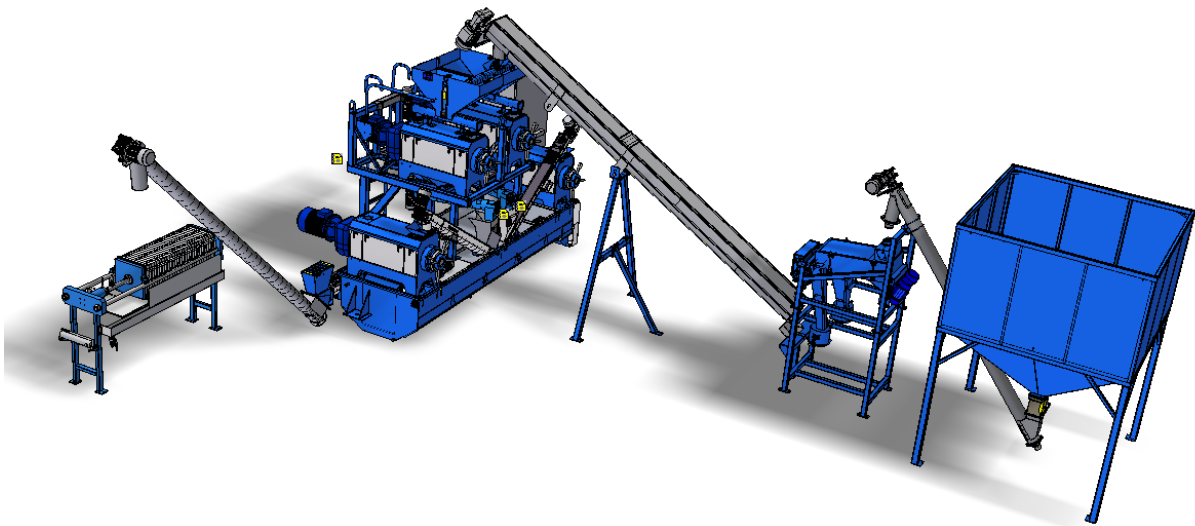


OPERATING MANUAL

PRESS SHOP WITH FILTRATION

“COMPACT CP2”



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IMPORTANT

READ CAREFULLY BEFORE USING

KEEP FOR FUTURE REFERENCE

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Abbreviations used

- **FIC** - Farnet Intelligent Control – a management system developed by Farnet
- **CS** - control system
- **PLC** - Programmable Logic Controller
- **VNC** - Virtual Network Computing - a graphical desktop sharing system which allows you to remotely connect to graphical user interface via a computer network
- **PID** - a controller composed of proportional, integrative, and derivative section
- **PD** - project documentation
- **M** - torque [Nm]
- **P** - power [W]
- **RPM** – a measure of frequency of rotation (revolutions per minute)
- **n** – speed [RPM]
- **Q** – material flow rate [kg/h]
- **MIN/MAX** – minimum/maximum value

Definition of terminology

- Oilseed – a common crop (or its seed) containing vegetable oil; prepared (i.e. cleaned and dried) for storage under the local conditions of the crop species
- Press cake (or just cake) – the material remaining after oil pressing
- Vegetable oil – oil obtained from oilseeds by pressing or chemical extraction
- Raw oil – vegetable oil after pressing (or extraction) and filtration without any other treatment (filtered oil)
- Oil pressing – expression of oil from oilseeds by mechanical force – pressure
- Screw (oilseed) press – equipment that presses oil using a rotating screw with variable geometry in a closed perforated filter (also called the basket)
- Cold pressing - pressing of oil in which the seed at the inlet to the press is either not preheated at all, or not more than to about 40 °C
- Hot pressing – pressing of oil during which the seed is preheated to higher temperatures – usually between 85 and 110°C – at the entry of the press
- Single-step (or one-level) pressing - pressing of oil in one passing through the screw press
- Two-step (two-level) pressing - pressing of oil in two successive passages: first, the pre-press separates a part of oil in the first step; the resulting press cake freely falls into the final press, which carries out the second, final pressing
- Oil separation - separation of gross mechanical impurities from the oil
- Oil filtration – separation of fine mechanical impurities from the oil (solids)
- Operating set PS - a set of machines and equipment that make up a functional unit and perform a coherent and defined technological process as described in the documentation of the construction
- DC - a delivery contract for the technology between the investor and the supplier of the technology
- GD - General Designer of an investment plan of the investor
- Screw geometry - it defines the shape of the screw shaft in the system of pressing screws as well as the spacing between slats
- Residual oil in cake - is defined as a percentage of the weight of the remaining oil relative to the weight of the cake, that is, the content of oil in the cake (in %). See also document Vegetable oil production
- Solids – are a portion of the solid matter in the seeds that escapes along with the oil through the slits of the pressing unit
- Oil viscosity - is a physical quantity characterizing the viscous friction of oil during its flow; Thin oil has low viscosity, thick oil has higher viscosity.
- PLC Automat – a programmable logic controller is an industrial computer used for automation and control of technology in real time

1. INTRODUCTION

Here we present you the operating manual for the press shop with filtration.

In this manual, we describe main technological data, instructions for installation, operation, maintenance, as well as repairs of the technological unit. Among the documentation accompanying the delivery are also operating manuals and spare parts catalogues for individual devices. Those documents offer detailed information regarding operation, maintenance and adjustment. However, by assembling individual devices into a functional technological unit, some functions may change. Note that if there is a discrepancy regarding safety, maintenance, or operation between this document and the individual device documents, the instructions contained in this manual shall prevail.

Therefore, pay due attention to all provided documentation. We sincerely hope that after acquainting yourself with operation and function of the equipment you will be happy with it and with its performance.







This manual also applies to technological wiring, designed according to the enclosed project documentation, and elaborated to meet the requirements of ČSN IEC 60300-3-11 parts 3 to 11 (instructions for use and maintenance focused on reliability of a device) and ČSN IEC 706-1-6 (instructions for good maintenance of the device). According to the Czech Government Regulation No 378/2001, the requirements for a safe operation of technical equipment must be fulfilled.



2. LIMIT PARAMETERS OF THE EQUIPMENT

The Operator may only use the equipment for oilseed pressing in accordance with this Manual.

Any other use of the device is prohibited, especially pressing or processing seeds other than oilseeds.

3. SAFETY MESSAGES

Symbol	Meaning
	A general warning tag that marks important information regarding work safety referred to in both the Manual and safety signs on the equipment. If you see this sign, be aware of danger of serious, potentially deadly injury. Instructions marked with this general warning sign must always be followed.
	Danger! This warning tag draws attention to an immediate impending dangerous situation, possibly leading to death or serious injury.
	Warning! This warning tag draws attention to an impending dangerous situation, possibly leading to death or serious injury.
	Caution! This warning tag draws attention to a situation that may lead to minor injury. It also draws attention to dangerous operations that are associated with activities that could lead to such injury.
	The symbol indicates an important instruction, property or procedure that must be followed during the installation, use or maintenance of the equipment. Failure to comply with the procedure can lead to damage to the equipment.
	The symbol indicates useful information related to the device.

A. GENERAL INSTRUCTIONS FOR USE	
	<p>A.1 The Operator must be acquainted with the device, its features and controls in detail before its first use.</p>
	<p>A.2 Operation of the equipment may only be conducted by personnel authorized under the following conditions:</p> <ul style="list-style-type: none"> • they must be verifiably acquainted with the safety regulations for working with the equipment and the operation of the technological unit in which the device is included and they must be able control the operation of the device in practice. • the device shall not be operated by minors (persons under the age of 18 years).



- they must know the importance of safety signs located on the device. Their observance is essential for a safe and reliable operation of the device.

A.3 Maintenance and repair of the device may only be performed by a person:

- designated by the operator
- who has training in the engineering industry and knowledge of repair of similar machinery
- who has proven to be acquainted with the safety regulations for working with the device.

A.4 The operators of the device must ensure the safety of other persons.

A.5 The operator may enter/climb on the device only when it is idle and only for these reasons:

- adjustment of working parts of the device
- servicing and maintenance of the device

A.6 Any amendments or modifications to the device may only be carried out with a written consent of the manufacturer. The manufacturer shall bear no responsibility for any damage incurred as a result of failure to comply with this guideline. All warning and safety signs must be kept legible and in appropriate places. In the case of damage to or loss of such marks they must be restored without delay.

A.7 When operating the device, the operator must have a copy of the Manual with requirements for work safety available at any time.

A.8 When operating the device, the operator must not consume alcohol, medications, narcotic or hallucinogenic substances which reduce attention and coordination. If the operator must take medication prescribed by a doctor, or if they take over-the-counter medications, the doctor must provide them with the information whether in these circumstances they are able to operate the equipment safely and responsibly.

A.9 The device can be run only if it is in a good technical state, conforms to the regulations of the safety and hygiene of work, and if used in accordance with the conditions laid down by the manufacturer.

A.10 When working with the device, observe not only the instructions in this manual, but also the generally applicable provisions of occupational health and safety, as well as fire, transportation, and environmental regulations.

A.11 Electrical equipment must not be extinguished with water. In the case of fire, observe the applicable fire regulations.

B. TRANSPORTING THE EQUIPMENT

B.1 Any means of transport intended for transporting the equipment must have a load-bearing capacity at least equal to the weight of the transported equipment. The total weight of the equipment is listed on the data label.



B.2 Dimensions of the transported equipment, including the transporting vehicle, must comply with the relevant rules and regulations (for example Road Traffic Ordinance No. 102/1995 in Czech Republic).



B.3 The equipment must be securely attached to the vehicle to prevent its release.



B.4 The carrier is liable for damage caused by a release of an incorrectly or inadequately fastened equipment.

C. HANDLING WITH LIFTING EQUIPMENT

C.1 Lifting equipment and slings designed for handling of equipment must have a load capacity at least equal to the weight of the handled equipment.



C.2 Mounting of the equipment for handling may be carried out only at designated sites, marked with labels showing a "chain".



C.3 After mounting (suspension) in designated places, it is forbidden to reside within reach of the handled device.

D. SAFETY LABELS

Safety warning labels serve for the protection of the operator.

General rules:

- Always comply with warning safety labels.
- All safety instructions are also valid for other users.
- If a safety warning label is removed, destroyed, or damaged, the staff **MUST SECURE IMMEDIATE REPLACEMENT!!!**
- Location, appearance, and the exact meaning of safety labels on the device are described in the instructions for individual machines.

