

vortex popcorn™ machine
Robopop®

VORTEX POPCORN™ MACHINE
ROBOPOP®

OPERATION MANUAL
VPM-RM4

2016

1. OVERVIEW AND PRINCIPLE OF OPERATION

1.1. POPCORN MACHINE DESIGNATION

Robopop® is a hot air popcorn machine designed for making butterfly and mushroom popcorn with or without salt and oil.

1.2. TECHNICAL SPECIFICATIONS

Throughput	Up to 28 kg/hour
Hoppers capacity	2 x 15kg
Maximum current load (total on all phases)	50 A
Rated voltage	400VAC 230VAC
Rated power	11,3 kW
Frequency	50/60Hz
Machine dimensions (LxWxH)	1430x600x1700 mm
Package dimensions (LxWxH)	1800x1530x800 mm
Net machine weight	250 kg
Net cart weight	8 kg
Shipping weight	400 kg

According to EN60204-1 mains for popcorn machine should have earth wire connection. For more information about mains connection see section 2.5.

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 has ingress protection rate IP22 (EN60204-1). The machine is to be used indoors with forced ventilation provided.



The machine is made in accordance to the following standards:

2006/42/EC Machinery Directive

2014/35/EU Low Voltage Directive

2014/30/EU EMC Directive

CE conformity certificate no.161299141, issue date 28.07.2016

1.3. DELIVERY SET

Popcorn machine delivery set includes:

Robopop® VPM-RM4 with two corn dispensers, salt hopper, oil pump and warmed compartment	1 pc
Power supply cord 5m*	1 pc
Cleaning scraper	1 pc
Oil pump bracket	1 pc
Popcorn cart**	2 pcs
Bags for popcorn	50 pcs
2 liters plastic cup	1 pc
Documentation set	1 pc



Popcorn machine is supplied assembled* and does not require any additional assembly or adjustment. After the package is removed, the machine is ready for use.

* – The equipment is supplied without power plug. It is recommended to use 3P+E, 32A power plug.

** Carts for popcorn are supplied unassembled, for assembling order see section 2.4

1.4. PRINCIPLE OF OPERATION



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

The machine general view is shown below:



Popcorn machine general appearance:

1 – chamber; 2 – corn dispensers; 3 – control unit and HMI panel; 4 – salt hopper with dispenser; 5 – sifter; 6 – waste tray; 7 – oil pump; 8 – oil warmed compartment; 9 – cart for popcorn with plastic bag; 10 – swivel casters with brakes.

The principle of operation is as follows.

Operator turns on the machine and set parameters by control panel with HMI 3. Corn kernels from one of dispensers 2 are pitched to the chamber 1 with temperature about 200-230°C inside. Continuous heating and closed hot air circulation happen in the chamber. The corn in the chamber is heated and pops eventually. As soon as kernels pop, the airflow immediately blew popcorn away from chamber to the sifter 5. Operator can check popping process through the observation port located on the left side of the machine.

Once in the sifter, popcorn is being cleaned of old maids, husk and other debris, which are filtered in the waste tray 6. Moving along the sifter, popcorn is being oiled and salted. Oil pump 7 pumps oil through an oil nozzle located in the sifter. Salt is fed from hopper 4 and is applied onto popcorn while it's in the sifter. High quality popcorn falls to a plastic bag in the cart 9.

The machine has non demountable construction and is mounted on swivel casters with brakes 10.

2. INTENDED USE

2.1. SAFETY REQUIREMENTS

READ OPERATION MANUAL BEFORE BEGINNING!

ONLY INSTRUCTED PERSONNEL IS ALLOWED TO OPERATE THE MACHINE!

Do not turn off the machine by EMERGENCY STOP button.

Use EMERGENCY STOP button only in emergency situations when human life or health is in danger.



WARNING! Many machine components are hot during operation and may cause burn injury!

STRICTLY PROHIBITED!

- TOUCHING MOVING PARTS OF RUNNING MACHINE!
- WASHING ELECTRICAL PARTS AND CONTROL UNIT WITH WATER! ONLY WIPING WITH WET CLOTH IS ALLOWED!
- DISASSEMBLING MACHINE OR REMOVING SEPARATE COMPONENTS WITHOUT DISCONNECTING THE MACHINE FROM THE MAINS!
- MODIFYING MACHINE DESIGN!
- USING MACHINE FOR POPPING ANY OTHER GRAIN THAN CORN!
- LEAVING MACHINE UNATTENDED DURING OPERATION!
- TURNING ON MACHINE IF THERE IS BURNED CORN LEFT IN THE CHAMBER!

PROTECTORS AND SYSTEM LOCKUPS

EMERGENCY STOP button is set on the back side of the control unit; this button completely shuts off the machine at any moment.



ATTENTION! In case of sudden de-energizing during the operation, the chamber might be clogged up with popcorn. To resume operation, the chamber must be cleaned.

There is a voltage relay included in the beginning of the circuit, which won't let to turn on the machine in case if voltage in the mains is too low or too high (the range set on the relay by the factory), excluding any risk of machine failure due to improper hookup or surges.

A contactor is set before heat elements. An emergency thermostat controls the contactor. The thermostat has a sensor which is installed in the chamber next to the heating elements. In case of failure of solid-state relay or main controller the thermostat will interrupt the powers supply of heating elements, preventing further overheating.

A circuit breaker locates at the power cord entry, the breaker will shut the machine off in case of short circuit.

There is a chamber clogging sensor inside the chamber. In case the sensor is triggered, the machine will try to increase turbine rate in order to clean the chamber. If this measure is not enough and clogging is quite massive, the main PLC will turn the machine automatically to cooling mode.



CAUTION! The bowl can be overfilled in case of improperly chosen parameters of operation as too low temperature or too low turbine rate, or in case of motor malfunction or heat elements malfunction.

The sifter is not rigidly connected to draw rollers. Thus, if a slight effort is applied, it won't turn and stayed in place.

The machine has an optical sensor next to the cart, which would suspend corn delivery if plastic bag in the cart is full with popcorn. Another optical sensors control capacity of both hoppers. In case of low corn, the machine will let know the operator by a message on the screen.

The machine is mounted on swivel casters equipped with brakes.

2.2. PREMISES REQUIREMENTS

We recommend providing the machine with purge ventilation. 750 cu.m/hour is the recommended rate of purge ventilation for Robopop[®] VPM-RM4 (see appendix D).

The maximum relative humidity (RH) at the facility should be not more than 45% at 24°C. Popcorn will absorb moisture quickly if the RH is higher than 45% and/or the temperature is higher than 24°C.

2.3. CORN REQUIREMENTS

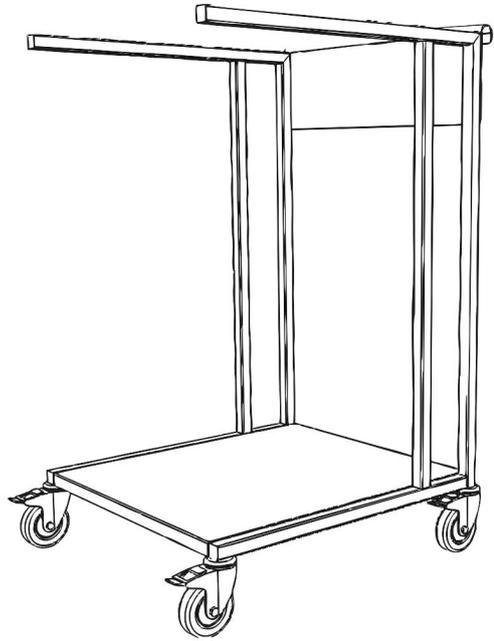
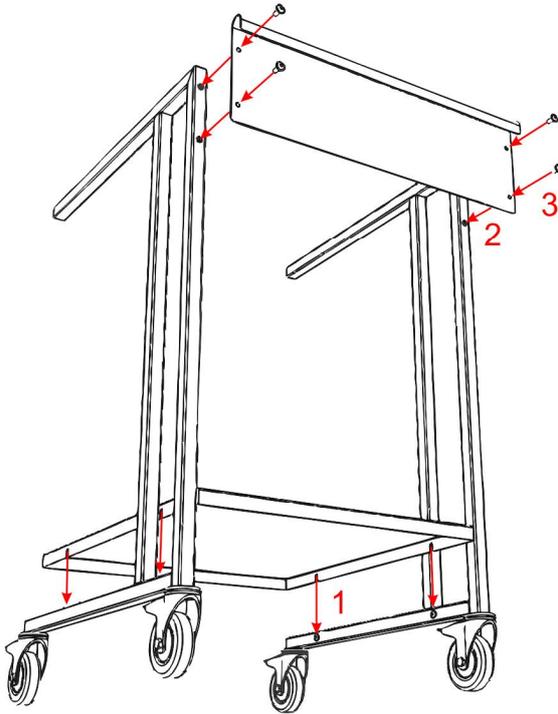
Popcorn is a very hygroscopic product. Popcorn imbibes moisture very fast if production and storage conditions are not complied. Dampened popcorn becomes tasteless and chewy.

Corn humidity must be in 13.5-15% range. Corn auger speed should be reduced when popcorn with higher humidity is processed (see section 2.9, **corn auger speed**).

Popcorn is crunchy when its humidity is about 1-2%.

2.4. GETTING STARTED

1. Carefully unpack the machine, check the completeness of the set and remove the protective film from all metal surfaces.
2. Assemble the cart for popcorn.



3. Connect the machine to the mains.

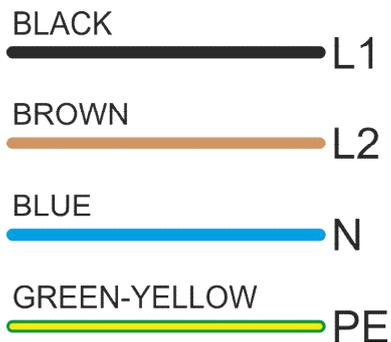
2.5. CONNECTION



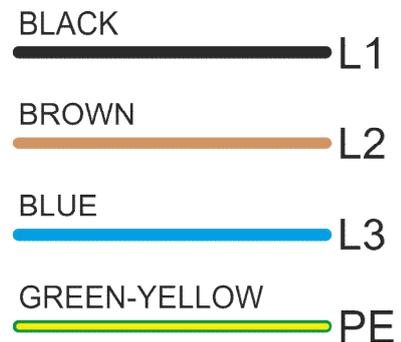
ATTENTION! The machine should be connected to the mains only by qualified electrician!

