



# RoboLabs

Incredible machines for fastfood & funfood

## OPERATING MANUAL GRAND ROBOPOP® 220 (VPM-RGM2)



**CAUTION: READ THE INSTRUCTIONS  
BEFORE USING THE MACHINE!**

*PDF version of this manual is available on [www.robolabs.pro](http://www.robolabs.pro)*

# Table of contents

Safety requirements.....	3
1. Overview.....	4
1.1. Purpose.....	4
1.2. Technical specifications .....	4
1.3. Delivery set .....	4
1.4. Power requirements .....	4
1.5. Getting started.....	5
1.6. Ambient conditions .....	5
1.7. Safety components.....	5
1.8. Main components .....	7
2. Intended use.....	9
2.1. Operation modes.....	9
2.2. Popping mode .....	9
2.3. Normal Operation Workflow .....	10
2.4. Settings .....	10
2.5. Testing mode .....	12
2.6. Popcorn quality .....	13
3. Technical maintenance .....	15
3.1. Cleaning guide .....	15
3.2. Chamber clogging .....	16
3.3. Light bulb replacement .....	17
3.4. Preservation .....	17
4. Troubleshooting .....	18
5. Transportation and storage .....	19
6. Acceptance certificate.....	19
7. Warranty obligations .....	20
8. Manufacturer details .....	20
Annex A. Electric components list.....	21
Annex B1. Temperature regulator settings.....	22
Annex B2. Safety temperature regulator settings.....	23
Annex C. VFD settings .....	24
Annex D1. Chamber optical sensor setup.....	25
Annex D2. Corn hopper sensor setup .....	26
Annex E. Chamber clogging .....	27
Annex F. Parts list.....	28

# Safety requirements



DO NOT WASH WITH WATER!



ONLY INSTRUCTED PERSONNEL ARE ALLOWED TO OPERATE THE MACHINE!



IT IS PROHIBITED TO USE MACHINE FOR PROCESSING OTHER KERNELS THAN CORN!



DO NOT LEAVE RUNNING MACHINE UNATTENDED!



SOME PARTS ARE HOT WHILE IN OPERATION!  
BURN HAZARD!



DO NOT TOUCH MOVING PARTS!



# 1. Overview

## 1.1. Purpose

Vortex Popcorn™ machine Grand Robopop® 220 VPM-RGM2 is a hot-air popcorn making machine (hereinafter “popper” or “machine”). It can process both Butterfly and Mushroom popcorn varieties. Popper is built on patented Vortex technology that has following benefits:

- No oil is used at all. As a result, popcorn has no carcinogens and trans-fats; moreover, production cost is lower.
- Once popped, popcorn is immediately removed from the hot area, thus its nutritional value and taste are kept as much as possible.

## 1.2. Technical specifications

Throughput <sup>1</sup>	75 to 100 kg/hour
Hopper capacity	25 kg
Ampacity	36 A
Rated voltage <sup>2</sup>	3/N/PE AC 400 V 50/60 Hz
Rated power	24 kW
Overall dimensions (LxWxH)	1220x810x1930 mm
Package dimensions (LxWxH)	2100x1400x1000 mm
Net/gross weight	300/500 kg
IP rating	IP22

## 1.3. Delivery set

<b>Popper</b>	<b>1 pc</b>
<b>Controls compartment key</b>	<b>2 pcs</b>
<b>Halogen lamp 64684ECO</b>	<b>1 pc</b>
<b>Documentation</b>	<b>1 set</b>

## 1.4. Power requirements



ELECTRIC SOCKET MUST HAVE GROUNDING CONTACT!

<sup>1</sup> Amount of raw corn processed. Production rate of the machine depends on corn quality.

<sup>2</sup> 3P 208/240 Vac option is available upon request.



CONNECTIONS MUST BE DONE ONLY BY QUALIFIED ELECTRICIAN!



IF SUPPLY CORD DAMAGED, IT MUST BE REPLACED BY MANUFACTURER, SERVICE AGENT, OR QUALIFIED PERSONS IN ORDER TO AVOID HAZARD!

It is necessary to periodically check electric connections, including grounding connection. Whenever any fault conditions are found, do not turn the equipment on, and call for qualified electrician!

Equipotential bonding wire (up to 10 sq.mm) shall be connected to screw terminal marked with IEC 5021 sign.



Cable plug is not included in the delivery set. Use a 63 A plug for 400 V service, or 80 A plug for 220 V service. Refer to the wiring diagram on the power cord label.

It is necessary to check electric wires and ground connection of the machine periodically. In case of faults found, an electrician must be called. It is allowed to turn the machine on only after all the issues are resolved.

## 1.5. Getting started

Unpack the machine carefully. Check the contents of the package. Remove protective film from all surfaces.



THERE MAY BE SOME CORN KERNELS FOUND IN THE MACHINE DUE TO QUALITY CONTROL CHECKS CONDUCTED AT THE FACTORY

## 1.6. Ambient conditions

The equipment must be operated at the ambient temperature from +5° to +40°C (+41°F to +104°F), relative humidity not more than 45% at 40°C/104°F). Altitude above sea level should not exceed 1000 m.

While in operation, a lot of moisture and heat is coming out of the popper. It is essential to provide exhausting hood (800x800 mm, 750 cu.m/h or more) installed above popper's output port.

**Ambient conditions have strong effect on the end product quality! See section 2.6 for more details.**

## 1.7. Safety components

EMERGENCY STOP button located on the front panel should be used in case of emergency. Press the button to turn popper off immediately.



USING EMERGENCY STOP BUTTON MAY LEAD TO CHAMBER CLOGGING!

Circuit breaker at the input protects the machine from short circuit.

Voltage control relay analyzes voltage at the machine's input. Tolerance gap is preset on the unit. If the voltage value is beyond the gap, popper won't be energized.

Safety temperature sensor is located close to heating elements. In case of overheating, safety temperature regulator will turn off the contactor that runs heating elements, so they will be de-energized and temperature won't rise further.

The main PLC controls actual turbine rotation speed. If the speed is below 20 Hz, then PLC will shut the machine off in 12 seconds.

Popper has four swivel casters with locking mechanisms, which avoid spontaneous movements of the machine.

## 1.8. Main components

Main components are: 1 – Turbine (Blower); 2 - Chamber; 3 – Corn Hopper; 4 – Sifter; 5 – Scrap tray; 6 – Controls, see Fig.1:

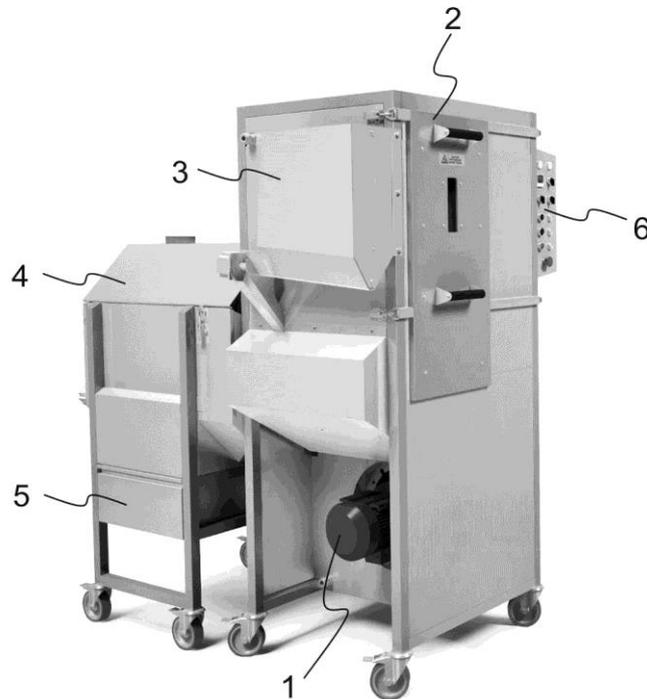


Fig. 1 Main components

### *Turbine (Blower)*

The turbine provides constantly circulating airflow inside the popper. This is a direct type drive; the blower sits on motor's shaft. Rotational speed is controlled by the main PLC.

