

OPERATIONS MANUAL
VORTEX POPCORN™ MACHINE
ROBOPOP® MARK 1 AND ROBOPOP® MARK 2

2014

1. DESCRIPTION AND OPERATION OF POPCORN MACHINE

1.1. POPCORN MACHINE DESIGNATION

Vortex Popcorn™ machine Robopop® is a fully automatic popcorn machine which pops kernels on the basis of the revolutionary technology. The corn evenly distributes over the parabolic bottom of the machine internal chamber, constant corn rotation around the chamber axis and simultaneous agitation takes place in the chamber, which in its turn provide their maximum fast and uniform heating. Owing to the artificially created vortex air stream inside the chamber, popcorn is immediately withdrawn from the hot zone. That cordially improves popcorn taste and quality.

1.2. TECHNICAL SPECIFICATIONS

Specifications	Mark 1	Mark 2
Output	34 kg per hour	
Corn hopper volume	25 L	
Salt hopper volume	no	2 L
Starting current	16 A	
The maximum load on all phases	42 A	
Nominal voltage	380...415 B	
Nominal power	8,9 kW	10 kW
Frequency	50 Hz	
Power consumption	5 kW/h	
Overall dimensions		
length	1150 mm	
width	830 mm	
height	2050 mm	
Weight	230 kg	280 kg

The machine should be operated at ambient air temperatures from +5°C to +40°C and relative humidity not exceeding 50% at 40°C. The above sea level should not exceed 1000 m (EN60204-1).

The popcorn machine protection class IP22 (EN60204-1). The popcorn machine is to be used indoors with forced ventilation provided.

The machine should be connected to the mains by qualified electrical staff only. A three-phase five-core circuit with an earth wire should be used for connection.

1.3. DELIVERY SET



CAREFULLY UNPACK THE MACHINE, CHECK FOR COMPLETENESS AND REMOVE THE PROTECTIVE FILM FROM ALL SURFACES.

The popcorn machine delivery set includes:

Vortex Popcorn™ machine Robopop® Mark 1 or Robopop® Mark 2	1 piece
Cart for popcorn	1 piece
Plastic bags for popcorn	50 pcs
Network Cable 5m with plug 3P + N + E, 32A	1 piece
Cable outlet 3P + N + E, 32A	1 piece
Spare parts set (see appendix B)	
Passport and operating manual	1 piece



THE POPCORN MACHINE COMES IN A DISASSEMBLED FORM. ASSEMBLY, SETUP, AND THE FIRST RUN OF THE MACHINE SHOULD PRODUCE PROFESSIONALS WHO HAVE RECEIVED INSTRUCTION.

1.4. ARRANGEMENT AND PRINCIPLE OF OPERATION



Prior to shipment to the customer all popcorn machines are tested, so a small amount of corn and oil may remain in the machine.

Robopop popcorn machine consists of the following main elements:

- 1 – popcorn machine with an internal chamber where corn is actually popped;
- 2 – 25 l grain dispenser with a screw conveyor;
- 3 – control unit;
- 4 – stand the machine is installed on. The stand for Robopop machine is equipped with a heat chamber for heating the coconut oil;
- 5 – sifter – a welded perforated stainless steel drum for sifting unopened and damaged corn; in this sifter the popcorn is also salted and oiled;
- 6 – collector – a stainless casing for temporary receiving popcorn when a cart with ready popcorn is replaced;
- 7 – separator, which uses directed airflow to separate unopened corn from husk;

- 8 – waste hopper;
- 9 – unopened corn hopper. Undamaged unopened corn can be reused;
- 10 – screw salt dispenser;
- 11 – droplet-type nozzle for feeding oil;
- 12 – cart for ready popcorn with a replaceable plastic bag (not shown in the drawing);
- 13 – oil supply pump;
- 14 – oil container (not included in the delivery set);
- 15 – peephole;
- 16 – access hole for cleaning the internal chamber.

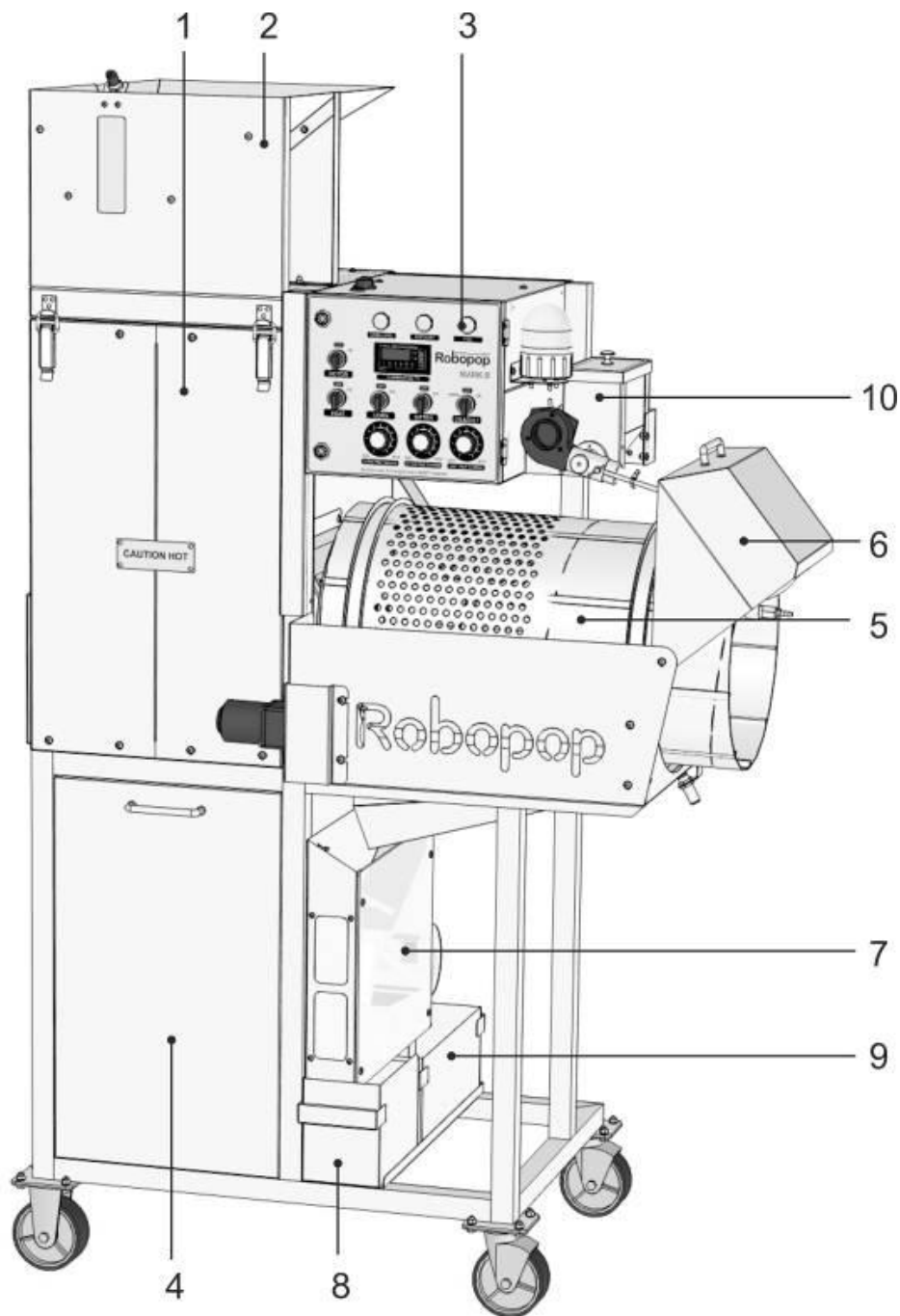


Fig. 1. Popcorn machine general view (front view)

Corn from dispenser 2 is fed to preheated up to 210-230 degrees chamber 2. The chamber performs continuous heating and closed circulation of hot air. The corn in the chamber is heated and bursts (pops). As soon as the corn is opened, the airflow immediately removes it from the chamber into sifter 5. Together with ready popcorn, unopened corn and husk also go to the sifter, where they are immediately sifted out.

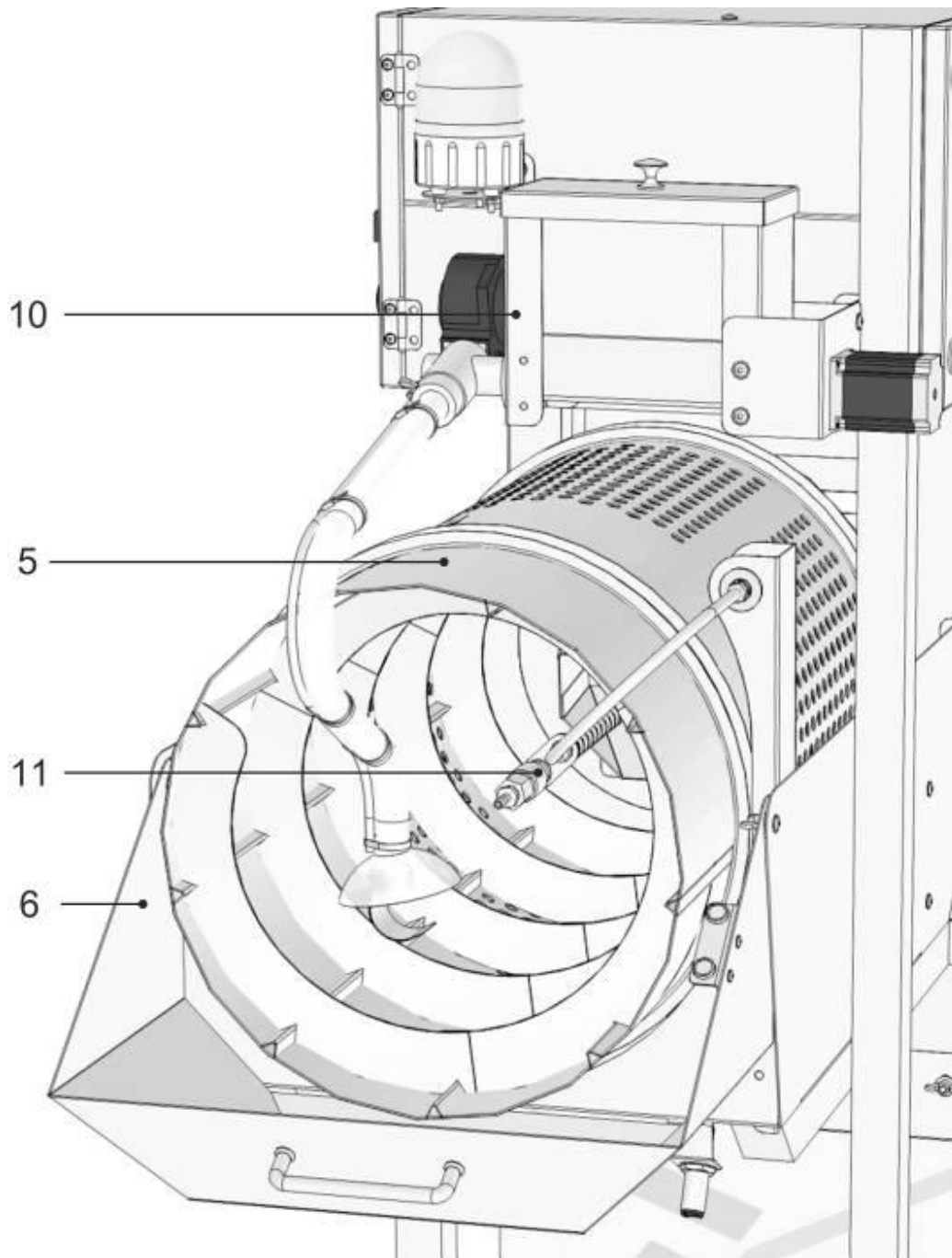


Fig. 2. Arrangement of Robopop popcorn machine (right-side view)

Moving along the sifter, the corn is mixed, oiled and salted. Oil is fed into the corn from droplet-type nozzle 10. Oil is fed by pump 13 from container 14 in the lower part of stand 4. Salt is fed from hopper 10 and sprayed over the popcorn by a fan.