It is recommended to use 3P+E, 32A power plug to connect the machine to the mains. The machine may be connected from 3 phase 400VAC or 230 VAC (50/60Hz) mains. Hookup diagrams are as following:

3 phase 400VAC



3 phase 230VAC



ATTENTION! The mains **MUST** have ground wire to connect equipment!

2.6. MACHINE FIRST START

1. Press START button to turn on the machine.



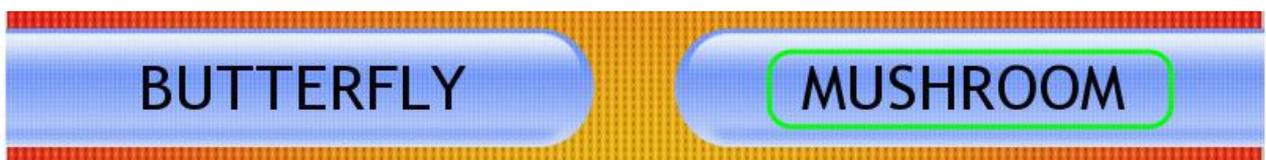
2. Wait for HMI panel boot. Put 10 kg of mushroom corn in the right hopper. The maximum amount of corn for each hopper is 15 kg.

3. Check the sifter rotation. Press SIFTER RUN&STOP button and hold it for a while.



If sifter does not rotate evenly and extraneous sound is heard, it means that sifter isn't aligned on the rollers. To align the sifter, lift it with hands and place on the rollers.

4. Press MUSHROOM button.



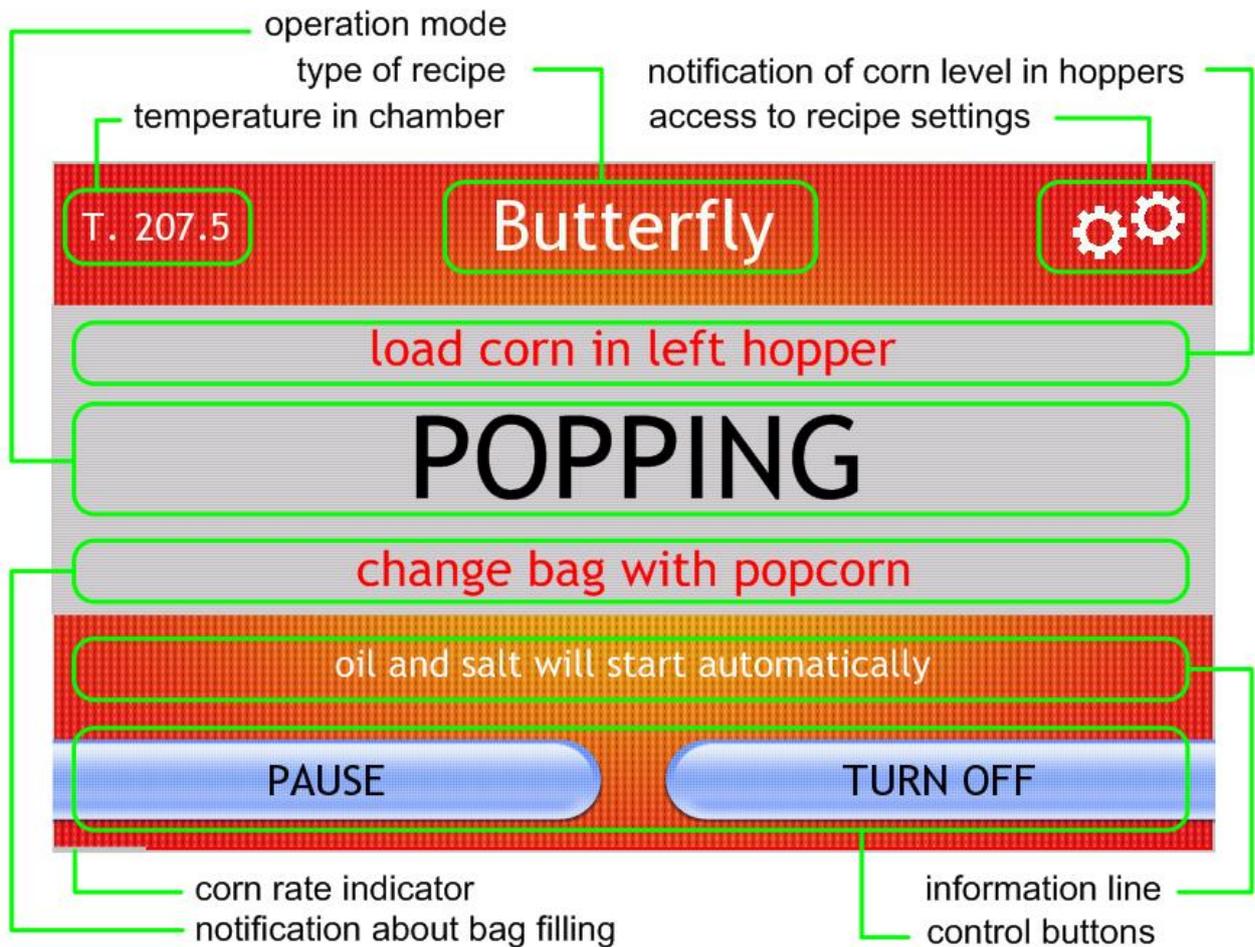
In a few seconds the popping process begins automatically.

turbine speed	50.00
temperature in chamber	230.0
oil feed rate	OFF
salt feed rate	OFF

5. Get ready two carts for popcorn with plastic bags. Each plastic bag could take about 5 kg of popped corn.

6. The machine operates in automatic way. Heat-up stage will take about 10-12 minutes; sifter will start automatically before popping process.

Corn delivery starts with minimum rate and smoothly increases to the rate set. First popped corn will come out from the chamber in 2 minutes. The set corn rate will be established in 6-7 minutes. It is recommended for the first 7 minutes of popping to observe the corn rotation through the observation port. Corn kernels should move in evenly manner, close to periphery of the bowl. Popcorn should pop and immediately leave the chamber, keeping the chamber free of possible clogging.



7. During popping stage you might need to replace the cart with popcorn. To stop sifter for a while, press SIFTER button and hold for 1 sec. Sifter stops for 10 sec. This is enough time to replace the cart with full bag with empty one.



8. Wait while the popcorn leaves the sifter. At the same time a buzzer sounds when, it signifies that the corn hopper is empty.



ATTENTION! “load corn in hopper” message appears on the screen when there is less than 5 kg of corn in the hopper. 5 kg of corn is enough for 10 min of popping.

When the buzzer sounds, turn off the machine, by pressing TURN OFF button on the screen.



The machine initiates cooling mode. The sifter stops automatically after the corn leaves the chamber.



ATTENTION! FIRST CORN LOAD IS MEANT FOR CHAMBER PURGING AND DOES NOT FIT FOR CONSUMPTION.

2.7. OPERATING PROCEDURE

2.7.1. Preparations

1. Put 15 kg of corn in a hopper. The left hopper is for butterfly corn, the right hopper is for mushroom corn;
2. Fill the salt hopper with a special salt, e.g. ‘Flavacol’;
3. Check to see if oil is liquid;
4. Check hose connection between oil pump and the machine feeding tube;
5. Get ready carts for popcorn, putting a bag in each cart.

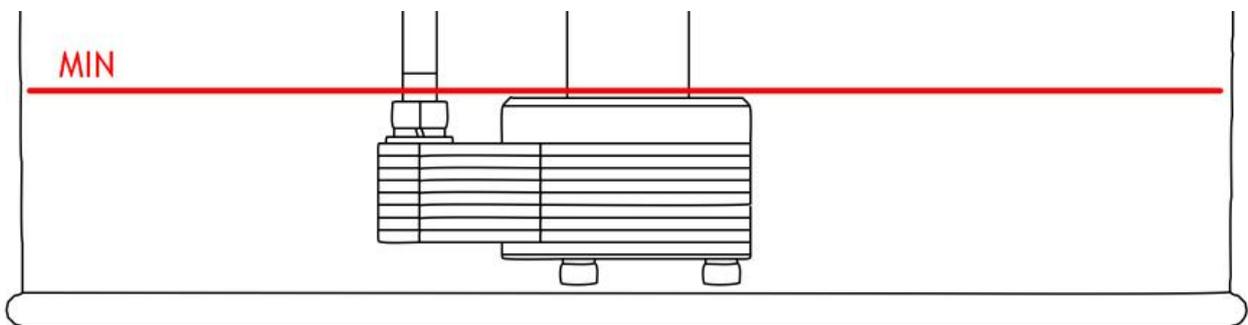
2.7.2. OIL WARMER SWITCH

If you make popcorn with oil and salt/seasonings, OIL WARMER switch should be always turned on. The switch has a backlight; even if the machine is turned off, that switch should

remain in ON position.



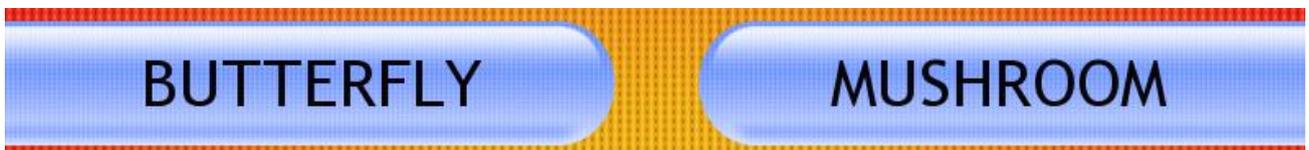
Oil pump head should be plunged into the oil. The minimum level of oil is shown below.



Heating elements of warmed compartment are intended to maintain sufficient oil temperature, so oil should be melted beforehand. Otherwise, it may take up to 12 hours to melt 22 L bucket of oil.

2.7.3. Operating procedure

1. Press START button to turn on the machine, wait for HMI boot.
2. Choose a desired recipe by pressing BUTTERFLY (left hopper) or MUSHROOM (right hopper). Oil and salt will use only for butterfly popcorn. Mushroom popcorn usually is used for further caramel coating and doesn't need to be treated with oil and salt/seasonings.



