# Information about the technology of seamless encapsulation and user guide of "Capsulator"

2019

# Training plan

## Day 1

1. Acquaintance with specialists — execution ☐
2. The demonstration of capsulator in use — execution ☐
3. Detailed inspection of capsulator with the explanation of its structure and purpose of components and parts — execution ☐
4. Dismantling of capsulator for cleaning with comments — execution ☐
5. The conversation on the topic of materials preparation, the characteristics of production of gelatine capsules in capsulator, Discussion about the technology of preparation of gelatin — execution ☐

## Day 2 (morning)

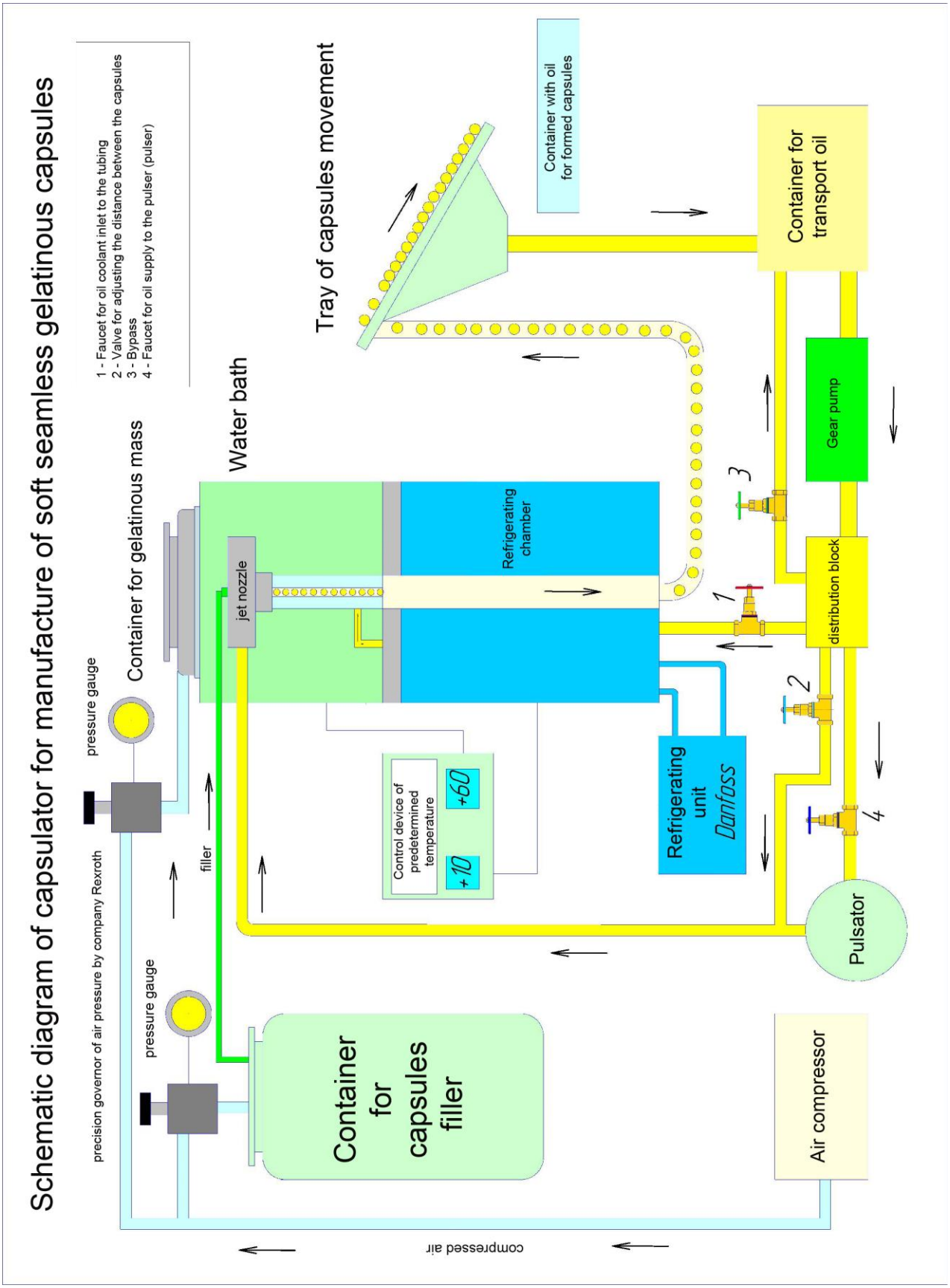
1. Discussion about arising issues — execution ☐
2. Implementation the startup of capsulator by the client and training the settings. Theory and practice with video recording — execution ☐
3. Startup and stopping by the client without assistance. With the checking by our specialist. Testing by questions. — execution ☐

Break.

## Day 2 (evening)

1. Discussion of the theory. Repetition and consolidation the skills Up-to-date of theory. — execution ☐
2. Disassembly and cleaning of capsulator with explanations of followed procedure of assembly and adjustment. — execution ☐

## Schematic diagram of capsulator



## Characteristics of production unit

The device of capsulator consists of the following main parts and components:

1. Completely sealed enclosure for isolation from environment
2. The pump for transport vegetable oil
3. Pulsator - creates pulsations of oil
4. The system of hoses and valves
5. The refrigeration unit and the refrigerating chamber - provide cooling of transport oil in the system of capsulator
6. Tank with heating elements is used to heat gelatinous mass
7. The head block of formation capsules
8. Electronic units of temperature control and stabilization of temperature in refrigerator and tank for heating gelatinous mass
9. Pressure air supply system
10. Panel and control unit

### Specifications of capsulator.

Capsules Diameter mm.....3-15

Frequency of pulsations, pulse\s.....1,2,3,4,5

Temperature of membranes, C °.....60-70

Temperature of filler.....12-40

Filling of capsules, gr.....0,05-0,4

The oil pressure in pulsator, kg\cm.....0.5-1.5

Electrical parameters of the installation

Voltage, Watt.....220

Overall dimensions, 700x600x2000 mm

Weight 150 kg, 220 kg with packing.

Installation is powered from AC, 220 volts. Productivity of capsulator is up to 15,000 capsules per hour. The production cycle from the beginning of encapsulation up to packaging is 2-3 days. Production area, numbering 5 people is able to produce 1.5 million capsules per month.