Underneath the sifter there is separator 7, which separates good unopened corn from husk and damaged corn. Husks go to hopper 8, while good unopened corns go to hopper 9. In order to reduce the percentage of unopened corns, those can be filled in dispenser 2 and reused.

Stand 4 is a welded structure fitted with wheels for free moving of the machine.

Ready popcorn goes from the sifter to the moving cart with a plastic bag. Use of two carts is recommended, which accelerates replacement of the bag with popcorn with a new one. Collector 6 is used for temporary, up to 30 seconds, holdup of the ready popcorn flow. This time is sufficient for changing the bag without stopping the machine.

Peephole 15 is used for visual control over the popping process. Access hole 16 in the lower part of the machine is used for cleaning the internal chamber from corn dust and husks.

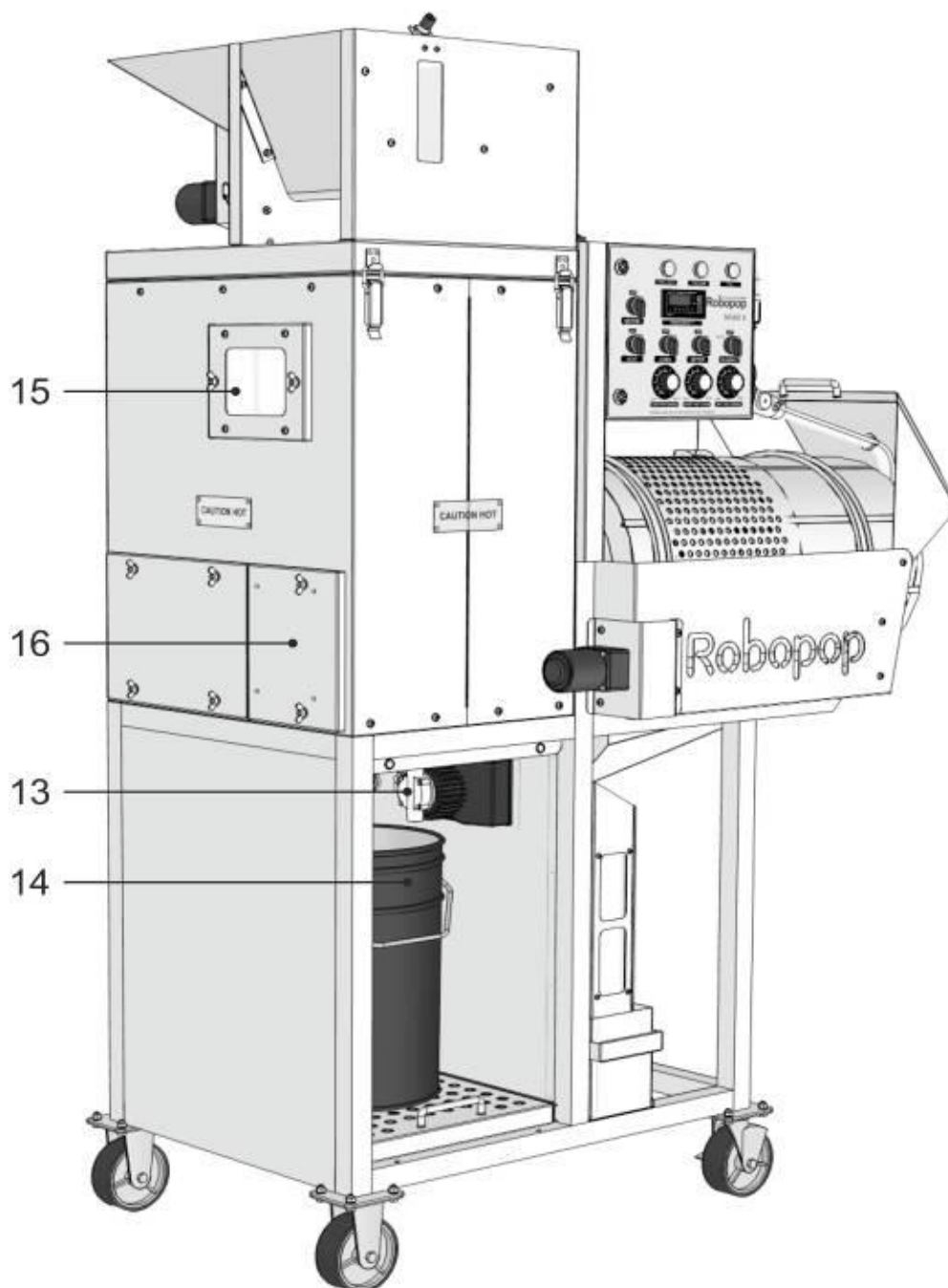


Fig. 3. Arrangement of Robopop popcorn machine (left-side view)

2. INTENDED USE

2.1. SAFETY REQUIREMENTS

Never turn the machine off using toggle <<MOTOR>> when it is running. This may result in fire and breakdown of the machine!

The machine should first be cooled down via turning heating off by toggle <<HEAT>>. Cooling takes about 10-15 minutes. And only cooling the chamber down to 180°C, which is indicated by light <<PREHEAT>>, you may turn off the turbine by switching toggle <<MOTOR>> in position <<OFF>>.

You should daily open access hole 16 in the lower part of the machine and remove husks and dirt from the chamber. It is convenient to do this with a vacuum cleaner. Failing to do this on a regular basis may result in fire!



WARNING! Many parts of the running machine are hot! Danger of burns!

2.2. PLACEMENT REQUIREMENTS

In a view of the equipment specialties we recommend to provide the machine with purge ventilation. 1000 m³/hour is recommended level of purge ventilation for Vortex Popcorn™ machine Robopop® Mark 2 and 890 m³/hour for Vortex Popcorn™ machine Robopop® Mark 1.

EXPRESSLY FORBIDDEN!

1. TOUCHING THE MOVING PARTS OF THE RUNNING MACHINE!
2. WASHING THE ELECTRICAL PARTS AND CONTROL UNIT WITH WATER! ONLY WIPING WITH A WET CLOTH IS ALLOWED!
3. DISASSEMBLING THE MACHINE OR REMOVING SEPARATE COMPONENTS WITHOUT ISOLATING MACHINE FROM THE MAINS!
4. MODIFYING THE MACHINE DESIGN!
5. USING THE MACHINE FOR POPPING ANY GRAIN OTHER THAN CORN!

ATTENTION!

PRIOR TO OPERATION READ THE OPERATING MANUAL CAREFULLY!

ONLY TRAINED PERSONNEL MAY BE ADMITTED TO USING THE POPCORN MACHINE!

DO NOT OPERATE THE MACHINE IF THE CHAMBER IS FULL OF POPCORN! IT SHOULD BE DELETED.

PROTECTORS AND SYSTEM LOCKUPS

“Emergency stop” button on the control panel completely shuts off the machine at any time.



WARNING! Use the button “Emergency stop” only in cases of emergency threatening life



WARNING! In case of emergent electricity shut off during the operation, the chamber can be clogged up with popcorn. In order to resume the operation it will be necessary to take the lid off the chamber and clean it from popcorn and kernels.

In the electrical network before solid state relays that control the heating elements (each approx. 11A at 230V), is set to 25A contactor (KM2 in the diagram), which is connected to the emergency thermostat sensor which is installed in the camera. In the event of a failure or solid-state relay or automation systems and uncontrolled heating heaters triggered emergency thermostat, which will disable the heating elements, preventing their further overheating.

An automatic switch 32 A (chart Q1) located at the power cable entry will shut the machine off in case of short circuit.

Inside the chamber there is an optic sensor which will shut off the input of kernels, in case the chamber is overfilled with corn, preventing overfilling of the chamber and exit clogging.



CAUTION! The bowl can be overfilled in case of wrongly chosen operating parameters: low temperature, etc., belt drive breakage, motor collapse, one of the heaters' failure.

The sifter drum is not rigidly connected with draw roller. Thus, if a slight effort is applied to it, it will turn and stay in place.

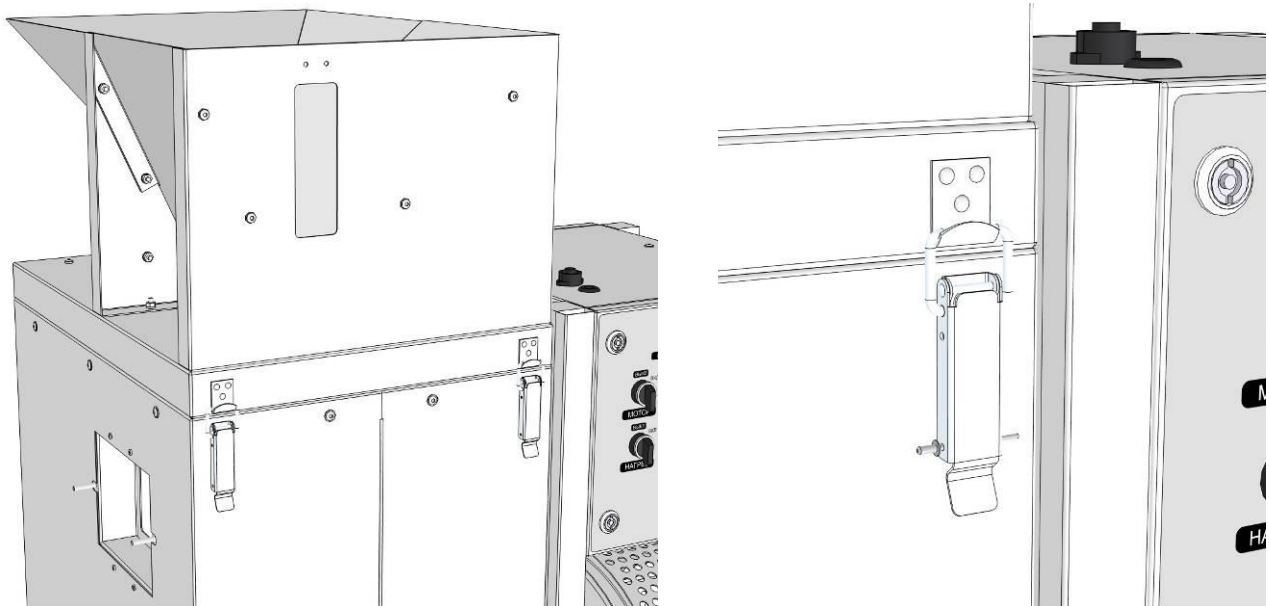
Inside the popper there is a sensor which will shut off the input of kernels if the cart with the popped corn is overfilled. There is also a sensor in the dispenser, which will shut off the input of salt and oil if there is no input of kernels.

