cylinders exactly on top of these holes.

4.5 SET UP THE FROSTGUARD WITH A GAS TANK OF 300 KG, 500 KG OR BIGGER.

It's also possible to use bigger gas tanks for the gas supply. Because the distance from the gas tank to the machine has a big influence on the gas supply, please ask the manufacturer how to set it up if your tank is more than 5 meters away.

For the R20 and R25, the tank must be at least 500 kg. This is because it's not possible to warm up the tank. You need a special gas hose with rotating coupling between the tank and the machine.

For the R30, a special heating pipe can be delivered if using a thank, smaller than 500 kg. The tank needs to be warmed with the special heating pipe, and the distance between tank and machine may not exceed 5 meters. You need a special gas hose for the gas supply (and a special heating pipe to warm up the tank if the tank is smaller than 500 kg)

If you want to use big storage tanks, with an underground pipeline network, please ask the manufacturer how to set it up.

4.6 SETTING THE GAS PRESSURE.

If you use a bottle rack, container or a tank, near the machine or on a larger distance, you always need a pressure regulator at the beginning of the propane line. (This propane line can be a rubber hose or a PE-line).
The gas pressure at the entrance of the machine must be 1.2 bar. This is the pressure whilst the engine is running, the burner is ignited, and the temperature of the burner is between 70 and 90 °C. (158 and 194 °F)

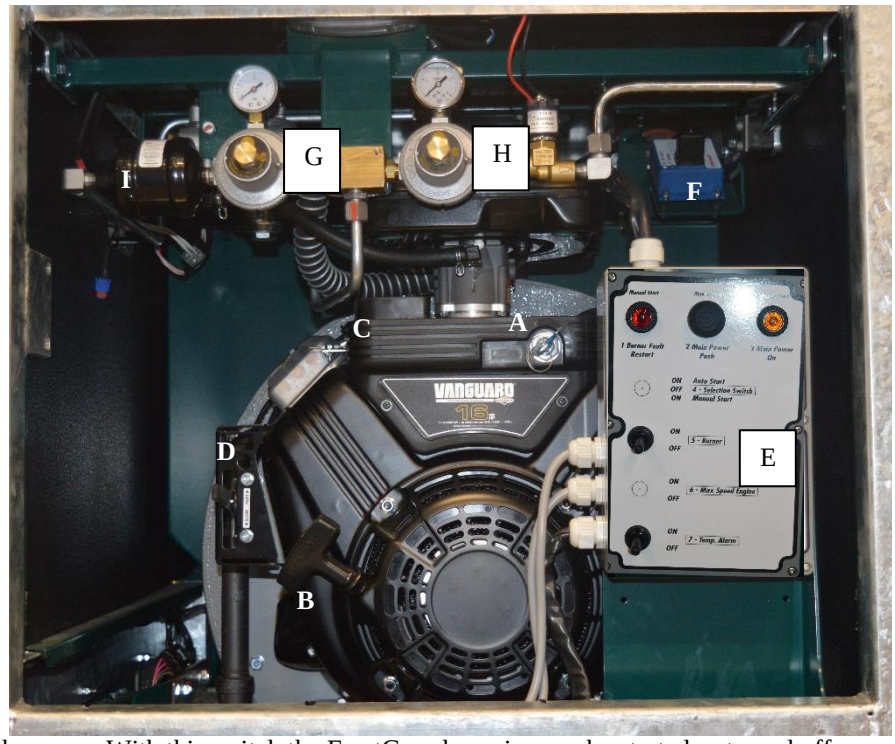
To adjust this pressure, **the outside temperature should be around 0°C**. Procedure to follow:

- Start up the machine
- Ignite the burner
- Let the machine run for 5 minutes and check the temperature. This must be between 70 and 90°C (158 and 194 °F).
- Adjust the pressure regulator - WHILST THE MACHINE IS WORKING - to obtain a pressure of exact 1.2 bar (17.5 psi) at the entrance of the machine.

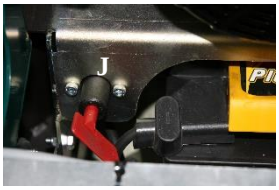
Before you open the gas bottles, make sure that they are in a vertical position for at least 10 minutes.

5 Operating the FrostGuard Revolution WITHOUT Auto Start System.

5.1 THE CONTROLS



A	Engine main switch	With this switch the FrostGuards engine can be started or turned off.
B	Rope handle	Pulling this handle will start the engine (in case the electrical start does not work).
C	Choke handle	Do not use the choke handle because the engine runs on propane gas.
D	Throttle handle	Handle down is running idle, handle up is running at operating speed.
E	Main Control Box	To operate the machines.
F	Ignition Box	Controls the ignition of the burner.
G	Sealed Pressure Regulator	This pressure regulator is sealed and pre-set in the factory. Do not change. (Not in R30)
H	Pressure Regulator	To change the gas pressure and in this way also the temperature of the burner.
I	Filter	
J	Battery Cut Off Switch	To connect or disconnect the battery.
K	Temperature meter	Shows the temperature of the out blown air.
L	Hour counter	The hour counter is optional.