Manufacturing of soft gelatinous capsules based on physical properties of gelatinous mass. Formation of capsules is going at the outlet of the head of capsulator in which under pressure is fed filler and gelatinous mass.

Under the influence of pulsating oil in the head the jet is dividing and out of surface tension of gelatinous mass separated part smoothly takes a spherical shape. Shaped capsule gradually hardens under a gentle stream of chilled vegetable oil. After forming the capsules come by pipeline to pan with oil located on the shelf of capsulator. Consumption of filler and gelatinous mass is regulated. This produces capsules with weight of filler from 0.05 to 0.4 grams. The pulsation frequency of oil in the head is equal to quantity formed Capsules and during the production cycle is stable, but depending on the weight of the filler can be varied from 60 to 250 Capsules per minute.

Premises is equipped with device for preparation of gelatinous mass, tanks for solution of filler, electronic scales.

The device for preparation of gelatinous mass is equipped with a stirrer and a container with water in which it automatically supported set temperature. The solution of filler is prepared according to technological instructions. Prepared gelatinous mass and filler in required quantities were weighed and poured into tanks of capsulator. After switching of capsulator transport oil cools in the system. Achievement of the state "mode" takes about 10 minutes. During this time, the operator of capsulator adjusts Capsules formation and their necessary dosage.

In process of filling the trays are changing, moving to the lower shelves of capsulator. Premises for wringing capsules from vegetable oil equipped with a centrifuge to wring and sink to wash the trays from vegetable oil. When small amounts of productions there is manual method extraction, excluding a centrifuge for wringing. After wringing the capsules is transmitted to the drying section. Drying room of soft gelatin capsules equipped with air-conditioner dryer and shelves on which placed trays with damp capsules after wringing.

When properly observance modes of temperature and humidity capsules dry in 24 hours. Dried capsules poured into containers from trays and transferred for washing with

isopropyl alcohol. Premises for washing capsules equipped with capacity for isopropyl alcohol and centrifuge to wash dried capsules of vegetable oil residues. The presence of exhaust ventilation required. Capsules are poured into centrifuge drum in which from the container through the valve is fed isopropyl alcohol by scattered jet.
When small amounts of productions there is manual washing method excluding a centrifuge.

## Requirements for premises and accessories in gelatin encapsulation technology.

### Item 1 | GELATIN PREPARATION

In practical use of the encapsulation lines for preparation of gelatin mass engaged one person. Time of preparation gelatine - 1 to 1.5 hours. At the beginning of every shift (the morning of each working day) gelatin mass is prepared at the rate of 7 liters of finished weight for 7 hours of operation.

Equipment for preparation of gelatine.

Gelatin is prepared in a steam bath temperature + 60°. It can be any dishware adapted for this purpose. The purpose – to mix gelatin on a steam bath at 60° until it's complete swelling.

### Item 2 | PREPARATION THE SUBSTANCE

In any suitable container mix capsule filler substance.

### Item 3 | CAPSULATING

Requirements for premises - maintenance constant temperature in the range of + 15 to + 25 degrees. For this purpose required any good air conditioner with moist separator.
Into the system of capsulator poured oil. Usually nutritional (for transporting the capsules in the system). Practically use olive or sunflower oil. At high humidity oil absorbs water, becomes cloudy and not suitable for use in capsulator.
Further in this premise goes encapsulation. Prepared capsules appear in special receiving trays with oil.
Requires several trays with height of 50 mm, overall dimensions - in accordance with the performance.
400 mm x 400 mm. Made from food stainless steel. Capsules at rate of 5 pieces per second falling into the pan with oil. As soon as the pan is filled sufficiently, it is placed into premise called "cooler". Requirements for the "cooler" - the constant temperature of 10 degrees.

It can be both a specially equipped room, and ordinary refrigerators. All pans with capsules produced per shift, must be placed in these refrigerators.
In the "refrigerator" capsules cools (because the operating temperature of gelatin in capsulator + 60 degrees).
There is a process - CONSOLIDATION of gelatin.
Period necessary for fixing capsules is 1 day. When planning necessary to consider that next day you would have consolidate new capsules in others "refrigerators".

### **Item 4 |** Preliminary separation capsules from oil.

Our capsules are "consolidated" in oil at temperature + 10 degrees, the next day it comes time to drain the oil. For this purpose any centrifuge is suitable, as an option - washer with vertical charging and wringing.
Obligatory condition for choosing a washing machine with centrifuge - stainless steel drum, and diameter of the holes within the drum do not exceed the diameter of capsules. For wringing is enough to buy only one washing machine. Fill in the drum, activate wring and in 4 to 7 seconds the batch of capsules will wringed.

### **Item 5 | DRYING OF CAPSULES**

Immediately after wringing of oil capsules laid out on large pans for drying. These pans should not have high walls, but must contain our gelatinous capsules as freely as possible. Capsules when drying should not touch each other and do not lie one on another.
Room for drying is also with air conditioning. The temperature is from + 20 to + 28 degrees, the humidity level to 50%.
Require appropriate air-conditioner (the third one).
Requires special racks for pans. The drying process should be streaming: in one corner - a rack with the first batch, in the other - with fresh one etc. The drying time is 1 day. Required special paper for bedding between the capsule and the pan. The requirement to paper - good absorbability of oil residues that remain after wringing in centrifuge.

### **Item 6 | WASHING CAPSULES in ALCOHOL**

In manufacture is unacceptable residue of oil on capsules. After drying, all of the capsules should be washed in small quantities at same centrifuge, but with isopropyl alcohol. Into receiving drum put 50% of capsules and pour ove with isopropyl alcohol, than activate centrifuge and wring out alcohol, part of alcohol evaporates, the other part is discharged into the bowels of a washing machine for reuse. Washed with alcohol capsules is removed from the washing machine, the alcohol evaporates quickly. The peculiarity of application isopropyl alcohol is that it does not leave any residue after evaporation (color,

smell, taste)and it's completely harmless. This alcohol is not for human consumption but dissolves oil very good. Over time alcohol becomes saturated with residues of oil, and it will be necessary to utilize it and use fresh in the washing machine.

### Requirements to premises for capsules washing.

Indoor temperature with no airconditioning. Air vent and using of safe electrical systems.