3. Popping will start automatically in several minutes. Sifter starts automatically, and once the set temperature is established, corn will start to be supplied to the chamber. After a while salt and oil starts to be applied to popped popcorn in the sifter.



ATTENTION! Salt and oil application is available only for BUTTERFLY recipe. MUSHROOM recipe does not have that option.

4. If the bag with popcorn is full, the following message will appear on the screen, and buzzer

gives a sound.

change bag with popcorn

Press and hold for a while SIFTER RUN&STOP button to replace the bag with popcorn. The sifter stops for 10 seconds, it's enough time to replace the cart or plastic bag. Sifter resumes rotation automatically.



ATTENTION! It is recommended to get ready a cart or bag beforehand. It allows you a quick replacement.

5. If there is less than 5 kg of corn left in a hopper, the following message will appear on the screen:

load corn in left hopper

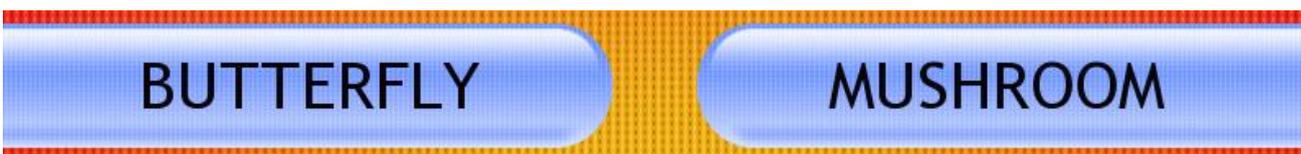
If you want to continue popcorn production (more than 5 kg left), the hopper should be refilled with corn. Otherwise the machine will finish the left amount of corn and then automatically turns to pause mode.

During the pause mode oil and salt application is suspended; the temperature in the chamber is maintained on the set level.

6. The machine has two hoppers. This way an operator is able to switch between two programs quite fast. To change the program, press PAUSE button:



It will take some time to finish current process, then the program buttons will be shown on the screen:



7. To turn off the machine, press TURN OFF button:



The popping process will be stopped and the machine will be switched to cooling mode. Sifter stops automatically when popcorn leaves the chamber. Cooling process takes about 5 minutes, and then the main menu will appear on the screen.

To turn off the machine press and hold TURN OFF button for 3 sec. Otherwise, the machine will shut down automatically after 10 min of idle.





ATTENTION! Use EMERGENCY STOP button ONLY in emergency cases threatening life!



ATTENTION! Using EMERGENCY STOP button for the equipment shutting off can lead to chamber clogging by popcorn and consequent machine breakdown!



ATTENTION! Chamber clogging with popcorn caused by unskilled actions of operating personnel is not the warranty case!

2.8. MODIFICATION OF RECIPE SETTINGS

Press BUTTERFLY or MUSHROOM recipes to modify them. Then press MODIFY button and enter 2325 (default password).



ATTENTION! If there is no MODIFY button on the main screen, TURN OFF DELAY setting should be set on more than 5 sec (see the next section).

The current settings are modified by up and down arrows.

turbine speed	⌵	45.00	⌶
temperature in chamber	⌵	210.0	⌶
oil feed rate	⌵	3	⌶
salt feed rate	⌵	3	⌶



ATTENTION! Salt an oil application is available only for BUTTERFLY program. MUSHROOM program does not have that option!

Each type of corn has its own popping temperature. Commonly, the appropriate temperature for butterfly corn is 200-215°C, for mushroom corn the temperature is about 210-225°C.

1 kg of butterfly corn turns to 35-40 liters of popcorn; 1 kg of mushroom turns to 25-30 liters of popcorn.

A small amount of mushroom corn always will be popped as butterfly; the exact amount depends on corn quality. This value is mentioned in batch certificate. The amount of butterfly popped corn would be reduced by increasing the temperature; however, too high temperature would decrease the size of mushroom, affecting the total volume of the production.

The program settings can be modified during the popping. Press and hold for 3 sec gears button in the right upper corner of the screen:



Current program settings will be shown:

turbine speed	45.00
temperature in chamber	210.0
oil feed rate	3
salt feed rate	3

To modify program settings, press MODIFY button and enter 2325 (password by default).



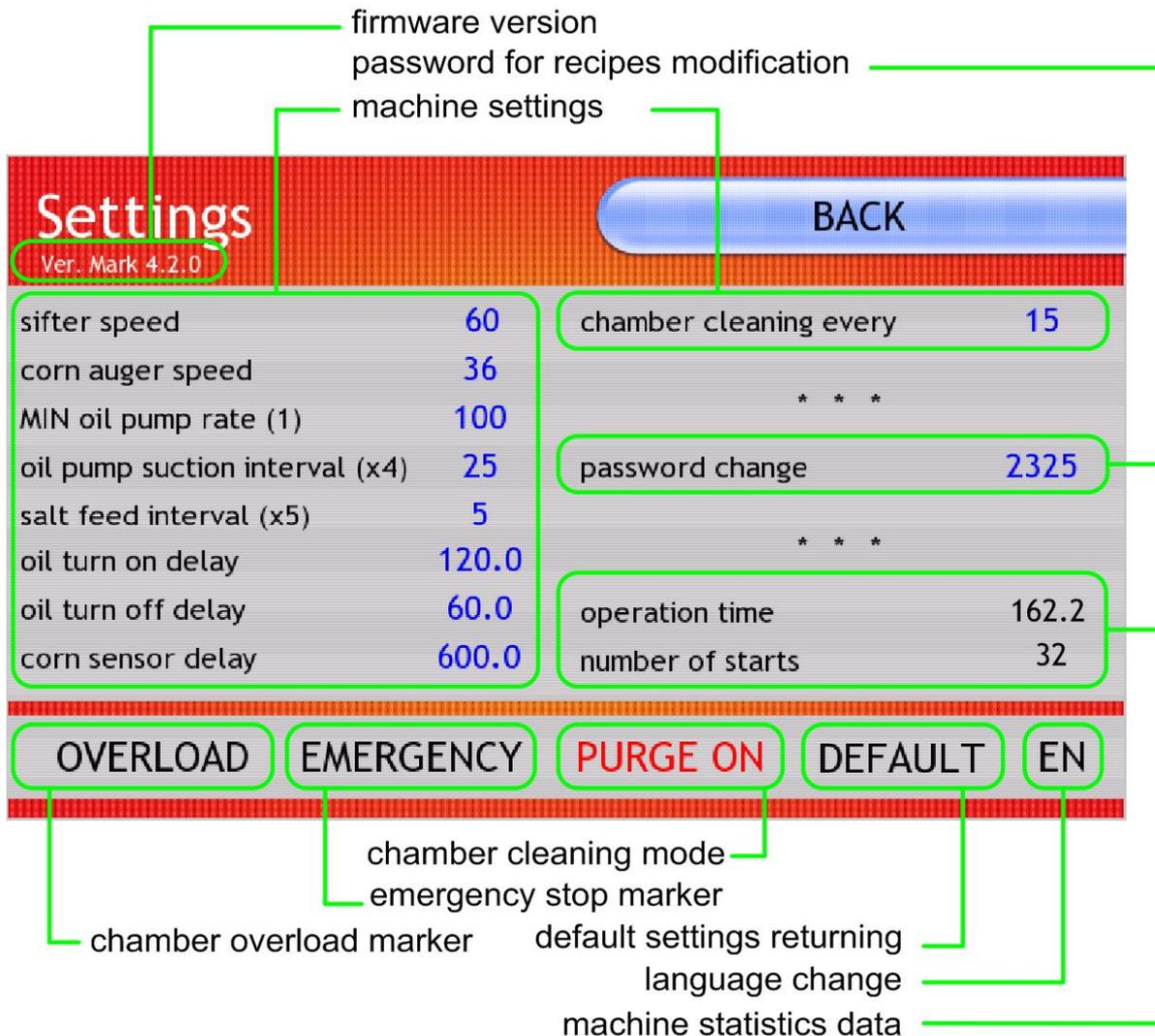
Adjust the settings by pressing up and down arrow keys. New settings are effective immediately. Without pressing MODIFY button, the machine will return in the previous screen automatically.

2.9. SYSTEM SETTINGS

To adjust the system settings, press SETTINGS button on the main screen and enter 6666 (system settings default password).



The system settings menu is shown below.



Values in blue can be changed, black ones are provided only for reference and can't be changed.

Each parameter has its own minimum and maximum values, which are shown when changing:

sifter speed – sifter rotation rate (10...100rpm range);

corn auger rate – corn auger rotation rate (20...40rpm range);

MIN oil pump rate (1) – minimal oil pump rate (100...300rpm range);

oil pump suction interval (x4) – rate increment of oil pump (10...50rpm range);

salt feed interval (x5) - increment rate of salt feed (4...20rpm range);

chamber cleaning every – cleaning interval (5..45 min range);

password change – program settings adjustment password (0...9999 range);

oil turn on delay – oil turn on delay (60...300 sec range);

oil turn off delay – oil turn off delay (60...180 sec range);

corn delivery delay – corn delay time after which the corn delivery is activated (5...60 sec range);

corn sensor delay – buzzer delay (300...900 sec range). This is the time from LOAD CORN

IN LEFT (RIGHT) HOPPER message appearing on the screen to buzzer alarm.

Statistical information values:

operation time – turbine operating time (hours);

number of starts – turbine no. of starts;

There are also the next indication switch buttons:

OVERLOAD – that button serves for unlocking the machine after chamber clogging;

EMERGENCY – that button serves for unlocking the machine after emergency stop;

PURGE ON/OFF – automatic chamber purging option at the interval, set by **chamber cleaning every** parameter (see above);

DEFAULT – restore all settings to default.

RU – interface language.

