

BELROBOTICS

Maintenance Guide for End-Users of Belrobotics robot BallPicker – 2015 models



About this document

This document is intended for End-Users in charge of daily operation and maintenance of Ballpicker robots on a golf practice. It contains necessary information to carry out the routine maintenance of the Ballpicker and the winter and mid-season maintenance.

More specifically, the good practice is to have one person on each golf practice responsible for these operations on Ballpickers and Bigmow robots, who knows the basic operation principles and commands of both machines. The service dealer must have shown to such person all procedures and commands detailed in this document. This “qualified operator” should have a deputy who knows basic instructions to act as appropriate in the case of absence of the qualified operator.

This document is organized as an easy, highly repetitive routine in maximum 18 steps, which need be repeated on a daily basis.

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Daily maintenance

1. This sequence should be carried out every day of operation of the Ballpicker. It all takes less than 15'. A similar sequence need be repeated for the Bigmow, meaning a total routine maintenance of 30' a day.

This routine is essential to keep both robots in perfect condition and to ensure reliable operation on the field. Do not skip this routine on busy days, when it is essential to have well maintained, fully reliable robots on the field.

2. Have following tools handy:

- Compressed air
- Protective gloves
- One 4 to 6mm flat screwdriver
- One spatula 50 to 60 mm
- One nylon brush (no metal brush)
- One sheet of sandpaper (fine grain – 400)
- **Never use water hose nor pressure water jet: electronics inside!**

3. Call the Ballpicker back to the docking station

- It is assumed the Ballpicker is busy collecting balls on the practice. The first action is to get the Ballpicker back to its unloading station and to unload balls, before starting maintenance routine. By running this operation, you can check at the same time that everything works normally: (i) travel back to the station, (ii) manoeuvres near the station, (iii) contact with loading arm of the station, (iv) unloading balls, (vi) start-up and proper operation of the ball transfer system. Practically speaking, you can
- Either go to the Ballpicker, open up the lid and press « F1 »¹
- Or send SMS « Backhome » to the Ballpicker. This is equivalent to « F2 »²
- Please observe the comprehensive operation of the Ballpicker till completion of balls unloading.
- Verify the contact of the charging arm and the robot charging, adjust height if necessary

4. Right after unloading, and before the Ballpicker starts again (in case “F1” was used)

- When the Ballpicker is at the station, and right after unloading balls,
- Take the loading arm of the docking station away from the robot, to create a “contact loss” and at the same time, open up the lid. These two actions will free the “electric brakes” of the robot and make subsequent manoeuvres very smooth³

¹ Pressing “F1” key means “go back to the station, unload balls, and if needed recharge your battery before getting back to collect balls”

² Pressing “F2” key means “go back to the station, unload balls, recharge your battery and wait for my instructions”. The robot stays at the docking station.

³ “Electric brakes” operate on back wheels of Belrobotics robots when the power switch is “On”. Such brakes oppose to movement of the robot, such as when the user pushes the robot manually. One way to disconnect these electric brakes when the robot is at the docking station is to

- Open up the lid and press “C” to erase alarm “contact loss”. The trapdoor is still open⁴
 - Gently push the Ballpicker away from the docking station to a free location to inspect and clean up the machine
5. If you did not call the Ballpicker back to the docking station, and want to inspect and clean the Ballpicker where it is, you must first open up the trapdoor: press « F1 » « # » « 5 » « # »
- The golf balls will flow down the trapdoor to the ground but will block remaining balls in the reservoir. You will have to push the Ballpicker one or two meters to fully empty the reservoir, before rising up the Ballpicker
 - This is not the proper way to do: you should only proceed in this way when something prevents the Ballpicker from normally returning to its station
6. Raise up the machine as shown below



simultaneously disconnect the loading arm and to open up the lid. Robot wheels are then free and the robot can be easily pushed to desired location.

⁴ The trapdoor closes only when the Ballpicker leaves its docking station ... to give a last chance to balls possibly trapped in the reservoir to go down the balls ditch.