4. TECHNICAL DATA OF THE DEVICE

4.1 WIRING

Voltage system: 3+PEN/3+PE+N, AC 50Hz, 400/230V

Protection against dangerous touch voltage: automatic disconnection from the source according to HD 60364-4-41: 2007

Connection to the terminals of the main switch and the main busbar PEN.

The recommended power cable cross section: CYKY (Copper-PVC-PVC) 3x95+50 for the equipment according to the project.

Table 1 - Power input values for equipment

PS (or part thereof)	Input		
	Installed power kW	Electrical load factor 10 %	Active power kW
in total	97,88	90	88,09

Short circuit protection

Short circuit protection is dealt with according to HD 384.4.43 S2:2001

Protection against overload and dangerous touch voltage

Protection against overload and dangerous touch voltage is solved according to HD 384.4.43 S2:2001 and HD 60364-4-41:2007.

Grounding

The connection of the main protective busbar PEN at the input of the electrical connection to the grounding system of the building will be secured by the investor. The constructions of the line will be connected to the protective bus RZ1 via a conductor CU, 16 mm². The separate parts of the line will be joined together by a protected conductor CU of a cross section corresponding to that of the phase conductor, but at least CU - 2.5 mm², in the case of unprotected conductors - CU 16 mm². All metal parts within range should be joined together, even those without electrical devices.

4.2 OPERATING PIPELINE

The pipeline infrastructure corresponds to the technological equipment of the press shop. Placement of the piping branches (plain, solid, including hinges) is handled according to the Czech norm ČSN 13 0725 (ON 13 0725), ON 13 0800, ON 130802, ON 13 0124.

As part of the operational sets the following pipelines are supplied:

Oil pipeline

Vegetable oil is led from the sedimentation tub through the filter into the tanks via a plastic hose DN 32.

Piping for thermal oil

Table 2 - The amount of thermal oil

LOCATION	AMOUNT OF OIL
Duplicator of the sedimentation tank (l)	17 (2 x 8.5 l)
Duplicator of the heated conveyor	23

Table 3 - Parameters of thermal oil

PARAMETERS	VALUE
Maximum kinematic viscosity at 40 °C (mm ² /s)	60
Maximum kinematic viscosity at 100 °C (mm ² /s)	8
Limit of pumpability (°C) (Freezing point ca. -12 °C)	7
Minimum temperature at the onset of boiling at atmospheric pressure (°C)	380
Minimum permissible temperature of oil film (°C)	320

4.3 FILTRATION

- Maximum pressure in the filter housings - 12 bar
- Permeability of the filter cloths 26 l/m²/s

5. TECHNICAL DESCRIPTION

5.1 TECHNICAL DESCRIPTION OF THE OPERATIONAL SETS

The technological equipment Press shop with filtration is made up of several parts, referred to as operating sets PS:

PS 1 Seed Reception

PS 2 Press shop

PS 3 Oil filtration

PS 4 Press cake - only transport pathway

PS 5 Oil storage - resolved by the investor

The technological process consists of the following main parts:

5.1.1 PS 1 - reception and cleaning of the seeds

Seed reception consists of an input intermediate (temporary) container, a magnetic separator of the dosing conveyor, and a conveyor leading into the extruder.

The seed goes from container 1.10.1, via magnet 1.10.2 into conveyor 1.10.3 with a frequency converter (FC). In the magnet 1.10.2, the seed is purged of any metal objects and debris. Any impurities captured are manually removed, as needed. Clean regularly, at least once a week. However, first close the manual gate at the container 1.10.1. The expected amount of debris should be minimal and the investor should treat it as waste. However, this is not waste produced by the technology, but only a protective measure of the technology against entrance of unwanted objects. From the inclined tube conveyor 1.10.3 seeds fall into the hopper of the cleaner KUT 500 1.10.4. The cleaner KUT 500 removes impurities of both larger size (straw, stalks, etc.) as well as the smaller ones (dust, sand, etc.). These impurities fall into bags placed on the sides of the cleaner KUT 500 and the operator must ensure their timely emptying. The seed further travels to the inclined tube conveyor 1.10.5 (this is a heated conveyor – on its coating there is a double-walled heat exchanger (duplicator) with thermal oil and three heating rods of the input power 3 kW each, which heats up the seed and transports it into the hopper of the dosing conveyor 2.14.1. Operating temperature of heating is controlled on each double-walled exchanger via a thermal sensor, which sends the values to the control system. In the case of failure, a manual emergency thermostat is also present. Operating temperature of heating must not be set above 70 °C; the temperature can be changed using the control system. Emergency temperature of the thermostat is set at 100 °C; it is not possible to change this setting.

5.1.2 PS 2 - Press shop

General description of the pressing process

To gain oil from oilseeds, people throughout the world use screw presses and the process of so-called screw pressing. Screw presses are multi-stage machines. Basically, as the shape of the screw flight inside changes throughout the stages, the processed material is gradually compressed. As a result of the increasing pressure, oil gradually seeps through the outlet slits in the 'basket' of the press. Changing of the shape of the screw flight in particular stages (the pressing geometry) and setting the width of the drain slits enable the optimization of the process for particular kinds of oilseeds.

Inside the seeds the oil is bound in the cells and the release process is influenced by not only the technology of pressing, but also the kind of oilseeds, their variety, the particular harvest, as well as post-harvest processing and storage.

In general we can say that in order to achieve the best possible yield of oil, the seed must be ripe, not damaged mechanically, and dried up to appropriate storage moistness in several steps (to prevent irreversible unwanted processes in the biological material).

For most oilseeds, biological ripeness is reached after about a month of storage. Therefore, pressing the seed immediately after harvest is often accompanied with problems and suboptimal parameters.

The impurities contained in the seed (straw, other seeds, etc.) cause a deterioration of pressing and reduce the final oil yield by soaking up the oil to the level of residual fat in the press cake.

For this reason, pay due attention to the quality of the processed oil seeds.

The pressing process itself is **waste-free**; i.e. the input **seed material** is separated into two useful fractions: the **oil** and the leftover material - the **press cake**.

Extrusion is a method of heat treatment for feed, and as such can be considered the most common. It belongs to the HTST methods (High Temperature Short Time), meaning that it is very gentle to the material. Part of the process is sterilization of the material, which is achieved by high pressures and high working temperature of the material during the extrusion process. The basic principle of extrusion is pushing material (feed) through a constricted space of the working unit, either through a nozzle or matrix with dies. The working mechanism consists of an array of screws along with throttle inserts located in chambers, ending with a chamber containing an output nozzle. The screws cause the material to move through throttle inserts, gradually heating and plastifying it along the way.

The extrusion equipment increases the nutritional value of the press cakes. If a subsequent pressing step is applied, it also increases oil yield.

Description of the technology of pressing

Above the press 2.15.2.1 and 2.15.2.2 is located bin with dosing conveyor 2.15.1 and 2.15.1.2. In the press 2.15.2.1 and 2.15.2.2, the first stage of pressing occurs. In the screw press the seeds are gradually squeezed and the oil drains through the slits of the basket into the sedimentation tub 2.30.1. This tub serves as a separator for the solids. It consists of the tub itself

and a chain separator located inside the tub. The tub is basically a metal vessel with heat exchangers on its sides. Heating is performed by using the above-mentioned heat exchangers with thermal oil and heating elements inside. Each body has an input power of 3 kW. The heating temperature is regulated by thermostats; each exchanger contains one operating thermostat and one emergency thermostat. The heating temperature is set with the lower thermostat to a maximum of 110 °C. This setting may be used to change the oil temperature for filtration. Along with the thermostat that sets the operating temperature, there is also the top, emergency thermostat, set at the maximum allowable temperature of 140 °C. This secures the tub against overheating. On the coat of the tub there are two outputs for connecting the pump 3.10.2 and one input for the filling of the filter 3.10.3. To suck the oil from the tub to the filtration, the top input is used. This is done in such a way so as to avoid sucking in the solids, which sediment at the bottom. The purpose of the input located near the bottom of the bath is to completely empty the tub, along with the last remaining oil. Inside the tub there is a sensor of emergency levels 2.30.1, which turns off the supply of seeds into the technology if it senses that the tub is already filled up to a potential overflow. The solids separator, located in the tub 2.30.1, contains a blade-equipped chain conveyor that has its own transmission, one driving and three driven gearwheels, and a chain. The speed of the separator chain movement is slow (~ 2 m/min) to avoid any back-mixing of the solids and the oil, which would hinder the effectiveness of the separation process. The chain moves the solids from the bottom of the tub onto a sieve. The sieve is placed in the upper part of the tub. Here the remaining oil flows out through the slits of the sieve. Behind the sieve lies a spiral trough conveyor 2.30.2, which moves the separated-out solids into an inclined conveyor 2.20.4.1 and 2.20.4.2 and further into the final press. In the conveyors 2.20.4.1 and 2.20.4.2, the solids are mixed with press cake from the pre-press 2.15.2.1 and 2.15.2.2. and sent to the final press. From the pre-press 2.15.2.1 and 2.15.2.2 the press cakes fall into the conveyor 2.20.7.1 and 2.20.7.2. From the conveyor 2.20.4.1 and 2.20.4.2, the cake, mixed with the solids, enters the final press 2.25.2.1 and 2.25.2.2, where the second stage of pressing takes place. The oil obtained during both final pressing and pre-pressing enters the separation tub 2.30.1. The cake obtained after the second stage of pressing enters the conveyor 2.30.3 and then the inclined tube conveyor 2.30.4. At the end of the latter conveyor the cake falls out into the customer's designated storage space.