## Item 7 | CALIBRATION of PREPARED CAPSULES

Calibration is used only to follow the GOST. The capsules are passed through any sieve, first to use a sieve with less than the required diameter of the window, eliminating small spoilage, then use a sieve with larger windows. Calibration of capsules up to 2,000,000 units per month is in manual mode. At very partial requirements to the quality, all of the capsules can still be visually monitored by the operator. Each capsule is viewed on a special glass table with lighting. Viewing identifies faulty, not filled with the substance capsules.

## Item 8 | STORAGE of PREPARED GELATIN CAPSULES

It is recommended to store capsules in sealed containers at room temperature in a dark place. To avoid clumping and distortion, capsules should be stored in packaged form. After calibration or after drying capsules should be packed into the package.
Storage life of gelatinous capsules up to 2 years.
In the process is possible getting into the system of capsulator portions of a substance that nourishes the oil and dilutes it. When carrying out maintenance work required to conduct the replacement of transport oil for new one time in a week.

As can be seen, especially devices that need to buy not much. All the devices are household products, and their quantity and cost depends on your budget. The most technologically sophisticated device stays capsulator.

# Technological instruction for the production of soft gelatinous capsules.

## INTRODUCTION.

Seamless soft gelatin capsules manufactured on a plant with the name capsulator. Installation is powered from AC, 220 V or 380 V. Productivity of capsulator is up to 11,100 capsules per hour. Apparatus of capsulator consists of the following main components and parts:

1. AC drive motor
2. Reducing device for the oil pump and the pulser
3. Pump of transport vegetable oil
4. Pulsator, creating pulsations of oil
5. The system of hoses and valves
6. The refrigeration unit and the refrigerating chamber - provide cooling for the transport of oil in the system of capsulator
7. Tank with heating element used to heat the gelatin mass
8. The block heads provides for the formation of capsules
9. The electronic unit of temperature control and temperature stabilization in the refrigerator and tank for heating gelatinous mass
10. Pressure air supply system
11. The panel and the control unit

Manufacturing of soft gelatinous capsules based on physical properties of gelatinous mass. Formation of capsules is going at the outlet of the head of capsulator in which under pressure is fed filler and gelatinous mass, heated to temperature +60 ... +70°C**.** The jet nozzle of capsules forming is designed so that the filler is supplied by inner stream and gelatinous vass – by outer stream. Under the influence of pulsating oil in the head the jet is dividing and out of surface tension of gelatinous mass separated part smoothly takes a spherical shape. Shaped capsule gradually hardens under a gentle stream of chilled vegetable oil with the temperature +10 ... +12°C. Consumption of filler and gelatinous mass is regulated. This produces capsules with weight of filler from 0,05 to 0,3 grams. The pulsation frequency of oil in the head is equal to quantity formed Capsules and during the production cycle is stable.

In production of soft gelatinous capsules at medical enterprises most widely used as filler such preparations as:

| Preparation | Filler |
|---|---|
| Vit A 5000 ME | 0,05 gr |
| Vit A 33000 ME | 0,15 gr |
| Validol | 0,1 gr |
| Vit E 50% dissolved in oil | 0,2 gr |
| AEvit | 0,2 gr |
| Nitroglycerine | 0,2 gr |
| Vitoil (fish oil) | 0,3 gr |

## Production premises & Description of the process in production of soft gelatinous capsules

1. Section for preparation substance (filler) and gelatinous mass.

Premises is equipped with device for preparation of gelatinous mass, tanks for solution of filler, electronic scales. The device for preparation of gelatinous mass is equipped with a stirrer and a container with water in which it automatically supported set temperature. First of all is preparing solution of glycerin with nipagin. Glycerin gives elasticity to capsules, and nipagin serves as a preservative. Glycerin is heated in device to +70 ° C and with running stirrer was added nipagin. On 10.0 pounds of glycerin was added 141.0 grams of nipagin. The solution was stirred until complete dissolution about 1.5 - 2 hours.

For preparation 10.0 kilograms of of gelatinous mass necessary:
The purified water - 6,7 kg
Glycerin & Nipagin - 0,8 kg
Gelatine - 2,5 kg

Depending on the quality of gelatin proportions can be changed.
Required quantity of purified water is poured into the container. Water is heated to +60°C in the device for preparation of gelatinous mass, then poured glycerin with nipagin and covered with gelatine. The gelatinous mass is stirred for 1.5 hours until complete dissolution, and then settles with off stirrer about 0.5 - 1.5 hours. After that, gelatinous mass is filtered through a nylon sieve and it's viscosity is measured by viscometer. The viscosity of gelatinous mass should be within 55 - 75 seconds. If the reading is not correct, is recalculated ratios of water and gelatin. The solution of filler is prepared according to

technological instructions. Prepared gelatinous mass and filler in required quantities were weighed and poured into tanks of capsulator.

### 2. Section of encapsulation

Section of encapsulationon on which is situated capsulator, equipped with air conditioning. The air temperature at the section must be within +18 ... +22 ° C, relative humidity of 55-75%. When working on capsulator with leaking body temperature increases at the section above 23°C. In the process of encapsulation it leads to a drastic turbidity of transport vegetable oil as a result of condensation on cold hosts of capsulator. The largest accumulation of condensate occurs on the tray for outgoing capsules from the refrigeration chamber of capsulator. This is especially detected during summer. After switching on capsulator transport oil in the system is cooling down to +10 ... +12°C for 30-40 minutes. Into the pan for capsules is poured about 2 liters of vegetable oil. Achievement of the state "mode" takes about 10 minutes. During this time, the operator of capsulator adjusts Capsules formation and their necessary dosage. In process of filling the trays are changing, moving to refrigerating chamber. In the process of encapsulation, to control the dosage, every 10 - 15 minutes the doser weighs capsules on electronic scales. It is desirable for accuracy of the weighing 10 capsules. The capsules are washed out under local exhaust ventilation in a cup with ether and weigh their total weight. Then, the filler removed from capsules shell washed in a cup with ether and weighed on electronic scales. By the difference between total weight and the weight of capsules gelatinous membranes is calculated the weight of filler. Depending on the controlled weight of capsules, the capsulator's operator can change the weight of the filler or gelatin shell in the process of encapsulation. After encapsulation pans with capsules is placed into the refrigerating chamber.