There is a block system in the machine which will not let to turn off the power feed in the chamber if its temperature is more than 180°C. The temperature in the chamber should be lower than the indicated one. “Emergency stop” button will cut off power, and it should be used only in cases of emergency.

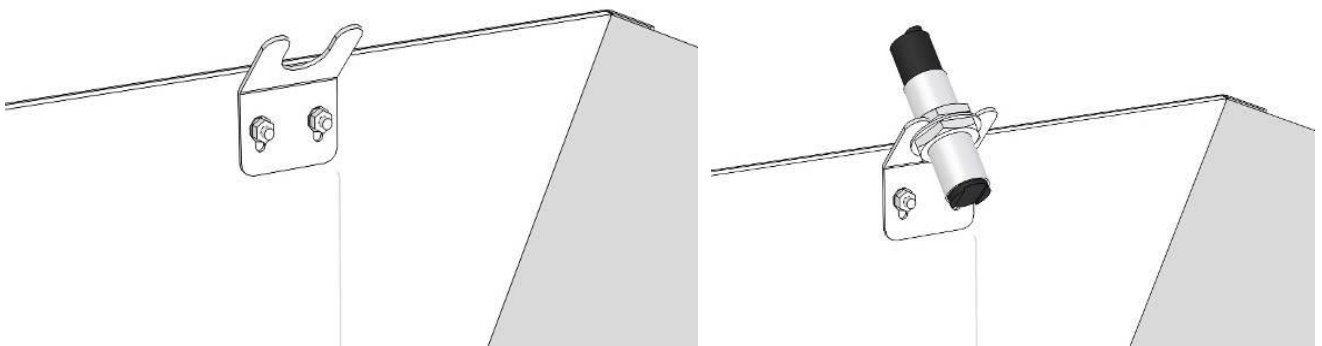
The base on which the machine is mounted has two wheels with a mechanical brake which excludes the possibility of spontaneous movement.

2.3. PREPARING FOR OPERATION

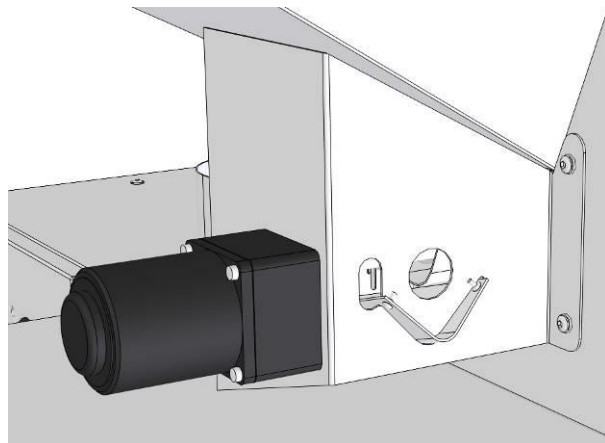
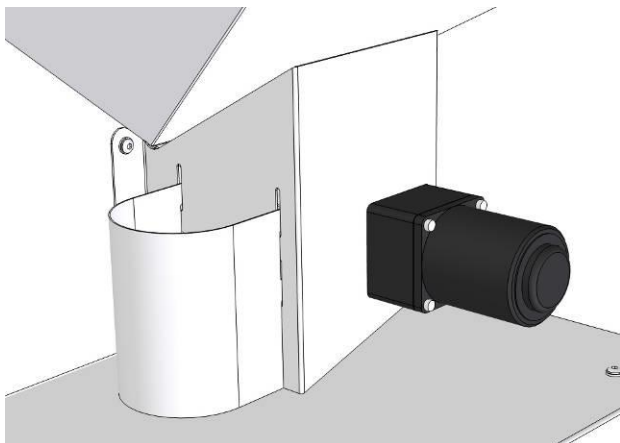
1. Carefully unpack the machine, check the completeness of delivery and remove the protective film from the metal parts.
2. Install the cover with the grain dispenser onto the machine. The dispenser peephole should be turned to the operator. Fasten the latches and fix them with pins.



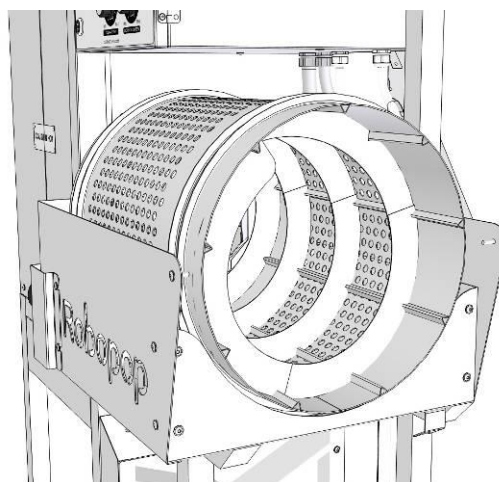
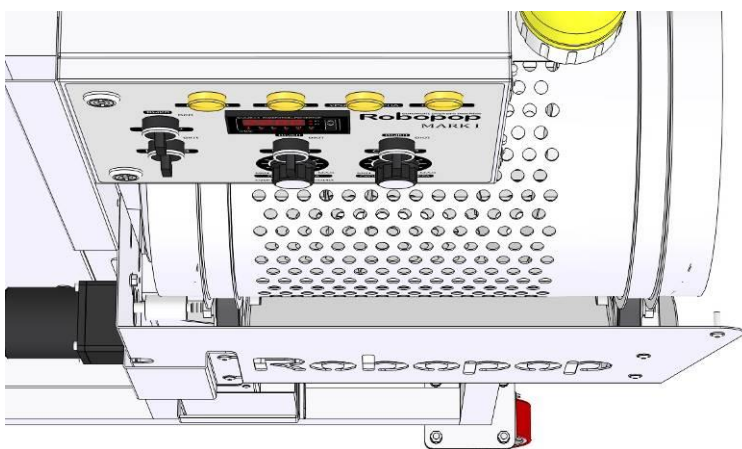
3. Install the bracket under the grain photo sensor at the front side of the dispenser. Install the photo sensor.



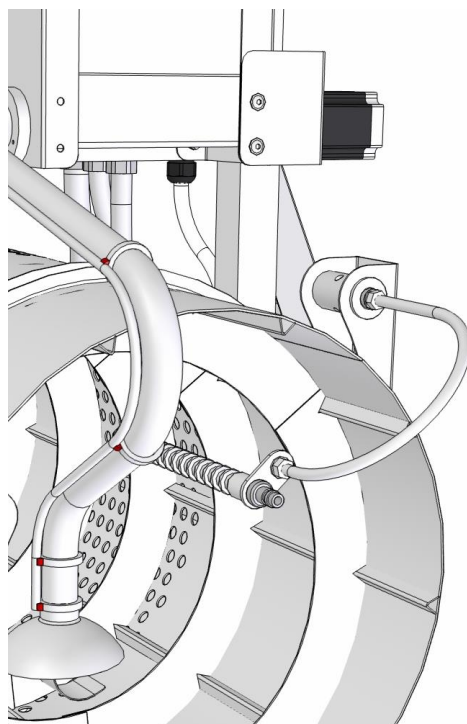
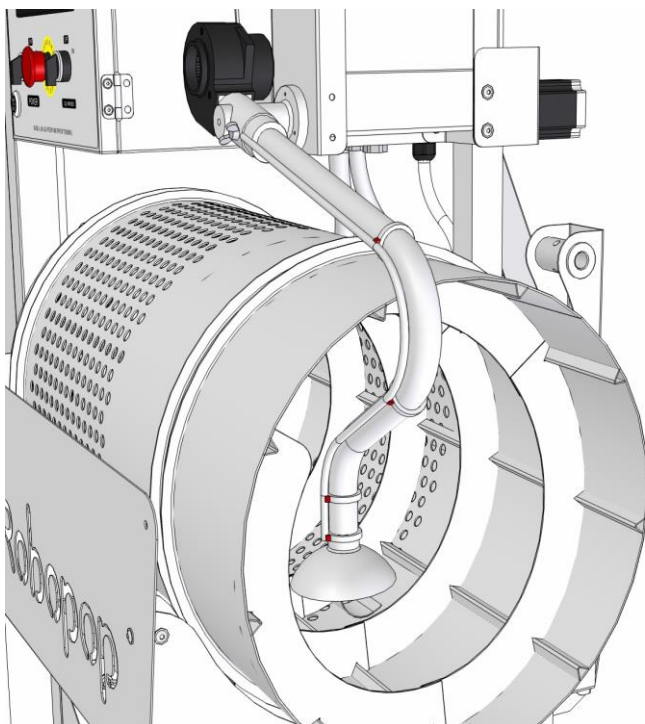
4. Connect the connector of the dispenser gear motor to the control unit.
5. Install the protective case and the guide groove.



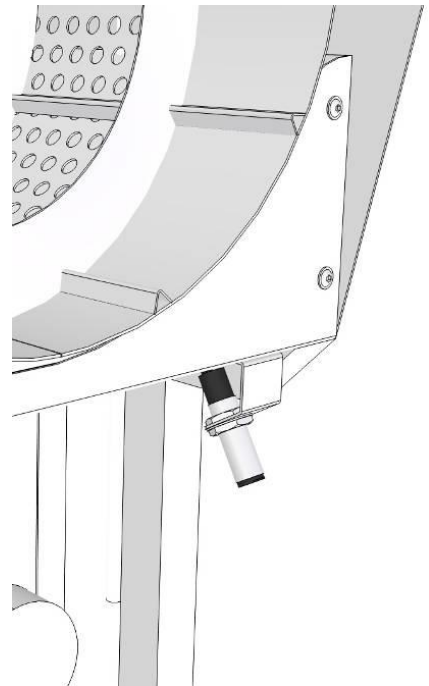
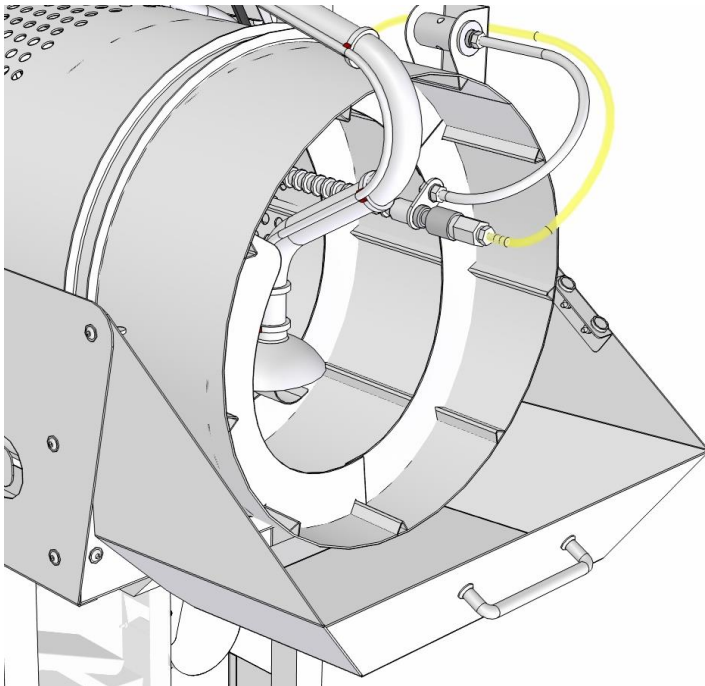
6. Install the sifter. The drive rollers should get into the slots of the sifter guides. Turn the sifter by the hand. It should rotate freely without touching the machine metal parts.