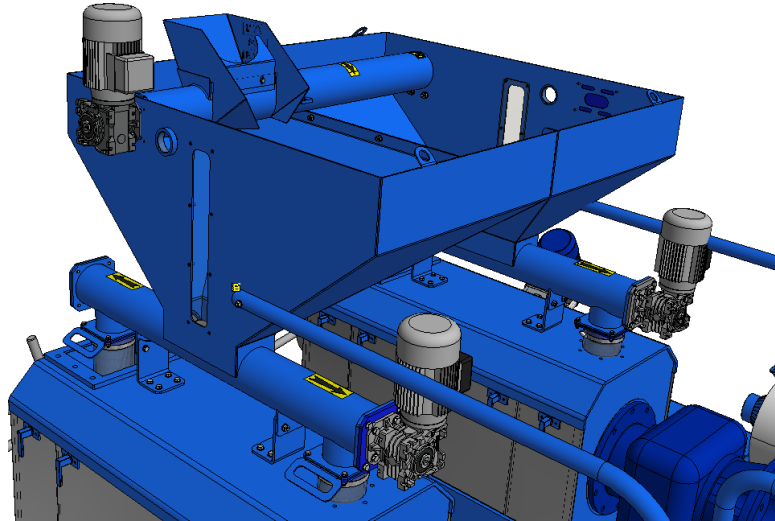


Figure 1 - Sliding conveyor 2.14.1 and dosing conveyor with a hopper 2.15.1.1 and 2.15.1.2

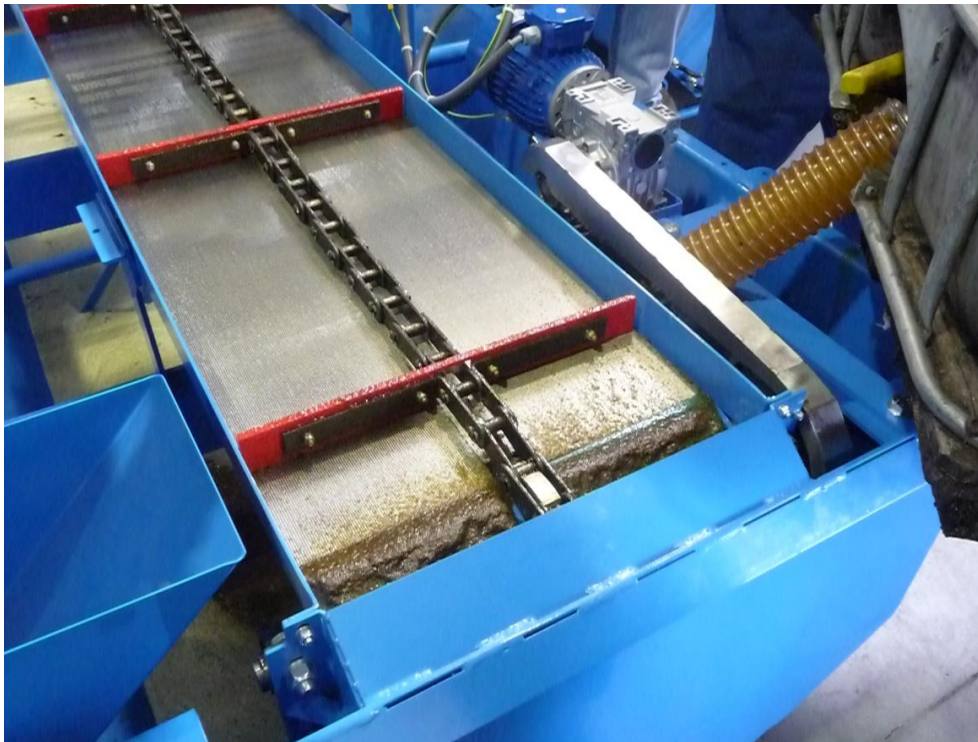


Figure 2 - Raking of sediment by the chain conveyor of the tub



Figure 3 - Transfer of sediment into the spiral conveyor

5.1.3 PS 3 - Oil filtration

Oil filtration is a set of machinery which purges the raw oil of impurities on a plate filter. Filtration capacity corresponds to the designed capacity.

Through the drain slits of the press, oil is expelled along with a solid portion of the seed structure - the so-called **solids**. The solids settles in the sedimentation tub, but is continuously raked and led through a drainage sieve, by a chain conveyor into the final press.

In order to obtain pure oil, it is necessary to filter it.

The plate filter, where the filtration itself takes place, is only intended for the filtration of vegetable oils. It consists of stainless steel front plates, filter frames, guide pins, a crossbeam, the central clamping screw with a regulatory wheel, and gutter bowls. By default, the input is equipped with a butterfly valve and a pressure gauge; the output contains a butterfly valve, pressure gauge and sampling valve.

Between the filter frames, filter cloths of specific pore size are inserted, according to the required purity of the filtered liquid. During the passage of the liquid the cloths capture debris that gradually reduces flow rate.

The structural materials coming into contact with the filtered liquid are sanitary. Design with stainless steel frames allows for permanent thermal load of up to 60 °C, for short time periods up to 95 °C.



Figure 4 – Plate filter

5.1.4 PS 4 - Press cake storage

The delivery includes the corresponding conveyors and a dividing steel wall.

5.1.5 PS 5 - Oil storage

Solutions for storage and its management are dealt with by the investor (trays for the filtered oil, hoses from the filter into the containers and the hose from the containers to the dispenser pumps); the delivery contains the output pump 5.10.2.

A hose from the filter DN 32, a hose from the tanks into the dispenser pumps DN 40

5.2 REQUIREMENTS FOR AND CHARACTERISTICS OF INPUTS AND OUTPUTS

5.2.1 Input raw materials

To ensure effective pressing it is necessary to pay close attention to the quality of oilseeds. Listed below are the decisive parameters that affect the pressing process:

Biological Ripeness and Drying Care - these parameters are very difficult to evaluate in practice and there is not a single unified methodology.

It is necessary to avoid the following:

- Charred oilseeds (odour, dark colour, hard)
- Atypically light colours indicating unripeness
- Oilseeds that are mouldy or affected in other ways

- Damaged oilseeds – according to most standards, the limit for **damaged seeds is max. 2 %** (Among other things, the oxidation of oil in the oilseed occurs, causing deterioration of the quality of oil)

Impurities - the threshold set to max. 2 % of impurities. If the supply of the above-specified grade of seeds is not secured, we recommend that you order the OPTION Seed Cleaning.

Humidity - for the pressing process, the humidity of entering seeds is significant. If the humidity of the seed lies above the limit recommended for storage (see table A below), seed might be damaged during storage (mould, etc.) and thus lead to a decrease in the performance of the technology.

The temperature of the supplied seed influences the yield of oil in the first pressing step. However, fluctuation of temperature of the input seeds means continual changes of setting. At temperatures of seeds below 15 °C and mainly in combination with higher humidity of the seed, the heat supplied by the pre-press might not suffice and the yield of oil in the first step would be lower.

Oiliness - (oil content in the seed) is a key parameter for determining the yield of oil (how much oil will be pressed). In the following Table 4 there are standard values for seeds of commonly grown species. These are the values that the technology is optimized for for every particular species.

Table 4 - Input parameters

Oilseeds	Max. humidity for storage	Medium humidity recommended	Medium humidity at medium oiliness	Oiliness Range of effective pressability
Rapeseed	8 %	6.5 %	42 %	38 - 44 %

Oilseeds with oiliness out of the range of effective pressing given in this table can be pressed, too; however, the throughput may decrease, the parameters may worsen and problems with solids and with the stability of the process may arise.

Processed oilseeds

Seeds must be stored in areas that are clean, dry, and easy to air; free of mould and pests, at a temperature below 20 °C and relative air humidity not more than 70 %. Such parameters guarantee the preservation of seed quality, integrity and sanitary safety. During storage, carry out regular checks of the condition and quality of oilseeds. Manipulation of the seeds in the press shop is assumed to be carried out using screw conveyors. Seeds from the storage must be cleaned and dried up. Temperature and moisture content of materials is associated with the growth of micro-organisms and storage pests, which might cause a deterioration of quality.

There is no flammability rating for oilseeds.

5.2.2 Output materials

Vegetable oils

Although vegetable oils are easily biodegradable, the spaces where they are kept must be secured against leakage into the groundwater or surface water. For this reason, the floors in the pressing plant must be made of a material resistant to the action and leakage of the liquids used. In case of an accident, the pressing plant must be equipped with a retaining basin that can capture a volume corresponding to that of the the largest oil reservoir in the facility. It is recommended to provide a smaller reservoir for drainage and secure the collection of the above-stated volume by constructing impermeable sills in the rooms.

Table 5 - Indicative properties of raw vegetable oils

	Unit	Rapeseed oil
Specific weight - see chart	kg/m ³	838 - 906
Flash point	°C	224
Kindling point	°C	447
Flammability rating		IV

Canola/rapeseed oil

The composition and health effects of canola oil are similar to those of olive oil. It contains only a low content of saturated fatty acids (about 8 %), and correspondingly, significant amounts of mono-unsaturated (about 61 %) and essential fatty acids omega 6 and omega 3. Canola oil is an important resource for the food industry.

Considering the chemical properties of vegetable oils during processing and storage one must take into account their **oxidative stability** in particular.

During pumping and storage autoxidation by aerial oxygen occurs. Products of oxidation harm mainly sensory properties (taste and odour) of vegetable oil. Therefore, oxidation must be prevented to the maximum extent. Resistance to autoxidation depends on the composition of fatty acids in vegetable oils. Oxidation resistance is very high for example in olive oil.

The rate of oxidation by aerial oxygen is very strongly dependent on the temperature, the oil-air interface area, and the time of exposure. The influence of temperature on the progress of the oxidation is particularly strong. It can be said that if the temperature increase by 10 °C, the rate of oxidation doubles.

The action of air moisture causes formation of phospholipid clusters in raw oil. This phenomenon cannot be completely prevented, and it is necessary to take it into account when designing the tanks and storage space for raw oil.

During oil storage, the following requirements must be particularly complied with:

- minimize the possibility of contact with oxygen
- avoid condensation of water vapour on the walls of the tanks

- use perfectly dry storage tanks
- avoid contact with non-ferrous metals and their alloys
- prevent oxidation, hydrolysis and polymerization
- storage tanks made of steel, stainless steel or polyethylene
- the lowest storage temperature possible, but always less than 50 °C (cooling of oil is not part of this technology and was not required by the investor)
- if a plastic tank is used for storage, it must be placed in a dark room
- regular cleaning of storage tanks is recommended

The rate of oxidation of oils is expressed by the **peroxide value** (result of an analysis of the content of primary oxidation products).

If the oxidation processes are initiated in the oil, they start a snowball effect leading to oil degradation.

Vegetable oils are thus not tolerant to long exposures to oxygen (free atmosphere) at elevated temperatures - certainly not at temperatures higher than 50 °C. Therefore, it is necessary to cool the oil before storage to at least 50 °C. The use of protective atmospheres is possible, but due to the large volume of storage containers it is not commonly implemented in large warehouses.