### *Chamber*

This is where popping happens. Airflow circulates through the chamber; air is being heated by heating elements. In the chamber's lower part there is a bowl with special shaped holes that causes air vortex.

During machine operation corn kernels are being fed into the chamber; kernels are being heated up, and finally, immediately blown away from the chamber once popped.

Chamber can be easily accessed through the door provided. Halogen lamp illuminates chamber inside, helping operator to control the operation. Chamber is equipped with temperature sensor and optical sensor (see below).

## *Chamber Optical Sensor*

The chamber optical sensor monitors processes happening in the chamber. Popper uses signal from this sensor in order to maintain smooth and effective operation process.

## *Chamber Temperature Sensor*

Chamber temperature sensor helps to maintain the temperature in the chamber.

## *Sifter and Scrap Tray<sup>3</sup>*

Sifter is a rotating drum that screens un-popped kernels (“old maids”), partly popped popcorn, and other small fractions into scrap tray located under the sifter. Scrap tray is easily removable.

## *Corn Hopper*

Corn hopper can hold one bag of corn (22.68 kg / 50 Lbs). Hopper equipped with feeder. Hopper is equipped with corn sensor that trips in case of low corn.

## *Controls*

Temperature regulator – popping temperature settings.

## *Light indicators*

CLOGGING – chamber optical sensor tripped.

LOW CORN – low corn.

HEATING – machine is in heating mode.

POPPING – machine is in operation mode (constant glow); machine is in pause mode (flashing).

COOLING – machine is in cooling mode.

## *Switches*

FEEDING – single batch amount.

SIFTER SPD – sifter speed.

TURBINE SPD – turbine speed.

---

<sup>3</sup> Sifter with scrap tray is NOT included in the delivery set of VPM-RGM2; it should be ordered separately!

## *Pushbuttons*

START – turns machine on.

PAUSE – turns on pause mode and resume popping mode.

TURN OFF – turns machine in cooling mode.

EMERGENCY STOP – immediately turns machine off.

## 2. Intended use

### 2.1. Operation modes

Popper has following operation modes:

- Heating mode. Once START button is pressed, popper automatically starts to heat up. Upon reaching certain temperature popper switches automatically to popping mode.
- Popping mode. This is the main operation mode.
- Pause mode. Popper doesn't process corn in this mode, but maintains temperature in the chamber; thus, popping process can be resumed in no time.
- Cooling mode. Before turning off, popper must be cooled down. In cooling mode heating elements are completely de-energized; turbine keeps running, cooling down the machine. Once temperature drops low enough, popper is turned off automatically.
- Testing mode. This mode is used for testing popper components. See section 2.5 for more details.

### 2.2. Popping mode

Popping mode is the main operation mode. Popper operates in cyclic way, processing corn kernels batch by batch. Each cycle consists of three stages:

- 1) Feeding. Hopper auger rotates, pushing corn kernels into the chamber.
- 2) Popping. Corn kernels are being heated up in the chamber, eventually being blown out from the chamber once popped.
- 3) Purging. Turbine is accelerated to higher speed in order to blow everything that are left in the chamber, i.e. unpopped kernels, dust and other scrap.

## 2.3. Normal Operation Workflow

Below is a quick, step-by-step guide how to operate the machine.



FIRST BATCH SHOULD NOT BE EATEN!

1. Make sure that scrap tray is empty and chamber is clean and not clogged.
2. Put one bag (22.68kg / 50Lbs) of corn into the hopper.
3. Press the START push button to turn the popper on. Popper will start to heat up.
4. Once heating up is completed, popper will be switched in popping mode automatically.
5. To make a pause in the process, press the PAUSE push button. Popper will stop producing popcorn, but will maintain temperature in the chamber at the set value. To resume production, press the PAUSE push button again.
6. To finish operation, press TURN OFF push button. Popper will be switched in cooling mode<sup>4</sup>; upon cooling completion, popper will be shut off automatically.

## 2.4. Settings

### *Popping Temperature*

Popping temperature shall be chosen by a customer. During operation, machine keeps temperature in chamber at the set value. Popping temperature affects the way how popcorn pops; first of all, its shape and size. Too high temperature leads to smaller popcorn and possible chamber clogging. Too low temperature leads to reduced productivity, improperly popped kernels, and finally, chamber clogging. So it is required to find a “sweet spot” while choosing the temperature.

Common value for Butterfly lies between 200 and 215°C; for Mushroom between 210 and 225°C.

Certain amount of Mushroom corn always will be popped as Butterfly. The percent of corn popped as Butterfly depends on quality of the corn as it stated in the certificate for that particular corn. Butterfly corn can be popped as

---

<sup>4</sup> Feeding auger will be stopped immediately once COOLING button is pressed; however, corn kernels that are already in the chamber will be processed and current cycle will be completed.

Mushroom by means of increasing popping temperature. But this could result in decreasing of overall volume of popcorn (per 1 kilogram of raw corn), due to negative effect of excessive temperature to the volume of popcorn.

Temperature set point can be adjusted using temperature regulator located on the front panel. To change the temperature, press up or down arrow keys. SV value is the set point; PV value is the current temperature in chamber.

## *Feeding Time*

Feeding time is the time auger operated pushing kernels to chamber. FEEDING switch has three positions:

‘1’ - 35 seconds; ‘2’ - 40 seconds; ‘3’ - 45 seconds

This parameter depends on corn quality. If the corn is good and kernels are big enough, then it is allowed to set this switch to the maximum. If corn quality is low, or kernels are too small, then it is better to keep this parameter on the minimum value.



IMPROPERLY CHOSEN PARAMETERS MAY LEAD TO CHAMBER CLOGGING!

## *Sifter Speed<sup>5</sup>*

SIFTER SPD switch sets sifter's rotational speed; three values are available:

‘1’ - 50 rpm; ‘2’ - 75 rpm; ‘3’ - 100 rpm

Sifter speed should be adjusted depending on batch size. With big batch, sifter must spin faster, to withdraw popped popcorn from the area of chamber output in order to avoid chamber clogging with popped popcorn.

## *Turbine Speed*

Turbine speed affects airflow intensity. As a rule, turbine speed for Mushroom should be higher than for Butterfly. Unlike Mushroom, which has proper spherical shape, Butterfly has irregular shape with “winglets”; hence less intense airflow is required to blow out Butterfly popcorn; and more intensive airflow is required for Mushroom.

Alike the popping temperature, excessive values of turbine speed may cause a bunch of issues. Too slow turbine will cause popcorn accumulation in the chamber, smoldering, smoke formation, and finally, chamber clogging. Too fast turbine increases scrap rate, because many kernels are blown out of the

---

<sup>5</sup> VPM-RGSM3EU sifter has separate speed control.

chamber before they pop.