2.10. TESTING MODE

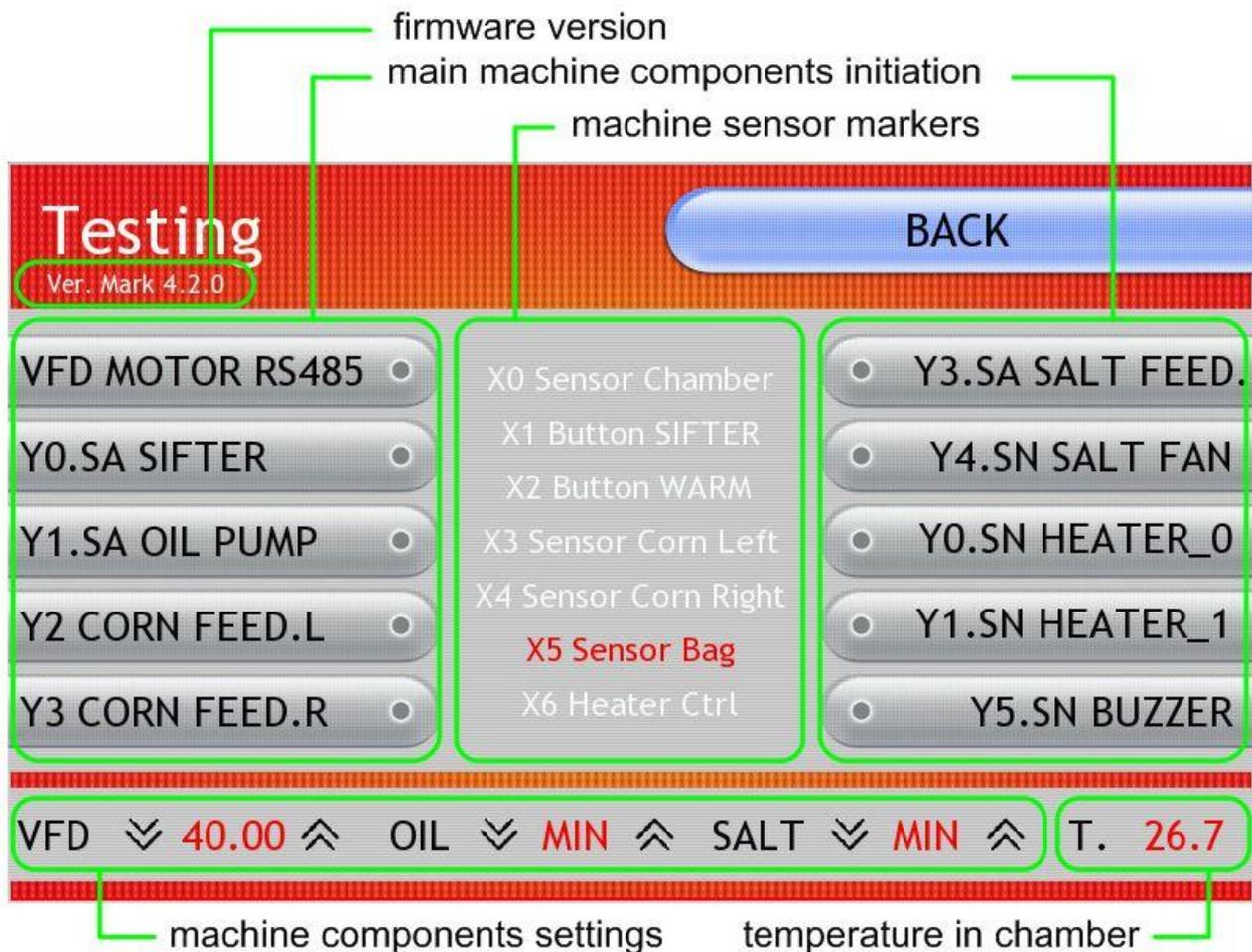


ATTENTION! Incompetent use of the equipment can lead to the equipment failure!

To enter testing mode press SETTINGS button and enter **3333**.



Testing mode screen is shown below.



In testing mode it is available to turn on each component separately:

VFD_MOTOR RS485 – turbine check;

Q.0 K504 SIFTER – sifter check;

Q.1 K504 OIL PUMP – oil pump check;

Q.2 CORN FEED.L – left corn dispenser check;

Q.3 CORN FEED.R – right corn dispenser check;

Q.1 SALT FEEDER – salt auger check;

Q.4 SALT FAN – salt fan check;

Q.5 HEATER_0 – heat elements (first group) check;

Q.6 HEATER_1 – heat elements (second group) check;

Q.1.0 BUZZER – buzzer check.



ATTENTION! **Q.5 HEATER_0** и **Q.6 HEATER_01** turning on are available only if **VFD_MOTOR RS485** was turned on beforehand.



ATTENTION! **VFD_MOTOR RS485** must be turned off only after **Q.5 HEATER_0** и **Q.6 HEATER_01** disconnection and only given that temperature in the chamber is fell below 20°C from the set temperature. This will help heating elements to avoid thermal shock and fault.



ATTENTION! Do not turn on **Q.1 SALT FEEDER** salt dispenser if **Q.4 SALT FAN** was not turned on beforehand. If the salt hopper is not empty, this will lead to salt fan failure.

The next settings can be changed in the testing mode (the changes effective in this mode only):

VFD ∨ 40.00 ∧ OIL ∨ MIN ∧ SALT ∨ MIN ∧ T. 26.7

VFD – motor rotation speed (40.00 ... 60.00Hz range);

OIL – oil supply rate (MIN – 2 – 3 – 4 – MAX);

SALT – salt supply rate (MIN – 2 – 3 – 4 – MAX).

All indicators and switches of the equipment are displayed in this menu as well:

I.4 Sensor Chamber – the chamber clogging sensor;

I.6 Button SIFTER – SIFTER RUN&STOP button (light when pressed);

I.7 Button WARM – OIL WARMER switch (light when the switch is ON);

I1.0 Sensor Corn Left – left hopper optical sensor;

I1.1 Sensor Corn Right – right hopper optical sensor;

I1.2 Sensor Bag – popcorn cart optical sensor;

I1.5 Heater Ctrl – temperature sensor (lights up when the temperature in the area of heating elements is higher than 350°C);

T. 27.8 – current temperature in the chamber (°C).

2.11. PID REGULATOR SETTINGS

The equipment uses a PID-regulator to maintain the temperature in the chamber in even manner.



ATTENTION! Improper settings of PID-regulator may lead to chamber clogging and equipment failure.

Default PID-regulator settings provide stable maintenance temperature in the chamber.

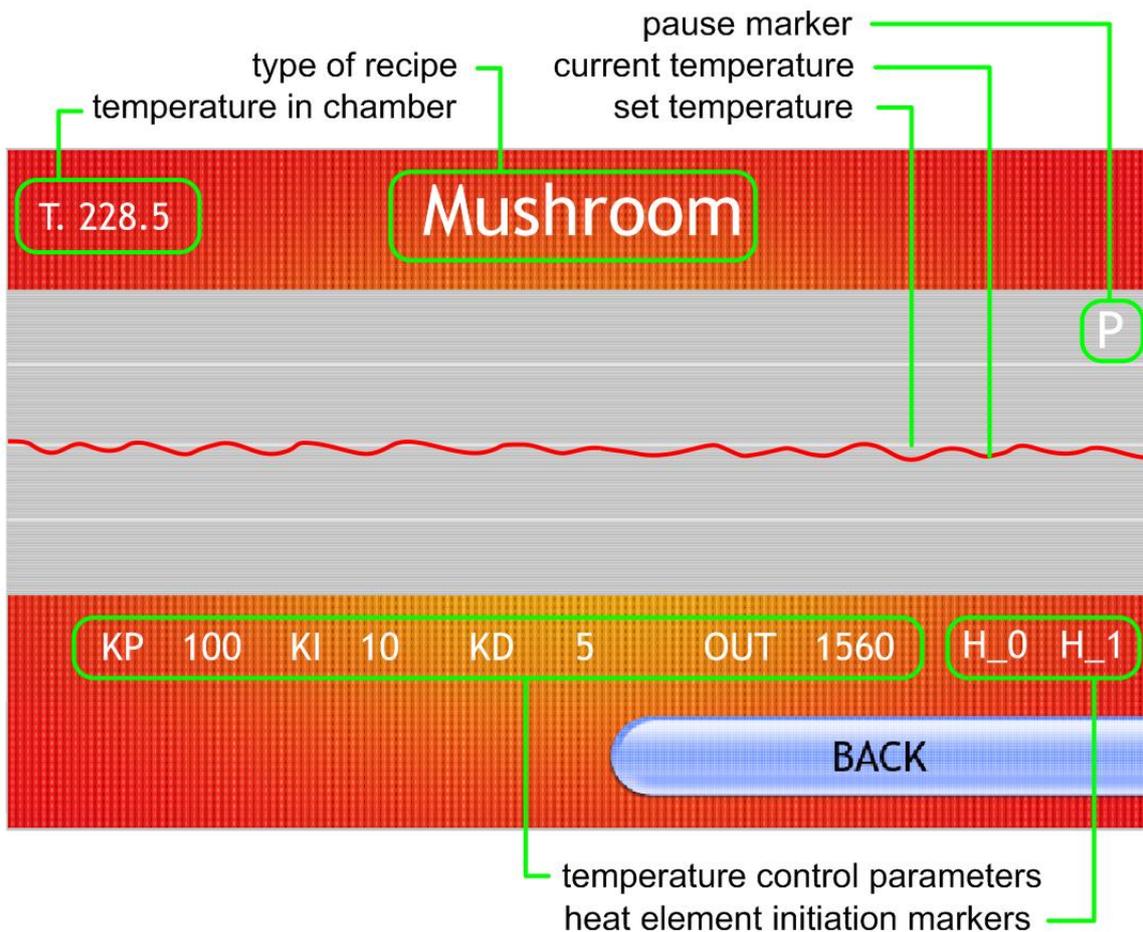
To enter the PID-regulator settings press and hold the button with gears for 3 sec:



Then press modify button and enter 3333 password:



The menu of PID-regulator is shown below:



The current temperature is represented by the red graph. The menu gives information for the last 30 min of machine operation.

The screen above shows the actual schedule in the chamber when the PID-regulator is set correctly.

2.12. HOW TO IMPROVE POPCORN QUALITY

A range of factors affect popcorn quality. Basic factors are described below.

1. CORN HUMIDITY

To make popcorn crunchy, corn humidity should be at 13-15%. Corn humidity information can be acquired from a certificate that provided along the batch. To process popcorn with different humidity value, the corn feeding rate should be reduced, because popping process with other humidity levels would take more time. To reduce corn feeding rate, the **corn auger speed value** should be reduced. See section 2.9 for details.