Press Cakes

Regarding the reduction of the microbiological effects we recommend that the press cake storage be realized in dry storage areas protected against pests, birds, and rodents for sanitary reasons (avoiding infectious diseases, such as salmonella). The handling operations and loading in particular, must be carried out with regard to the maximum reduction of dusting. Press cakes should not be stored near sources of excessive heat or near flames.

Indicative characteristics of press cakes (related to dustiness) regarding fire safety:

- | | |
|---|---------------------|
| • Grain size | 50 mm |
| • Humidity | 8 – 10 % |
| • The minimum temperature of the settled dust | 210 °C |
| • Lower explosion limit | 85 g/m ³ |
| • Minimum ignition temperature of dust clouds | 450 °C |
| • Non-toxic | |
| • Non-conductive | |

BEWARE of high proneness to spontaneous ignition when storing press cakes in thicker layers at elevated temperature (over 50 °C).

For safe storage it is necessary to cool the press cake under 50 °C. Even so, it is necessary to inspect the storage area regularly and we recommend equipping the space with temperature and smoke sensors.

Regarding the reduction of the microbiological effects we recommend that the press cake storage be realized in dry storage areas protected against pests, birds, and rodents for sanitary reasons (avoiding infectious diseases, such as salmonella). The handling operations and loading in particular, must be carried out with regard to the maximum reduction of dusting. Press cakes should not be stored near sources of excessive heat or near flames.

Rapeseed press cakes

Rapeseed cake is used as an important component of feed in compound feed production plants as a feed supplement rich in protein and carbohydrates. It contains significant amounts of protein, vitamins A, B, E, and some valuable minerals. The type and quantity of press cakes used for the particular type of compound feed is determined by the species and age of the animal for which the feed is intended.

5.2.3 Air emissions

Evaporation of water

Evaporation of water is dependent on input humidity of the seed. When using a single pressing step with extrusion, most of the evaporate originates at the outlet of the extruder. The amount of evaporated water is thus determined by input moisture (most often 11 - 14 %), and its reduction to around 5-8%. Then the maximum evaporation of water results in $13 - 7 = 6$ % of the weight of the entering purified seed.

Technological suction of vapour is partially dealt with in the pressing plant, and is part of the delivery. At a pressing plant capacity of 0.25 tonnes/hour the evaporation of water reaches levels up to 15 kg/h. This water content must be sucked out in the form water vapour by a ventilation system. We assume that for the suction of the vapour-containing air some ~ 1050 m³/h will be necessary. In the ventilation system, which is part of this project, water vapour condensation may occur. This is dealt with by a desludging system, using a set of hoses at the sites of condensate accumulation. The desludged water contains traces of oil and dust, and as such it is not appropriate for discharge into the sewage system. Instead, it should be redirected into the press cake conveyor 2.30.3. Such moistening of cake is desirable, and the traces of oil and dust are further used. As a result, no waste is generated.

Aromatic substances

In the technology of pressing, the temperature of the oilseeds increases while the seeds are also mechanically disrupted (by the press or a flaking mill, if used). This involves emissions of natural aromatic substances corresponding to the particular type of oilseed. Two-step cold pressing only generates a very low emission of natural aromatic substances. To reduce emissions of aromatic substances you can apply ventilation to extract water vapour directly at the sites of its generation (not included in the delivery).

Determination of the quantity and intensity of aromatic substances is complicated and depends on the kind of oilseed as well as on temperature and the layout of the ventilation.

Emission of aromatic substances occurs throughout the course of the technological process and even during the cooling and storage of the cakes.

The emissions of aromatic substances from the pressed oil are considerably smaller.

Dust

The pressing is carried out inside the press and does not cause emissions of dust.

Dust may be generated during the handling of oilseeds and press cakes. Therefore, it is necessary to deal with the emissions of dust during loading and unloading of the seeds and cake.

5.3 THE REQUIREMENTS FOR TRANSPORT TO AND FROM THE TECHNOLOGICAL UNIT

The supply of raw materials to PS 2 and PS 3 and their transport to other steps of the technology is automated and uses conveyors and pumps (for oil).

Within PS 2 and PS 3, the handling of seeds, and press cake is also dealt with automatically, using conveyors. Oil transport is automatic, using pumps.

There are no other requirements for transport in the technology.

5.4 LIST OF MACHINERY AND EQUIPMENT

Table 6 - List of machinery and equipment

Position	Equipment name	Type	kW
PS1	Seed reception and cleaning		13,02
1 10	Seed reception and cleaning		
1 10 1	Input container	9m3	0
1 10 2	Grate-based magnet	MR4	0
1 10 3	Inclined tube conveyor	DŠT 140 - 3,5m FR + additional cooling	1,1
1 10 4	Vibrating cleaner	KUT 500	0,72
1 15 1	Inclined trough conveyor with heating	DŠK 250 - 5,3m + insulation	11,2
1 15 2	Duplicator of the heated conveyor		
1 20	Wiring	Classic	
PS2	Press shop		81,86
2 20 1	Distribution conveyor for seed	DŠT F 90 - fully equipped	0,18
2 35	Pre-press		
2 35 1	Dosing conveyor to FL incl. the hopper	incl. mounting on Compact, and a bypass of FL	0,5
2 35 2	LIS FL200 (pre-press)	incl. mounting on Compact, 9402026	30
2 35 3	Slide for press cake		0
2 35 4	Drainpipe for pressed oil		0
2 35 5	Tool for handling the shafts	Manual crab 500 kg	0
2 40	Extrusion		
2 40 1	Hopper	EP2	0
2 40 2	Extruder FE250	incl. mounting on Compact	0
2 41 1	Opening into the trough conveyors		0
2 41 2	Inclined trough conveyor	Farmet 120 - 2m	1,5
2 42 1	Suction at extruders		0
2 42 2	Fan	RNH 160	0
2 43 1	Press cake conveyor belt (in the case of CP)	DŠT F 90	0,5
2 45	Final press		
2 45 1	Seed hopper		0
2 45 2	Press FL200 (final press)	incl. mounting on Compact, 9402027	30
2 45 3	Outlet for solids		0
2 45 4	Drainpipe for pressed oil		0
2 50	Separation tub and transport of sediment		
2 50 1	Sedimentation tub with heater	without the installation of FL and FE	18,25
2 50 2	A conveyor belt for the sediment	Farmet 76 - 1,5m	0,18
2 50 3	Inclined trough conveyor	DŠK 160 - 4m	0,75
2 60	Wiring	Classic	
PS3	Oil filtration		1,15
3 10	Filtration		
3 10 1	Oil transport		0
3 10 2	Pump	Gear pump Viking GG	1,5
3 10 3	Plate Filter	Antares (25 filter cloths) m15956	0
3 60	Wiring	Classic	0
PS4	Press cake storage		1,5
4 10	Press cake storage		

PRESS SHOP WITH FILTRATION

4	10	1	The filter cake hopper		0
4	10	2	Inclined tube conveyor for press cake	DŠT 140 - 4,5m	1,5
4	10	3	Retaining wall		0
4	20		Wiring	Classic	0
PS5		Storage of oil			0
5	10		Storage of oil - see OPTIONS		
TOTAL					97,88

6. ASSEMBLY AND INSTALLATION

During the construction it is necessary to comply with local regulations regarding safety at work and technical equipment to be used on construction sites. The operator must perform the installation according to the instructions of the manufacturer. Installation must be carried out by suitably qualified personnel and under the professional supervision of the company Farnet a.s.

The operator must ensure that after completion of the installation there will be a functionality test of all assembled parts.

The operator must ensure that all device handling using lifting equipment during the installation was in accordance with Chapter 3.

The spatial arrangement of the technology must provide free access to the device so as to allow easy maintenance and repair.

Before the installation is finished, the equipment must be properly checked for absolute constructional evenness; it must be made sure it is not even slightly twisted or otherwise distorted. Use suitable pads for settlement. If the device is mounted on a steel construction along with other heavy devices, these devices must be placed on the construction before the final settlement of the device to the water level.

6.1 REQUIREMENTS FOR FIRE ALARM

The requirements are handled by the General Designer. CAUTION – for press cake storage we strongly recommend implementing signalization due to the possibility of spontaneous combustion.

6.2 REQUIREMENTS FOR SURFACE PROTECTION

All equipment and constructional elements are supplied with surface treatment. After installation, it is only necessary to repair possible damages, if any, and sites of connection and welding. The piping should be painted with a protective coating.

The technological equipment and all structures must be provided with a coating resistant to the action of vegetable oils.

Colour design RAL 5015, 5013, 5005, 1015, 9006.

The equipment from rustproof materials is unpainted. The coating of the insulation elements (oil heater, heating conveyor) made of sheet metal is left unpainted.

Caution - equip the floors with anti-slip surfaces. Even a minimum amount of oil increases the risk of slipping.

6.3 DESCRIPTION AND REQUIREMENTS FOR COMPREHENSIVE TESTING

Before the commissioning of the facility, tests and revisions required by the law, reference parameters, the contractual terms and conditions must be undertaken and reviewed.

Individual tests

- Testing of individual machines and equipment independently without operating media is done by idle runs.

Comprehensive tests**PS 1 - Seed reception and cleaning**

- checking the correct operation of the mode of mutual blocking (see Chapter 7)

PS 2 Press shop

- gradual start-up of the presses with a controlled (slow) seed input in the run-in mode
- gradual start-up of the extruders with a slow material inflow
- gradual start-up of the presses with a slow material inflow
- sensitivity adjustment, and a check of the correct function of all sensors (see section 7)
- A check of operation of the automatic mode and mutual blocking
- Pressing of a reserve of oil for PS 3

PS 3 Filtration

- checking the settings of manual valves and oil transport routes
- start-up of the first cycle of filtration
- checking the correct operation of the pump

PS 4 - Press cake storage

- testing the conveyors, checking the correct direction of rotation of transport screws

PS 5 Oil storage

- checking the settings of manual valves and oil transport routes

Trial run - see General terms and conditions

For all the tests and trial operation the operator must secure properly trained service staff for continuous operation (frequent downtime of the technology is not desirable), raw material, and energy.

The requirements for safety and health at work and the protection of the environment.

The device is manufactured according to the customs and laws of the Czech Republic and the European Union, and is supplied in accordance with Council Regulation 2001/95/EC on general product safety (CE declaration).

During the construction it is necessary to comply with local regulations regarding safety at work and technical equipment to be used on the construction site.