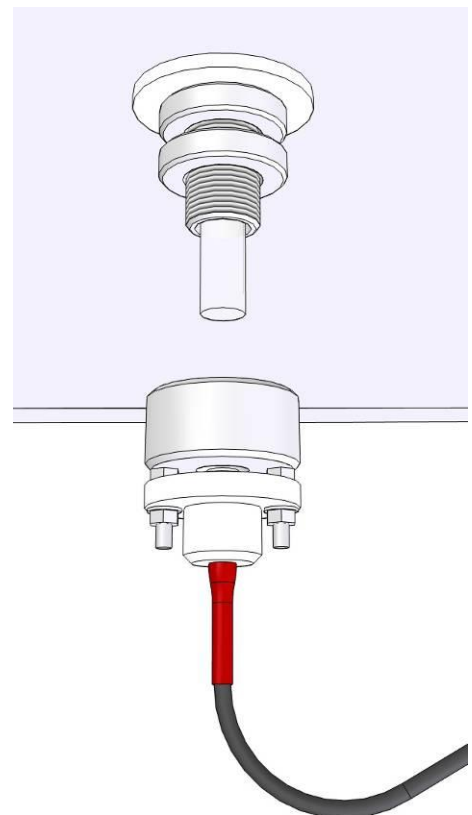
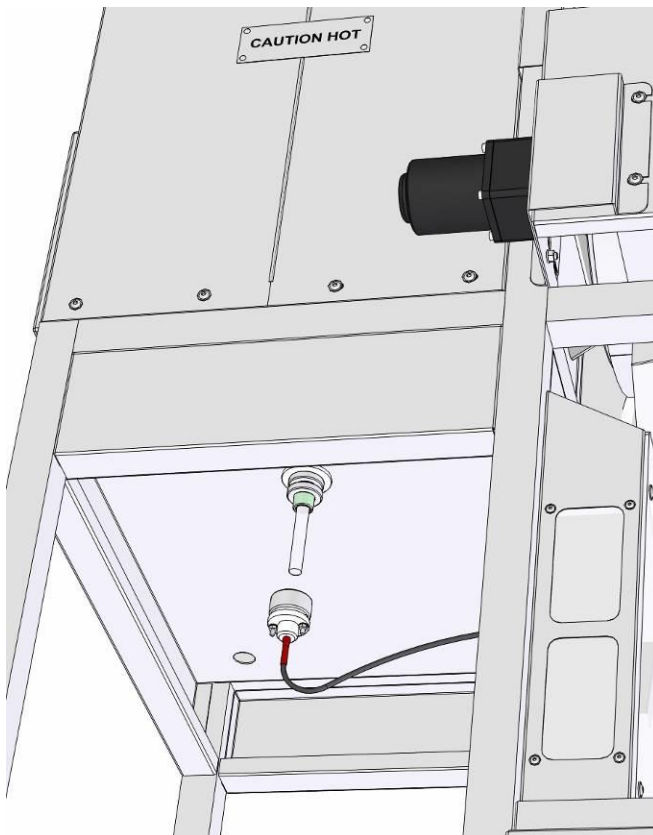
7. Install the salt dispenser pipe.



8. Install the oil nozzle and connect the oil pipework to it and the connector in the casing under the main motor.
9. Install the collector. Fix it with wing nuts.



10. Install the cart overflow sensor on the bracket under the sifter.

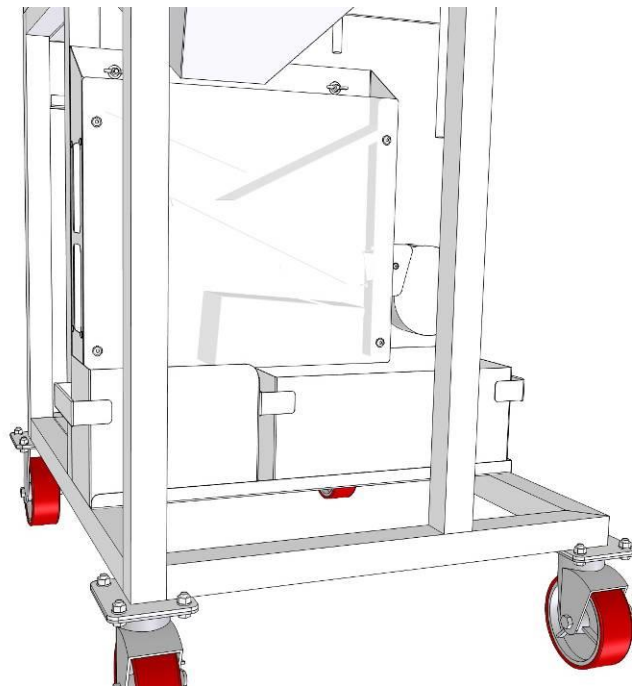
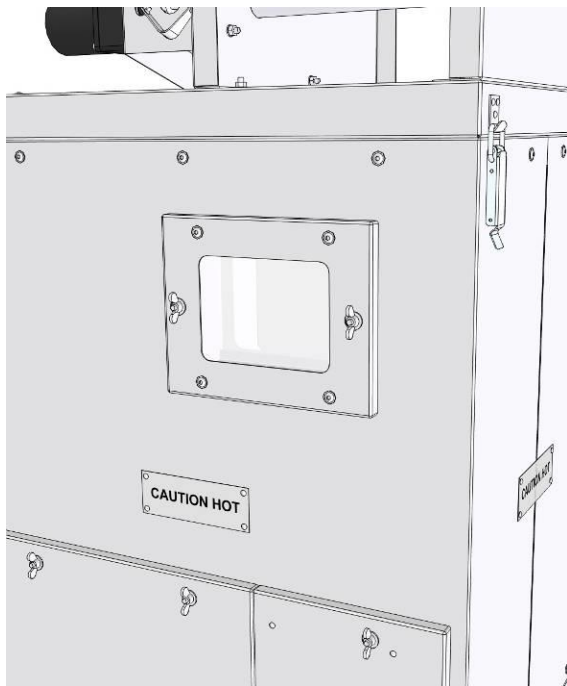


11. Carefully unpack the light conductor (quartz rod) and the chamber overload sensor. Insert the light conductor into the hole at the bottom of the machine chamber. Screw

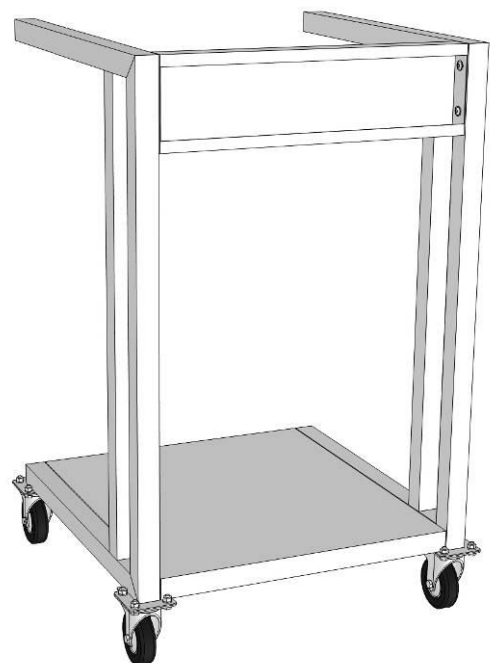
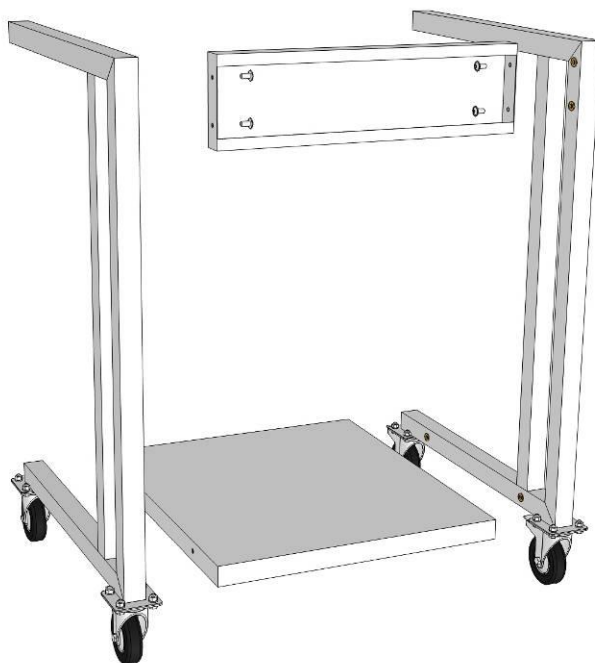
on the locknut, and then the chamber overload sensor. The light conductor should protrude by 5mm inside the machine bowl. For controlling the sensor protrusion height, insert your hand into the chamber through the peephole. Connect the overload sensor to the power socket.