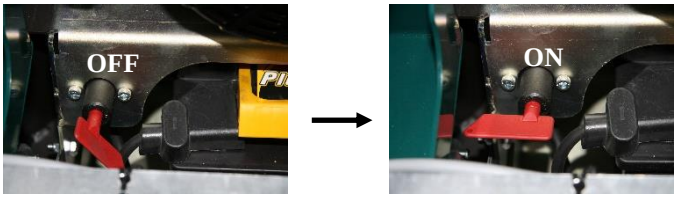
M	Rotation Control Handle	To engage or disengage the rotation of the machine (R20 and R25)

5.2 START UP AND STOP PROCEDURE FOR REVOLUTION WITHOUT AUTO START SYSTEM.

5.2.1 The Main Control Box

There are 2 switches, one push button and 2 warning lights on the main control box.

1 Burner Fault / Restart: Warning light that lights up when the burner does not ignite.
2 Main Power / Push: Push button to put power on the control box.
3 Main Power On: lights up after pushing button '2 Main Power'.
5 - Burner: to switch the burner on or off.
7 - Temp. Alarm: to switch the acoustic alarm on or off. Please note that the acoustic alarm does not work in "Auto Start Mode".

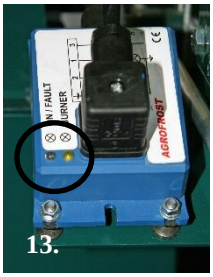


5.2.2 Battery Cut Off Switch

Before you can use the machine, make sure that the 'Battery Cut Off Switch' is turned on.

5.2.3 Starting Procedure for Revolution without Auto Start System.

1. **<u>Only R20 and R25</u>: remove the latch: remove the cover plate on the fan's exit and place the exit pipe in the gliders. If the exit pipe is not mounted, the engine will not start.**
2. Remove the cover on the engine side (acoustic screen) and open the grid cover.
3. **Open all the gas cylinders or gas tanks (propane supply)**.
4. Switch the **'Battery Cut Off Switch'** to "ON".
5. Put the switch **'5 - Burner'** down to "OFF".
6. Put the switch **'7 - Temp. Alarm'** down to "OFF".
7. Turn the ignition key of the engine to "ON".
8. Push on the **'2 - Main Power'** button. The yellow check light **'3 - Main Power'** has to light up.
9. Put the **'gas throttle'** of the engine down to "IDLE".
10. Start the engine by turning the ignition key. (Don't use the choke because the engine is running on propane.). Let it run idle for 1 minute to warm it up before you start the burner.
11. **<u>R30 only</u>: make sure that the exit pipe does not point towards you. If it does, wait until the exit pipe has turned sufficiently until it points away from you. (Flames may come out when the burner is ignited.)**
12. Put the **'5 - Burner'** switch up to "ON" to ignite the burner.
13. The yellow and green LED on the blue box (behind the main control box) light up.
14. If the burner does not ignite, the red warning light **'1 - Burner Fault'** will light up. In this case, put the **'5 - Burner'** switch to "OFF" and go back to point 12 to restart the burner.