2. CHAMBER TEMPERATURE

A PID regulation is used to maintain temperature during cooking stage. PID values by default provide stable operation for most kinds of corn. The PID regulation is considered as stable if during popping stage the temperature tolerance is no more than on 5°C from the set one within 15 minutes. Otherwise, the PID parameters should be adjusted. Each parameter of PID regulator should be tested for a long term period. See section 2.11 for entering into PID regulator parameters.

PID regulator has the following adjustable parameters: KP, KI, and KD.

Excessive value settings will lead to sharp temperature rise. Low values will result in lack of temperature to pop the corn.

Start testing from KP parameter. Set KP consecutively on the following values: 5, 10, 20, 40. KI and KD are set on 0.

Once KP parameter value is found, it's time for KI parameter. Change KI parameter from the smallest to the largest. The step should be as following: 1; 2; 4; 6; 8. KI should be no more than KP. KD should be no more than 15% of KP value.

The testing is considered completed when temperature tolerance does not exceed 5°C during 15 minutes of popping.

3. POPCORN DRYING IN THE SIFTER

Popcorn becomes crunchy while popping in the chamber and moving along the sifter (some amount of hot air blows out from the chamber and going through the sifter, affecting popcorn in the sifter). An operator can adjust the time popcorn stays in sifter.

Default sifter rotation rate is suitable for most kinds of corn. Reducing the rate increases the time popcorn stays in the sifter, so it loses more moisture. Vice versa, increasing the rate will make popcorn to move quicker through the sifter and loose less moisture.

Sifter speed value is in charge for sifter adjustment (see 2.9 section to find out more about that value adjustment).



ATTENTION! Excessive reduction of sifter rate without corn auger adjustment may lead to sifter clogging and chamber clogging as well.

3. MAINTENANCE

3.1. GENERAL INSTRUCTIONS

The maintenance purposes are to keep the popcorn machine operable during the entire service life and the fire safety rules observance.

The maintenance should be done as necessary.

The recommended maintenance schedule with types of actions is presented below.

Actions	Period
Cleaning of machine external surfaces	Once a day
Cleaning of sifter by scraper	Once a day
Cleaning of oil drop type nozzle	Once a day
Cleaning and drying of salt nozzle	Once a day
Internal chamber cleaning from corn dust and husk	Once a week
Net cleaning from corn dust and husk	Once a month
Sifter cleaning	Once a month

3.2. SAFETY 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 inflammation occurs during the equipment operation, it should be disconnected from the mains and fire-fighting actions should be taken.

Если при работе аппарата внутри произошло возгорание, то следует обесточить

3.3. MAINTENANCE PROCEDURE

At the end of a day external surfaces of the machine should be cleaned.



ATTENTION! Do not leave corn in a hopper. Left corn is imbued with moisture, which leads to quality popping reduction. Keep corn in sealed container.

It is convenient to clean the sifter by a scraper included in the delivery set. To rotate the sifter, press and hold SIFTER RUN&STOP button.

Oil drop type nozzle should be wiped by a damp cloth every day at the end of a day.

Salt nozzle should be taken off from the machine and washed with hot water in order to get

rid of oil, salt, and corn dust. After this, the nozzle should be completely dried before setting back to the machine.

The internal chamber should be cleaned from corn dust and husk once a week. To clean the chamber, unfasten the latches holding the observation port door and pull it out. Then the chamber cleaning can be done. It is convenient to do by a vacuum cleaner.

Upon the operation performing, the observation port door should be set on place.



ATTENTION! DO NOT CLEAN THE CHAMBER BY WATER JET!

Visual checking of the chamber net should be done once a month. If corn husk or dust is noticed on the net, the net cleaning should be done. Remove the observation port door and clean the net by the means of brush. Upon finishing set the door on the place.

In case of net pollution and impossibility to clean it, the net should be removed. The internal partition should be removed beforehand. The net assembling should be done in the reverse order.

Complex sifter cleaning should be done once a month. The salt nozzle should be removed beforehand. The sifter can be removed after that. Sifter washing can be done by means of hot water and neutral detergents which are intended for stainless steel. The sifter installation should be done in the reverse order.

3.4. CHAMBER CLOGGING WITH POPCORN

Robopop[®] VPM-RM4 has an automatic system of chamber protection from popcorn clogging. If that system cannot maintain the stable process during popping stage, it shifts the machine in an automatic cooling stage.

During that process the next message appears on the screen.

chamber is clogged with popcorn

To find out more about staff actions during that process see Appendix E.

3.5. TROUBLESHOOTING



ATTENTION! Before any repair works it is necessary to unplug the machine from the mains and discharge the EMI filter by bridging all the pins in the plug!

Fault	Possible cause	Remedy
The machine doesn't turn on when the START button is pressed. There is no indication on the HMI panel.	There is no power in the mains.	Use a tester to check voltage presence on all phases. Provide power supply.
	Power cord is broken.	Use a tester to check for a breakage.
	Absence of contact of one or more mains wires in the plug or in the QF1 circuit breaker.	Use a tester to check the contact, renew the contact in case of break, replace fault circuit breaker.
	QF1 circuit breaker has activated.	Find out, referring to the schematic circuit, a component or a section, which causes the short circuit and replace it.
	Circuit interruption in the QF1 circuit breaker.	Use a tester to check the QF1 circuit breaker for a breakage, replace fault circuit breaker.
	Circuit breakage in the EMI filter.	Use a tester to check the EMI filter, replace fault one.
	SA1 emergency stop button is pressed.	Find out the reason of SA1 emergency stop button pressing by personnel. If it is caused by failure of the machine, fix it.
	SA1 emergency stop button isn't pressed but doesn't close the circuit.	Use a tester to check emergency stop button SA1 (unpressed), replace fault button.
	Breakage of NC contacts of K1 relay.	Use a tester to check NC contacts of K1 relay, replace fault relay.
	Breakage of KM1 contactor's coil; contact groups don't close during contactor operation; wires and contactor terminals connection breakage.	Use a tester to check the contactor's coil for break, contact stack closure while pressing the armature, inspect coming up wires and terminals. Replace fault contactor. Replace or clean up wires with signs of oxidation or burning.
	TV 24VDC power supply unit failure.	Use a tester to check direct current 24VDC presence on output terminals given that 220VAC is applied on input terminals of the unit. Replace fault component.
	Short circuit in 24VDC power supply. Overload protection actuated on TV power supply unit.	Use a tester to check for 24V voltage on output terminals of power supply unit, given that wires are disconnected. If output voltage is presented, but is gone with wires connected, then find and fix short circuit in 24VDC power supply circuit.
HMI panel failure with no indication.	If there is no indication on the HMI, use a tester to check 24V voltage on its output terminals. Replace HMI panel if the power is provided.	
During execution of a program and M1 turbine	M1 motor winding breakage/short	Use a tester to check motor's windings for a breakage or shortening to the frame. Disconnect them from the VFD

Fault	Possible cause	Remedy
checking in service mode motor's rotor doesn't rotate.	circuit.	first. Replace fault motor.
	M1 motor bearings wedging.	Use a hand to check free rotation of the rotor from the cooling impeller site; remove the protective cover to do this. Replace fault motor.
	UZ converter failure, accompanied with absence of indication.	In case of no indication on the VFD, use a tester to check 220VAC voltage at its output terminals. If voltage is provided, replace fault converter.
	UZ converter error.	Use converter documentation to pinpoint the error code. If error code is pointing to motor failure, test the motor. Check correctness of VFD settings, refer to an appendix in Robopop operation manual. Replace fault motor/converter. Set the correct settings.
	UZ converter improper settings.	Check correctness of VFD settings, refer to an appendix in Robopop operation manual. Set the correct settings of the converter.
	220 VAC isn't provided to UZ converter.	In case of no indication at the VFD, use a tester to check 220VAC voltage at its terminals. If no power provided, check circuit through KM1 contactor, EMI filter, QF1 circuit breaker to the plug.c Replace fault component, fix the circuit in case of breakage.
Side tones during M1 motor (turbine) operation.	Loose bolt fixture of propeller to the motor.	Demount the motor from the machine, check propeller's fixture bolt gripping, tighten the loose bolt.
	Propeller deformation, cracking, destruction.	Remove the motor from the machine, inspect the impeller for damages. Replace fault propeller.
	Motor's rotor bearings wearing, damage.	Remove the motor from the machine, check rotor's rotation by a hand for side tones, rotation problems, bearings' backlash. Replace fault motor.
Heating elements EK1-EK4 aren't heated, or heating speed is significantly reduced.	EK1-EK4 heating elements failure.	Use a tester to check heating elements EK1-EK4 for a breakage, and reduced resistance between insulation and housing. Replace fault heating element.
	Break of heating elements EK1-EK4 supply circuit, oxidation/burning of terminals/wires.	Use a tester to check supply circuit for a breakage, from solid-state relays to heating elements terminals. Inspect heating elements' terminals, check terminals nut gripping. Fix circuit breakage, clean up or replace oxidized terminals/wires.
	VS1, VS2 solid-state relay failure. The relay doesn't open when control voltage is applying.	Use a current clamp to measure current strength in the circuit between solid-state relays and heating elements; voltage drop on relay's power terminals with and without control 24V voltage applied to the relay. With control voltage applied, current strength should be about 20 Amps; voltage drop should be a few Volts; with no control voltage applied, current strength should be about 0 Amps; voltage drop should be about 220 Volts. If control voltage is applied, and current strength is about 0 Amps and voltage drop is 220 Volts, then the relay is out of order, it needs to be replaced.
	Breakage of KM2 contactor's coil; contact groups don't close during	Use a tester to check the contactor's coil for break, contact stack closure while pressing the armature,