Airflow intensity can be reduced because of clogged metallic mesh inside the chamber. See Chapter 3 for more details.

The Vortex patented technology is based on air convection inside the machine. Airflow intensity is being changed during operation accordingly to the operational algorithm. Airflow is being generated by the turbine (blower) that is being controlled automatically via VFD unit.

While popper is in heating/pause/cooling mode, the turbine rotates with basic speed F that is set on the VFD unit.

F setting can be adjusted using controls on VFD unit.



HIGH VOLTAGE! ONLY INSTRUCTED AND QUALIFIED PERSONNEL ARE ALLOWED TO DO THE FOLLOWING OPERATIONS!

1. Open electric compartment.
2. Press START button to turn the machine on.
3. Wait until turbine is started.
4. Use 'up' and 'down' arrow keys on VFD control panel to set the desired value. New figure will be shown on the display in real time.



F VALUE MUST BE WITHIN 20.00 AND 40.00.  
OTHER VALUES MAY LEAD TO CHAMBER CLOGGING, SMOKE FORMATION AND/OR EQUIPMENT FAILURE!

5. Once new value is set, close the compartment.

If the airflow isn't strong enough, then the mass of popcorn would not be moved in the chamber; that will probably cause chamber clogging with further popcorn smoldering. In that case F value should be increased.

Too high F value may lead to excessive waste percentage; if scrap rate is more than 5-7% (comparing to the weight of raw corn processed), then the F value should be decreased.

Popper's algorithm changes turbine speed depending on current cycle stage using value set by TURBINE SPD switch. Available values are 6, 8, or 10 Hz; which are corresponded to switch positions #1, 2, and 3, accordingly.

It is recommended to choose higher increment to avoid chamber clogging.

## 2.5. Testing mode

Testing mode used for testing and adjusting. Turn the machine off. Press and keep pressed PAUSE button, then press and release START button, wait for temperature regulator boot up, and then release the PAUSE button.

## *Sifter Testing*

Press and hold PAUSE button more than for 3 seconds. Sifter is rotating as long as PAUSE button is pressed.

## *Feeder Testing*

Press and release PAUSE button. Feeder will execute a single cycle of feeding.



CORN WILL BE FED INTO THE CHAMBER DURING FEEDER TESTING. ALL CORN MUST BE REMOVED FROM THE CHAMBER BEFORE START!

To exit the testing mode, press TURN OFF button.

## 2.6. Popcorn quality

Popcorn is a product that requires ultimate attention towards many aspects. Understanding popcorn processing technology is essential to get high quality product.

### *Raw Corn*

It is impossible to get good stable result using low quality supplies, first of all, raw corn kernels. Choose reliable corn suppliers. Make sure that raw corn is stored and handled properly at your production site or warehouse. Ask your supplier for corn storage recommendations.

### *Popcorn Crunchiness*

Popcorn is crunchy when its moisture content doesn't exceed 1-1.5%. Popcorn that just came out of the machine has higher moisture rate, it is still losing moisture as cooling down. It is recommended to establish proper environment and workflow in such a way that will let you to achieve proper moisture content and product quality.

### *Production Capacity*

Due to the nature of popping process, there is always a difference between weight of raw corn processed and weight of ready-to-eat product in popcorn cart. This difference may vary. Low quality corn or improperly chosen popper parameters may increase the weight difference. For example, if too dry corn used, or there are a lot of damaged kernels, then there will be a lot of "old maids" screened in sifter and dumped to scrap. Another example, if turbine speed is set too high, a lot of unpopped kernels will be blown out before they

would have been popped.

The real production capacity depends on many aspects, including corn quality and popper parameters and settings, including:

Single batch weight, which is defined by Feeding time setting. There is a simple way to measure batch weight. Fill the hopper full, and then do three consecutive feeding cycles by activating feeder testing procedure as described in section 2.5.

Then take out all corn from the chamber, weigh it and divide by 3. This is the average weight of a single batch.

Popping stage duration. Popper uses chamber sensor data to manage the popping process. Depending on quality of corn used, duration of popping stage may vary, while duration of feeding and purging stages are constant.

So, knowing cycle duration for certain corn and settings, and batch weight, it is possible to find out the real throughput rate.

## 3. Technical maintenance

The purpose of technical maintenance is to keep equipment in good condition during all the lifetime and to meet safety requirements.

### 3.1. Cleaning guide

Recommended cleaning schedule is listed below<sup>6</sup>:

ACTION	PERIOD
Outer surface cleaning	once a day
Chamber cleaning, including mesh screen	once a day
Sifter cleaning	once a week
Sifter drive shaft rollers cleaning	twice a month
Hopper/feeder cleaning	once a month



DISCONNECT ELECTRIC PLUG BEFORE CLEANING!



DO NOT WASH WITH WATER!



DO NOT USE SHARP TOOLS OR ABRASIVES FOR CLEANING!



WAIT UNTIL MACHINE IS COOLED DOWN BEFORE CLEANING!

#### *Outer Surface Cleaning*

Clean outer surfaces of the machine by the means of dry and clean cloth; it is allowed to use a cloth slightly dampened with soap water.

#### *Chamber Cleaning*

It is necessary to clean the chamber of husk and dust once a day. To clean the chamber, unfasten the latches which hold the door, and pull it out. After that, remove husk and debris from the chamber. It is handy to use a vacuum cleaner for this operation.

After cleaning, place the door back and fasten up the latches.

---

<sup>6</sup> Any cleaning procedure has to be performed as often as required.

During long time operation, certain amount of corn dust is accumulated in the chamber. It is important to clean mesh screen.

Open the chamber. There is a baffler in the center. The mesh screen is behind the baffler. Normally there is enough room to get access to the screen in order to clean it. However, if required, baffler can be removed. To do so, remove two bolts that fix the baffler to sidewalls. And then pull the baffler out. Once cleaning is done, put the baffler back and fix it with the bolts.

### *Sifter Cleaning*

Sifter is not rigidly connected to the machine and can be taken out of the machine. Sifter lies freely on two shafts each with couple of rubber rollers. In the course of time, the rollers' surface may become greasy and slippery, because of natural corn oil and dust. This may cause sifter stop and chamber clogging. To avoid this, rollers must be cleaned as necessary. It is suitable to do with a hard steel brush or other tool that provides strong impact on grease layer on rollers' surface.

## 3.2. Chamber clogging

Refer to Annex E for list of actions should be taken in case of chamber clogging. It is recommended to print it out and keep next to machine.

### 3.3. Light bulb replacement

To replace lightbulb do the following.

1. Turn off the machine and disconnect it from the mains. Wait until the machine cools down.
2. Take chamber door off to open the chamber.
3. Backlight is located on the right sidewall of the chamber.
4. Remove four screws that holds lamp screen and take the screen off. If it is stuck, carefully insert flat screwdriver under the metal frame of the screen and turn it gently to detach the screen.
5. The lightbulb is being hold by spring loaded socket. Shift the bulb upwards or downwards to release its opposite end, and then take the bulb out.



BULB MAY BE EXTREMELY HOT! BURN HAZARD!

6. One must not touch the new lightbulb with bare fingers; skin fat can cause bulb destruction during further operation. If the bulb is greasy, it is required to wipe it thoroughly with soft, clean and dry cloth before putting it in.
7. Once bulb replacing is done, put the protective screen back and fix it with four screws. Close the chamber.