6.4 INSTALLATION OF THE INSULATION OF DOUBLE-WALLED HEATERS OF TUBS



Figure 5 - Insulated tub

The insulation of the heater of the tub consists of mineral wool strips taped by insulating adhesive foil Mirelon. At the site of the double-walled element it is necessary to place the mineral wool belt. The strip of the Mirelon insulation thus overlaps the mineral wool and is affixed to the top and bottom side of the casing of the tub.

To install the insulation of the double-walled tub heater, follow the following procedure:

- Cut the mineral wool and the Mirelon foil sheets into strips so that they together surround the double-walled heater of the conveyor and at the same time so that the overhanging Mirelon sheet can be stuck to the coating of the conveyor.
- Fix a strip of mineral wool to the Mirelon foil, and fix both together onto the coating of the conveyor. Mineral wool must encircle the entire area of the double-walled heater, but the Mirelon foil must not be in direct contact with the double-walled heater.

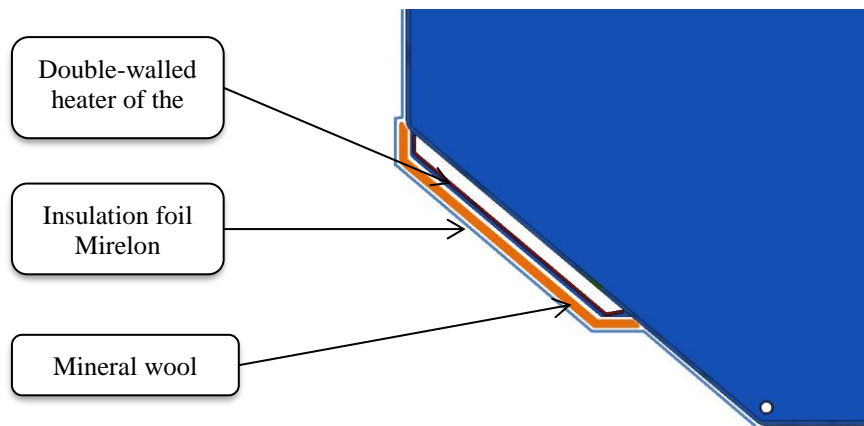


Figure 6 - A section through an insulated tub

7. OPERATION AND SETTINGS

An HMI touch panel at the switchboard door serves as a visualisation and control element. The machine is designed for automatic mode, for the purposes of servicing there is also a sevcing mode.

A system for controlled access ACCESS CONTROL

Management and interferences into the operation of the entire equipment system are tied to number of levels assigned with passwords. This eliminates the risks when training new workers and leaves some rights only for the main engineer or the facility supervisor. Passwords are assigned by the investor. Therefore, there is no dependence on our company as a supplier.

Startup of the technology

The equipment is switched on using a power switch on the front of the switchboard. This switch connects the power circuits to voltage source, activating also the control system along with the visualization screen on the switchboard door. The start-up of the visualization screen takes about 1 min. After that the control system always enters the off state, from which you can go either into service mode or automatic mode.

To turn off the equipment, use the main power switch located on the door of the main switchboard.

7.1 CONTROL OF THE PRESSING PLANT

All operating procedures shall be carried out using the touch panel HMI on the switchboard door using touch and virtual keyboards.

7.1.1 Visualization screens

The main menu allows you to access the control of the individual operational blocks. Touch with a finger to choose the desired tab.

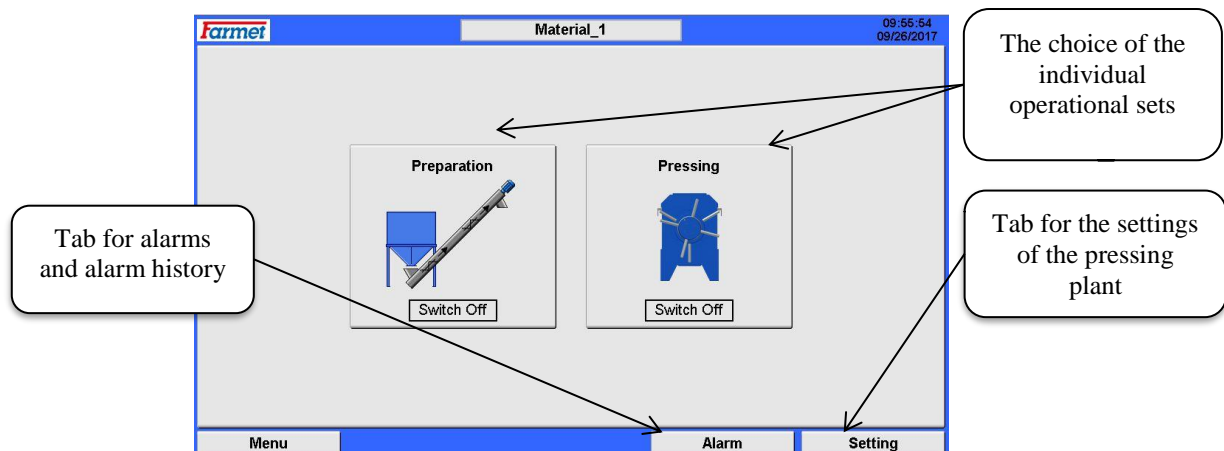


Figure 7 - Main menu

The operational set "Preparation" carries out the cleaning and pre-heating of seeds and filling up the hopper above the operational set "Pressing".

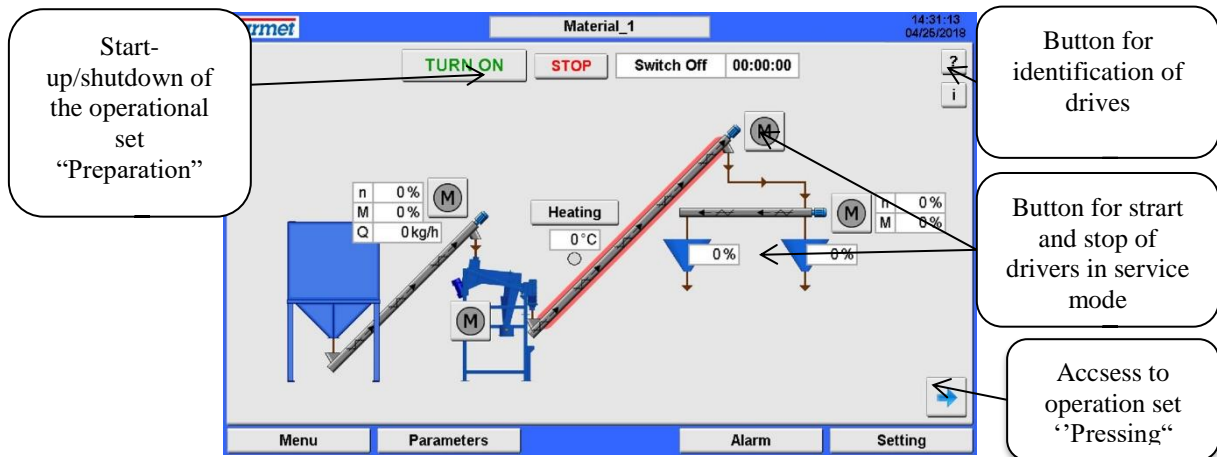


Figure 8 - Preparation

Operational set "Pressing" (and its other variants)

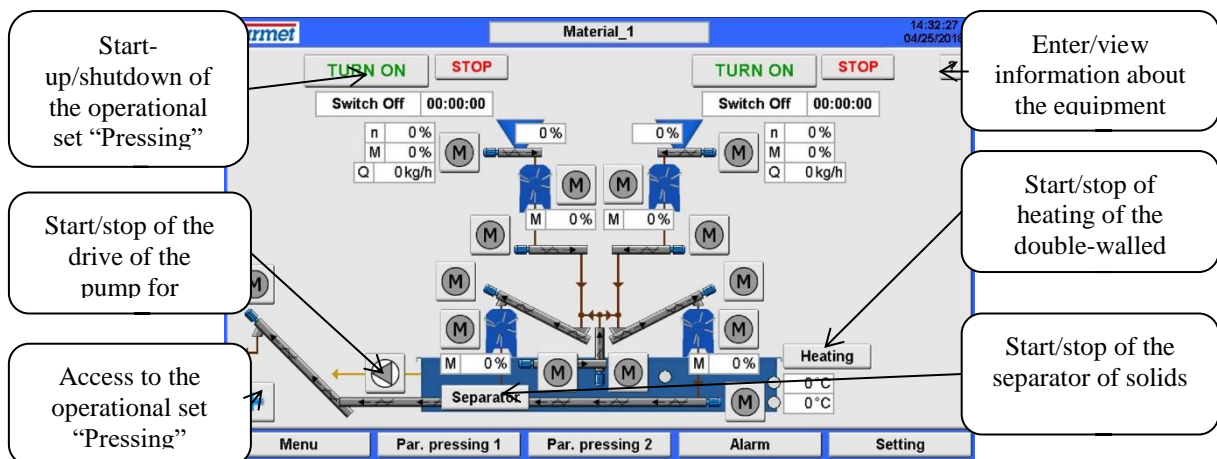


Figure 9 - Pressing EP2

7.1.2 Automatic mode

In this mode, all the possible logical relations, blocking, and prevention of adverse conditions are dealt with. The start-up of the engines and other functional elements occurs automatically according to the status of the equipment. The equipment status (along with the duration of that status) is displayed in the status window. If the equipment is in automatic mode, control options of the service mode are blocked.

The equipment is started using certain buttons with a description. Pressing the button immediately initiates the appropriate sequence, or opens an additional window confirming the action (for example with a choice of additional options, see *Figure 10*).



Figure 10 - Automatic mode start-up

Turning off of these processes is realized in a similar manner, again with or without confirmation.