### 3. Refrigerating chamber

Refrigerating chamber is equipped with air conditioner. The air temperature in the chamber within +5 .. +10 ° C, relative humidity 55-75%. Premise is equipped with shelves, on which place pans full of capsules in the process of encapsulation. Capsules in pans settled for 24 hours and then transferred to wringing section.

### 4. Section for capsules wringing

Premises for wringing capsules from vegetable oil equipped with a centrifuge to wring and sink to wash the trays from vegetable oil. After wringing the capsules is transmitted to the drying section.

### 5. Drying section of soft gelatine capsules

Drying section of soft gelatin capsules equipped with air conditioner and dryer. The room temperature during the drying process varies from +20 to +30°C. Premise is equipped with shelves, on which places pans with damp capsules after wringing. Each pan is previously covered with parchment paper for preventing the adhesion of capsules. Wet capsules arranged in a single layer on pans in order to prevent adhesion. During the drying process capsules carefully stirred every hour. When properly observance modes of temperature and humidity capsules dry in 24 hours. Dried capsules poured into containers from trays and transferred for washing with isopropyl alcohol.

### 6. Section of washing capsules with isopropyl alcohol.

Premises for washing capsules equipped with capacity for isopropyl alcohol and centrifuge to wash dried capsules of vegetable oil residues. The presence of exhaust ventilation required. Capsules are poured into centrifuge drum in which from the container through the valve is fed isopropyl alcohol by scattered jet. Washing goes in 30 seconds. 80 kg of capsules was washed with 15 liters of isopropyl alcohol. After washing, the capsule in containers is transferred for viewing and calibration.

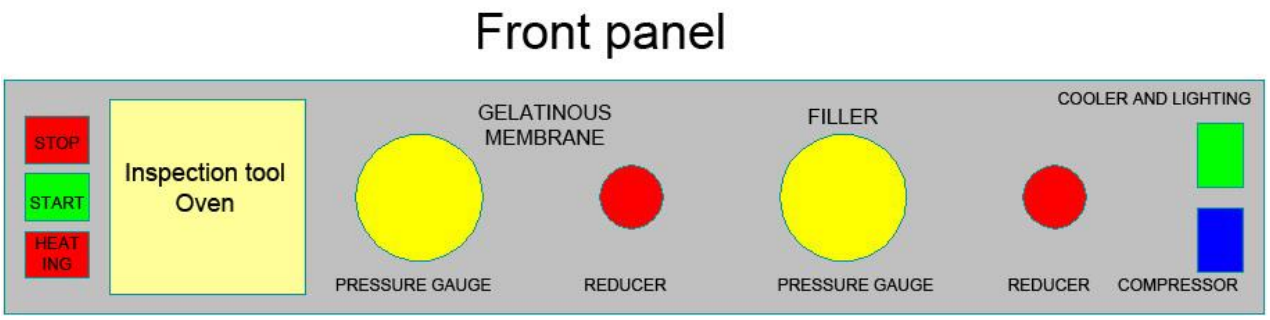
### 7. Section of calibration and viewing

Section of calibration and viewing of soft gelatin capsules equipped with viewing table and lighting. After washing, the capsules is calibrated by the sieve with holes of certain diameter. This is necessary to reject capsules with deviations from the mean weight. Then capsules viewed on tables with lighting. Capsules should be circular shape without streaks do not have mechanical injuries and air bubbles. After viewing capsules in containers pass to packing section.

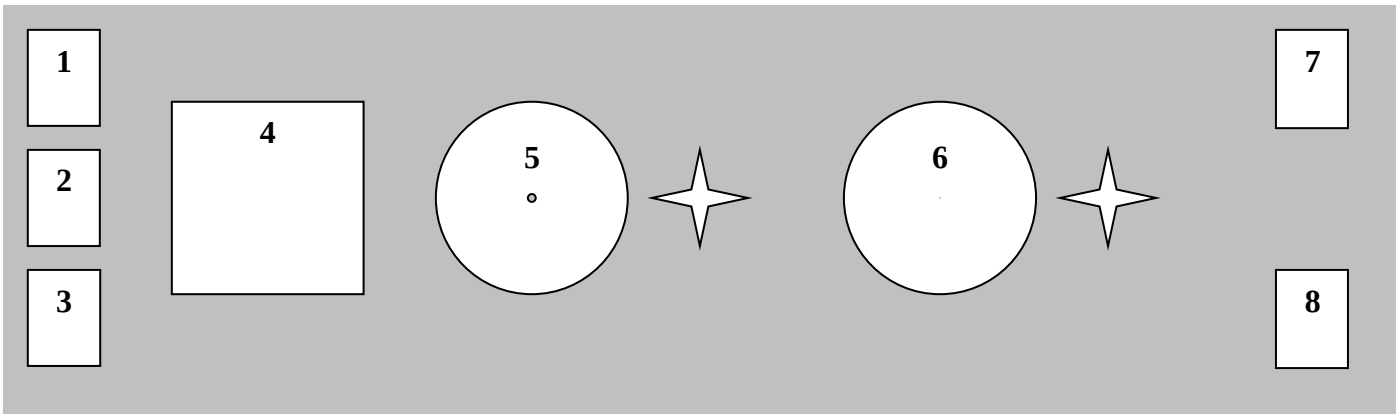
Capsules Packing is carried out in blisters or in glass or plastic jars with lids

All rooms shall have general ventilation with air cleaning.

## Launching of capsulator.




### Diagram of the top panel of capsulator




**Button 1** on and off heating of gelatin

**Button 2** on and off electric motor of pump for transport oil

**Button 3** on and off the compressor for transport oil cooling

**Button 4** Measurer and temperature controller

**Button 5** Pressure gauge of gelatinous membrane

**Button 6** Pressure gauge of filler

**Button 7** on and off the ventilator of refrigerator (only at work)

**Button 8** on and off the compressor of refrigerating chamber

## The startup order of capsulator

- Open the control panel and turn on the toggle switch
- Turn on the button [transport oil], switching on the motor transport oil pump and pulser
- Turn on the button [cooling transport oil], switching on the compressor of lower refrigerating chamber providing cooling of transport oil to temperature +10 ... +12°C**.**
- Check the transport oil level in the tank of refrigeration chamber. Cooling coil must be completely covered with transport oil
- Unscrew the screw cover and check the water level in the water bath. The tube for feeding gelatin mass in the head should be fully immersed in water.
- Turn on the button [heating of gelatin shell], switching on heating element in water bath. During operation temperature is kept automatically. Depending on the viscosity of gelatinous mass temperature should be in the range +55 ... +75°C
- **Since the sensor temperature control is located in the upper part of the housing, you can not switch on heating without tank with gelatinous mass. This leads to boiling of the water!**
- Turn on the buttons [cooling of the upper chamber] and [ventilator]

The gelatinous mass in the tank is usually warmed up in an hour. During the warming up it is necessary to periodically stirring it. Transport oil is cooled for 30-40 minutes, and in the process of encapsulation is automatically maintained within +10 ... +12°C**.** Overtemperature influences on formation of capsules.