IT IS NOT ALLOWED TO OPERATE POPPER WITHOUT BAFFLER OR MESH SCREEN!

### 3.4. Preservation

In case of prolonged period of no use all the technical maintenance routine must be executed.

## 4. Troubleshooting

Problem	Possible cause	Possible remedy
Chamber clogged with popcorn frequently	<ul style="list-style-type: none"> <li>- low quality corn</li> <li>- corn storage conditions are not met</li> <li>- wrong chosen settings of the machine</li> <li>- chamber clogging sensor is detuned.</li> </ul>	<ul style="list-style-type: none"> <li>- use high quality corn</li> <li>- provide proper storage conditions for raw corn</li> <li>- adjust popping temperature</li> <li>- adjust turbine speed</li> <li>- adjust corn auger speed</li> <li>- set up chamber clogging sensor operation distance properly, see Annex related.</li> </ul>
Too much scrap	<ul style="list-style-type: none"> <li>- low quality corn</li> <li>- too high turbine speed</li> </ul>	<ul style="list-style-type: none"> <li>- use high quality corn</li> <li>- decrease turbine speed</li> </ul>
Popcorn is not crispy	<ul style="list-style-type: none"> <li>- low quality corn</li> <li>- extreme ambient conditions</li> <li>- no exhausting hood provided</li> <li>- popcorn is still hot</li> </ul>	<ul style="list-style-type: none"> <li>- use high quality corn</li> <li>- provide proper ambient conditions</li> <li>- provide exhausting hood</li> <li>- arrange the workflow such a way to let popcorn to cool down</li> <li>- use a special tool to check moisture content of the product</li> <li>- note that generally Mushroom is less crispy than Butterfly</li> </ul>
Oil supply is not stable	<ul style="list-style-type: none"> <li>- machine operated by short (10-15 min) sessions, which is not enough for reaching stable operation mode</li> <li>- oil temperature is not constant</li> </ul>	<ul style="list-style-type: none"> <li>- make sure the machine operates for longer periods without interruption, avoid frequently activating pause mode and/or to switch between programs frequently</li> <li>- keep oil compartment closed all the time</li> <li>- keep oil heater on all the time, including night time</li> <li>- replace empty oil containers in time</li> <li>- aim to keep room temperature as stable as possible all the time</li> </ul>
Salt supply is not stable	<ul style="list-style-type: none"> <li>- common salt used</li> <li>- excessive ambient conditions in the production room</li> <li>- no exhausting hood provided</li> <li>- improper and/or irregular maintenance</li> </ul>	<ul style="list-style-type: none"> <li>- use special salt only</li> <li>- provide proper ambient conditions</li> <li>- provide exhausting hood - perform maintenance as required</li> </ul>
Oil/salt start to be supplied too early or too late	<ul style="list-style-type: none"> <li>- improper delay parameter</li> </ul>	<ul style="list-style-type: none"> <li>- set delay parameter properly</li> </ul>
Popcorn with oil and salt has patchy look	<ul style="list-style-type: none"> <li>- oil with colourant added is used</li> <li>- not enough time for oil to be soaked into popcorn and spread over it</li> </ul>	<ul style="list-style-type: none"> <li>- use oil with no colourant added</li> <li>- let popcorn rest for a while, oil will be soaked into and spread over popcorn</li> </ul>
Too small popcorn	<ul style="list-style-type: none"> <li>- too high popping temperature</li> </ul>	<ul style="list-style-type: none"> <li>- reduce popping temperature</li> </ul>
Too much butterfly shaped popcorn while making Mushroom	<ul style="list-style-type: none"> <li>- too low popping temperature</li> </ul>	<ul style="list-style-type: none"> <li>- increase popping temperature</li> </ul>

## 5. Transportation and storage

The equipment may be transported by any kind of covered vehicle, in accordance with transportation rules for this kind of vehicle.

Ambient temperature during the transportation and storage must be between minus 25°C to +55°C (-13°F to 131°F).

## 6. Acceptance certificate

ACCEPTANCE CERTIFICATE	
Product Name	Serial No.
<p>The equipment is made with accordance to mandatory requirements of the state standards, actual technical documentation, and approved for use.</p> <p>QC Engineer</p>	
STAMP HERE	
Signature	Full Name
DD.MM.YYYY	

## 7. Warranty obligations

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

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 equipment 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 equipment 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!**

## 8. Manufacturer details

NPO Tvertorgmash LLC

11 Industrial Street, Tver, 170000 Russia

Technical support:

Email: [support@robotlabs.pro](mailto:support@robotlabs.pro)

Phone: +7 495 956 4000

## Annex A. Electric components list

DESIGNATION	NAME	MODEL, MANUFACTURER	SPECS
BL1	Optical sensor	E3F1-DP12 2M, Omron	24 Vdc
BL2	Digital fiber amplifier	E3X-NA41, Omron	24 Vdc
	Optical head, heat-resistant	E32-D61 2M, Omron	24 Vdc
BT1	Temperature sensor	ДТC124-PT100-A3.10/2, or ДТПК124-00.10/2	Pt100 (RTD) or type K
BT2	Temperature sensor	ДТПК-054-00.120/2, Owen	Type K
BZ	Buzzer	SC235B, Sonitron	24 Vdc
DC1	PLC	DVP14SS211T, Delta	24 Vdc
DC2	I/O extension module	DVP16SP11T, Delta	24 Vdc
DC3	Thermoregulator	TCN4S-24R, Autonics	230 Vac
DC4	Thermoregulator	TC4SP-14R, Autonics	230 Vac
	Thermoregulator socket	PG-11, Autonics	—
DD1, DD2	Stepper driver	DM556, Leadshine	24 Vdc
EK1 — EK3	Heating elements (9 pcs)	1GIK8BL33001, IRCA	230 Vac, 2.5kW
EL1, EL2	Signal lamp	NA201, Emas	24 Vdc
	Lighting, yellow	S224S7, Emas	—
EL3 — EL5	Signal lamp	NA201, Emas	24 Vdc
	Lighting, white or green	S224B7 or S224Y7, Emas	—
FV	Voltage control relay	Y3M-16 УХЛ4, Meandr	16 A
HL	Halogen lamp	64684 ECO	250 Vac
K1, K2	Electromechanical relay	G2RV-SL700 DC24, Omron	24 Vdc
KM1	Contactora	LC1D09M7, Schneider Electric	9 A
KM2	Contactora	LC1D40M7, Schneider Electric	40 A
M1	Asynchronous motor	AИP80B2Y2	2.2 kW
M2	Stepper motor	FL86STH65-2808A	2.8 A
M3	Stepper motor with gear	FL86STH65-2808AG5	2.8 A
QF	Circuit breaker	S204-C50, ABB	50 A
R1, R2	Resistor	C2-23-2	2 kΩ, 2 W
SA1	Emergency stop button	B200E40, Emas	4 A
SA2 — SA4	3 position switch	B101S30, Emas	4 A
SB1, SB2	Push-button, black	B100DH, Emas	4 A
SB3	Push-button, red	B100DK, Emas	4 A
TV	Power DC supply	S8VK-C24024, Omron	24 Vdc, 10 A
VS1 — VS3	Solid-state relay	G3PE-545B DC12-24, Omron	45 A
UZ	Voltage frequency driver	VFD037EL43A, Delta	3.7 kW

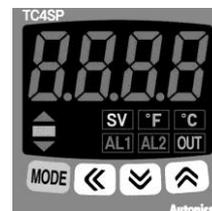
# Annex B1. Temperature regulator settings



PARAMETER	VALUE	DESCRIPTION
IN-T	dPt.H or Pt.R.H	Temperature Sensor Pt100 type or K type
L-SV	190	SV low-limit value
H-SV	240	SV high-limit value
OUT	SSr	Controls output (to SSR)
AL-1	AN I. <input type="checkbox"/> AN <input type="checkbox"/> A	Alarm Operation Mode
AHYS	15	Alarm Output Hysteresis
AL1	-5	Alarm Temperature
P	5,0	Proportional Band
I	10	Integral time setting
d	0	Derivative time setting
LoC	LoC?	Lock settings (all settings, except Operating temperature)

Temperature set point (SV) is 220°C (428°F).