12. Carefully unpack the door. Install and fix it by finer-nuts.

13. Install the trays for grain and husks under the separator.

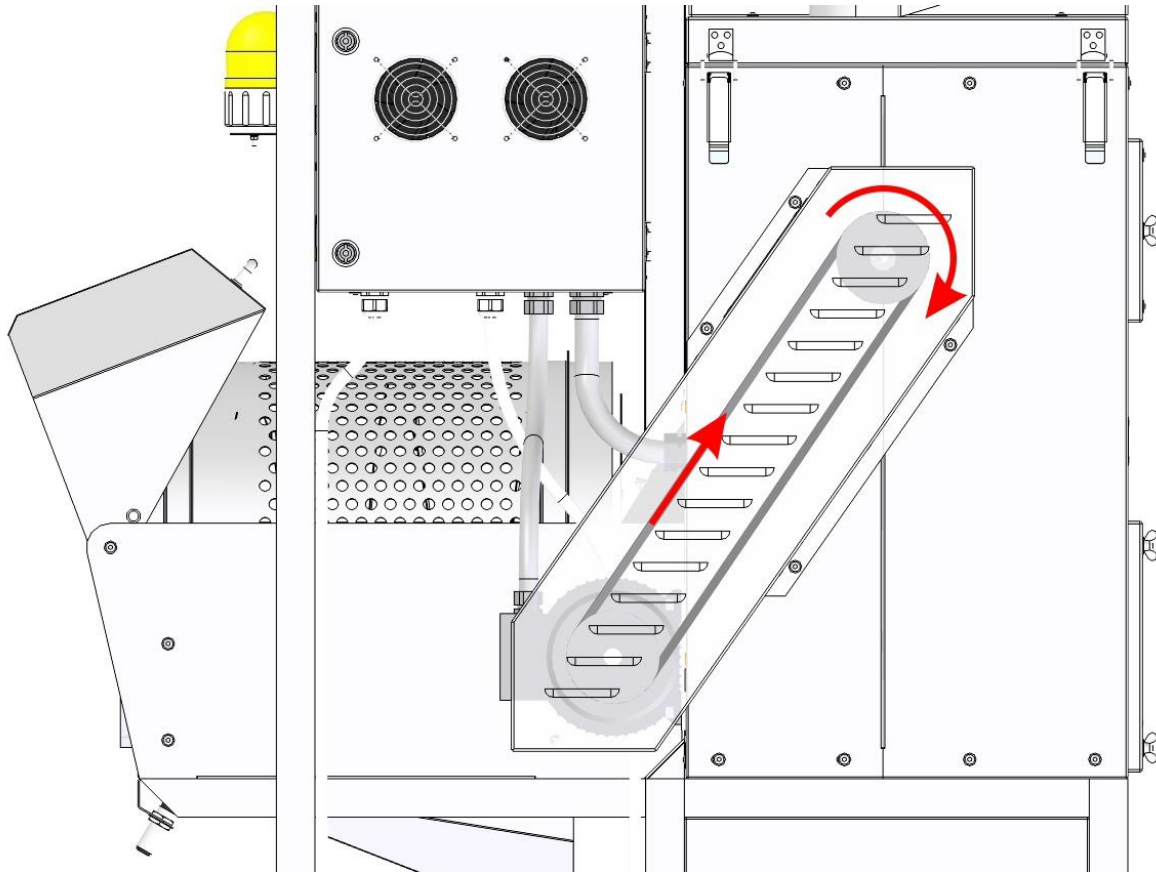


14. Assemble the cart for popcorn.



2.4. MACHINE FIRST START

1. Turn on the main switch <<MOTOR>> electric turbine. Check the direction of rotation of the motor shaft. The shaft must rotate clockwise. If the shaft is rotated in the other direction, you need to reverse two phases in the plug.



2. Turn on the heating system, turning the switch <<HEAT>>. The unit will heat to the set temperature 210-235°C for 10-15 minutes. Allow the unit to work in a 30 minute mode. During the first run may cause specific smell. This is a normal process.
3. The sifter will automatically be started at achievement in the chamber of temperature 180 °C. The sifter should rotate freely, without touching the metal parts of the machine. The separator turbine will also start.
4. Test the separator by dropping several grains in it. The grains should go to the grain tray without stopping on the angle plates.
5. Lift the collector and fix it in the upper position. Position the cart with a bag for ready popcorn.
6. Load 3-4 kg of grain per dispenser. Set the minimum level of grain feed, turn on the main switch of corn <<CORN>>. The first disclosed grain will fly out of the chamber after about 2 minutes.



CAUTION! THE FIRST FILLING WITH CORN IS USED FOR CLEANING THE CHAMBER AND THIS CORN IS NOT SUITABLE FOR EATING.

2.5. PROCEDURE

Prior to operation, fill corn into hopper 2.

When using Mark 2 machine, you should also fill salt in hopper 10 and place the pre-melted oil container into the stand niche. Dip the oil-intake pipe into the oil container. Prepare carts with bags for popcorn.

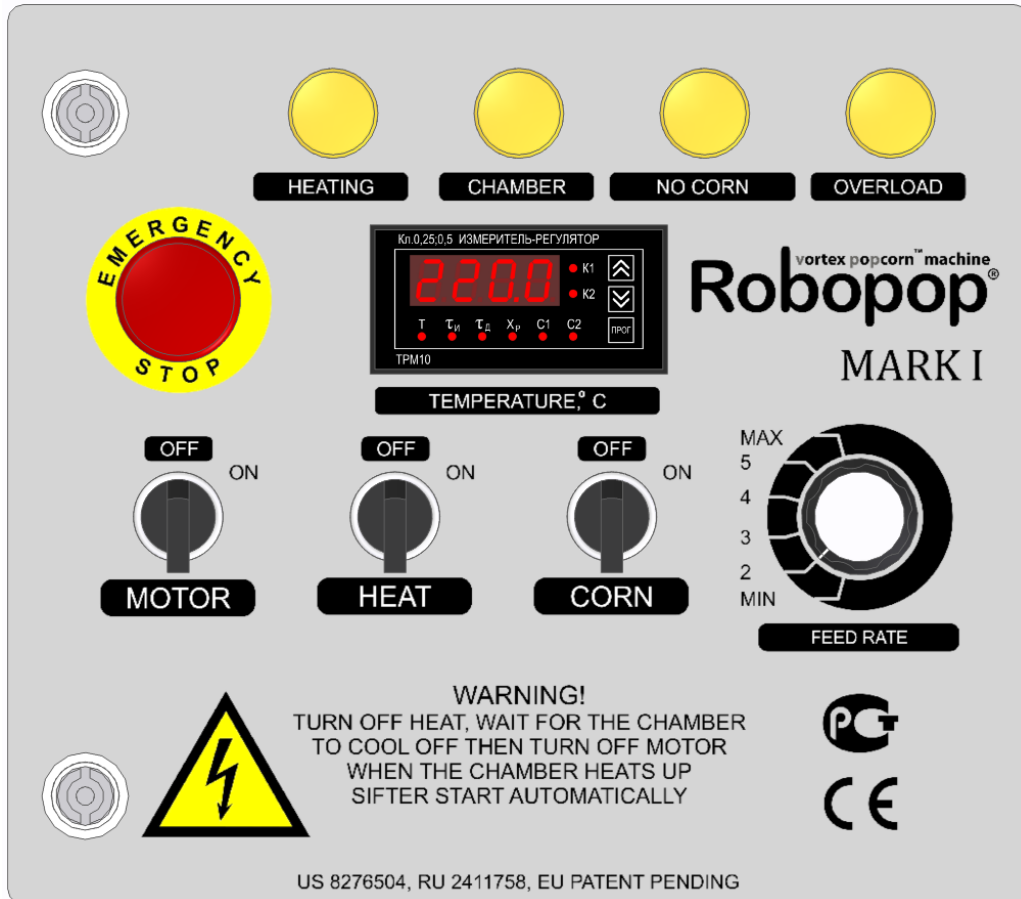




Fig. 4a. Machine control unit Robopop® Mark 1

Turn toggle <<MOTOR>> in position <<ON>> to turn the machine on. The main turbine will start running, which ensures air circulation in the machine. The machine will produce distinctive monotonous noise. Use arrows   on the measuring regulator to set the desired temperature.

For popcorn “butterfly” the usual temperature is 210-215°C, for popcorn “mushroom” – 210-235°C. The temperature can be adjusted depending on the corn.

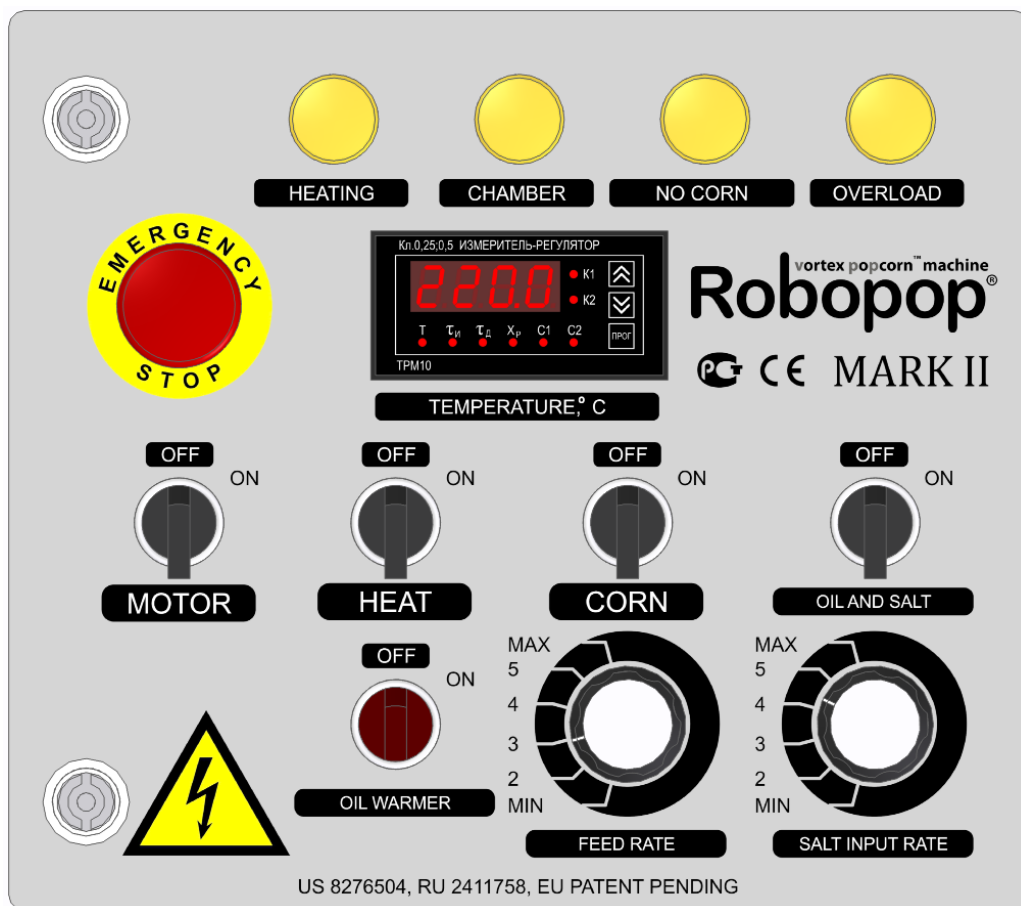


Fig. 4b. Machine control unit Robopop® Mark 2

Turn toggle <<HEAT>> in position <<ON>> to start warming up of the machine. Indicator <<HEATING>> will light up on the control panel indicating that the chamber is still warming up.



CAUTION! DO NOT TURN THE FEEDING OF CORN ON UNTIL THE CHAMBER IS WARMED UP TO THE REQUIRED TEMPERATURE.

Lift the collector 6 sifter start automatically when heating chamber. As soon as the temperature in the chamber reaches the set value, turn on the main switch grain <<CORN>> and adjust the feed rate.

During the first 10 minutes of operation, the corn feeding should be set at minimum value – It corresponds to the performance of about 14 kg of grain per hour. And only when the machine is thoroughly warmed up, the feeding may be set in accordance with the output requirements.



FOR BUTTERFLY POPCORN, THE MAXIMUM CORN FEEDING SHOULD NOT EXCEED 4-SPEED – THIS CORRESPONDS TO APPROXIMATELY 26 KG OF PRODUCTIVITY PER HOUR. POPCORN MUSHROOM MAY BE GIVEN MAX SPEED, WHICH CORRESPONDS TO 34 KG PER HOUR.