7. Clean front wheels

- Remove grass, mud and debris on the wheels, around wheel axis and in both wheel hubs



8. Clean ball collecting drum

- Visually inspect all disks. Identify worn disks to have them replaced in due time
- Remove grass, mud and debris



9. Clean back wheels

- Remove grass, mud and debris on the rolling surface, between the wheel and the aluminium casing

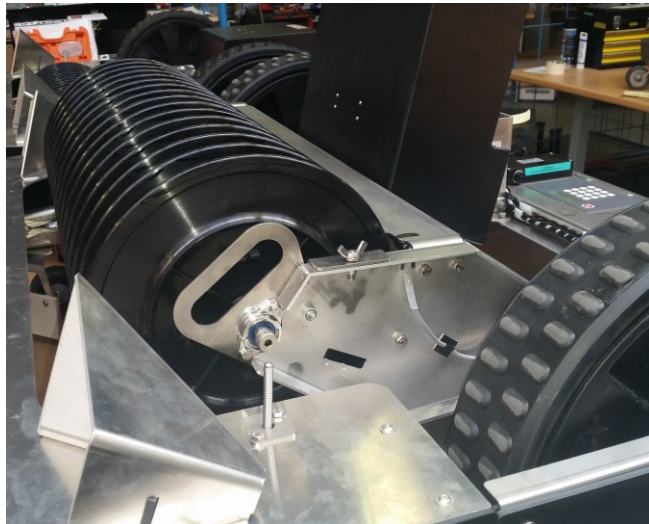


10. Clean balls reservoir

- Clean the balls reservoir using a brush

11. Clean roller (if necessary)

- Set the roll up using option 05 “unload” to “√”



- Remove the wing screw on each side of the roller



- Remove the roller by taking it by its handle
- Clean it with pressured water if necessary and make sure not water is sent to the robot



- Put the roller back to its position, fix it with the wing screw
- Set the roll down by setting option 05 "unload" to "-"

12. Put the Ballpicker back on wheels

13. Press « F1 » « # » « 5 » « # »

- It is the same short command to open and close the trapdoor
- If something has been misplaced, the Ballpicker will try twice to close the trapdoor. If unsuccessful, an error message will show on the screen

14. Check charge contacts on the robot

- Visually inspect the contacts on the Ballpicker
- If dirty, have them cleaned
- If a black spot is visible, sand spot location with sandpaper (fine grain – 400)

15. Check charge contacts on the docking station

- Visually inspect the contacts on the docking station
- If dirty, have them cleaned
- If a black spot is visible, sand spot location with sandpaper (fine grain – 400)

16. Check access path to the unloading ditch

- Make sure there is nothing on the way that may divert or make the Ballpicker slip on its way to the station
- Check for ruts, uneven ground surface just before, in the immediate vicinity of the docking station: a misalignment of contacts (15 to 20 mm can be enough) may result either in “No contact” or “Contact loss” errors

17. Restart the Ballpicker. We recommend you to send the Ballpicker back to the docking station to be recharged before resuming operation:

- Move the Ballpicker 5 meters away from the docking station, orient the Ballpicker towards the peripheral wire – typically 5 to 10 meters before the docking station
- Press “F1” and “On”. Close the lid within 10’. The Ballpicker moves to the wire and manoeuvres towards the station.

18. If you prefer to send the Ballpicker back to work (you have noticed that voltage is near to full charge):

- Move the Ballpicker 5 meters away from the docking station, orient the Ballpicker towards the zone where balls need be collected
- Press “On”. Close the lid within 10’

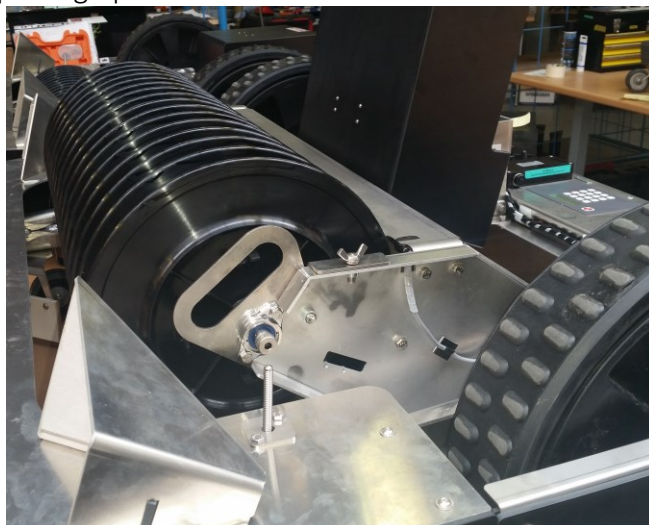
Winter and Mid-season maintenance

Twice a year, the BallPicker needs a full maintenance including the motors inspection. Perform the following steps in a clean environment as it requires some inspection of sensitive mechanical parts.