- Hermetically sealed containers with a gelatinous mass and filler
- Screw the supply tube of gelatinous mass
- Unscrew the top regulating head and rinse thoroughly under running hot water.

Especially pay attention to cleanliness of the lower "nozzle". It should not remain dried gelatin. Do not wipe the top regulating head after washing, and screw her soaked with water. This will prevent sticking of gelatine to regulatory head while screwing. Disassembly brass encapsulating heads for cleaning should be done once weekly. Not washed encapsulating heads negatively influence on formation of capsules. Especially necessary to pay attention on cleanliness of outlet holes of gelatinous mass in bronze head. When washing, use plastic brushes. Do not clean the hole with metal objects. When assembling brass head, pay attention to availability of food rubber gaskets and location the inner holes for feeding pulsating transport oil.

After the gelatinous mass warmed up to the set temperature and transport oil is cooled it's allowed to start preparations process of encapsulation.

- Put the pan with oil under the tray for out of capsules.

In the process of encapsulating capsules in the pan with oil use to be stirred with a plastic spoon.

- Open the compressed air by valve on the back of the capsulator.

The air pressure in the tank with gelatinous mass should be 0.2 - 0.25 kgf/cm² (increased pressure leads to uneven gelatinous shell when forming capsules). The filler pressure 0.2 - 0.4 kg/cm². For more denser filler (Aevitum) and depending on hose length, the pressure may be up to 1 kgf/cm². Before encapsulation, you must remove air from the hoses of filling gelatinous mass and filler, from encapsulating head and hose system of transport oil.

## Order of actions:

- Open the valve № 2 (adjustment of capsules movement)
- Close the valve № 3 (the oil pressure in the system of capsulator)
- Close the valve № 1 (oil supply from refrigeration chamber)
- Close the valve № 4 (pulsating oil supply)

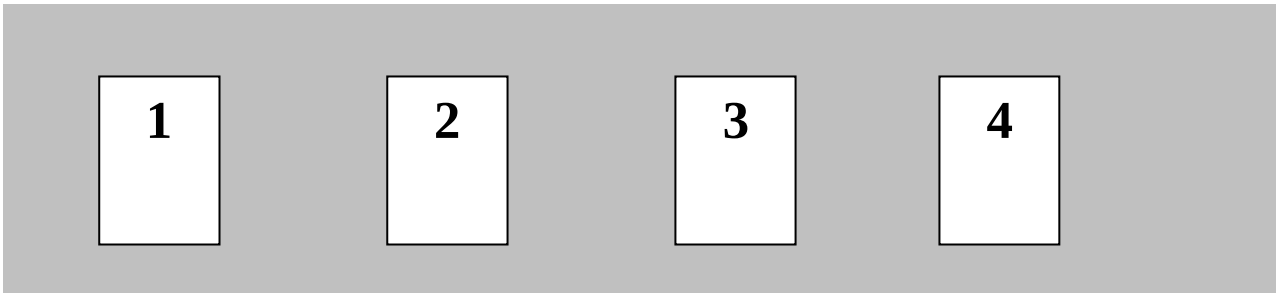
If the level transport oil rises quickly, slightly open the valve № 3

During this process, watch over the oil level in the glass of bottom head to prevent the overflow of transport oil.

- Open counterclockwise by 360 º, then close clockwise the upper regulating head of gelatinous membrane to remove air. Repeat these steps several times until the complete removal of air from the head. Leave the head in a slightly open position, so that the gelatin can flow a thin stream.
- Remove the clamp from the filler hose to remove the air from it. After removing the air put the clamp on the hose.

Only after removal air from supply system you can begin the process of encapsulation.