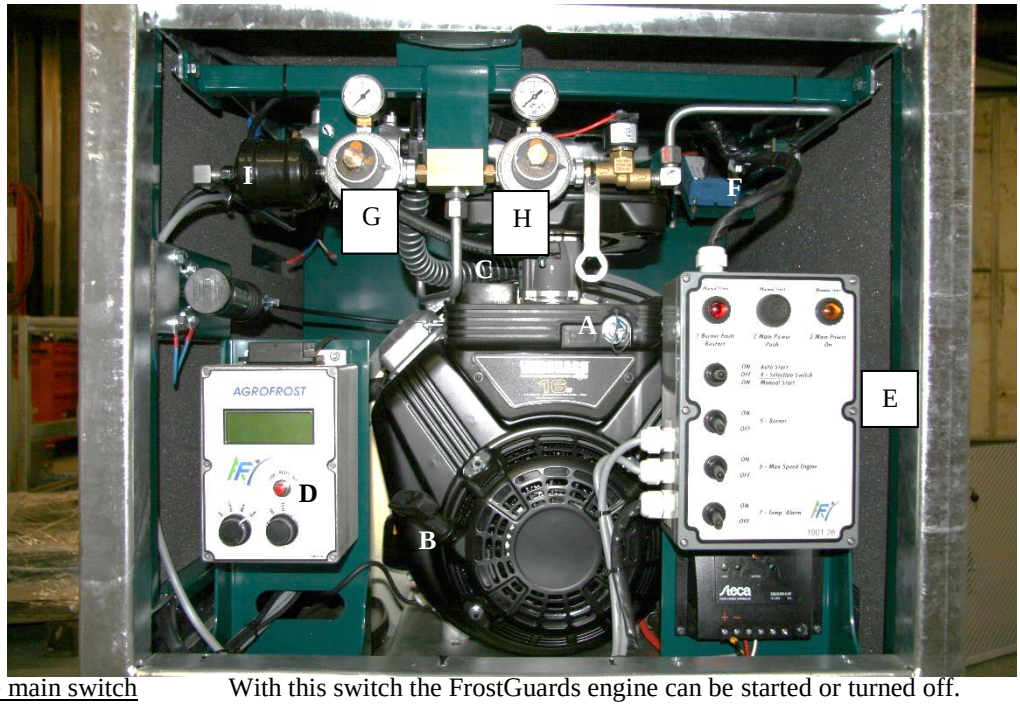
15. Put the **'gas throttle'** UP to Full Throttle, **immediately after ignition of the burner.**
16. R20 and R25: Check the gas pressure on the sealed pressure regulator (=the left one). It should indicate approx. 0,8 bar. R30: check the gas pressure on the pressure regulator on top of the machine.
17. Check the gas pressure on the other pressure regulator. It should indicate approx. 0,5 bar.
18. **Check the temperature gauge in the side panel**. The correct temperature is between 75 °C and 85 °C. It can take up to 10 minutes before the machine is warmed up so do not start changing the gas pressure immediately after start up to change the temperature.
19. If necessary, adjust the gas pressure to get a temperature of 80 °C. **Do not exceed 85 °C**. After adjusting the gas pressure, wait long enough until the temperature is stable before you make another correction. Check the temperature at the end of the fan's exit pipe with the small digital temperature to read the exact temperature. It might be a little different from the reading on the temperature gauge.
20. **Eventually, activate the acoustic alarm by setting the '7 - Temp. Alarm'** switch **in the "ON" position. To do so, wait until the red light on top of the machine is off, otherwise the acoustic alarm will be activated immediately.**
21. Close the grid cover and replace the acoustic screen.
22. **R20 and R25 only: do not forget to put the handle at the bottom, next to the red warning light, all the way down into the "RUN" position, in order to engage the rotation and start the rotation. The red light will go out. If you fail to do so, the machine will not rotate, so there will be no protection!**

5.2.4 Stopping Procedure for Revolution without Auto Start.

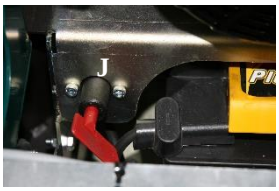
1. Remove the acoustic screen and open the grid cover (engine side).
2. Put the **'7 - Temp. Alarm'** switch down to "OFF".
3. Put the **'5 - Burner'** switch down to "OFF". The burner will stop immediately.
4. Let the engine run at full throttle for at least 1 minute to cool down the sensors and the fan.
5. Put the **'gas throttle'** down to "IDLE" and stop the engine by turning the ignition key to "OFF".
6. Close all gas cylinders.
7. Switch the **'Battery Cut off Switch'** to "OFF".
8. **Only R20 and R25**: before transporting the machine, you must block it into "TRANSPORT POSITION". To do so, put the handle at the bottom up to disengage the rotation and turn the machine into position. Take out the exit pipe and replace the cover plate on the fan's exit. **Do not turn the machine by hand when the rotation is still engaged.**

6 Operating the FrostGuard Revolution – Machine WITH Auto Start System.

6.1 THE CONTROLS



A	Engine main switch	With this switch the FrostGuards engine can be started or turned off.
B	Rope handle	Pulling this handle will start the engine (in case the electrical start does not work).
D	Auto Start Control Box	To operate the machine in Auto Start Mode.
E	Main Control Box	To operate the machines.
F	Ignition Box	Controls the ignition of the burner.
G	Sealed Pressure Regulator	This pressure regulator is sealed and pre-set in the factory. Do not change. (Not in R30)
H	Pressure Regulator	To change the gas pressure and in this way also the temperature of the burner.
I	Filter	
J	Battery Cut Off Switch	To connect or disconnect the battery.
K	Temperature meter	Shows the temperature of the out blown air.
L	Hour counter	The hour counter is optional.