# Annex B2. Safety temperature regulator settings



PARAMETER	VALUE	DESCRIPTION
In-t	TCRH	Temperature Sensor (Thermocouple, type K)
AL1	-20	Alarm temperature
HYS	20	Alarm Output Hysteresis
L-Sv	250	SV low-limit value
H-Sv	400	SV high-limit value
out	RLY	Controls output
Control	onof	Control type ON/OFF
AL-1	AL (0)	Alarm Operation Mode
ALHYS	10	Alarm Output Hysteresis
LoC	LoC3	Lock settings (all settings are locked)

Temperature set point (SV) is 320°C (608°F).

# Annex C. VFD settings



PARAMETER	VALUE	DESCRIPTION
00.03	1	Start-up Display selection Display the actual output frequency (Hxxx)
01.00	60.00	Maximum Output Frequency
01.09	15.0	Acceleration Time
01.10	15.0	Deceleration Time
01.16	4	Auto Acceleration/Deceleration
02.00	3	Source of First Master Frequency Command (RS-485)
02.01	4	Source of First Operation Command (RS-485)
02.04	0	Motor Direction Control
02.07	1	Up/Down Mode (Based of Acceleration/Deceleration time specified)
02.09	0	Source of Second Frequency Command (Digital keypad UP/DOWN keys or Multifunction Inputs UP/DOWN)
02.10	1	Combination of the First and Second Master Frequency Command
02.11	25.00	Keypad Frequency Command (by default)
09.00	1	Communication Address of the VFD
09.01	2	Transmission Speed (19200bps Baud rate)
09.02	3	Transmission Fault Treatment (No warning and keep operating)
09.04	3	Communication Protocol (8,N,2 (Modbus, RTU)

## Annex D1. Chamber optical sensor setup

Enter the testing mode of the machine.



**ATTENTION! SOME COMPONENTS IN THE COMPARTMENT ARE UNDER HIGH VOLTAGE! BE CAREFUL WHILE OPERATING INSIDE!**

Open electric compartment, find the optical amplifier, see Fig.1

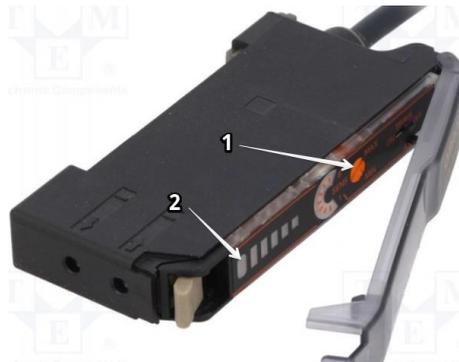


Fig. 1 Optical amplifier: 1 – Operation distance adjusting screw; 2 – Operation indicator

Open the chamber and make sure that the sensor head is clean, use a dry soft cloth if necessary.

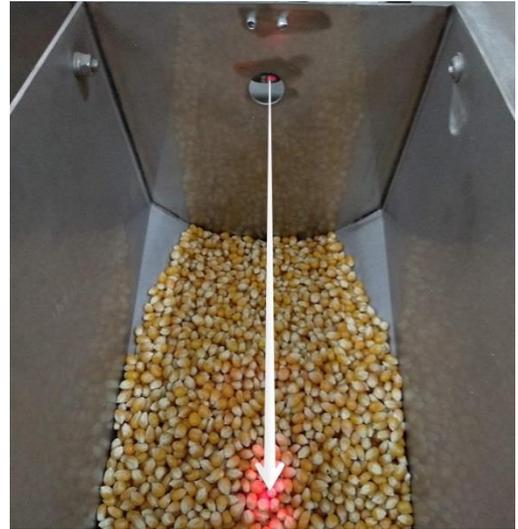
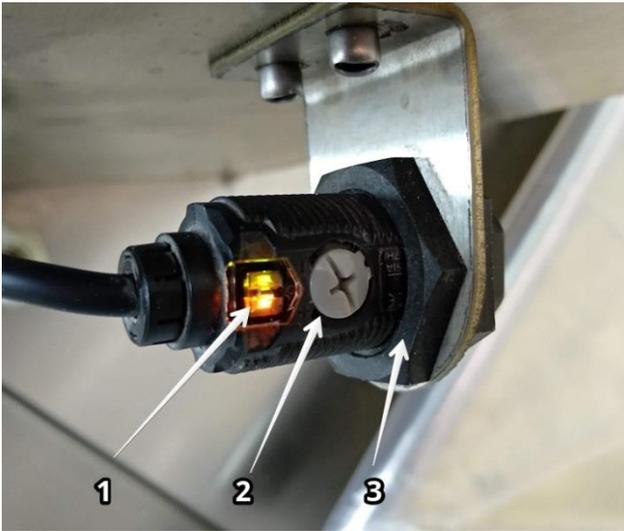
Put a piece of paper or any suitable item inside the chamber, in order to block sensor's sightline in the middle of the chamber, see Fig.2.

Use the adjustment screw on the amplifier to set the operating distance accordingly. Use the operation indicator on the amplifier to see the moment of tripping, see Fig.1.



Fig. 2 Paper screen

## Annex D2. Corn hopper sensor setup



Operating distance of each sensor can be adjusted with adjustment screw 2 (coarse tuning), and locking nut 3 (fine tuning). Use operating indicator to see the current status of the sensor.

## Annex E. Chamber clogging

If chamber is clogged, and/or smoke is coming out from the machine, DO THE FOLLOWING:

1. Press EMERGENCY STOP button.
2. Disconnect the plug from the mains.
3. Wait until machine is cooled down.



DO NOT OPEN THE CHAMBER DOOR! DO NOT USE FIRE EXTINGUISHER!