Scheme of purpose valves in the refrigerating chamber




**Valve 1** Feed the cooled transport oil to the head of capsulator

**Valve 2** Adjustment the speed of Capsules movement (oust air from the transport oil)

**Valve 3** Setting the level of oil in glass of the bottom head

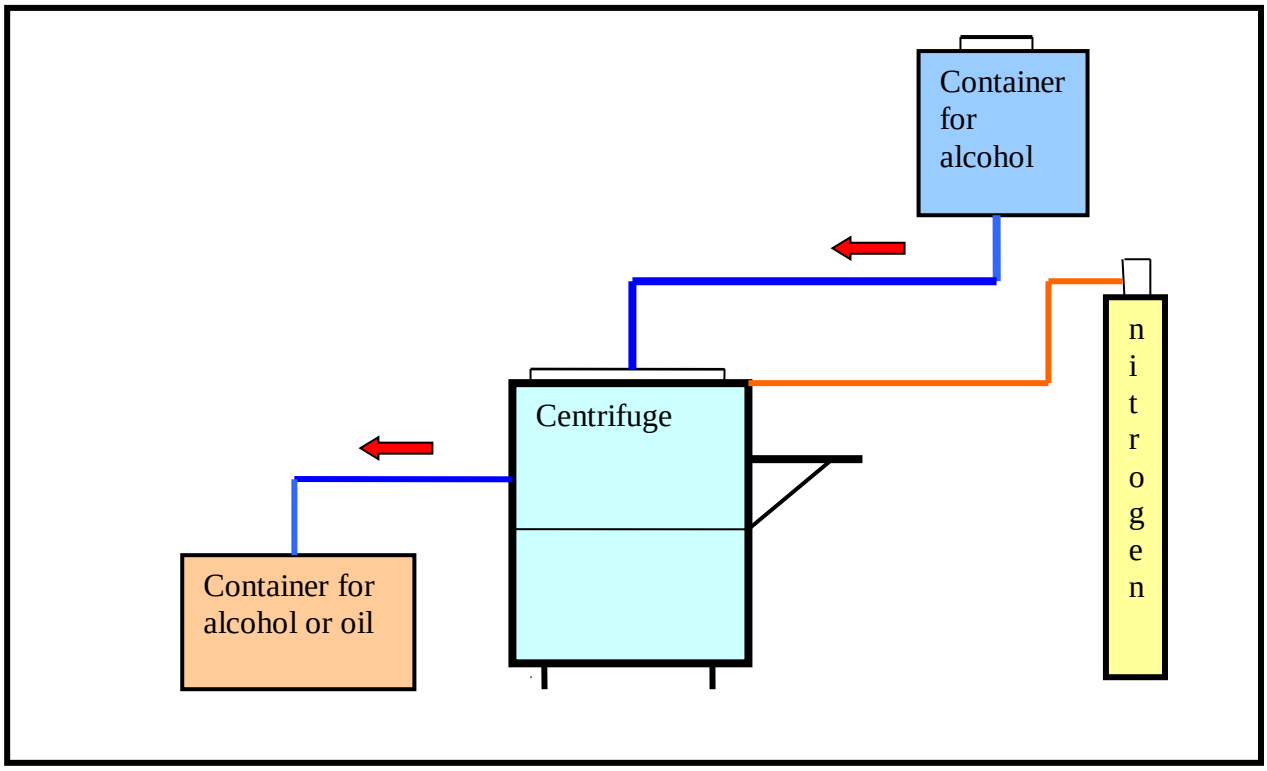
**Valve 4** The valve for feeding pulsating oil

- Open the valve № 1 and № 4
- Adjust the level of oil in glass of the bottom head by the valve № 3. The level of transport oil should be at the level of fittings.
- Close halfway the valve № 2 (Adjustment the speed of Capsules movement), Adjust the level of oil by the valve № 3.
- Slightly open the top regulating head counterclockwise to feed the gelatinous shell of approximately 90°
- By adjusting the valves № 2 and № 3 Achieve formations of capsules without filler Ø 3-5 mm.
- Remove the clamp from feed hose of filler and by adjusting the valves № 2 and № 3 Achieve formations of capsules with filler.
- Adjust the thickness of the gelatinous shell by upper regulating head (clockwise – less, counterclockwise - more). Fix with locknut top regulating head of the gelatinous membrane.
- Adjust the flow filler by the threaded clamp on the hose supplying filler. Pressure regulator in the tank with filler on the front panel used for fine adjustment of weight of the filler during encapsulation.

The capsules are washed in cups with ether and weighed on electronic scales.

## Centrifuge for wringing and washing of soft gelatinous capsules

For wringing of soft gelatinous capsules from pans with vegetable oil and it's subsequent washing from oil residual after drying with isopropyl alcohol is used an Universal centrifuge. All relevant components of centrifuge contacting with oil and isopropyl alcohol are made of stainless steel AISI 316 (resistant to salts and acids). Removable drum of centrifuge rotating at 400 revolutions per minute and communicated through a belt transmission with explosion protected electric motor. Managing of centrifuge carried out by remote control equipped with time relay.
During wringing of soft gelatinous capsules from the pans with vegetable oil into the centrifuge is loading up to 5 kg of capsules. During washing capsules from oil residue after drying with isopropyl alcohol into the centrifuge is loading to 2 kg of capsules. When washing capsules to the center of the centrifuge through the valve supplied isopropyl alcohol from container. Due to the centrifugal force occurs washing of soft gelatinous capsules. Washed capsules taken out with the drum and poured into the container located in a draft hood for the final evaporation of isopropyl alcohol from capsules surface. Further capsules are weighed and poured into sealed containers to prevent moisture ingress. To prevent of ignition isopropyl alcohol into the centrifuge is fed nitrogen.




## The dosage of capsules during encapsulation

Mass of contents of one capsule ($M_3$):

$M_3$= (M-,- $M_2$)/10

Where is:

$M_3$ - the average weight of content of one capsule, gr;

M-i - total weight of ten capsules, gr;

$M_2$ - mass of the shell of ten capsules.

The deviation in the mass of content of one capsule allowed to within + 10% of the PS.

Mass of shell shall not be less than 30% from weight of one capsule content and set by technologist of production section.

## The values of controlled parameters are shown in Table 3

| Preparation | Dosage, gr. | for 10 capsules | | |
|---|---|---|---|---|
| | | Total mass, gr (Mi) | Mass of membrane, gr ($M_2$) | Mass of contents, gr |
| Vit. A 5000ME | 0,05 | 0,900-1,100 | 0,450-0,550 | 0,450 - 0,550 |
| Validol; Nitroglycerine 1 % p-p | 0,10 | 1,500-1,800 | 0,600 - 0,700 | 0,900-1,100 |
| Vit. A 33000ME | 0,15 | 2,150-2,650 | 0,800-1,000 | 1,350-1,650 |
| Vit. E 50% p-p; | 0,20 | 2,790-3,410 | 0.990-1,210 | 1,800-2,200 |
| AEVit | 0,20 | 2.925 - 3,575 | 1,125-1,375 | 1,800 - 2,200 |

Determining the mass of capsules conduct in an air oven at switched ventilation. Delivery of medical ether to the workplace is carried out every shift from the supply storeroom in an amount not exceeding 0.5 liter by bottle of dark glass with capacity of 1 liter. When transporting and storage bottle with medical ether mounted in container with a lid on a sandy base, height from 5 to 7 cm.

After completion of encapsulation clean capsulator with washing liquid alike Fairy. Not wiped in time drops of oil eventually dry up, leaving yellow traces soluble only with an alkaline solution!

## Instructions for use viscometer to determine the viscosity of the prepared gelatinous mass.

Viscometer, at this version - a device that is used to determine the viscosity of the prepared gelatinous mass.

The viscometer consists of two vessels, with the help of which is determined viscosity of the prepared gelatinous mass. The vessel, which is filled with gelatinous mass, is the standard volume. The vessel, which is filled with gelatinous mass, has a certain diameter hole through which flows researched gelatinous mass.