M	Rotation Control Handle	To engage or disengage the rotation of the machine (R20 and R25)

6.2 START UP AND STOP PROCEDURE FOR REVOLUTION WITH AUTO START.

6.2.1 Main Control box for machines with AUTO START.

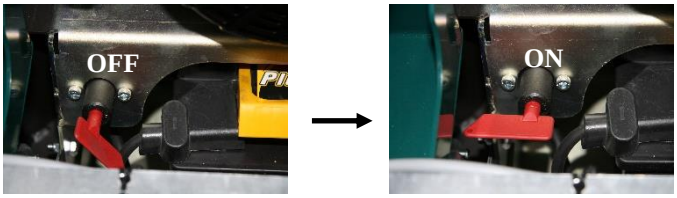
There are 4 switches, one push button and 2 warning lights on the main control box.
The most important switch is the "**4 - Selection Switch**" and it has 3 positions:
UP: the machine is put to AUTO START. In this position, all the other switches are **not** active.
CENTER: the machines is switched off. In this position, nothing will work.
DOWN: the machine is put to MANUAL START. In this position, all other switches are active.

1 Burner Fault / Restart : Warning light that lights up when the burner does not ignite at manual start up.
2 Main Power / Push : Push button to put power on the control box during manual start up.
3 Main Power On : lights up after pushing button '2 ' during manual start up.
4 - Selection Switch : to choose between Auto Start, OFF or Manual Start.
5 - Burner : to switch the burner on or off.
6 - Max Speed Engine : to switch engine to full throttle or idle.
7 - Temp. Alarm: to switch the acoustic alarm on or off. Please note that the acoustic alarm does not work in "Auto Start Mode".

6.2.2 AUTO START control box for machines.

There are 2 switches and one push button on the Auto Start Control box.
The red **'STOP - RESET - SET'** push button **(P1)**: to stop the machine in Auto Start Mode, or to set the clock.
The left black switch **(L)**: to set the clock
The right black switch **(R)**: to choose between TEST, WIRELESS and the different start up temperatures.

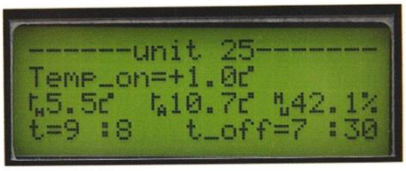
The screen shows all kind of information like the time, the stopping time, the start-up temperature, the dry temperature, the wet temperature, the relative humidity, working time, machine number etc.



6.2.3 Battery Cut Off Switch

Before you can use the machine, make sure that the 'Battery Cut Off Switch' is turned on.

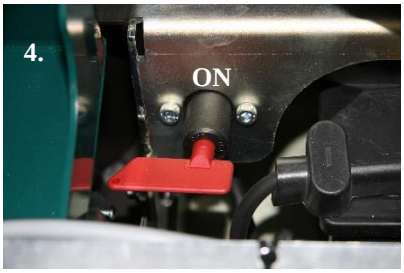
6.2.4 Information on the screen



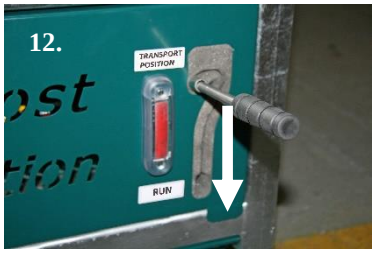
The screen shows a lot of information.
We show here an example when the machine is ready to start up in Auto Start Mode.

—> unit number of the machine: this will be important in 'Wireless Mode' (not active yet).
—> Temp_on = +1.0°C: this means that the machine will start up at + 1.0 °C.
—> Wet Temperature (5.5 °C) - Dry Temperature (10.7°C) - Relative Humidity (42.1 %)
—> System time (09h08) - Stopping time 't_off=7 :30' (machine stops at 7h30)

6.2.5 Setting up the Revolution for Auto Start.



1. **<u>Only R20 and R25</u>: remove the cover plate on the place the exit pipe in the gliders. If the pipe is not engine will not start.**
2. Open all gas cylinders or gas tanks. (use only
3. Remove the cover on the engine side (acoustic screen) grid cover.
4. Switch the **'Battery Cut Off Switch'** to "ON".
5. On the Auto Start Control Box: make sure that the **Left Switch (L)** is put to "Run".
6. On the Auto Start Control Box: make sure that the **Right Switch (R)** is **<u>not</u>** in the position "TEST".
7. On the Main Control Box: put the **'4 - Selection Switch'** up to "ON Auto Start".
8. On the Auto Start Control Box: choose the start temperature with the **Right Switch (R)**. You can choose between "WL = wireless" and different starting temperatures, going from –5 °C to +1 °C. The selected temperature is shown on the screen. Do not put the switch to "TEST".
9. Check if the System Time is correct. See "Setting the System Time" if it needs to be updated.
10. Check the 't_off - Stopping Time" on the screen. See "Setting the Stopping Time" if it needs to be changed.
11. Close the grid cover and replace the acoustic screen.
12. **<u>Only R20 and R25</u>: do not forget to put the handle at the bottom, next to the red warning light, all the way down into the "RUN" position, in order to engage the traction. The red light will go out. <u>If you fail to do so, the machine will start up but will not rotate, so there will be no protection</u>!**



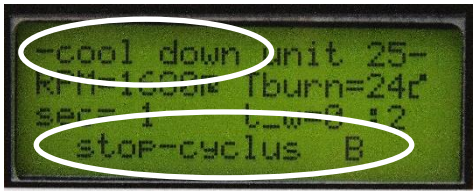
<u>IMPORTANT</u>: when the machine is starting up in Auto Start Mode, make sure that you are not in front of the exit pipe. Stay at least 5m away from the machine. During ignition of the burner, flames might come out!