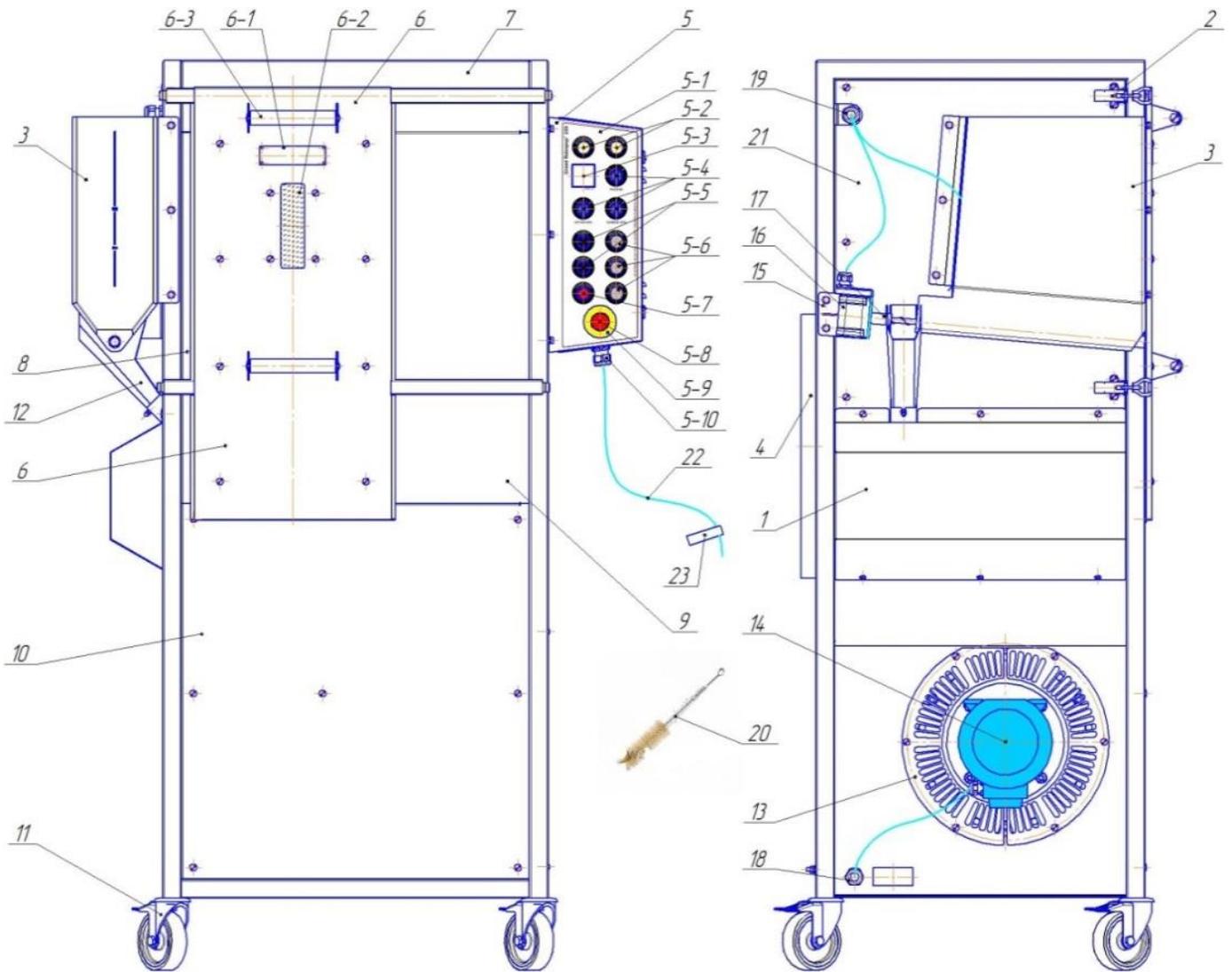
**POPPER IS MADE OF STEEL AND CHAMBER IS SEALED; EVEN IF POPCORN BEGINS TO SMOLDER, IT WON'T GET A FIRE WITHOUT EXTRA AIR!**

4. Cooling down will take not less than 2 hours.
5. Carefully open the chamber and proceed to cleaning.
6. If corn supply tube is clogged with popcorn, use some flexible item, like a piece of thick rubber hose, to remove clogging.



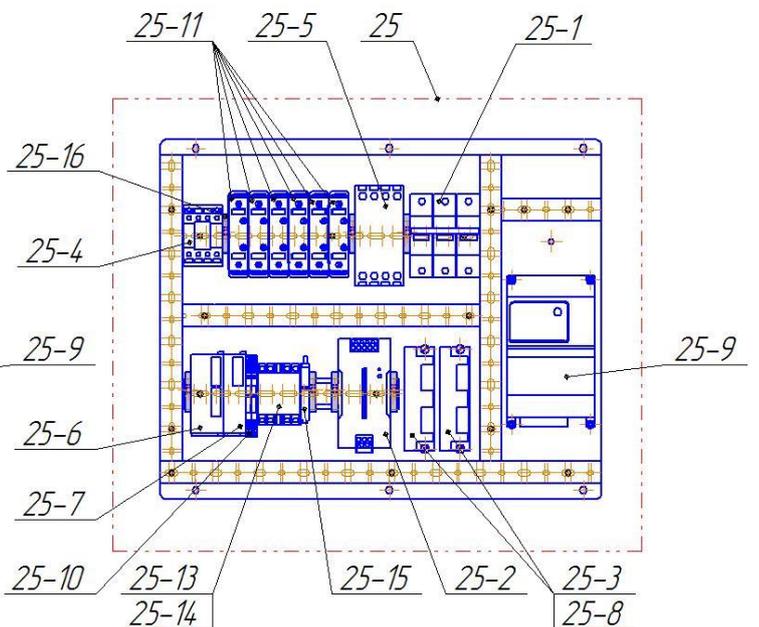
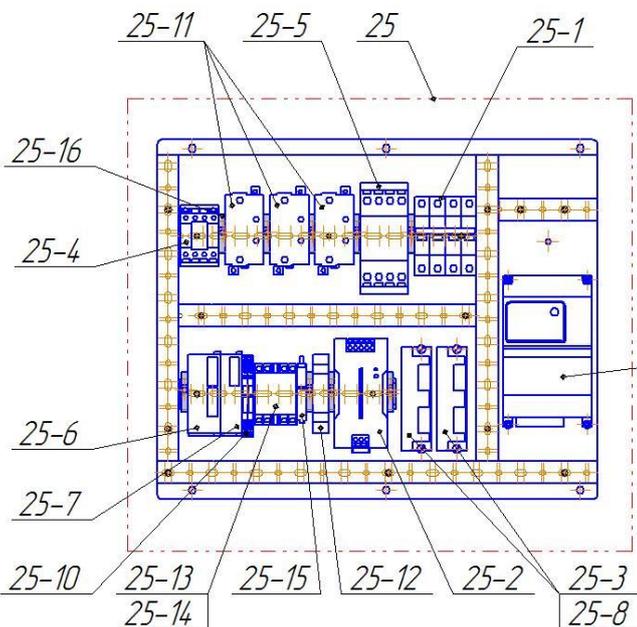
CHAMBER CLOGGING CAUSED BY UNSKILLED ACTIONS OF OPERATING PERSONNEL IS NOT THE WARRANTY CASE!