Before determining the viscosity of gelatinous mass, check the quality of washing the instrument. To avoid inaccurate readings, pay special attention to the cleanliness of hole of the vessel, which is filled with researched gelatinous mass. The hole should be perfectly washed under hot running water using a synthetic brush. Not allowed cleaning of hole with metal spokes.

For more accurate readings of viscosity prepared gelatin mass, heat the vessel with hole in the thermostat or under a stream of hot water to a temperature of 60˚C (recommended). Hold the container with hole in your left hand, cover the hole with yout ring finger. Pour into the vessel with hole by a 100 ml container prepared gelatinous mass, filtered through a nylon sieve. The gelatinous mass must have transparent appearance. Foam gelatinous mass will lead to higher viscosities. Screw into the vessel with hole the lid with valve. Direct the vessel with hole above the vessel with the standard volume. Open the valve and simultaneously start the stopwatch. As soon as the vessel with the standard volume is filled, stop the stopwatch. Viscosity of prepared gelatinous mass should be between 60 to 70 seconds. If the viscosity of prepared gelatinous mass is large, recalculation is done and added purified water. If the viscosity prepared gelatinous mass is low recalculation is done and added gelatin. Low or high viscosity influences the quality of formation soft gelatinous capsules. After measuring the viscosity wash device under hot running water.

## Characteristics of raw materials and intermediate products

| № s/p | Name of raw materials and supplies | № State Standard | Qualification | Variety or Article. | The basic physicochemical and flammable characteristic |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1. | Gelatin | State Standard 11293 | | P-11<br>K-13 | Flame resistant, coarsely crystalline powder, light yellow color. Extinguish with water, foam. |
| 2. | Glycerine reactive | State Standard 6824 | ч | superior quality | Flammable, transparent, colorless, syrupy liquid. Mixes with water and ethanol in any ratio. Thermally unstable, with prolonged heating (90 - 130°C), decomposes with the formation of flammable liquids. Density 1.2604 kg/ml at 20°C. The flash point 198°C. Boiling temperature 290°C. The ignition temperature 203°C. Autoignition temperature 400°C. The melting point 17,9°C. Ignition temperature limits: the lower 182°C and the upper 217°C. |
| 3. | Nipagine (methyl ether - N - hydroxy benzoic acid) | | | | Flammable crystalline powder from white to light yellow color. Poorly soluble in water. The flash point 174°C. The ignition temperature 175°C. Auto-ignition temperature 559°C. The melting point 127°C. |

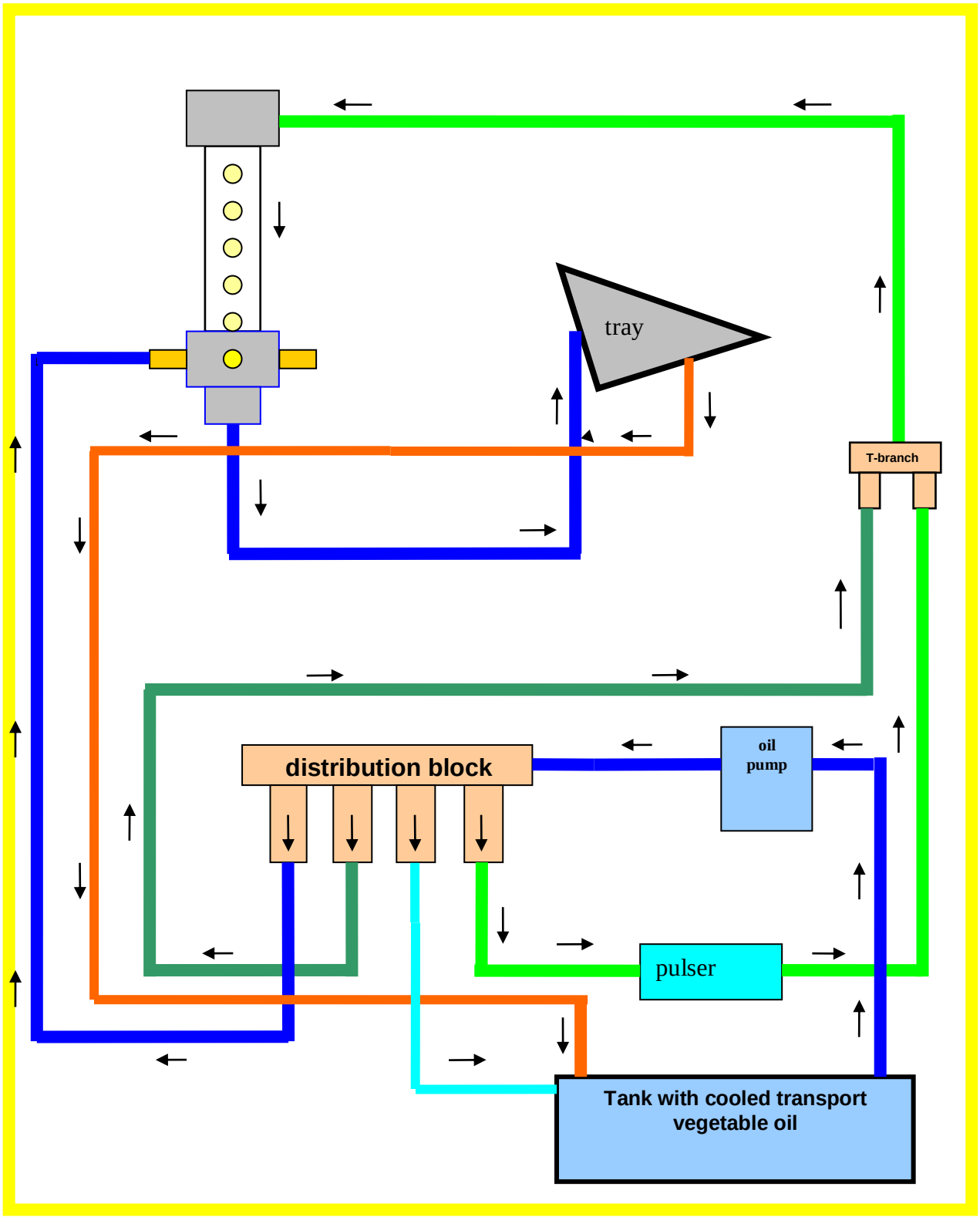
## MARK and CHARACTERISTIC of GELATIN

### Mark of gelatin MANDATORY K-13

Must be chosen according to characteristics:
Ask seller to show the certificate of quality from the factory, there should be data that you compare with the figures in this table