6.2.6 Setting the Stopping Time in the Auto Control Box.

Changing the Stopping Time can be done while the machine is ready for start-up in Auto Start Mode and when it is operating in Auto Start Mode as well.
To change the Stopping Time:
1. Turn the **Left Switch (L)** to "SET".
2. Turn the **Left Switch (L)** to "Hour".
3. Push on the **Red Button (P1)** until you see the correct Hour on the screen.
4. Turn the **Left Switch (L)** to "Min.".
5. Push on the **Red Button (P1)** until you see the correct Minutes on the screen.
6. Turn the **Left Switch (L)** back to "Run".

Warning: if the stopping time is programmed too soon, for example at 6h00, and the temperature is still below the starting temperature, the machine will restart automatically and will stop 24 hours later at 06h00.

6.2.7 Stopping the Revolution when operating in Auto Start Mode.



Normally, in Auto Start mode, the Revolution stops automatically when the stopping time, that is programmed in the clock, is reached. If you want to stop the machine earlier, push the **Red Button (P1)** on the Auto Start Control Box. The FrostGuard will shut down the burner, cool down the machine and stop the engine. **Make sure to let the machine run till the end of the program. This takes about 2 minutes.** The screen will show that the machine goes through it's 'stop-cyclus'. After that, the machine is ready again for the next Auto Start. If you do not want the machine to be ready for the next Auto Start, put the **'4 - Selection Switch'** on the Main Control Box to the "OFF" position.

Only R20 and R25: before transporting the machine, you have to block it into "TRANSPORT POSITION". To do so, put the handle at the bottom up to disengage the rotation and turn the machine into position. Take out the exit pipe and replace the cover plate on the fan's exit. **Do not turn the machine by hand when the rotation is still engaged.**

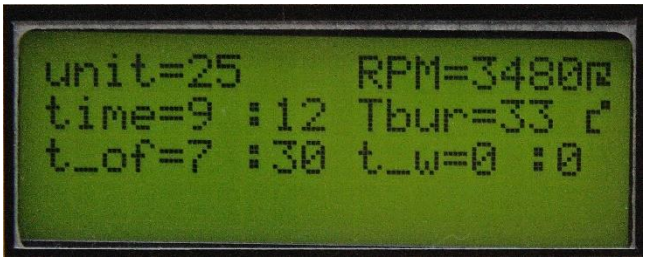
6.2.8 Setting the System Time.

This can be done just after putting the **'4– Selection Switch'** on the Main Control Box up to "ON Auto Start".

1. Turn the **Left Switch (L)** to "Run".
2. Put the **'4 - Selection Switch'** on the Main Control Box up to "ON Auto Start". The screen starts showing different messages: Agrofrost System, Diagnostics, Set Clock.
3. When the 'SET CLOCK' message is shown, press on the **Red Button (P1)** and hold it until you here a beep.
4. The screen will show the message 'Select Hour'. Turn the **Left Switch (L)** to "Hour".
5. Push on the **Red Button (P1)** until you see the correct Hour on the screen.
6. Turn the **Left Switch (L)** to "Min.".
7. Push on the **Red Button (P1)** until you see the correct Minutes on the screen.
8. Turn the **Left Switch (L)** back to "Run".

6.2.9 Information on the screen when running in Auto Start Mode.

The screen shows the following information when it's working in Auto Start Mode:



- **'Unit=25'**: unit number of the machine: this will be important in 'Wireless Mode' (not active yet).
- **'RPM=3480'**: revs per minute of the engine.
- **'time=9: 12'**: this is the system time (9H12).
- **'Tbur=33 °C'**: this is the temperature of the burner. (in this case only 33 °c because the machine was still starting up..)
- **'t_off=7 :30'**: this is the stopping time (7h30).
- **'t_w=0: 0'**: this is the working time since start up (in this case 0h00 because the machine was starting up..)