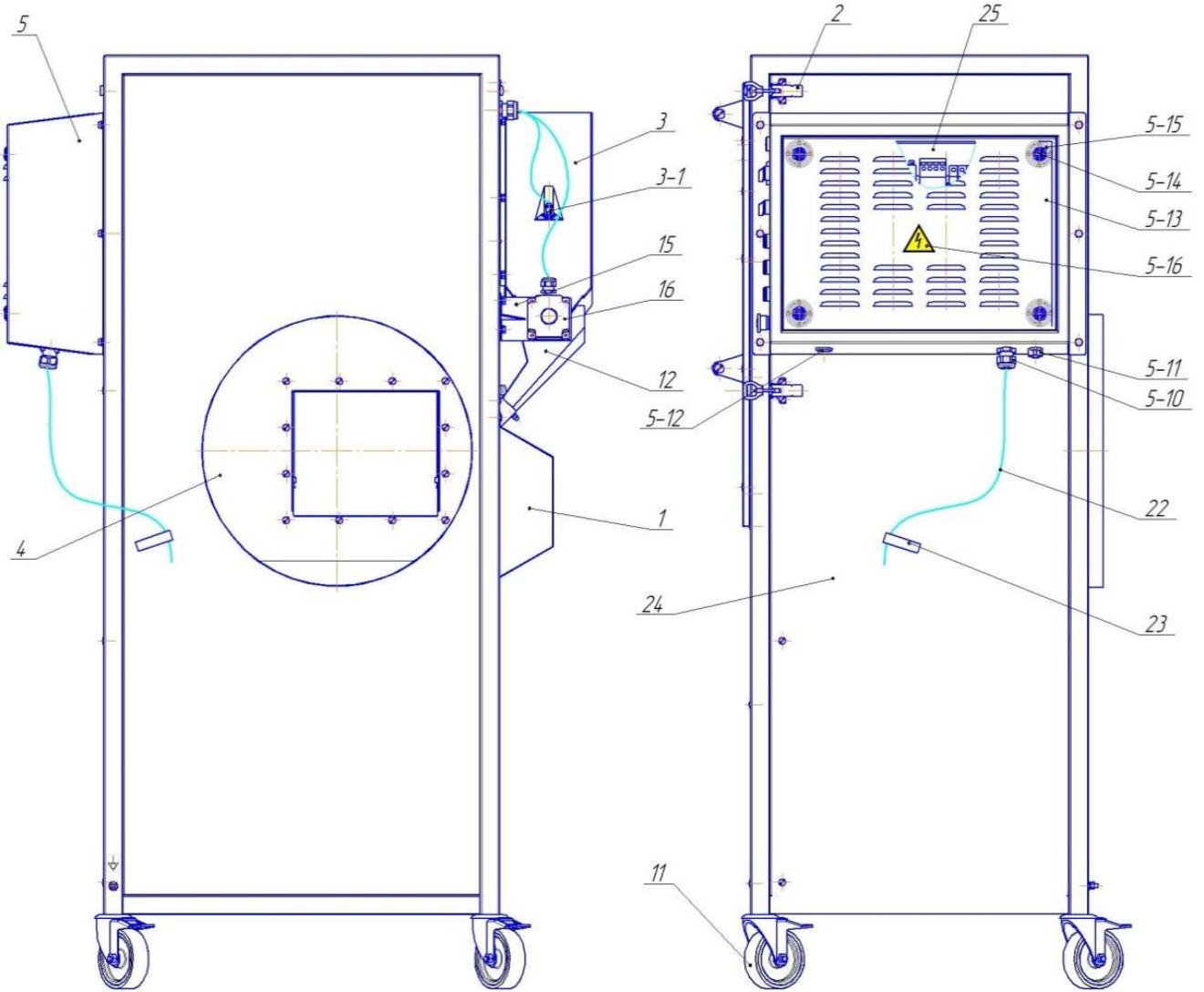
# Annex F. Parts list

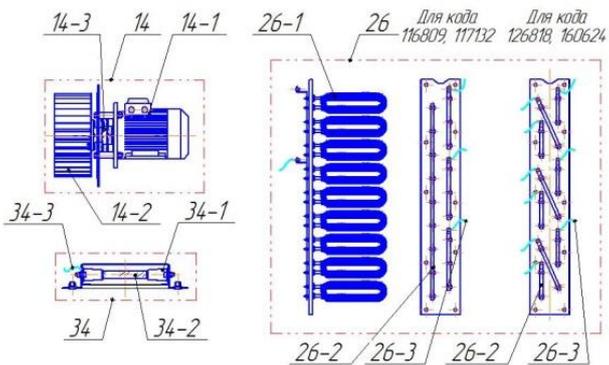
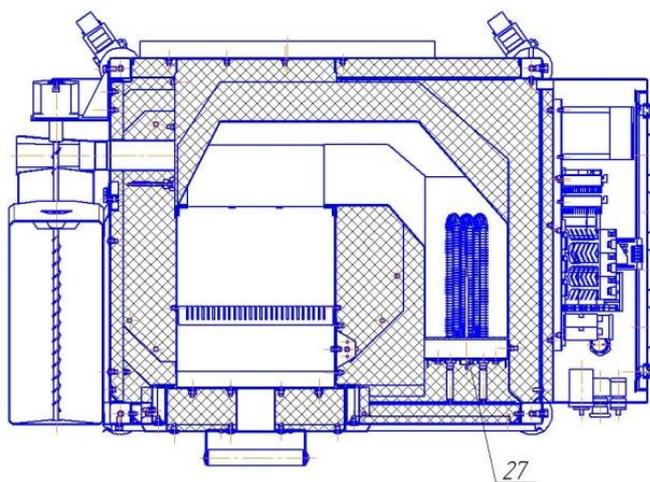
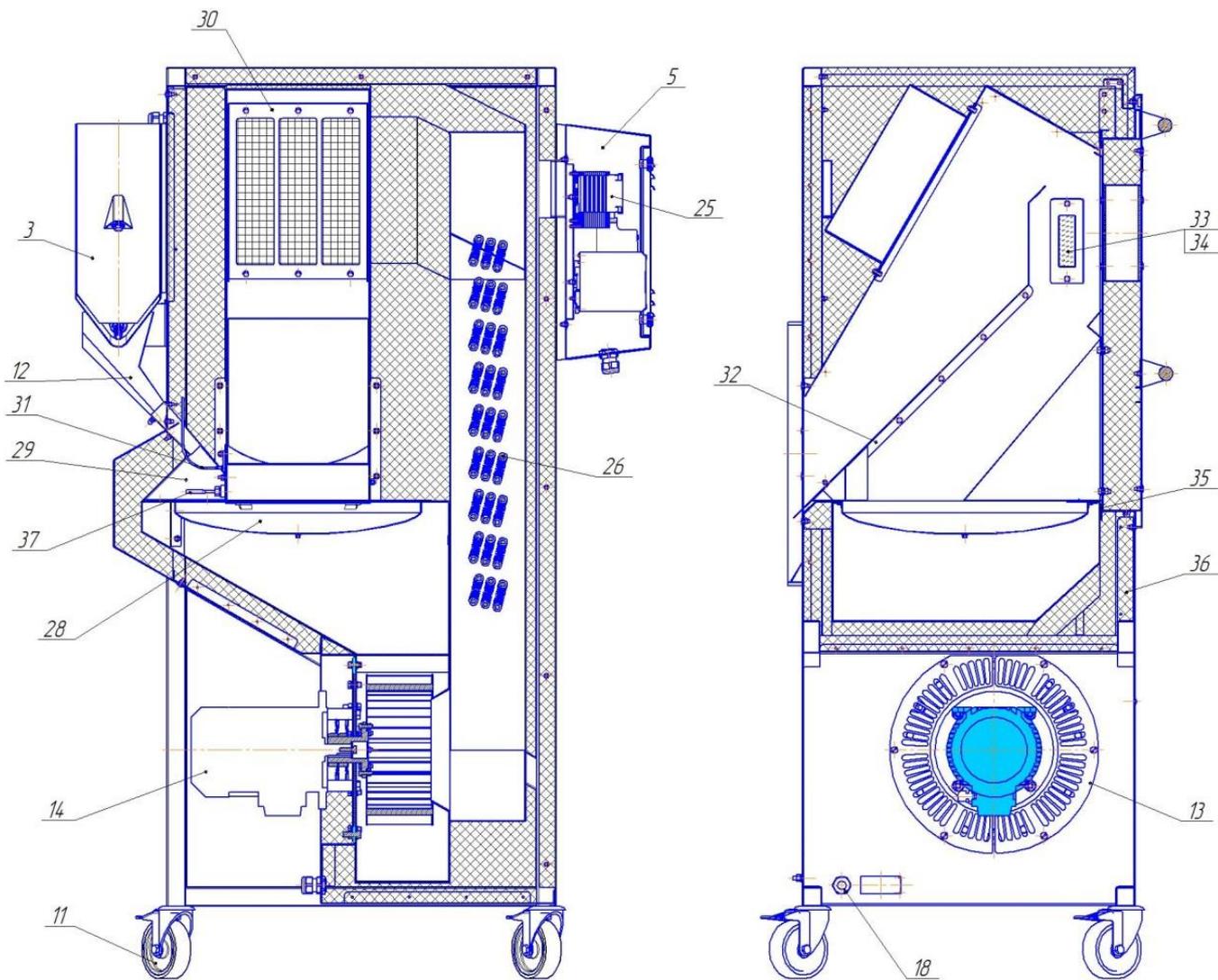