To preserve the good popcorn quality different temperature requires for each feed

rate. Below there are recommended temperature settings, the figures may differ (+/-5 °C) in a few of big variety of corn.



200°C and below – 2 feed rate and lower
205-215°C - 3-4 feed rate
220-235°C – 5-6 feed rate

The corn has a small amount of moisture which it transfers to heat elements, after that the reduction of temperature takes place. The time of set temperature reaching mainly depends on the feed rate and takes from 5 to 15 minutes (voltage and corn quality also affect that figure)

So the popcorn quality may be appreciated only after the delay time expiration.

The speed of rotation of the sifter automatically varies with the level of feed rate. This is required for the oil and salt to be also filled as an even layer on the ready popcorn.

As soon as the even layer of popcorn covers the sifter surface, turn on the oil and salt feeding by a respective toggle (This feature is available only for the model Robopop® Mark 2). Adjust the required amount of salt by the knob. The oil feeding rate is regulated directly on pump 13 located in the heat niche of the stand.

The measuring regulator is set in such a manner that it automatically blocks the corn feeding if the chamber temperature is below 180°C or above 250°C. In this case, indicator <<HEATING>> will light up on the control panel.

There are three more light indicators on the control panel. Indicator <<CHAMBER>> lights up when the popping chamber is overfilled. Overfilling may occur if too great corn feeding rate is set or of the chamber temperature is below the set value. When the overload sensor actuates, a sound-and-light signal is given and the corn feeding automatically stops until the chamber self-cleans.



CAUTION! IN ORDER TO PREVENT THE CHAMBER OVERLOAD YOU SHOULD REDUCE THE CORN FEEDING. OTHERWISE THE CHAMBER MAY BE BLOCKED WITH CORNS, WHICH RESULTS IN FAILURE OF THE MACHINE.

Indicator <<NO CORN>> lights up in case of corn level reduction in the loading hopper, which is followed by a sound-and-light signal. Usually, in this case the machine still contains enough corn for 2-3 minutes of running. It is recommended to top up corn in the hopper.

Indicator <<OVERLOAD>> actuates when the bag is filled with ready popcorn. Sound-and-light signal is also given in this case.

If the bag is overfilled with ready popcorn, then, without stopping the operation, lower collector 6 and thus interrupt the flow of ready popcorn. In those 20-30 seconds during which the ready popcorn will be accumulated in the collector, you should remove the bag with ready popcorn from the moving cart and insert a new empty bag in it.

When the cart with the empty bag is placed in the previous position, lift up the collector and the popcorn will pour out of it into the bag.

The machine only controls the corn level in the upper hopper and the ready popcorn level in the receiving hopper (moving cart). The operator should control the salt and oil level on his own.

Salt may be topped up in the hopper without stopping the machine. The oil container may also be replaced when the machine is running by quickly taking the oil-intake pipe out of the emptied container and immediately dipping it into a full one. The salt hopper's capacity is sufficient for 2 hours of operation; the oil consumption is 6-8 liters per hour, depending on the mode.

The machine is turned off in reverse order. First, turn off the feeding of corn. After all corn escapes the chamber, in about 2-3 minutes turn off the heating and feeding of oil and salt. Sifter turn off automatically when the cooling chamber.

Prior to turning off the motor, cool the machine down. Cooling takes about 10-15 minutes. And only cooling the chamber down to 180°C, which is indicated by light <<HEATING>>, you may turn off the turbine by switching toggle <<MOTOR>> in position <<OFF>>.

If you use oils with melting temperature higher than the room temperature (coconut, palm), toggle <<OIL WARMER>> should be constantly on. When it is on, the niche that accommodates the oil container and oil pump is warmed up and does not allow oil to harden. Also, when using such oils, the oil pipes and nozzle that feeds oil to popcorn should be stored in a heated car in the nighttime. Otherwise the oil will harden inside and the machine will be inoperable.

We recommend using liquid vegetable oils, which will not solidify at room temperature. Canola, sunflower, corn oils, their blends, especially RoboOil (the blend of coconut and canola) are the best choices for RoboPop machines. These oils are always available at the popcorn market.

If you use such oils you will not have to partially take the machine apart every night and put in back in place every morning in your worries about solidified oil in the tubes, oil dispenser and the pump condition and whether your personnel remembers to put the tubes away in the right place for the night.

When the machine is running, separator 7 separates husks from unopened corns. The closer hopper 8 accumulates waste (husks, burnt corns etc.), which should be removed when it is full, while the farther hopper 9 accumulates unopened corns. These corns should be periodically, at least every 2 hours, be removed and added to the fresh corns in the loading hopper.

2.6. THE OIL SUPPLY ADJUSTMENT (ONLY FOR MARK 2 MODEL)

Oil flow regulator located directly at the pump dispenser (item 3, Fig. 5). On the pump housing is a small potentiometer (see Fig. 5) which allows to regulate the oil flow from 0% to 100%.

The value of the regulator 100% corresponds to the real oil supply 5-5.5 kg per hour.

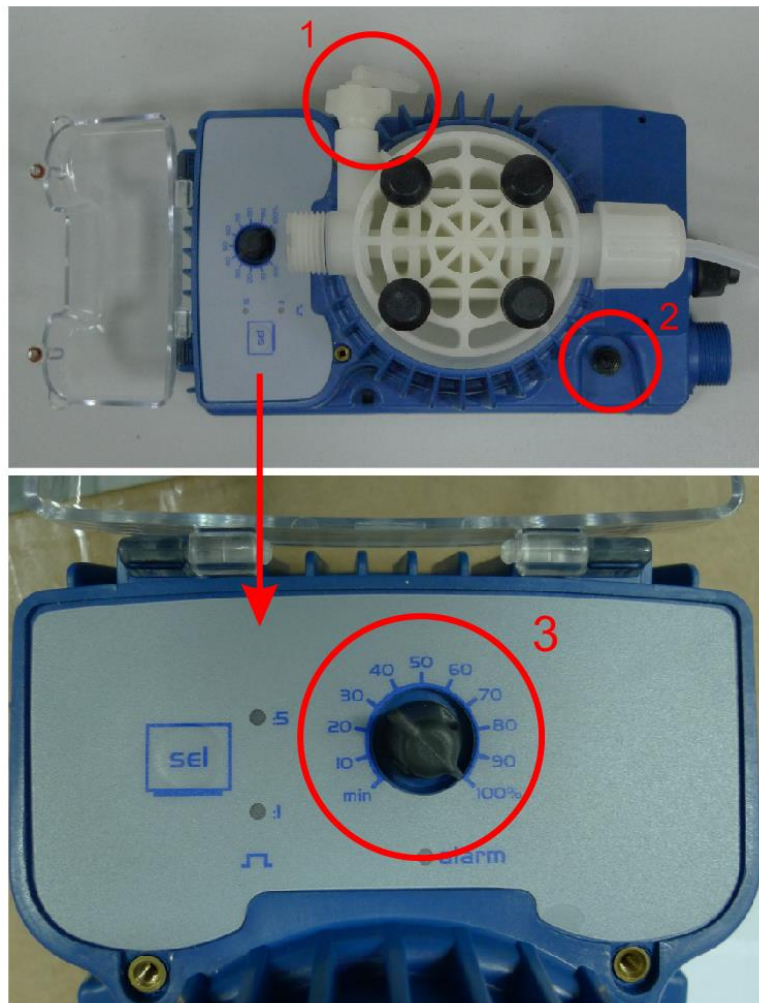


Fig. 8. the oil supply Adjustment

100 % regulator value corresponds to 5-5,5 per/hour oil supply.

The switch item 2 also located on the pump housing. To ensure that the pump work properly and get "ON", "OFF" signal from the main controller, that switch should be in "ON" position.

There is a special valve on the pump housing for oil pumping item 1. For more information concerning oil pumping see 3.8 section.

3. MAINTENANCE

3.1. GENERAL INSTRUCTIONS

The purpose of maintenance is to keep the popcorn machine operable during the entire service life and observance of the fire safety rules.

Maintenance of the popcorn machine should be performed as separate parts become dirty.

The recommended maintenance schedule with certain actions is presented below

No.	Actions	Period
1.	Washing the sifter, salt dispenser pipe and oil nozzle	Once a day
2.	Cleaning the external surface of the machine from dust and dirt	Once a day
3.	Cleaning the internal chamber from husks and corn dust	Once a week
4.	Cleaning the internal chamber net from husks and corn dust	Once in 3 months
5.	Chamber lamp replacement	Once in 3 months
6.	Drive belt replacement	Once in 6 months

3.2. SECURITY MEASURES

Prior to maintenance, disconnect the machine from the electrical mains.

Do not wash electrical parts and control unit with water. You may wipe them with a soft cloth moistened in a soap solution.

If combustion occurs when the machine is running (it is possible if the machine is not cleaned or turned off incorrectly), you should de-energize it by pulling the power cord from the socket, and only after that you may take any fire-fighting actions.

3.3. MAINTENANCE PROCEDURE

In the end of the working day or before a long idle time clean the internal chamber from husks and corn dust, and, in case of using salt and oil, remove and wash the sifter and oil nozzle.

In order to clean the chamber, unscrew the wing nuts and open access hole cover 16 in the lower part of the chamber. Remove husks and dirt from the chamber through special hole 17. It is convenient to do this with a vacuum cleaner.

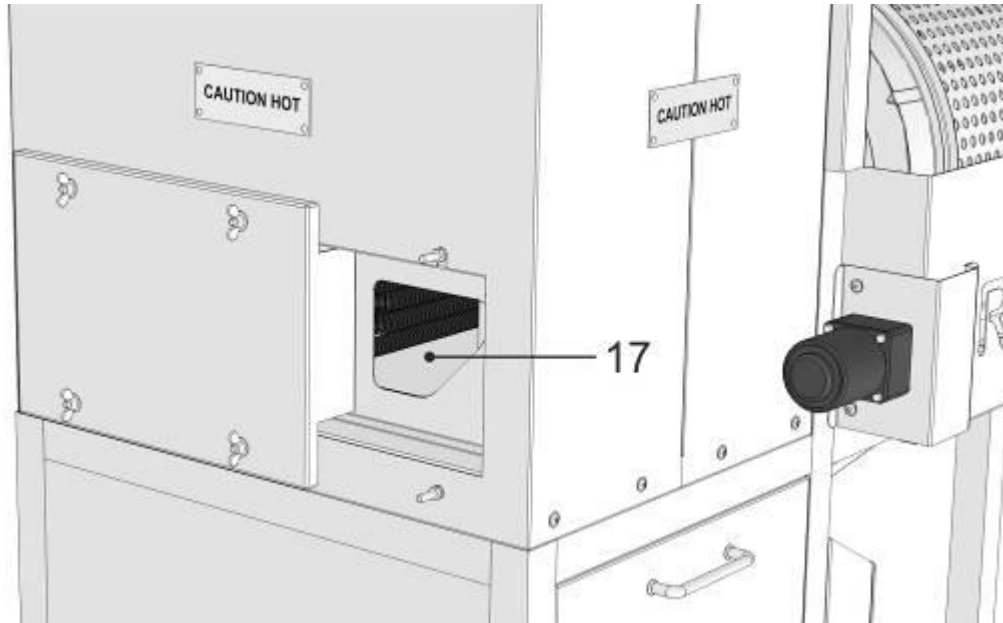
After you have cleaned the chamber, replace the access hole cover and fix it with the wing nuts.