6.2.10 Running a Test of the Auto Start System.

It is possible to run a 'TEST' in the Auto Start Mode. To do so:

1. Remove the cover plate on the fan's exit and place the exit pipe in the gliders. If the pipe is not mounted, the engine will not start.
2. Remove the cover on the engine side (acoustic screen) and open the grid cover.
3. Open all gas cylinders or gas tanks. (use only PROPANE)
4. Switch the **'Battery Cut Off Switch'** to "ON".
5. On the Auto Start Control Box: make sure that the **Right Switch (R)** is in the position "TEST".
6. On the Main Control Box: put the **'4 - Selection Switch'** up to "ON Auto Start".
7. The machine will now start up and go to the complete Start Up Procedure.
8. To stop the machine, press the Red Button (P1) and wait until the machine has finished it's Stopping Procedure. **Warning: after this, the machine will not be ready for an Auto Start**.
9. If you do not stop the machine manually by pressing (P1), the machine stops at the programmed 'Stopping Time'. **Warning: after this, the machine will not be ready for an Auto Start**.

Warning: if you try to restart the machine in "TEST MODE", just after you have stopped it, it might be possible that you see the message ''temp burner >'' on the screen. In this case, the machine will not start because the burner is still too warm. To solve this: start the engine and let it run at full speed for a few minutes to cool down the burner.

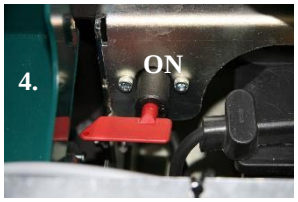
6.2.11 Using the "TEST" Mode for a fast Start Up.

You can use the 'TEST' mode for a fast 'manual' start up of the machine. Instead of going through the Manual Starting Procedure, you can just set the machine into Auto Start Mode and switch the **Right Switch (R)** on the Auto Start Control Box to "TEST". The machine will start up automatically and will stop at the programmed Stopping Time.

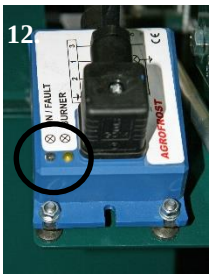
Warning: once the machine has stopped, it will not be ready for a new Auto Start. To make it ready for a new Auto Start, turn the Right Switch (R) out of the "TEST" position and switch the machine 'OFF' and 'ON' again. (See "Starting up in Auto Start Mode" on the previous page)

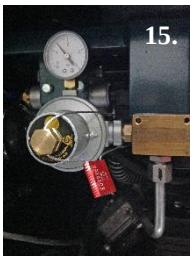
6.3 MANUAL START UP AND STOP PROCEDURE FOR REVOLUTION WITH AUTO START SYSTEM.

6.3.1 Starting Up a Revolution with "Auto Start" in MANUAL MODE.



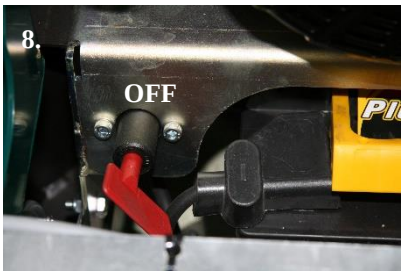
1. Only R20 and R25: remove the latch: remove the cover plate on the fan 's exit and place the exit pipe in the gliders. **If the exit pipe is not mounted, the engine will not start.**
2. Remove the cover on the engine side (acoustic screen) and open the grid cover.
3. Open all the gas cylinders or gas tanks completely (propane supply).
4. Switch the **'Battery Cut Off Switch'** to "ON".
5. Put the switches **'5 - Burner', '6 - Max Speed Engine'** and **'7 - Temp. Alarm'** all down to "OFF".
6. Put the switch **'4 - Selection Switch'** down to "ON Manual Start".
7. Turn the **ignition key** of the engine to "ON".
8. Push on the **'2 - Main Power'** button. The yellow check light **'3 - Main Power'** lights up.
9. Start the engine by turning the ignition key. (Don't use the choke because the engine is running on propane.). Let it run idle for 1 minute to warm it up before you start the burner.
10. R30 only: make sure that the exit pipe does not point towards you. If it does, wait until the exit pipe has turned sufficiently until it points away from you. (Flames may come out when the burner is ignited.)
11. Put the **'5 - Burner'** switch up to "ON" to ignite the burner.
12. The yellow and green LED on the blue box (behind the main control box) has to light up.
13. If the burner does not ignite, the red warning light **'1 - Burner Fault'** will light up. In this case, put the **'5 - Burner'** switch to "OFF" and go back to point 11 to restart the burner.
14. Put the **'6 - Max Speed Engine'** switch up to "ON", **immediately after ignition of the burner**.
15. R20 and R25: Check the gas pressure on the sealed pressure regulator (=the left one). It should indicate approx. 0,8 bar. R30: check the gas pressure on the pressure regulator on top of the machine.
16. Check the gas pressure on the other pressure regulator. It should indicate approx. 0,5 bar.
17. Check the temperature gauge in the side panel. The correct temperature is between 75 °C and 85 °C. It can take up to 10 minutes before the machine is warmed up so do not start changing the gas pressure immediately after start up, to change the temperature. Check the temperature at the end of the fan's exit pipe with the small digital temperature to read the exact temperature. It might be a little different from the reading on the temperature gauge.
18. If necessary, adjust the gas pressure to get a temperature of 80 °C. Do not exceed 85 °C. After adjusting the gas pressure, wait long enough until the temperature is stable before you make another correction.
19. Eventually, activate the acoustic alarm by setting the **'7 - Temp. Alarm'** switch in the "ON" position. To do so, wait until the red light on top of the machine is off, otherwise the acoustic alarm will be activated immediately.
20. Close the grid cover and **replace the acoustic screen**.
21. **R20 and R25 only: do not forget to put the handle at the bottom, next to the red warning light, all the way down into the "RUN" position, to engage the rotation and start the rotation. The red light will go out. If you fail to do so, the machine will start up but will not rotate, so there will be no protection!**