Fault	Possible cause	Remedy
	contactor operation; wires and contactor terminals connection breakage. XXXXX	inspect coming up wires and terminals. Replace fault contactor. Replace or clean up wires with signs of oxidation or burning.
	<i>PLC Delta*</i> . 220VAC voltage isn't supplied from the output of DC4 controller to KM2 contactor's coil. <i>PLC Kinco**</i> . 220VAC voltage isn't supplied from the output of DC3 controller to KM2 contactor's coil.	Use a tester to check 220VAC voltage at the output of DC4 controller, and at the KM2 contactor's coil, given that displayed temperature on the controller less than 370 degrees. Check the controller's settings. Replace fault controller, set the correct settings.
	<i>PLC Delta*</i> . 24VDC voltage is supplied from the output #7 of DC4 controller to X6 input of DC1 controller, given that displayed temperature on the DC4 controller less than 350 degrees. <i>PLC Kinco**</i> . 24VDC voltage is supplied from the output #7 of DC3 controller to 15 input of DC1 controller, given that displayed temperature on the DC4 controller less than 350 degrees.	Check the DC controller settings. With displayed temperature less than 350°C, 24VDC shouldn't be supplied from the output #7. Replace fault controller, set the correct settings.
	<i>PLC Delta*</i> . DC4 controller improper settings. <i>PLC Kinco**</i> . DC3 controller improper settings.	Check to see if settings of the controller are correct. Set the correct settings.
	<i>PLC Delta*</i> . DC4 controller failure, accompanied with absence of indication. <i>PLC Kinco**</i> . DC3 controller failure, accompanied with absence of indication.	In case of absence of indication, use a tester to check supply voltage 220V on its terminals 10 and 11. Replace fault controller.
	<i>PLC Delta*</i> . 220VAC supply voltage isn't provided to DC4 controller. <i>PLC Kinco**</i> . 220VAC supply voltage isn't provided to DC3 controller.	In case of absence of indication, use a tester to check supply voltage 220V on its terminals 10 and 11. If no power provided, check circuit through KM1 contactor, EMI filter, QF1 circuit breaker to the plug.c Replace fault component, fix the circuit in case of breakage.
	<i>PLC Delta*</i> . DC4 controller error. <i>PLC Kinco**</i> . DC3 controller error.	Use controller documentation to pinpoint the error code. If error code is pointing to BT1 thermocouple failure, use a tester to check it for breakage and short circuit. Inspect thermocouple's wire for mechanical damages. Check controller's settings. Replace fault controller/thermocouple. Set the correct settings.
	<i>PLC Delta*</i> . BT2 sensor and DC3 module failure, accompanied with the message on HMI screen about temperature sensor failure. <i>PLC Kinco**</i> . BT2 sensor and DC2 module failure, accompanied with the message on HMI screen about temperature sensor failure.	In case that there is a temperature sensor failure message on HMI screen and some graphic signs are displayed instead of numbers, use a tester to check BT2 sensor for a breakage and short circuit. Inspect the sensor's wire for mechanical damage. Replace fault sensor. If the sensor is ok, but error message is still displayed, replace DC3 module.
During heating up EK1-	VS1, VS2 solid-state relay failure.	Use a current clamp to measure current strength in the

Fault	Possible cause	Remedy
EK4 elements, temperature in the chamber is significantly higher than set temperature.	The relay is in open stated despite presence of control voltage (relay breakup).	circuit between solid-state relays and heating elements; voltage drop on relay's power terminals with and without control 24V voltage applied to the relay. With control voltage presented, current strength should be about 20 Amps, voltage drop should be about a few Volts; without control voltage, current strength will be about 0 amps, voltage drop - about 220V. If control voltage isn't supplied to the relay, but current strength measured is about 20 Amps, and voltage drop is a few Volts.
	BT2 temperature sensor failure/errors.	Use a tester to check BT2 sensor for a breakage and short circuit. Inspect the sensor's wire for mechanical damage. Replace fault sensor.
	Magnetic freezing of the KM2 contactor in working mode.	<p><i>PLC Delta*</i>. Inspect the armature of KM2 contactor. Push the armature with a screwdriver, it should move inside with pressure and release back in the base position. Armature freezing doesn't allow DC4 controller to turn off heating in case that acceptable temperature values are exceeded. Replace fault contactor.</p> <p><i>PLC Kinco**</i>. Armature freezing doesn't allow DC3 controller to turn off heating in case that acceptable temperature values are exceeded.</p>
HMI to PLC interaction error on the screen.	Circuit breakage between HMI panel and DC1 controller.	Use a tester to check interconnection circuit for a breakage, inspect the terminals for oxidation, damages. Fix the circuit breakage, clean up oxidized terminals.
	DC1 controller failure, accompanied with absence of indication.	<p><i>PLC Delta*</i>. Check light indication on DC1 controller. If there is no indication, check 24V voltage on power terminals of the controller. If there is no indication with 24V voltage presented, replace the controller.</p> <p><i>PLC Kinco**</i>. Check light indication on DC1 controller. If there is no indication, check 220V voltage on power terminals of the controller. If there is no indication with 220V voltage presented, replace the controller.</p>
Corn isn't supplied from the hopper to the chamber.	Corn supply tube clogged with popped and unpopped corn.	Inspect the funnel for clogging. If there is no funnel clogging, check to see if corn gets the chamber, pouring a little amount of kernels to the funnel. Eliminate pipe and funnel clogging.
	Foreign objects ingress into corn supply tube.	Use a wire with a ball, which tightly fit the tube, to check the tube for foreign objects. Stretch out the wire through the tube and remove a foreign object with the ball.
	M4, M5 motors (corn augers) failure.	Check operation of the motors in testing mode. Use a tester to check motors' windings for a breakage. Check the motors by connecting to other operable motor's driver. Replace fault motor.
	DD3, DD4 drivers failure.	Check operation of motors and driver in the testing mode. Check the drivers by connecting to other operable motor. Replace fault driver.
	Improper SW1-SW8 switches positions on DD3, DD4 drivers.	Check SW1-SW8 switches positions, referring to the circuit diagram. Set the correct position.

Fault	Possible cause	Remedy
	Auger clutch fixing to motor's shaft is loose. Breakage of fixing screw of the clutch.	Check auger's clutch fixing to the shaft of the motor, entirety and gripping of fixing screw. Tighten the loose junction, replace the broken bolt.
Salt isn't supplied from salt hopper to the sifter.	Removable salt supply tube is clogged.	Remove the tube, inspect for salt clogging. Remove the clog by washing in warm water, dry out the tube and put in back to its place.
	MF supply fan clogging with salt, fan impeller damping.	Disassemble the fan blower, check if the propeller rotates freely. If rotation is hampered because of salt clog between the propeller and the housing, remove salt with blowdown.
	MF fan blower failure.	Disassemble the fan blower, check if the propeller rotates freely. Use a tester to check winding of the fan blower for a breakage. Check if there is 220VAC is providing from the output of K2 relay to the fan blower. Replace fault fan blower.
	K2 relay failure.	Use a tester to check K2 relay for a breakage. Disconnect wires from relay terminals #11 and 14, use a tester to check for contact closing with 24V voltage presented at the outputs of relay's coil. Replace fault relay.
	M6 motor (salt auger) failure.	Check operation of the motor in testing mode. Use a tester to check the motor's winding for a breakage. Check the motor by connecting to other operable motor's driver. Replace fault motor.
	DD5 driver failure.	Check operation of motor and driver in the testing mode. Check the driver by connecting to other operable motor. Replace fault driver.
	Improper SW1-SW8 switches positions on DD5 driver.	Check SW1-SW8 switches positions, referring to the circuit diagram. Set the correct position.
	Auger clutch fixing to motor's shaft is loose. Breakage of fixing screw of the clutch.	Check auger's clutch fixing to the shaft of the motor, entirety and gripping of fixing screw. Tighten the loose junction, replace the broken bolt.
Oil isn't supplied from the tank to the sifter.	Pump's inlet opening clogging.	Inspect inlet openings for a clogging. Clean in case of clogging.
	Wedging of pump's gear with debris.	Check pump's shaft free rotation by a hand; in case of hampered rotation, dismantle the pump, inspect the gears for clogging with foreign objects or debris. Clean in case of debris ingress.
	Oil solidification between in the tube between fitting in the oil compartment and the nozzle.	Blowdown the tube to check it for cleanliness. If there is oil solidified in the tube, let warmed machine to work for a while to melt the oil.
	Solidified oil in the sprayer.	Remove the sprayer, check for clogging by blowing through. Nozzle, clogged with solidified oil, wash with hot water and dry out.
	M3 motor (oil) failure.	Check operation of the motor in testing mode. Use a tester to check the motor's winding for a breakage. Check the motor by connecting to other operable motor's driver.

Fault	Possible cause	Remedy
		Replace fault motor.
	DD2 driver failure.	Check operation of motor and driver in the testing mode. Check the driver by connecting to other operable motor. Replace fault driver.
	Improper SW1-SW8 switches positions on DD2 driver.	Check SW1-SW8 switches positions, referring to the circuit diagram. Set the correct position.
	Auger clutch fixing to motor's shaft is loose. Breakage of fixing screw of the clutch.	Check auger's clutch fixing to the shaft of the motor, entirety and gripping of fixing screw. Tighten the loose junction, replace the broken bolt.
	Solidified oil in the tank with the pump immersed.	Check the oil in the tank. In case of solidification place the pump in another container with liquid oil and turn on warming in the oil compartment. Or, don't get the pump out from solidified oil and turn on warming of the compartment.
Sifter doesn't rotate or rotates with reduced rate.	Loosen grip of fixing nuts (sifter's driving shaft rollers).	Check nuts gripping. Tighten the loosen junction.
	Wedging of bearings on driving/supporting shaft.	Disconnect driving shaft with rollers from the motor by through the clutch. Check free rotation of drive and support shafts in the bearings. Replace the fault bearing.
	The fixing of driving shaft clutch to motor's shaft is loosen. Breakage of fixing screw of the clutch.	Check auger's clutch fixing to the shaft of the motor, entirety and gripping of fixing screw. Tighten the loose junction, replace the broken bolt.
	M2 motor (sifter) failure.	Check operation of the motor in testing mode. Use a tester to check the motor's winding for a breakage. Check the motor by connecting to other operable motor's driver. Replace fault motor.
	DD1 driver failure.	Check operation of motor and driver in the testing mode. Check the driver by connecting to other operable motor. Replace fault driver.
	Improper SW1-SW8 switches positions on DD1 driver.	Check SW1-SW8 switches positions, referring to the circuit diagram. Set the correct position.
BL1, BL2 corn sensors don't react to corn level or react in a wrong way.	BL1, BL2 sensors failure.	Do an obstacle test for the sensors. Once happened in the operating area, a red LED lights up, 24V voltage appeared on the output of the sensor. If supply 24V voltage is applied, but red LED doesn't light up with any range adjusted; or 24V voltage doesn't appear, the sensor needs to be replaced.
	BL1, BL2 sensors incorrect setting.	Do the obstacle test on different distances to check the sensor's operation. Adjust, if necessary, sensor's range with a potentiometer in the sensor.
BL3 bag sensor doesn't react to popcorn level or react in a wrong way.	BL3 sensor failure.	Do an obstacle test for the sensors. Once happened in the operating area, a red LED lights up, 24V voltage appeared on the output of the sensor. If supply 24V voltage is applied, but red LED doesn't light up with any range adjusted; or 24V voltage doesn't appear, the sensor needs to be replaced.