Washing the internal chamber with water jet is prohibited.

If the machine is used for preparing popcorn with oil and salt, then you should daily remove the sifter (drum) and wash it with warm water. Also remove runs of oil and dirt from other parts of the machine.

In order to remove sifter 5, lower collector 6, and remove the salt feeding pipe and the

oil nozzle.



To dismount the salt feeding pipe, unscrew the fixing wing screw near the fan and carefully pull the pipe out.

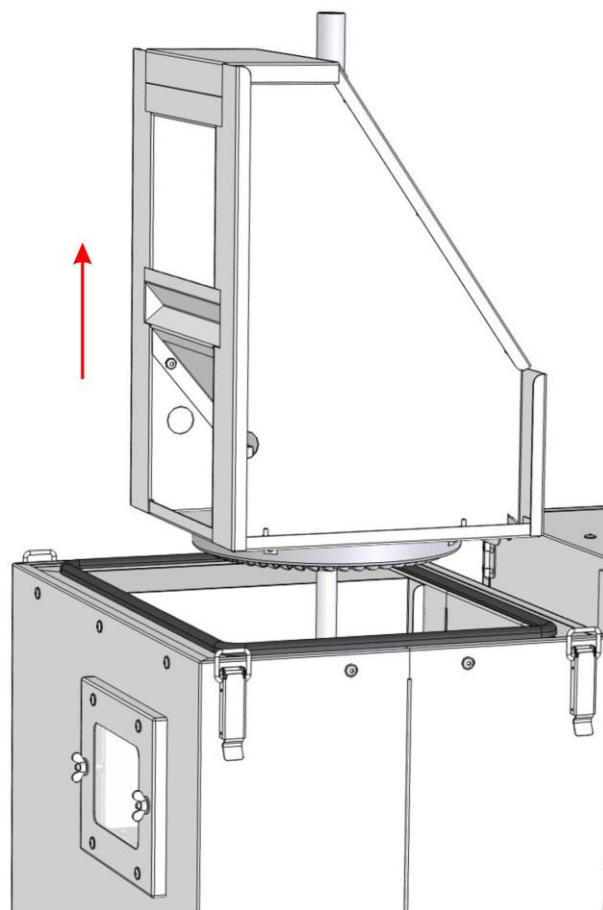
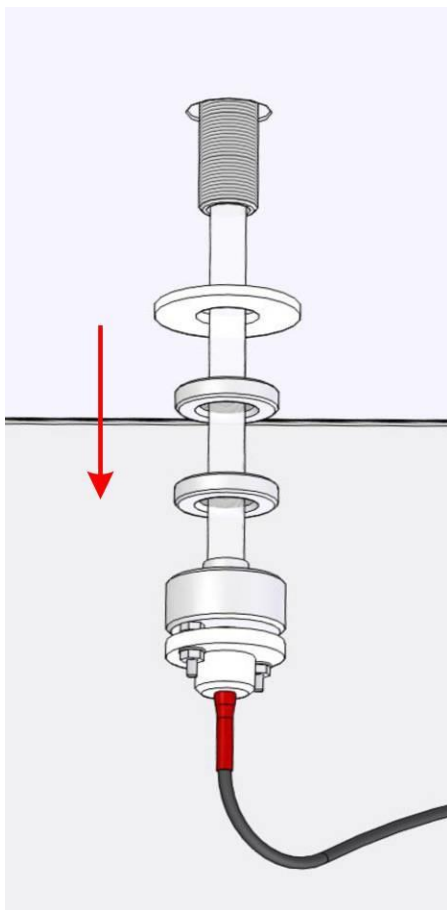
To dismount the oil pipe, first disconnect the oil pipework. Then unscrew the wing screw on the bracket and pull out the nozzle together with a U-shaped stick. Then carefully lift the sifter up and pull it out.

The sifter may be washed in a washing bath or a dishwasher. Let the sifter dry before reinstalling it.

The machine is assembled in reverse order. First, install the sifter, seeing to it that the guides are positioned exactly on the rollers. Make several turns manually in order to center the sifter. Install the salt feeding pipe and the oil nozzle.

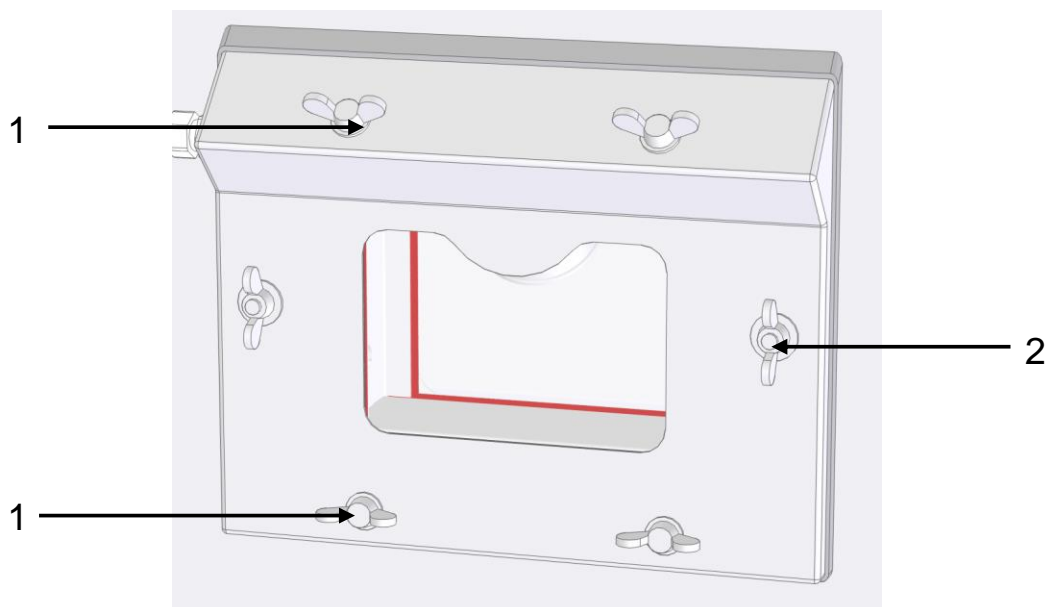
3.4. POPCORN MACHINE CHAMBER DISASSEMBLY PROCEDURE

1. Turn the machine off and disconnect it from the mains.
2. Disconnect the corn dispenser motor from the control unit.
3. Dismount the grain (corn) sensor.
4. Unfasten the latches that hold the machine cover and carefully remove the cover together with the dispenser.
5. Disconnect the chamber overload optical sensor.
6. Unscrew the chamber overload sensor and carefully remove the light conductor.
7. Unscrew the nuts that fix the light conductor tube below.
8. Lightly swaying the internal chamber to and fro, pull it out by the projecting parts of the machine.



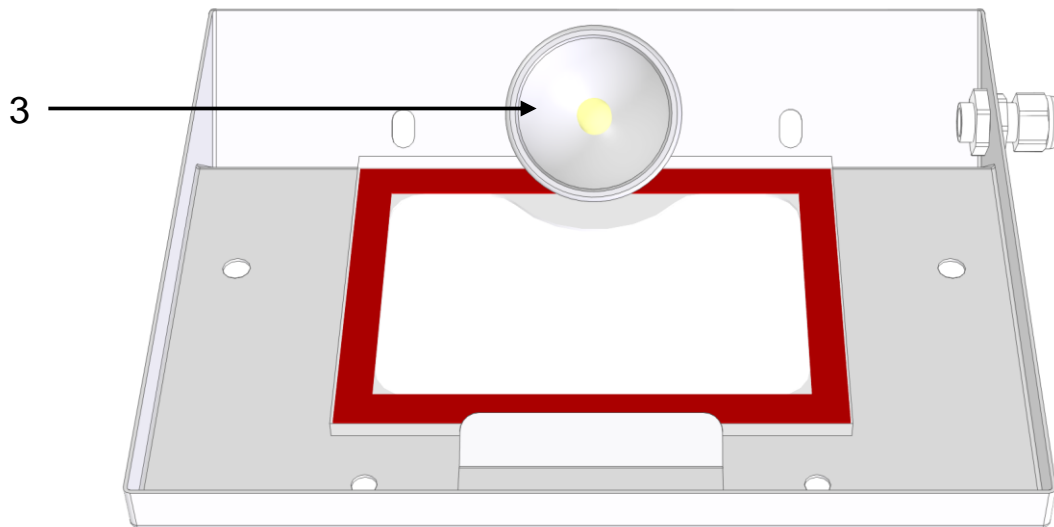
3.5. REPLACING CHAMBER LAMP

1. Turn the machine off and disconnect it from the mains.
2. Unplug the connector from the door control unit.



3. Unscrew the thumbscrews that secure the front panel door (item 1).

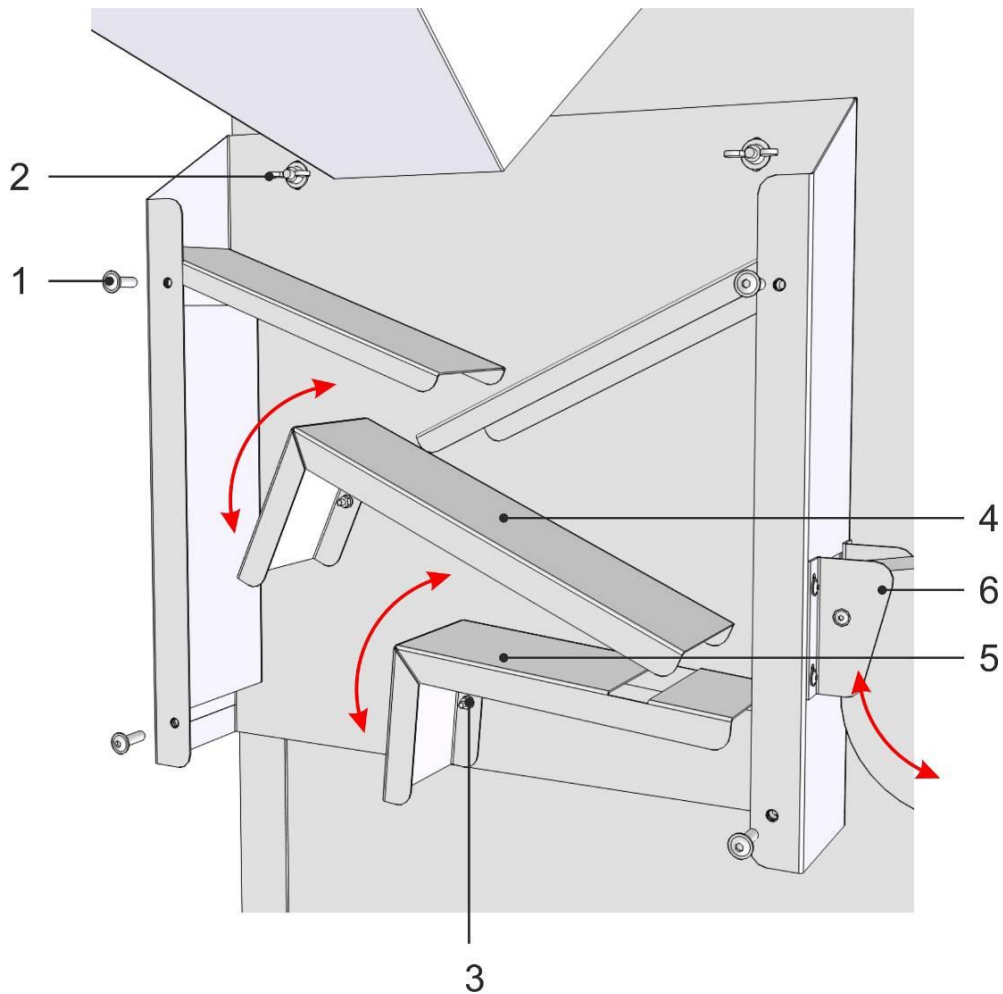
4. Unscrew thumbscrews that secure the door (item 2).
5. Carefully remove rear door panel with glass and light bulb. Be careful not to break the front glass!
6. Remove the fused bulb (item 3) from the socket by pulling it toward you, and replace it with a working light bulb.
7. Assemble in the reverse order.