1. Read and store the history of the robot on your computer
2. Switch off the robot
3. Clean the charge contacts using sandpaper
4. Remove the shell of the robot
5. Inspect the silent block and replace if necessary



6. Remove the roller
 - Set the roll up using option 05 “unload” to “√”



- Remove the wing screw on each side of the roller

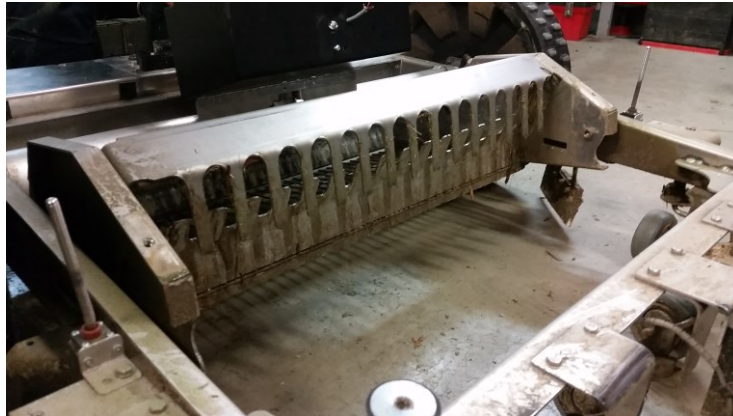


- Remove the roller by taking it by its handle
- Clean it with pressured water and make sure not water is sent to the robot



7. Remove the tank

- Set the roll (still removed) to low position using option 05 “unload” to “-”



- Remove the bottom axle jack axle



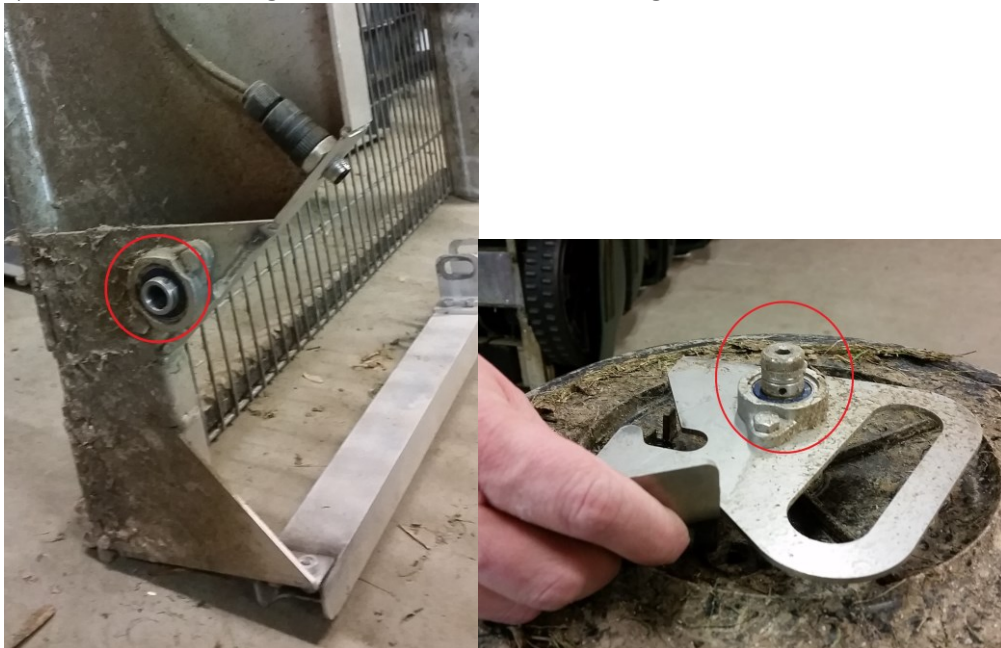
- Disconnect the cable of the ball counter cable