Fault	Possible cause	Remedy
	BL3 sensor incorrect setting	Do the obstacle test on different distances to check the sensor's operation. Adjust, if necessary, sensor's range with a potentiometer in the sensor.
Chamber overload sensor doesn't react to overload or react in a wrong way.	Mechanical damage of optical conductor, contamination of emitting surface of the conductor.	Inspect optical conductor in full-length for damages; optical head for contamination. Turn on the machine and check the red light emission from the optical head inside the chamber. If there is no emission from the optical head, disconnect the conductor plug on digital amplifier; check the emission at the amplifier's output. Replace the damaged wire, clean soiled head.
	BL4 digital amplifier failure.	Use a tester to check 24VDC on output terminals of the amplifier. If there is no indication at the amplifier with supply voltage applied, then the amplifier is fault and needs to be replaced.
	BL4 digital amplifier improper setting.	Enter into the test mode; locate 'Sensor Chamber', which will glow in red when the sensor is reacted to an obstacle. Put in the chamber a sheet of paper, vertically, folded twice. The amplifier should trigger and 'Sensor Chamber' should turn in red. If it doesn't happen, adjust amplifier sensitivity.
	Improper positioning of the optical head in the chamber.	Check the optical head position, it should be stick out of the side wall surface for not less than 1 mm. Set the correct position.
No warming in the oil compartment with SA2 switch turned on.	There is no 220VAC provided to the terminals of SA2 switch.	Use a tester to check 220VAC voltage at output terminals of SA2 switch. If there is no voltage, check the supply circuit of the switch in accordance to the schematic circuit. Fix the circuit.
	SA2 switch doesn't close the circuit when pressed.	Use a tester to check SA2 switch for a breakage. Replace the fault switch.
	Circuit opening, oxidation, wires burning down next to terminals of EK5, EK6 heating elements, AT1, AT2 thermostats.	Use a tester to check supply circuit of heating elements for oxidation, burning out; also check gapping of terminals. Clean up or replace oxidized wires and terminals.
	EK5, EK6 heating elements failure.	Use a tester to check EK5, EK6 heating elements for breakage. Replace fault heating element.
	AT1, AT2 thermostats failure.	Use a tester to check AT1, AT2 thermostats for a break. Replace the fault thermostat.
No sound alarm at hopper emptying, bag overfilled with popcorn.	BZ buzzer failure.	Check the buzzer in service test, connecting it to power supply 24VDC. Replace the fault buzzer.
No light in the chamber.	EL lamp failure.	Inspect the EL lamp, use a tester to check it for a breakage. Replace the fault lamp.
	EL lamp socket break.	Inspect the lamp socket for breaks, oxidation, contacts. Check spring contacts of the socket. Replace the fault lamp socket.
	Breakage of EL lamp power circuit.	Use a tester to check the lamp power circuit for a

Fault	Possible cause	Remedy
		breakage. Restore the circuit.
Chamber clogged with popcorn.	Chamber bowl and grid clogging with husk and debris.	Do complete cleaning, diagnosis of the machine, check the grid and the bowl in the chamber. Draw customer's attention to necessity of periodic cleaning of mesh and bowl of the chamber.
	Too high corn auger rate, too low turbine rate.	Do the full cleaning and diagnosis of the machine. If the machine is operable, check the operation with butterfly and mushroom corn in continuous mode. If, during check, chamber clogging is going to happen, reduce corn auger rate by 4 units and check the operation with corn again. Repeat until the stable operation in continuous mode is achieved. It is possible to increase turbine rate instead of reducing corn auger rate. The productivity rate will remain, but it will increase unpopped corn carry-over.
	Chamber clogging sensor failure.	Do the full cleaning and diagnosis of the machine. Check the optical conductor, emitting head of the sensor for mechanical damage, check the digital amplifier for emission presence with 24V supply voltage applied. Replace fault amplifier.
	Sifter stop.	Do the full cleaning and diagnosis of the machine. Check sifter roller fixing nuts gripping, sifter shaft bearings, drive shaft clutch, M2 motor, DD1 driver, DIP-switches (SW1-SW8) positions on DD1 driver. Tighten loose junction, replace the fault component.
	Sifter rate is too low.	Do the full cleaning and diagnosis of the machine. If chamber clogging happens because sifter doesn't have enough time to draw aside popped corn from the chamber output window, it is necessary to increase sifter's rate. If sifter's rate increasing doesn't help, the it is necessary to reduce feeder's rate.
	Technical fault of the machine.	Clean the chamber, the grid, and corn supply tube from popcorn and dust. Remove 4 screws to remove the bowl from the bottom of the chamber. Do a full diagnosis of the machine, paying special attention to components, which are responsible for production rate (impeller's motor, heating elements, solid-state relays, sifter's drive). Replace the fault component.
Too much 'butterfly'-shaped popcorn during mushroom corn processing.	Low quality corn.	Do the full diagnosis of the machine. If the machine is ok, change the chamber temperature with 5 degree step lower and higher, controlling the end result on the machine's output. Set the temperature corresponding to the best quality.
	Technical fault of the machine, caused by inaccurately maintained temperature in the chamber.	Do the full diagnosis of the machine, paying special attention to components, which are responsible for heating up (heating elements, solid-state relays, wires and terminals of the heating elements). Replace the fault component.
	Improper popping temperature.	Check the popping temperature. For most kinds of corn temperature range for 'mushroom' corn is about 220-

Fault	Possible cause	Remedy
		230°C. Set the correct temperature.
The machine doesn't turn off after pressing TURN OFF button on the HMI panel, or after 10 minutes of idleness.	Normal closed contacts of K1 relay don't open with 24V control voltage is applied.	Use a tester to check opening of the contact between relay outputs #11 and 12 when control 24V voltage is applied on its coil. Replace fault relay.
Sifter doesn't stop by pressing SB2 button.	SB2 button doesn't close the circuit when pressed.	Use a tester to check button SB2 (pressed), replace the fault button.

* - this information is effective for machines built on Delta controllers. PLC Delta: firmware version Mark 4.2.x Firmware version can be seen in the settings mode (see section 2.9)

** - this information is effective for machines built on Kinco controllers. PLC Kinco: firmware version Mark 4.1.x Firmware version can be seen in the settings mode (see section 2.9)

3.6. PRESERVATION

If the equipment is not in use for a long time, do all the maintenance routines.

4. TRANSPORTATION AND STORAGE

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

5. ACCEPTANCE CERTIFICATE

Robopop® popcorn machine corresponds to the requirements of the EN60204-1 and is qualified as suitable for operation.

Acceptance Certificate	
<u>Popcorn machine Robopop® VPM-RM4</u> (Article description)	№ _____ (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	_____ Full name
_____ Year, month, date	

6. WARRANTY OBLIGATIONS

The manufacturer guarantees trouble-free operation of the machine during 12 months from the date of receiving the machine by the dealer (in accordance with transport documentation); or, in case of purchase directly through Business Russia LLC, from the purchase date, given that terms of using, transportation, and storage are met.



ATTENTION! Chamber clogging with popcorn caused by unskilled actions of operating personnel is not the warranty case!

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

Technical specifications of the machine can be changed by manufacturer at any time due to improvements and/or other reasons. Technical specifications stated in this document are intended to act as a reference point, which is necessary to evaluate suitability of the machine for the customer's needs, and are not the subject of warranty policy.

The information stated in this document has been thoroughly checked and considered as accurate one; nevertheless, the manufacturer is not responsible for any typographical errors or misprints.

Due to constant improvement of the equipment, technical specifications are subject to change without prior notice.

7. MANUFACTURER DETAILS

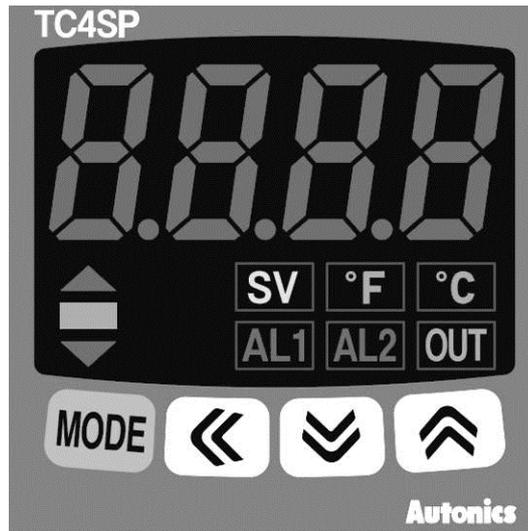
NPO Tvertorgmash, LLC, 11 Industrial Street, Tver, 170000 Russia www.robopocorn.com

APPENDIX A. WIRING DIAGRAM SPECIFICATION FOR VORTEX POPCORN™ MACHINE ROBOPOP VPM-RM4

<i>Signs</i>	<i>Name</i>	<i>Description</i>
AT1, AT2	Thermostat	230AC, 16A
BL1, BL2, BL3	Photoelectric sensor	24DC
BL4	Digital fiber amplifier with sensor head	24DC
BT1	Temperature sensor	K type
BT2	Temperature sensor	Pt100
BZ	Buzzer	24DC
DC1	Programmable logic controller	230AC
DC2	Output point extension	24DC
DC3	Temperature module	230AC
DC4	Temperature controller	230AC
DD1, DD2, DD3, DD, DD5	Digital stepping driver	24DC
EK1, EK2, EK3, EK4	Heat element	230AC, 2500W
EK5, EK6	W-type heat element	230AC, 600W
EL	Halogen lamp	230AC, 48W
EMI	3-phase filters	400AC, 25A
HL	Contact block with white led	230AC
HMI	Human machine interface	24DC
K1, K2	Electromagnetic relay	24DC, 4A
KM1	Contactora	400AC, 9A
KM2	Contactora	400AC, 32A
M1	AC Motor	400AC, 3000rpm
M2	Gearbox stepping motor	
M3, M4, M5	Stepping motor	
M6	Stepping motor	
MF	AC centrifugal blowers	230AC
QF	3-poles circuit breaker	32A
R1, R2, R3, R4, R5, R6, R7	Resistor	2kΩ, 2W

SA1	Emergency stop	4A
SA2	Selector switch stable red	4A
SB1, SB2	Pushbutton black	4A
TV	Power supply	24DC, 10A
UZ	AC motor drive	230AC
VS1, VS2	Solid state relay	24DC, 45A

APPENDIX B. TEMPERATURE CONTROLLER SETTINGS



370°C is temperature of emergency shutdown by default.