3.6. SETTING SEPARATOR

If the corn separation quality is insufficient, you should calibrate the angle plates of the separator (pos. 4 and 5) and fan position (pos. 6).

1. Remove the transparent wall by unscrewing the 4 screws (pos. 1) at angles.
2. Unscrew the wing nuts (pos. 2) that fix the separator and carefully remove it.
3. Slightly loosen the screws (pos. 3) that fix the angle plates at the rear of the separator.
4. Replace the separator and the transparent wall.
5. Start the machine and manually adjust the position of the angle plates. The criterion is as follows: unopened corns should freely roll down into the corn tray without being caught by the angle plates, while the husks and broken popcorn should be blown into the waste hopper.
6. After you have found the optimal position of the plates, you should again dismantle and remove the separator and tighten the screws that fix the angle plates.



3.7. SETTING THE PID-CONTROLLER TRM10



CAUTION! BELOW THESE PARAMETERS HAVE ALREADY BEEN SET BY THE MANUFACTURER. IT IS NOT RECOMMENDED TO CHANGE THEM UNLESS ABSOLUTELY NECESSARY.

1. You must configure the type of thermocouple. The parameter b1-0, sensor code 02 for RTD Pt100, 04 - Thermocouple THC (L) and 05 - Thermocouple TCA (K).

Robopop[®] Mark 1 and Mark 2 by default comes with a temperature sensor RTD Pt100.

The access code for the parameters of a - 135

The access code for the parameters of b - 246

The access code for the factory reset - 118

2. Need to customize the operation of comparison "Output 2". For the parameter a2-1 must be set 03 - P-ramp.

3. Exhibitor at the following PID parameters

$$\tau_n = 255; \tau_d = 31; x_p = 9,6; CI = 180; C2 = 250$$

Parameters τ_n , τ_d and x_p are responsible for the accuracy of temperature in the chamber.

Additionally the apparatus has protection that eliminates the flow of corn at a temperature below 180 and more than 250 degrees, is responsible for the parameters C1, C2 and "Output 2".

More detailed programming PID-controller TRM10 described in the manual of the device on page 47-51. This guide can be downloaded from the manufacturer's website www.owen.ru.

3.8. PUMPING OIL (ONLY FOR MODEL MARK 2)

If the oil does not flow from the nozzle while the pump is smoothly running, it means that the pump has caught air.

In order to resume the oil supply, you should remove air from the pump membrane. Disconnect the oil pipework from the nozzle. Press inside the quick-detach connector with a thin metal object like a screwdriver. This will unblock the oil pipework.

Dip the oil-intake pipe into the oil tank. Make several long draws with the mouth through the open quick-detach connector until the oil fills the pump membrane.

The motion of the oil can be visually observed: the oil will move along the oil pipework higher and higher.

3.9. TROUBLESHOOTING

Problem	Possible reason	Remedy
Corn rotates slowly in the bowl; open popcorn does not fly out of the machine	Electric motor rotates in the opposite direction	Swap the two phases in the wall plug
When corn feed is on, the chamber overload sensor responds, while the bowl is empty	Chamber illumination lamp is burnt off	Change the lamp
	Optical chamber overload sensor is not connected	Connect the sensor
	Light conductor is damaged	Change the light conductor
	Optical sensor failed	Change the sensor
Chamber overload sensor responds while the bowl is more than half empty	Optical chamber overload sensor is set incorrectly	Adjust the light conductor protrusion height in the chamber. The light conductor should protrude by 5mm inside the machine bowl. Adjust the sensor sensitivity
Corn sensor responds, while the corn dispenser is not sufficiently filled with corn yet	Optical corn sensor in the dispenser is set incorrectly	Adjust the corn sensor sensitivity
Ready popcorn sensor responds, while the cart is not sufficiently filled with popcorn yet	Optical ready popcorn sensor is set incorrectly	Adjust the ready popcorn sensor sensitivity
Corn is opened not as a “mushroom”, but as a “butterfly”	Low temperature in the chamber	Increase the chamber temperature. “Butterfly” pops at 210-215°C, “mushroom” at 210-235°C.
The chamber is overfilled while the corn feed speed is set lower than the medium	Low temperature in the chamber. One or more heating elements failed	Replace the failed heating element
	Low turbine rotation speed due to V-belt slippage	Check the V-belt tension; replace the V-belt if necessary
	Internal chamber is jammed	Clean the internal chamber
Abnormal sound during turbine rotation	Foreign object inside the internal chamber	Clean the internal chamber
	V-belt low tension	Check the V-belt tension; replace the V-belt if necessary

	Bearing unit of the turbine is worn out	Replace the turbine bearing unit
Corn and husks get stuck in the separator	Oil in the separator	Wash and dry the separator
	Angle plates of the separator positioned incorrectly	Set the separator (see the manual)
During separation, some husks get into the corn hopper / good corn gets into the husks hopper	Angle plates of the separator positioned incorrectly	Set the separator (see the manual)
Oil thickens on the drum walls forming uniform deposit	Low temperature in the room where the machine is being run	Additionally heat the drum, e.g. by a heat gun
Oil flows from the nozzle unevenly	Nozzle jammed	Wash the nozzle with warm water and dry
Oil does not move along the oil pipework, while the pump runs and there is enough oil in the container	Air in the oil pipework	Purge the pump in manual mode (see the manual)

3.10. PRESERVATION

If the equipment is not used for a long time, perform all maintenance works.

4. TRANSPORTATION AND STORAGE

Robopop® popcorn machine may be transported by any roofed transport in accordance with the transportation rules for this kind of transport.

The popcorn machine transportation conditions are as per group (J2), and the storage conditions are as per group (C) GOST 15150-69.

The transportation conditions as to the mechanical effect are as per group (C) GOST 23216-78.

5. ACCEPTANCE CERTIFICATE

Robopop® popcorn machine corresponds to the requirements of the Technical Conditions TU 5151-016-74387948-2010 and is qualified as suitable for operation.

Acceptance Certificate

Robopop® Mark 1 / Mark 2 popcorn machine
(Article description)

No. _____
(serial number)

Manufactured and accepted in accordance with the mandatory requirements of the state standards, current technical documentation and qualified as suitable for operation

Quality Control Department Engineer

Personal signature

Printed name

Year, month, date

6. WARRANTY OBLIGATIONS

The warranty period for the popcorn machine is 12 months from the date of receipt of the equipment by the dealer (according to the transport documentation) or in case of purchasing directly through Business Russia LLC structures – from the date of shipping the equipment from Business Russia LLC, subject to observance of the operation, transportation and storage conditions.



ATTENTION! The warranty does not cover the chamber lamp and the V-belt.

The warranty repair is performed upon presentation of this manual and filled in warranty ticket with the seller's seal and sale date.

The manufacturer reserves the right to change the design of the popcorn machine without notice to the customer.

7. MANUFACTURER'S DETAILS

Address: Russia, 170000, Tver, Industrial street, 11.

“NPO Tvertorgmash” LLC

Phone: +7 (4822) 77-81-73

www.npo-ttm.ru

APPENDIX A. SPECIFICATION OF THE WIRING DIAGRAM FOR POPCORN MACHINE ROBOPOP® MARK 1 AND MARK 2

Signs	Name	Description
AP	Pump	230AC
AT1	Thermostat 90°C	230AC, 16A
AT2	Thermostat 300°C	230AC, 16A
BL1	Photoresistor (overload sensor)	
BL2, BL3	Photosensor BR-400	24DC
BT	The temperature sensor (RTD)	Pt100
C1, C2, C3, C4	Capacitor	1,5 µF
DC1	PID-controller TRM10	230AC
DD1, DD2, DD3	Motor speed control unit	230AC
EK1, EK2, EK3	Heater	230AC, 2500W
EK4	Heater	230AC, 800W
EL	Lamp halogen	12DC, 20W
EMI	EMI Filters DL-25EA3	440AC, 25A
HL1	Lamp signal HEATING	230AC
HL2	Lamp signal CHAMBER	230AC
HL3	Lamp signal NO CORN	230AC
HL4	Lamp signal OVERLOAD	230AC
HL5	Lamp signal WARM	230AC
HLA	Lamp with buzzer alarm	24DC, 8A
K1, K4	Electromagnetic relay CR-P220	230AC, 8A
K2, K3	Electromagnetic relay CR-P024D	24DC, 8A
KM1	Comtactor	400AC, 9A
KM2	Contactora	400AC, 25A
KS	Twilight switch SOU-1	230AC, 16A
M1	Asynchronous motor AIR71V2	380AC, 3000rpm
M2	Electric motor YN70-15 with reduction gear 1:36	230AC
M3	Electric motor YN70-25 with reduction gear 1:10	230AC
M4	Electric motor YN60-6 with reduction gear 1:36	230AC
MF1	Fan (separator)	230AC
MF2	Fan (salt spray)	230AC
MF3, MF4	Fan (rear building)	24DC
Q1	The switch automatically	32A
S1	MOTOR switch	4A
S2	HEAT switch	4A
S3	CORN switch	4A
S4	Emergency stop	4A
S5	FEED RATE switch	RCL371
S6	OIL AND SALT switch	4A
S7	SALT INPUT RATE switch	RCL371
S8	WARM switch	4A
TV12	The power supply	12DC, 5A
TV24	The power supply	24DC, 10A
VS1, VS2, VS3	Relays Solid State HD-2544.ZD3	230AC, 25A

APPENDIX B. SPARE PARTS SET FOR POPCORN MACHINE ROBOPOP MARK 3 AND MARK 3DF

1	V-belt 3A1275	1 piece
2	Halogen Lamp 12VDC 25W GU5.3	1 piece
3	Power Supply for Halogen Lamp	1 piece