- Remove the screw fixing the tank on both side



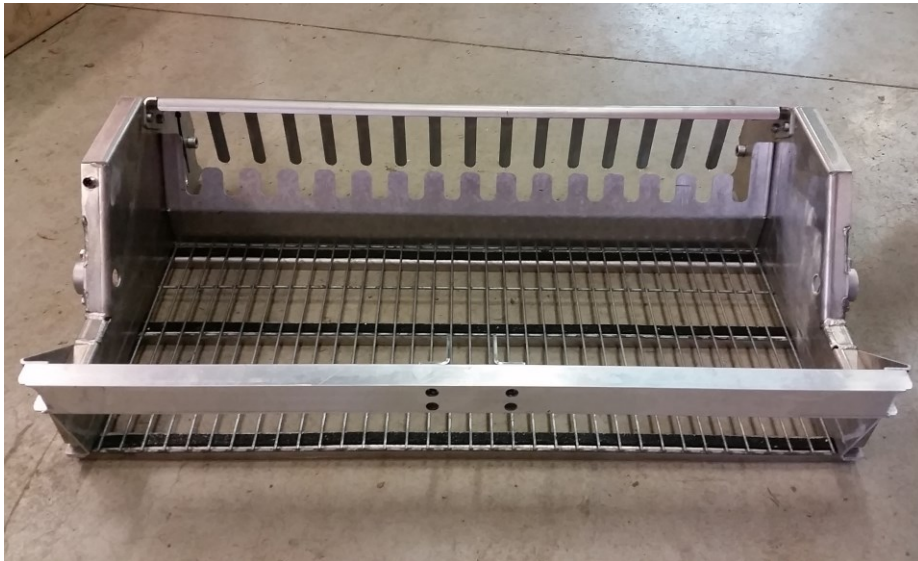
- Inspect the ball bearing of the tank and the roll. A slight clearance is normal.



- If the ball bearing of the roll must be changed, it is necessary to block the roll using the nut on the plastic roll side



- Clean the tank using a wire brush



- Re-install the tank using the screws, reconnect the ball counter cable
- Re-install the roll

8. Front wheel maintenance

- Remove the wheels by taking out the 2 pins

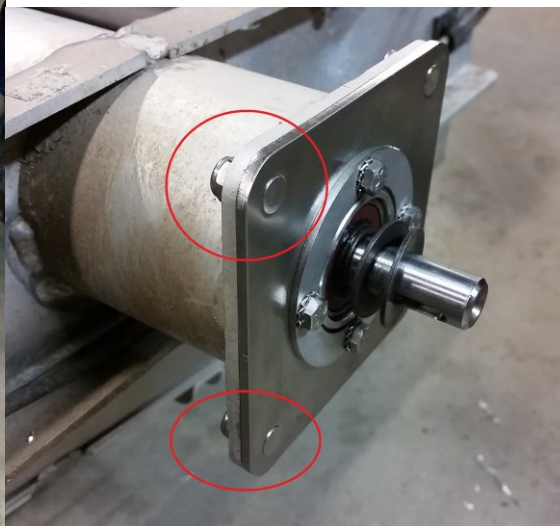


- Inspect the wheel system conditions and replace if necessary. In most of the case, cleaning the axle using sand paper and greasing using silicon grease is enough



9. Engines maintenance

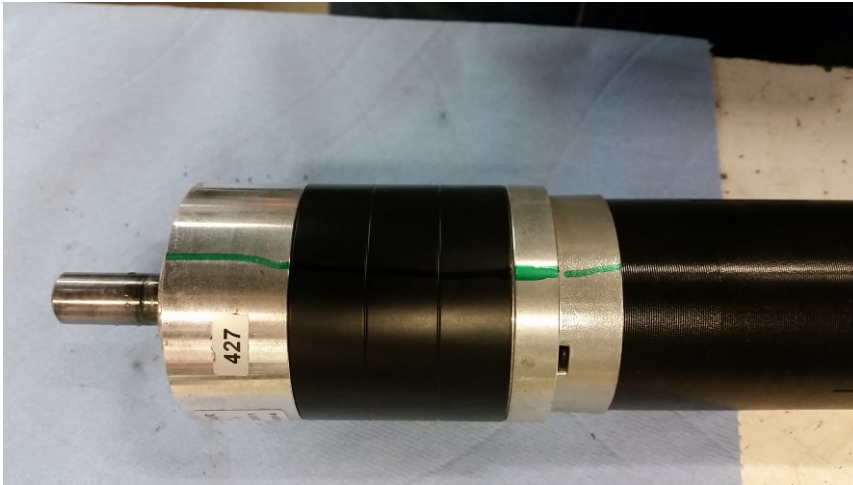
- Remove the wheel and the engine from the chassis. Note: a small diversity exists regarding the engine fixation system



- Remove the fixation system from the engine. It requires to use a blowtorch to melt the glue used to block the screw