6.3.2 Stopping Procedure for Revolution with "Auto Start" after MANUAL START.

1. Remove the acoustic screen and open the grid cover (engine side).
2. Put the **'7 - Temp. Alarm'** switch down to "OFF".
3. Put the **'5 - Burner'** switch down to "OFF". The burner will stop immediately.
4. Let the engine run at full throttle for at least 1 minute to cool down the sensors and the fan.
5. Put the **'6 - Max Speed Engine'** switch down to "OFF" and stop the engine by turning the ignition key to "OFF".
6. Put the **'4 - Selection Switch'** in the "OFF" position.
7. Close all gas cylinders.
8. Switch the **'Battery Cut off Switch'** to "OFF".
9. **Only R20 and R25**: before transporting the machine, you must block it into "TRANSPORT POSITION". To do so, put the handle at the bottom up to disengage the rotation and turn the machine into position. Take out the exit pipe and replace the cover plate on the fan's exit. **Do not turn the machine by hand when the rotation is still engaged.**



6.4 DURING OPERATION

During operation, there is no need to be close to the FrostGuard all the time.

Check the temperature after a few times and adjust the pressure to obtain an air temperature of 80 °C. Check the temperature one more time after 10 minutes If the temperature remains stable, you can leave the FrostGuard.
The normal working pressure will be approx. 0,5 bar. However, this could change depending on air temperature, humidity, wind etc. Always let the engine run at full throttle.

6.5 REPLACING THE GAS CYLINDERS DURING OPERATION

When the temperature drops 20 degrees in a few minutes, the alarm will sound and the propane cylinders must be replaced. It is of course recommendable to keep the replacing time as short as possible, and below 10 minutes.

1. Follow the Stopping Procedure. Let the engine run (full throttle) for at least 1 minute, to cool down the machine.
2. Close all the bottles.
3. Disconnect the propane bottles and take them out of the holders or container.
4. Put new bottles in. Fix all bottles with the straps, connect all the bottles and open them ALL. To start the FrostGuard again, the start procedure must be followed.
5. Try to stay below 10 minutes to change the bottles.

6.6 WHEN TO START? – WHEN TO STOP?

The starting temperature depends on the flowering stage.

Once you got a balloon or during full flowering, it's very important that the machine is started up before the wet temperature drops below 0 °C.

When the wet temperature outside the treated orchard/vineyard is positive again, the machine may be stopped.

If you use the Auto Start System, we strongly recommend to put the starting temperature at + 0.5 °C. (33°F)

7 Maintenance – Cleaning

7.1 CLEANING

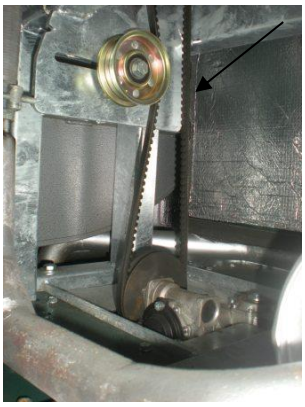
The outside of the machine you can wash the FrostGuard by hand, but you may not use a high-pressure cleaner.
You can use a garden hose, but not nearby electrical parts or sensors.
Don't use water inside of the machine.

7.2 MAINTENANCE

7.2.1 Transmission belts

Check the tension of the belts every 50 to 100 hours.

R20 and R25: on the outside belt under the machine, there are 2 idler pulleys, one on each side of the belt. To loosen these pulleys, unscrew the 2 bolts located at the upside of the mounting bracket. The tension of the belt is correct when the belt does not slip in operation. **Put the handle in ''Run'' position when you check this one. (R20 and R25)**



On the inside of the machine, the belt is located between the engine and the fan at the bottom of the machine. For obtaining a long life of the belt, it is better not to tighten the belt too strong either.