<i>Parameter</i>	<i>Value</i>	<i>Description</i>
AL1	-20	Temperature alarm output
HYS	20	Hysteresis
In-t	PCA	Temperature sensor (thermocouple, K type)
L-Su	250	Lower value
H-Su	400	Upper value
out	RLY	Relay control output
C-nd	onof	Type of control ON/OFF
AL-1	AL1	Signalization settings
ALHYS	10	Hysteresis alarm output
LoC	LoC2	Settings locking (only emergency temperature is available)

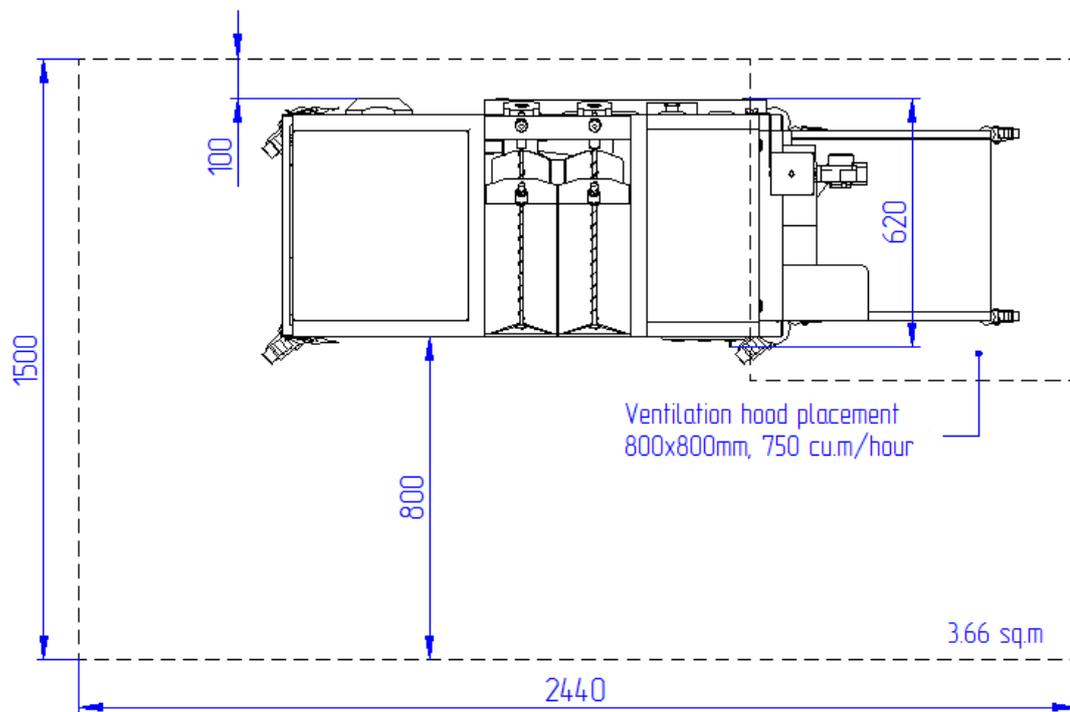
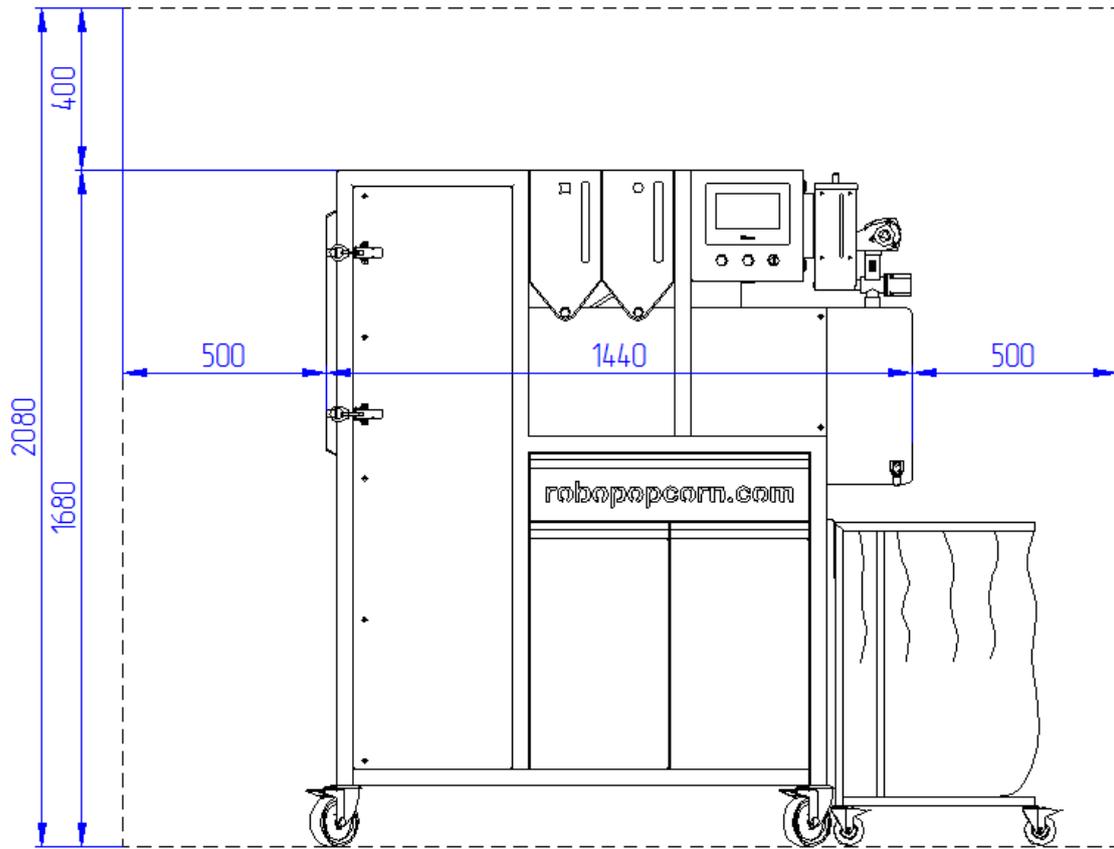
Others settings are set by default.

APPENDIX C. AC MOTOR DRIVE SETTINGS

<i>Parameter</i>	<i>Value</i>	<i>Description</i>
01.00	60.00	Maximum frequency
01.09	15.0	Motor acceleration time
01.10	15.0	Motor deceleration time
01.16	4	Automatic acceleration and deceleration
02.00	3	First output frequency settings (RS-485)
02.01	4	Drive control
02.04	0	Control of direction of rotation
02.07	1	Rate of change of set frequency, in accordance with acceleration and deceleration settings
09.00	1	Communication figure
09.01	2	Data transfer rate (19200 bits/sec)
09.02	3	Motor drive continues to function if there is loss of connection
09.04	3	Communication protocol (RTU 8, N, 2)

Other parameters are set by default.

APPENDIX D. EQUIPMENT OVERALL DIMENSIONS AND PREMISES REQUIREMENTS



* – Location for hood installation 800x800mm, 750 cub. m./hour.

APPENDIX E. STAFF ACTIONS DURING CHAMBER CLOGGING

Robopop® VPM-RM4 has an automatic system of chamber protection from popcorn clogging. If that system cannot maintain the stable process during popping stage, it shifts the machine in an automatic cooling stage.

During that process the next message appears on the screen.

chamber is clogged with popcorn

If staff sees that information on the screen the next steps should be done.

1. By means of the observation port visually control the popcorn rotation. During clogging the chamber is overfilled with popcorn.
2. Do not turn off the machine, wait until cooling stage termination. The whole process of cooling is automatic. There is no need in staff interference. Cooling process may take from 10 to 15 minutes.



ATTENTION! Do not turn off equipment by Emergency Stop button during cooling stage. That may lead to smoke formation and complication of chamber cleaning.



ATTENTION! Do not open chamber lid during cooling stage. Do not use fire extinguisher. Chamber is hermetically sealed and made of steel. Even if popcorn in chamber is smoldering without additional air intake it does not ignite.

3. Upon cooling stage finishing turn off the machine. To do it press and hold for 3 sec TURN OFF button.

SETTINGS

TURN OFF

4. Only now the lid should be removed and the chamber cleaned. To open the lid four latches should be unfastened.

Pay attention to inside hollows of the chamber and corn delivery tube. There should not be any popcorn inside. The mesh of the chamber should be cleaned also by a brush.

5. The corn sensor in the chamber should be cleaned as well. It locates on the left side of the chamber upper the temperature sensor. Use a dry cloth for sensor cleaning.

6. Close the door and turn on the machine. Make sure that there is no warning message of chamber clogging. Proceed to system settings menu. Check for OVER.LOCK red flag in the lower part of the screen:

OVER.LOCK

EM.LOCK

PURGE ON

DEFAULT

RU

Press and hold it to uncheck. If the machine was stopped by EMERGENCY STOP button, then EM.LOCK flag should be also unchecked. Without this further operation of the machine would be impossible. Come back to the main screen; the machine is ready for operation.



ATTENTION! Unskilled actions of staff during chamber clogging and popcorn smoldering are not warranty.

If you cannot to clean the chamber of popcorn by yourself, contact support@robo labs.pro