7.2 SERVICE MODE

Service mode is intended for example for testing of the equipment, or repair. During this mode, there are no logical connections or blockage between the different parts of the equipment. Any part of the equipment can be run separately in this mode. Service mode is available if the device is not in automatic mode. Service control uses the buttons for regulation of motors and pumps, see below:



Figure 11 - Buttons for drives

Upon pressing the corresponding button on the position of the motor or pump a window will appear with the options for running the corresponding element. The window of the motor will also display a box containing information about the particular device (identification), in the case of an engine driven via frequency converter there will be an option to set the speed (in percentage of nominal revolutions), see Figure 12:

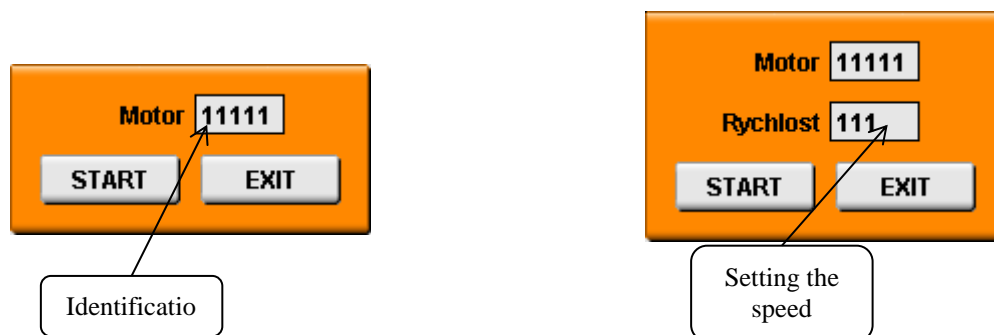







Figure 12 - Start-up of drives in service mode

7.3 DEVICE STATES





The current status of devices that can only be turned on or off is illustrated in colour. In total, there are 5 states:

Table 7 - Device states

Status	View	Description
Off		Stopped equipment is shown in grey. In this state the device is not working and it can be started.
Running		A currently running device is shown in green. The device can function only if it does not report any fault and the conditions for its operation are met.
Start-up Rundown		Start-up or rundown of the device is shown by alternating gray and green.
Blockage		Blockage of the device is shown by alternating gray and white. In this state it is not possible to start the device. Blocking protects the device from running if conditions do not allow that.
Failure		A failure of the device is shown by alternating gray and red. In this state, it is not possible for the device to run. Blockage of the device is performed automatically. If the “failure” state occurs, the alarm is automatically triggered and informs you about the current state. After removing the cause of the failure, it is possible to start the device again.

7.4 THE STATUSES OF SENSORS

Table 8 - Sensor states

Status	View	Description
Inactive		inactive state
Active		operational status – the right end position, ...
Active		operational status - operational level
Failure		emergency state – a failure of the machine, a full hopper, a full tank, ...

7.5 SETTING UP AND VIEWING THE VALUES


Table 9 - Setting and displaying the values

Quantity	Symbol	Unit	Description for view and entering	Display example
Temperature	T	°C		96 °C
Mass	m	kg	(only where weight, or mass flow meter are used)	2 456 kg
Torque	M	N/m	Displayed as a percentage of the nominal motor torque. Exceeding 100 % over a short time is possible	75 %
Revolutions	n	Rev/min	Appears as a percentage of the nominal engine revolutions range. It commonly ranges between 25 - 120 %, sometimes more, according to the used motor and frequency changer.	120 %
Mass flow	Q	kg/h		500 kg/h
Volume flow	Q	l/h	Only with "wet" extrusion	15.0 l/h

The FIC system checks the input parameters and allows you to specify values only in the range defined by your allocated rights.

7.6 THE SYSTEM OF ERROR MESSAGES (ALARMS)

If a fault occurs alarm is set off. It is displayed at the top of the screen, highlighted by a warning triangle and a concurrent sound alarm. The current alarms are shown in the Alarms window, history of all alarms can be found in the History window.

If the alarm message is reported in the alarm window, the button  will stop the siren and if the error is resolved, the alarm message will disappear from the window.

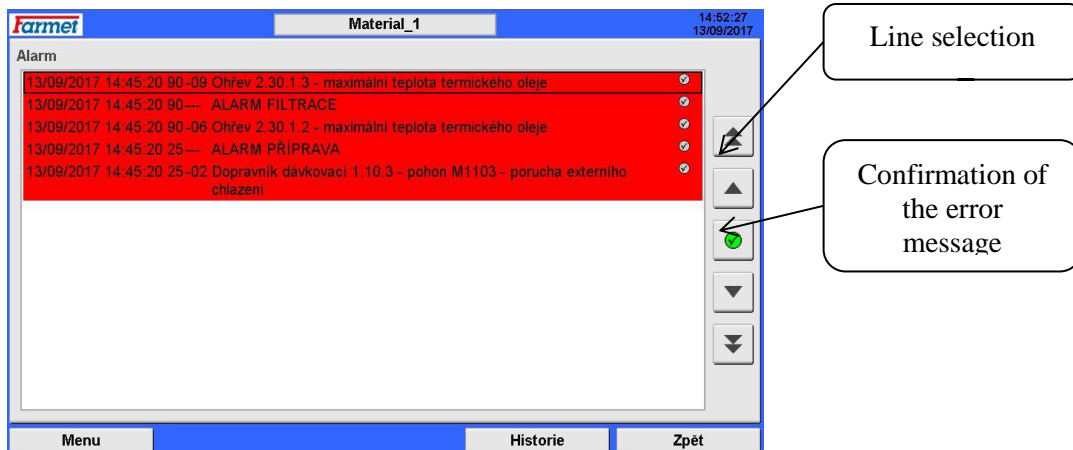


Figure 13 - List of current failures

The alarm history records when the error occurred, when it was deactivated, and when deleted. Movement between alarm messages is possible using the arrow buttons up and down, double arrows allow scrolling by entire pages.

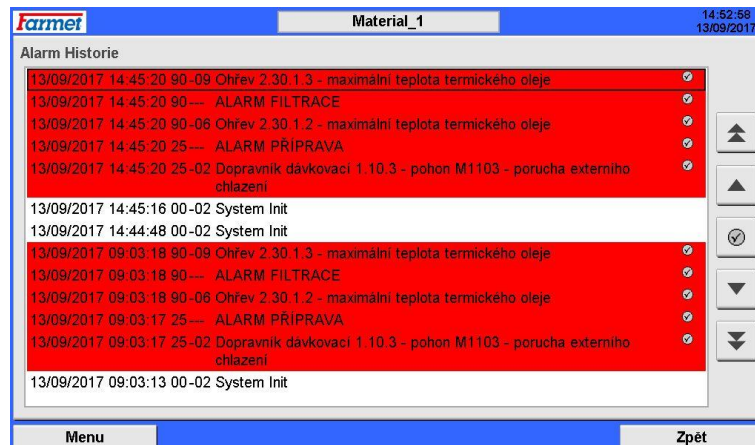


Figure 14 - History of failures



Note: The "History" tab does not allow confirmations of failures.

7.7 SETTING THE QUALITY OF SEED CLEANING IN THE SEED CLEANER KUT 500

The purpose of seed cleaning is to remove both gross and fine impurities in order to improve the parameters of the resulting products and to protect the working mechanism of the machinery and equipment of the press line from damage and excessive wear and tear. Gross impurities are mainly composed of the remnants of plant parts after the harvest. If they remain in the processed material, they increase the proportion of fiber in the cake and reduce the yield of oil during pressing. Fine impurities are largely made up of small mineral materials such as dust, grains of sand, and soil, which cause excessive wear on the working mechanism of the machinery and press line equipment.

By standard, the cleaner KUT 500 ships with screens for cleaning of the most commonly processed oilseeds - rapeseed, sunflower seed and soybean. Most beneficial for cleaning of these crops (and included in the delivery) are metal sieves with round holes with the following dimensions:

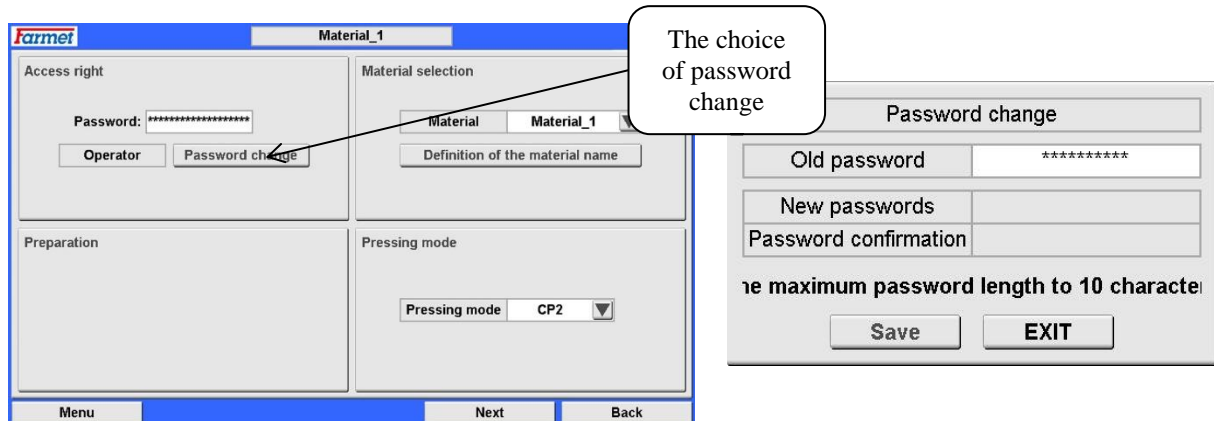
rapeseed	lower sieve 1 x 1 mm	upper sieve 4 x 4 mm
----------	----------------------	----------------------

The above dimensions are for information only; while cleaning, it is possible to swap the sieves as necessary for the those of the size that will help achieve better results. The choice of the dimensions of the holes depends on the desired degree of cleaning, the required performance, moisture of raw material to be cleaned, the degree of pollution, and the size of the individual fractions. Since the performance and quality of cleaning is also greatly impacted by the pollution of the sieves, it is necessary to periodically clean the sieves, removing them from the machine and thoroughly cleaning the dirt that got stuck there. This cleaning should be performed after about 1 week of continuous operation or as needed. If necessary, it is possible to perform a quick cleaning of the screens when the machine is idle, by means of 1) removing the front with the discharge outlets and 2) cleaning the sieves with a scraper specially supplied for this purpose. This method of cleaning allows the sieves to remain mounted in the machine.

During maintenance and adjustment of seed cleaners KUT 500, always follow the Operating Manual of the Seed Cleaner KUT 500.

7.8 TECHNOLOGY SETTINGS

7.8.1 Access rights



Most of the settings of technology parameters can only be set by the main technologist. The operator only has the option to set process parameters. The technologist has the option to change their password. Upon entering any other password than that of the technologist the system enters a basic login level for the operators.