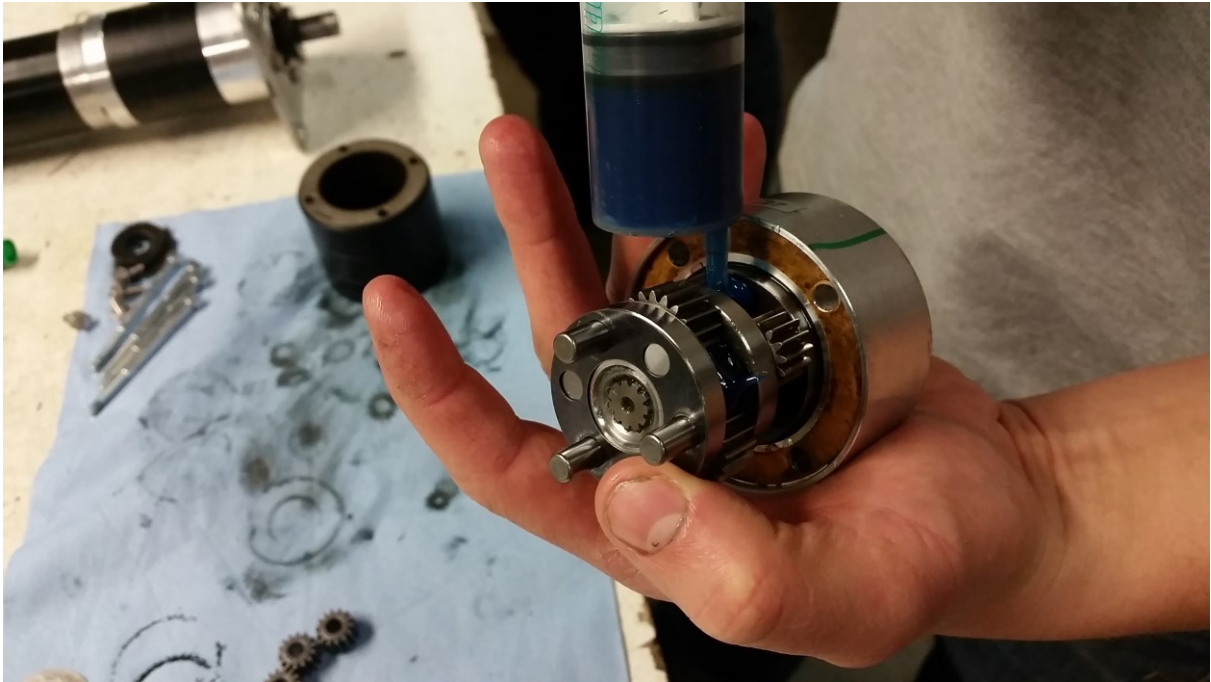
- Before opening the engine, make a marker for rebuilding the engine



- Open the engine, inspect all elements, clean them all using degreasing product



- Re-assemble the engine, using 1ml of grease for each pinion for each pinion (3 per cell)



- Close the engine using some mechanical glue like Loctite 243. Do not grip it too strong as the body is aluminium



- Fix the engine to the metal plate for chassis fixation, using some mechanical glue like Loctite 2701



- Insert the motor in the body and fix it



- Fix the wheel using a torque wrench set at 65Nm



10. End of winter and mid-season maintenance

- Re-install the body
- Switch on the robot
- Perform roll position test:
 - Set the roll up using option 05 “unload” to “√”
 - Check the trap is correctly being open
 - Set the roll down using option 05 “unload” to “-”
 - Check the trap is correctly being closed
- Perform obstacle detection test:
 - Set the robot to demo mode using option 03 “demo mode” to “√”
 - Press start and close the hood
 - Verify the robot slow down when an obstacle is on its path
 - Verify the robot stops and manoeuvre if the bumper is pressed
 - Verify the robot stops when the body switches are triggered by an impact
 - Verify the robot stops when the hood is opened

11. Return to the field

- Switch on the robot inside the working area
- Call the Ballpicker back to the docking station
 - Either go to the Ballpicker, open up the lid and press « F1 »
 - Or send SMS « Backhome » to the Ballpicker. This is equivalent to « F2 »
 - Please observe the comprehensive operation of the Ballpicker till completion of balls unloading.
 - Verify the contact of the charging arm and the robot charging, adjust height if necessary