1. Appearance: granules, particles, powder
2. Color: from light yellow to yellow
3. The particles size: not more than 5 mm
4. PH - from 5 to 7
5. Moisture not exceeding 16%
6. Ash mass content not exceeding 2%
7. The strength of jelly with mass fraction of gelatin 10% - not less than 13 H.
8. The dynamic viscosity of solution with mass fraction 10% of gelatin - not less 21.5 MPa / second
9. The melting point of jelly at least 30 degrees C.
10. Transparency with a mass fraction of gelatin 5% - not less than 50%.
11. Extraneous matter not allowed.
12. Microbiological purity less than 10,000 cells per gram.
13. Coliform bacterium not allowed.
14. Pathogenic microorganisms not allowed.
15. !!! IMPORTANT !!! Gelatin thinning bacteria CFU in 1 gram not more than 200
16. MM of small particles not more than 30%
17. Duration of dissolving no more than 25 minutes.

## Scheme of circulation transport vegetable oil into capsulator for production of soft gelatinous capsules.

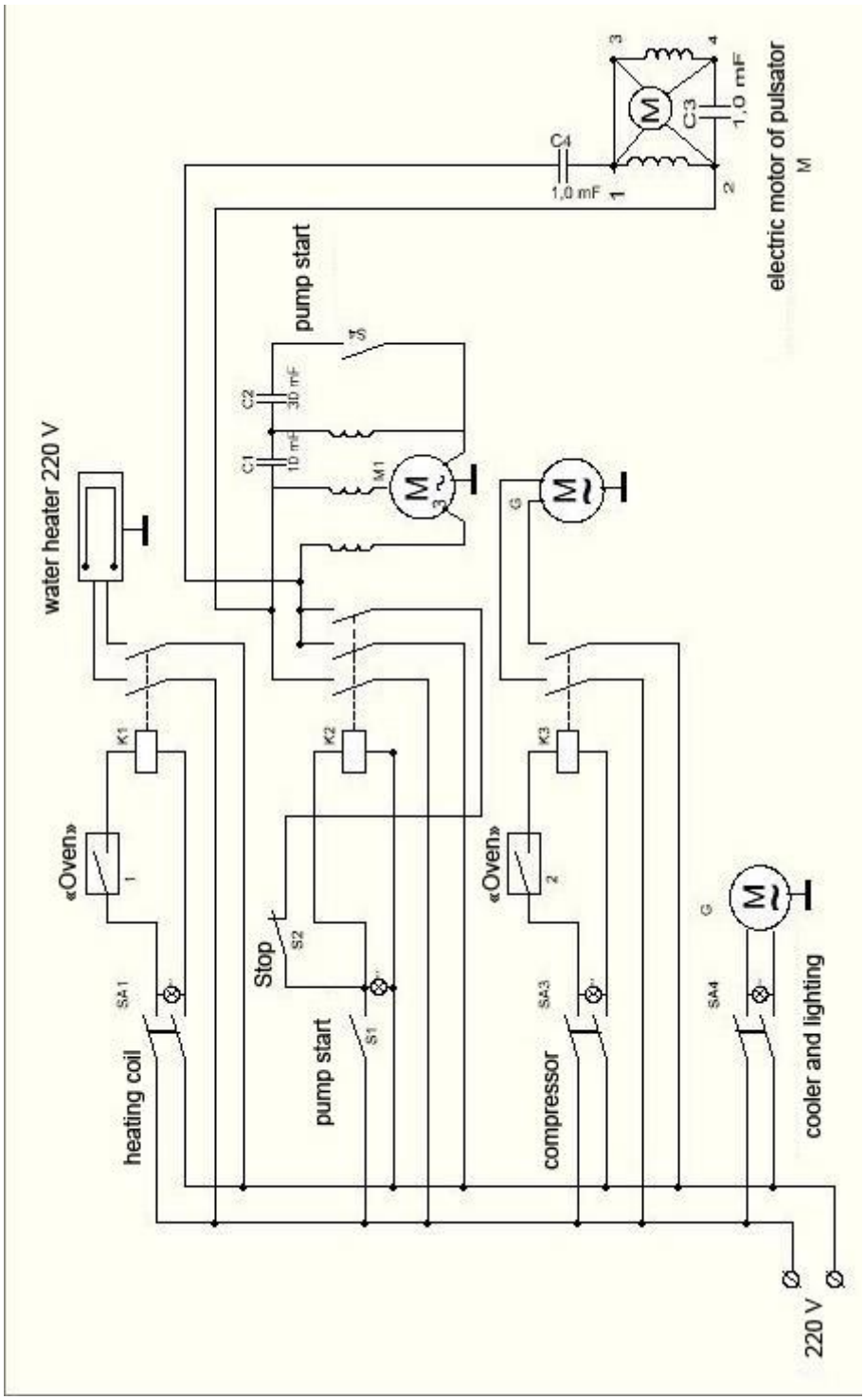


## Connection diagram of electric motor, compressor, heating coil.

| contact | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| colour | blue | white | green | blue | brown | blue | brown | green | | blue | brown | green |
| description | compressor supply | compressor supply | earthing | Supply of temperature control unit | Supply of temperature control unit | heating coil of water bath | heating coil of water bath | earthing | | motor supply | motor supply | electric motor condenser |

| Connection diagram of the control unit | | | |
|---|---|---|---|
| contact | | colour | description |
| 1 | 1 | brown | reserve |
| 2 | 2 | blue | reserve |
| 3 | 3 | blue | Button to activate the compressor |
| 4 | 4 | brown | To the unit of temperature control of water bath |
| 5 | 5 | brown | Button to activate heating coil |
| 6 | 6 | green | To the unit of temperature control of transport oil |
| 7 | 7 | brown | Button to activate the compressor |
| 8 | 8 | blue | To the unit of temperature control of transport oil |
| 9 | 9 | зелёный | To the unit of temperature control of water bath |
| 10 | 10 | blue | Button to activate heating coil |
| 11 | 11 | blue | Button to activate the pump of transport oil |
| 12 | 12 | brown | Button to activate the pump of transport oil |

## Electrical scheme



## The scheme of production cycle