7.8.2 Choice of material and the definition of the name of the material, choice of technology

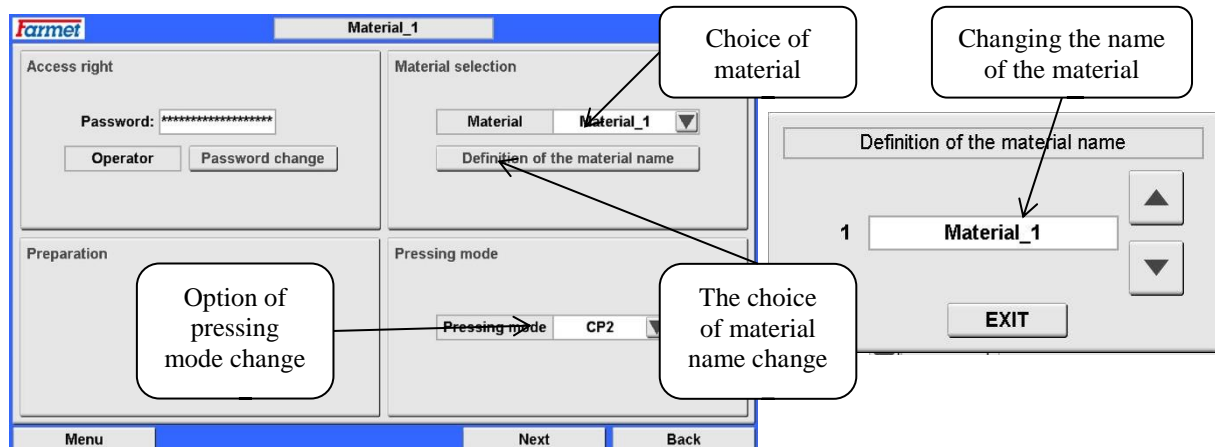


Figure 15 - Definition of the name of the material

The technology can handle different kinds of material. For each material the technology remembers the process parameter settings (preparation, pressing, etc.) and technology settings (the calibration of the conveyors and pumps, settings of the presses). Each processed material can be assigned with a name.

7.8.3 Pressing mode

Here you can select the different pressing modes. For CP2 mode, the conveyor 2.20.4.1 must be installed in place of extruder 2.20.2.1

7.8.4 Calibration of the dosing conveyor 1.10.3 and 2.15.1

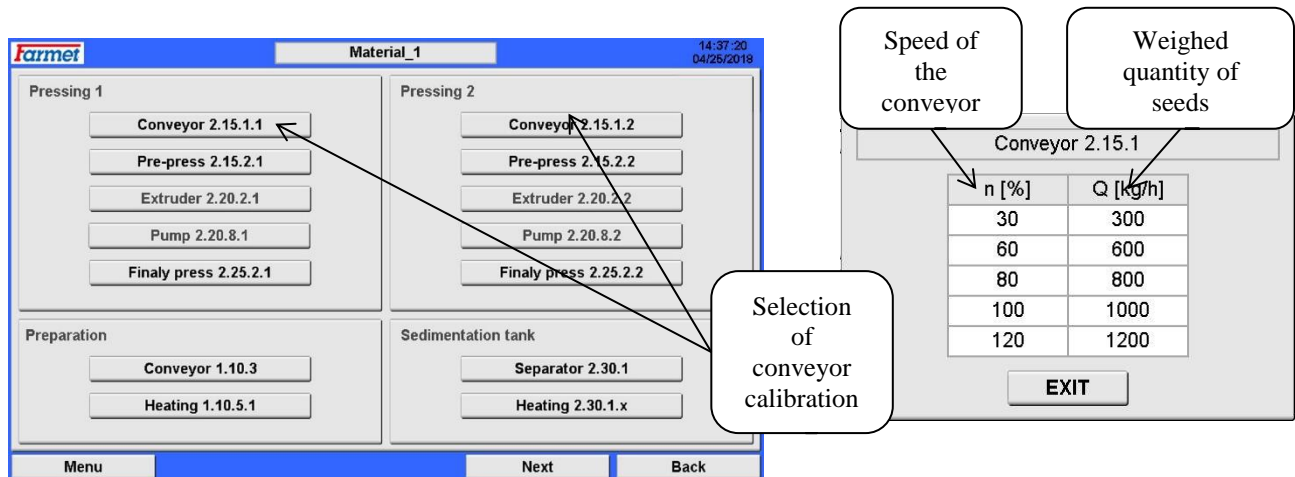


Figure 16 - Calibration of the dosing conveyor

The screw conveyor is a volume-based dosing device, i.e., on each turn it supplies a constant volume of material (in the common RPM range this dependency is almost linear). The performance in kg/hour depends on the density of the material. Therefore, it is necessary to calibrate the conveyor for each material separately. Calibration of the conveyor is carried out as follows:

- run the full conveyor at certain revolutions, record the RPM at which the conveyor is currently running
- for one minute fill up a container with the material (it must be falling evenly out of the conveyor), measure the amount of material in the container
- do this at different speeds of the conveyor (e.g. 30, 60, 80, 100 and 120 %)

recalculate the measured values in kilograms per hour (multiply 60 times) and type to the table in the settings menu, Conveyor 1.10.3 2.15.1.1 and 2.15.1.2. Values must be entered in ascending order, when entering values out of sequence the error message appears.

In such way it is necessary to calibrate the conveyor separately for each type of material.

7.8.5 Thermal oil heating in the tub coating and in the conveyor

In order to heat the incoming raw material and the oil in the sedimentation tub, heater rods located in the double-layered wall of the vessel are used. The double-walled coating is filled with a special oil, which provides heat transfer to the surface.

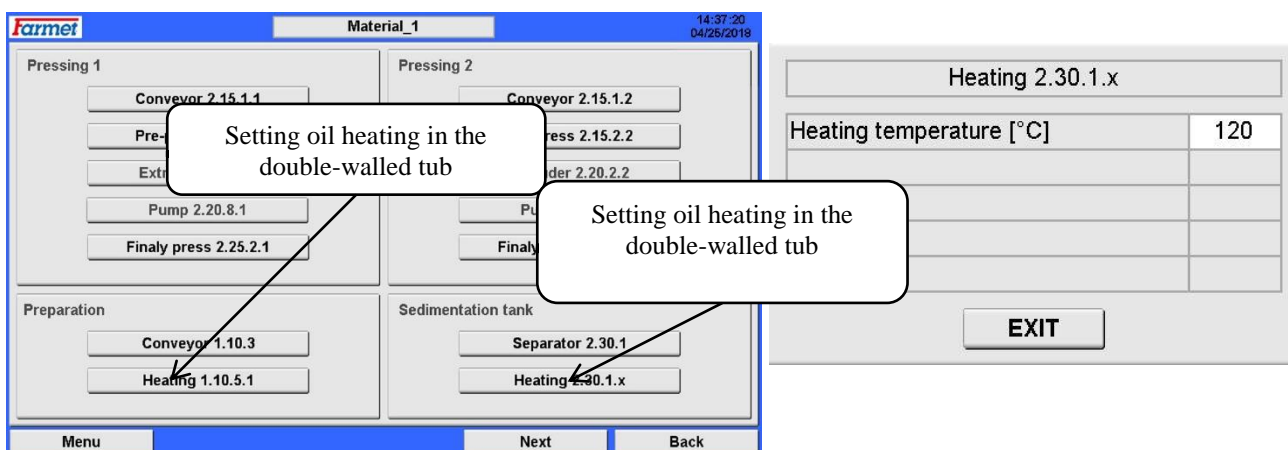


Figure 17 - Heating of thermal oil

Heating temperature [°C] setting the temperature of the heating medium (oil)

7.8.6 Setting the delay for pre-press and final press shutdown

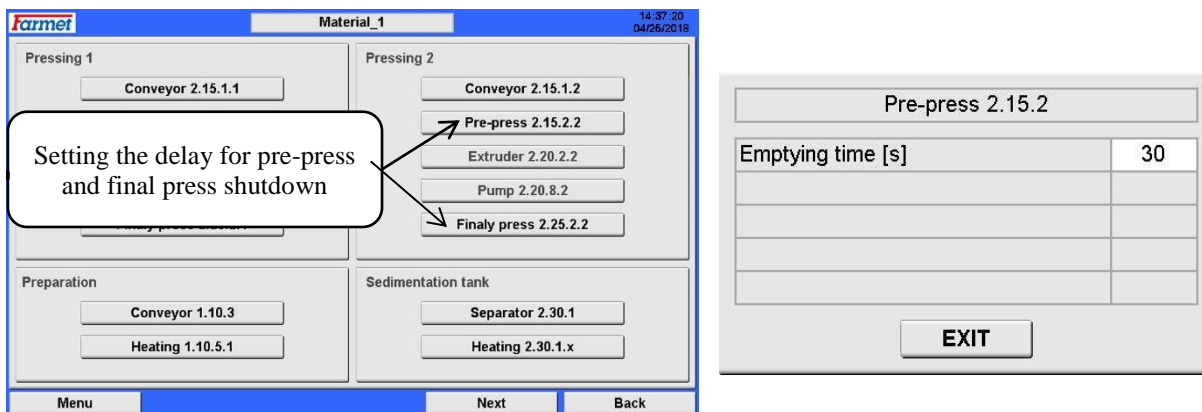


Figure 18 - Setting the delay for pre-press and final press shutdown

Shutdown delay [s] – the time after which the main drive of the pre-press or final press turns off following pressing of the "STOP" button in the visualization screen of the operating set “Pressing”.

7.8.7 Setting of the raking arm of solids separator

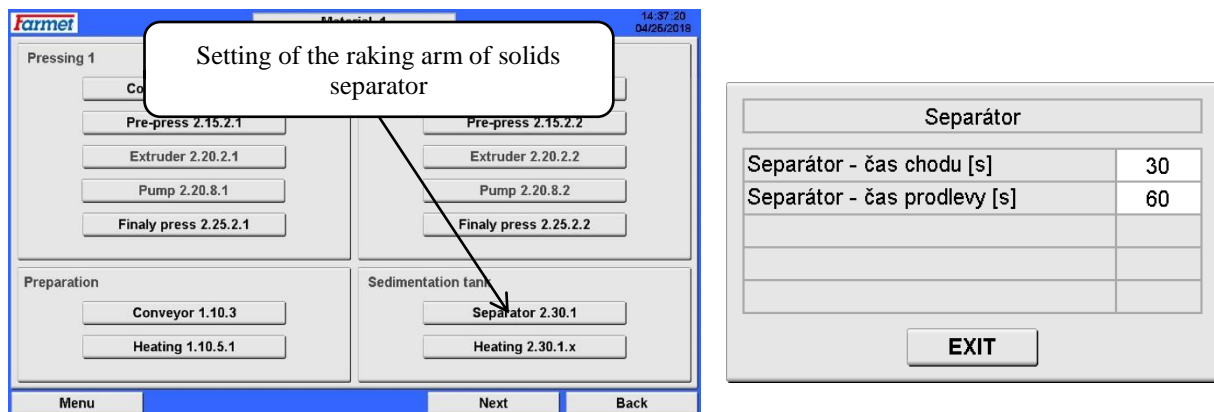


Figure 19 - Setting the raking arm of solids separator

The pressing plant is equipped with solids separation for both pressing steps. The importance of the separation lies in an increase of the performance of filtration by the partial removal of the solid particles from the oil even before the filtration process itself.