7.2.2 Burner

The burner does not require any maintenance.

7.2.3 Transmission shaft R20 - R25 models.

Every 20 till 50 working hours, the bearings of the transmission shaft at the centre of the machine must be greased.
Two grease nipples are mounted in the chassis to make this work easy.
Use a normal grease pump and press twice to lubricate.

7.2.4 Engine

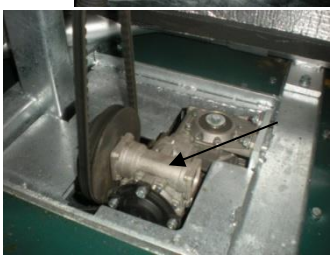
> There is a manual for the engine, provided by the manufacturer of the engine. As the manual of the engine is also part of the manual of the machine, you need to follow all the instructions written in that manual to.
> The issues mentioned below are just a brief summary and not a complete list of actions to do. This brief summary does not replace any other actions written in the manufacturer's manual.

The most important issues about the engine are:

Check the oil level every 20 hours.
Replace the oil of the engine every 75 hours of operation.
If the machine did not operate 75 hours a year, you need replace the oil every year in the beginning of the working season.
The drain hole of the engine is connected to a rubber hose and a plug. Open the front door, below the grid panel. This makes it easy to drain the engine.

Clean the air filter with compressed air every 75 hours of operation.
Replace the air filter every 225 hours of operation.
If the machine did not operate 75 hours a year, you must clean it every year in the beginning of the working season.
Mandatory replacement is every 3 years.

Replace the oil filter of the engine every 75 hours of operation.
If the machine did not operate 75 hours a year, you must replace the oil filter every year in the beginning of the working season.



7.2.5 Annual maintenance to prevent corroding

To prevent corroding, these parts need to be sprayed with oil (WD40) once a year.
outside of gearbox

All key locks on the machine need to be treated as well.

7.2.6 Propane hoses: obligatory to replace every 5 years

The propane hoses need to be replaced every 5 years. There is a date mark on each hose that indicates the year of fabrication.
You are obliged to contact your local supplier or Agrofrost to have them replaced before they expire.
For instance: hoses with 2012 written on it should be replaced before end 2017.

7.3 WARRANTY – SCRAPPING – SPARE PARTS LIST.

7.3.1 Warranty

The warranty covers the parts that are defective from the start, and that are produced by AGROFROST. This warranty expires when it is a matter of normal wear, when a malfunction is caused by incorrect operation or maintenance of the machine, in case the user has not observed the instructions in the manual, or when non-genuine parts, not produced by AGROFROST are used.
We do not accept complaints about changes that will be introduced in the future to improve the machine.
It is important that the document, called “INSTALLATION PROCEDURE” is filled up and send back to the address of the manufacturer: AGROFROST NV - Canadezenlaan 62 - 2920 Kalmthout - BELGIUM
If this document is not sent back, the manufacturer reserves the right to cancel any warranty.

7.3.2 Scrapping

The following table gives an overview of the correct way of disposal of the different parts, in case the FrostGuard has to be dismantled.

Part	**Way of disposal**
Bearings	scrap
Oil from the gearbox	chemical waste
Frame and cover plates	scrap
Screws, bolts, washers	scrap
Gaskets	container for synthetic material
Insulation	construction / building waste

7.3.3 Parts list

If you need a parts list, you can ask for it at the manufacturer.
Send an e-mail to: info@agrofrost.be !!

8 EC Declaration of Conformity

EC Declaration of Conformity.

We declare under our own responsibility that the machine complies with the safety and health requirements established by the European Directive 2006/42/EG.
EN standard codes:
BS EN 1672-2:2005+A1:2009 ; BS EN ISO 14123-2:2015 ; BS EN ISO 12100:2010 ;
BS EN 1005-1:2001+A1:2008 ; EN 894-1:1997+A1:2008 ; BS EN 1037:1995+A1:2008 ;
BS EN ISO 13857:2008 ; BS EN 60204-1:2006+A1:2009 ; BS EN ISO 13850:2006 ;
BS EN ISO 13850:2015 ; BS EN 61310-1:2008 ; BS EN ISO 14119:2013 ;
BS EN ISO 13732-1:2006

Manufacturer	: Agrofrost S.A.
Address	: Canadezenlaan 62 – 2920 Kalmthout - Belgium
Telephone	: +32 495 517689
Fax	: +32 3 2958428
Authorized representative	: Patrik Stynen
Address	: Canadezenlaan 62 – 2920 Kalmthout - Belgium
Machine	: FrostGuard Revolution Type ……
Serial number	: ……
Production date	: ……
Year in which CE mark was affixed	: ……

Signature:

Patrik Stynen
Director