Для кода 116809, 117132

Для кода 126818, 160624







ITEM#	ARTICLE#	PART	MODEL
1	23095	Side cover	TM 1698.01.00.001
2	21477	Latch assembled	TM 2677.09.00.000
3	23096	Corn hopper	TM 1698.01.01.000
3-1	3856	Optical sensor	E3F1-DP12 2M
4	23097	Flange	TM 1698.01.08.000
5	23098	Control unit assy (EU version)	TM 1698.01.05.000
5	23139	Control unit assy (US version)	TM 1698.01.05.000-02
5-1	12543	Control panel sticker	-
5-2	3824	Light cap yellow	S224S7
	14297	LED lamp	BA9S 24B EKF Proxima
5-3	11446	Temperature controller	TCN4S-24R
5-4	16120	Switch 3-pos	B101S30
5-5	3623	Push button non-latching black	B100DH
	3844	Contact block	B1
5-6	22052	Light cap white	S224B7
	14297	LED lamp	BA9S 24B EKF Proxima
5-7	3827	Push button non-latching red	B100DK
5-8	3869	Emergency stop button	B200E40
5-9	4016	STOP nameplate	BET60A
5-10	22046	Cable gland metal	PG29
5-11	3932	Socket	C016 30G006 100 12
5-12	11613	Buzzer	SC235B
5-13	23099	Control unit door	TM 1698.01.05.200
5-14	3819	Door lock	KY05.1.2
5-15	14960	Door lock sticker (4 pcs set)	-
5-16	1818	Bolt sticker	-
6	23100	Chamber door assy	TM 1698.01.02.000
6-1	-	Caution plate	-
6-2	23101	Glass unit	TM 1698.01.02.200
6-3	23102	Handle	TM 1698.01.02.001
7	23103	Upper panel	TM 1698.01.12.000
8	23104	Middle left panel	TM 1698.01.09.000
9	23105	Middle right panel (EU version)	TM 1698.01.10.000
9	23106	Middle right panel (US version)	TM 1698.01.10.000-01
10	23107	Lower panel	TM 1698.01.11.000
11	3568	Swivel caster lockable 125 mm	3300-PUR-125-F18
12	23109	Corn loading funnel	TM 1698.01.17.000
13	23108	Protective grid (2 pcs set)	TM 1698.01.00.003
14	23110	AC motor assembled with blower	TM 1698.01.14.000
14-1	16444	AC motor	AIP80B2 IM3081
14-2	23111	Blower with flange	TM 1698.01.14.100

14-3	23112	Cooling impeller	TM 1698.01.14.200
15	23113	Motor bracket	TM 1698.01.03.000
16	13832	Stepper motor	FL86STH65-2808A
17	21093	Auger	TM 1698.01.04.000
18	13446	Cable gland	PG13,5
19	22315	Cable gland	PG16
20	20744	Cleaning brush	-
21	23114	Rear panel	TM 1698.01.06.000
22	21103	Power cord (4m) (EU version)	KГH 5x10
22	21588	Power cord (4m) (US version)	KГH 4x10
23	13592	Power cord sticker (EU version)	
23	13592	Power cord sticker (US version)	
24	23115	Front panel	TM 1698.01.07.000
25	23116	Mounting panel with components (EU version)	TM 1698.01.05.300
25	23117	Mounting panel with components (US version)	TM 1698.01.05.300-02
25-1	12478	Circuit breaker (EU version)	S204-C50
25-1	15786	Circuit breaker (US version)	S803C-C80
25-2	13451	Power supply unit (240 W, 24 Vdc output)	S8VK-C24024
25-3	13715	Stepper driver	DM556
25-4	14681	Contactora (25 A)	LC1D25M7
25-5	14897	Contactora 40 A (EU version)	LC1D40M7
25-5	22967	Contactora 65 A (US version)	DILM65
25-6	13765	PLC	DVP12SA211T
25-7	14895	I/O extension unit	DVP16SP11T
25-8	2786	Resistor (2 W, 5%, 2kOhm)	C2-23
25-9	16432	VFD unit	VFD022EL21A
25-10	12647	Electromechanical relay	G2RV-SR700 24VAC/DC
25-11	13682	Solid-state relay (EU version)	G3PE-545B
25-11	14641	Solid-state relay (US version)	SAL963460
25-12	14429	Voltage control relay (EU version only)	RM17UBE15
25-13	16118	Temperature regulator	TC4SP-14R
25-14	11445	Socket 11 pin	PS-11
25-15	12798	Digital amplifier	E3X-NA41
25-16	21721	DIN-rail clamp	EW1
26	23118	Heating assembly (EU version)	TM 1698.01.13.000
26	23141	Heating assembly (US version)	TM 1698.01.13.000-01
26-1	3925	Heater finned (2500 W, 230 V)	1GIK8BL33001
26-2	23119	Copper bus set (EU version)	4 pcs set
26-2	23120	Copper bus set (US version)	9 pcs set
26-3	23121	Heat resistant wire set (EU version)	3 pcs set
26-3	23122	Heat resistant wire set (US version)	9 pcs set
27	21469	Temperature sensor	ДТПК 054-00.120/2
28	23123	Bowl	TM 1698.01.16.000

29	23124	Corn supply tube	TM 1698.01.19.000
30	23125	Chamber mesh screen	TM 1698.01.20.000
31	12888	Heat-resistant optical head	E32-D61
32	23126	Chute	TM 1698.01.15.000
33	23127	Backlight glass unit assy	TM 1698.01.22.100
34	23128	Backlight assy (without glass)	TM 1698.01.22.000
34-1	2760	Ceramic lamp socket	R7s 211
34-2	13454	Halogen light bulb 64684 ECO	48 W 78mm 230 V R7s
34-3	23129	Heat-resistant wire set (lamp)	-
35	23130	Silicone gasket white	TM 1698.01.23.400
36	13860	Thermal insulation mat 38 mm thick (1 roll)	Avantex 1260 (1300) - 128
37	13496	Temperature sensor (TC type K)	ДТПК 124-00.10/2,5
	23131	PLC-VFD interconnection cable	