Separator – running time [s] – This value sets the time during which the separator is in operation in one cycle.

Separator – pause time [s] – This value sets the time during which the separator is idle in one cycle.

Set the separator running time so that each of the blades of the chain stops at least 1x on the top separation sieve and set delay time so that the oil has enough time to drain from the sediment back into the tub. Both values must be set to avoid the bath from overflowing with sediment, i.e. the chain cannot have long idle (delay) periods, which would cause each chain blade to carry a too large amount of sediment. An excessively large amount of solids coming to the final press can cause oil fouling!

7.8.8 Setting of the raking arm of solids separator

For the solids separator to function properly, it is necessary to ensure the correct position of the raking arm, so as to avoid the friction of the rake on the tub wall.



Danger!

Only adjust the position of the raking arm when its drive is off.

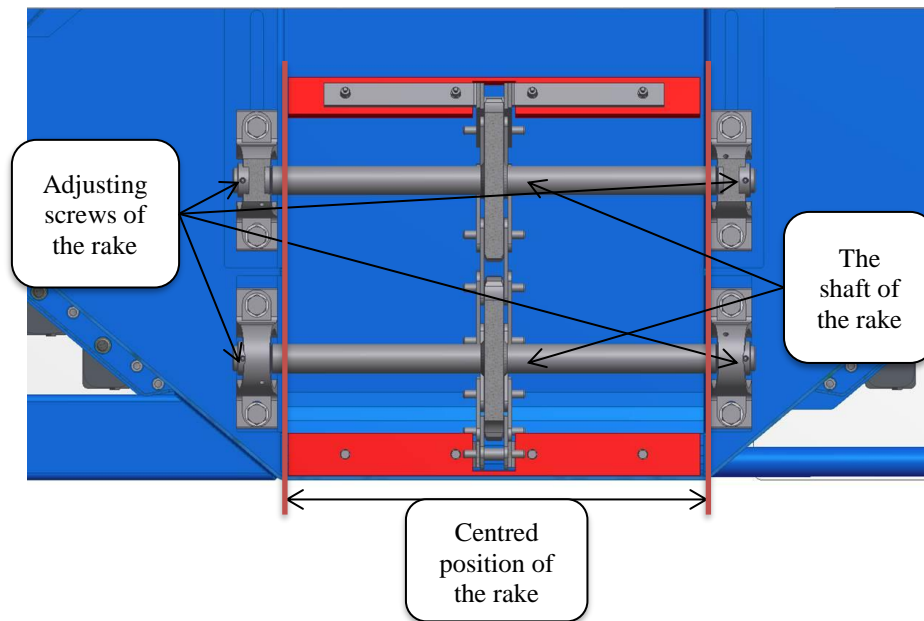


Figure 20 - Setting the position of the raking arm of solids separator

Correct setting lies in positioning the rake to the centre relative to the tub walls:

- Turn off the drive of the rake
- Loosen the adjusting screws on the shafts of the rake. There are 4 shaft in total, 2 on each side of the tub. They are located on the inside of the tub.
- Centre the rake position so that on both sides there is an even gap between the edge of the tub and the edge of the rake (so that the rake does not touch no point grazes the wall of the tub)
- Tighten the adjusting screws
- Briefly start the rake drive to make sure that it is not grazing the wall of the tub. In the case that it does scrape the wall, turn off the drive and repeat the adjustment procedure of the rake.

7.9 OTHER SETTINGS

7.9.1 Engine hours

Component	Engine hours total	Change gearbox oil	Remaining to service	Reset
Pre-press 2.15.2.1	0	8000	8000	Reset
Extruder 2.20.2.1	0	1000	1000	Reset
Finaly press 2.25.2.1	0	8000	8000	Reset
Pre-press 2.15.2.2	1	8000	8000	Reset
Extruder 2.20.2.2	0	1000	1000	Reset
Finaly press 2.25.2.2	1	8000	8000	Reset

Engine hours display how much engine hours are left until next oil exchange in the transmissions of the presses and in the mounting of the extruder.

7.9.2 Settings for language, time and date, network, and display

Figure 21 - Settings for language, time and date, network, and display

In this settings menu you can change the language of the control system, enter the time and date, set the parameters for a network connection for remote management and diagnostics. You can also calibrate the touch panel and adjust brightness.

7.9.3 Setting the float sensor

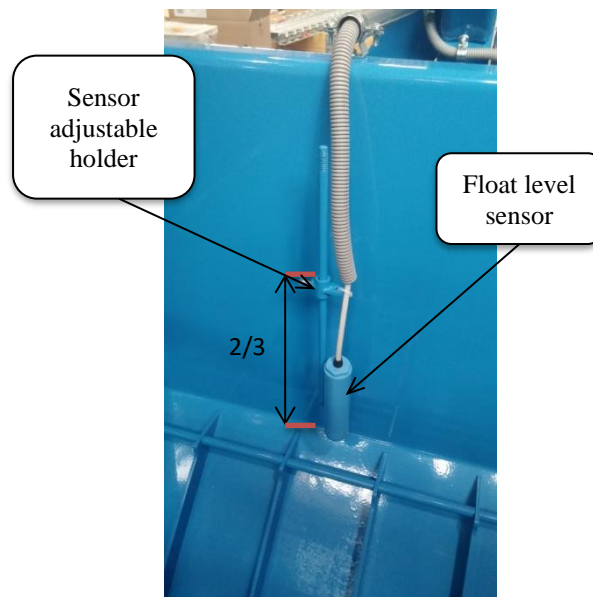


Figure 22 - Setting float sensors

The sedimentation tub contains an emergency level float sensor that is located on a rider in the tub. The position of this sensor is factory-set to a height of approx. $2/3$ of its fixture. Check and, if necessary, set it to a correct position before starting the equipment. If the sensor is lower, it will activate and respond too early, which is undesirable for the capacity and the progress of the filtration process.

7.10 SETTING THE PARAMETERS OF THE PRESS

7.10.1 Pressing parameters

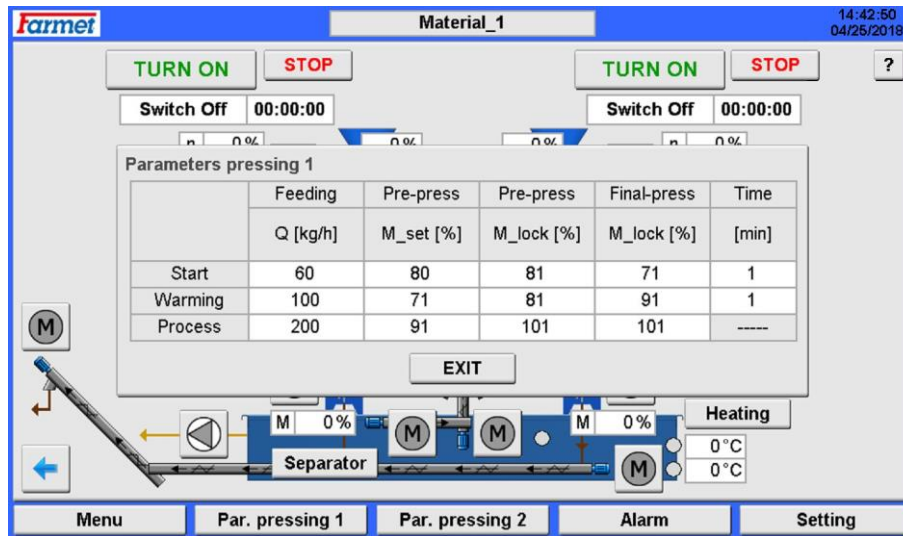


Figure 23 - Setting the pressing parameters

In the table Setting the pressing parameters it is possible to change the settings for each state; these settings are made for each material separately. For the correct operation of the pressing plant, it is necessary to correctly calibrate the dosing conveyor according to *Chapter 7.7.4*.

In the column "Dosage - Q [kg/h]" it is possible to set the quantity of supplied material.

Pre-press – "M_set [%]" is the setting of the moment load of the pre-press which will cause a slow-down of the dosing conveyor 2.15.1.1.; when the load falls below this value, the dosing conveyor will resume its operation at the set value.

Pre-press – "M_lock [%]" is the setting of the moment load of the pre-press which will cause a shutdown of the dosing conveyor 2.15.1.; when the load falls below this value, the dosing conveyor will resume its operation at the set rate.

In the column "Final press – M_lock [%]" you will find the setting of the moment load of the final press which will cause a shutdown of the dosing conveyor 2.15.1.; when the load falls below this value, the dosing conveyor will resume its operation at the set rate.

In the column "Time [min]" you enter the delay, after which the dosage of the material will increase to the value of the subsequent state.



Note: In some modes, some pressing parameters cannot be set.

7.11 SAMPLING

For the correct setting of the entire technology it is necessary to regularly take samples and measure the performance of the technology. The most important parameters to observe are:

- Oiliness and humidity of the seeds
- Residual fat and humidity of the press cake
- The mass of press cake falling out of the final press per hour

In the course of pressing we recommend regular sampling of the incoming seeds and press cake every 4 hours and carrying out an analysis on the fat and water content of the cake. When you take samples, always measure the performance of the machinery as well. Lab results should be available as soon as possible (within two hours), so that a timely intervention can be made into the setting of the technology. After making changes in the technology settings, it takes about an hour for the process to stabilize, and then it is advisable to carry out additional measurements.

Pay attention to correct sampling. To correctly perform humidity analysis, pressing cakes must be captured and instantly enclosed (e.g. in a plastic bag), and when cooled down, analyzed for humidity and fat.

8. START-UP AND SHUTDOWN OF THE TECHNOLOGY

8.1 BEFORE PUTTING INTO OPERATION



The operator must not:

- **start or use a machine with damaged or disassembled coating**
- **touch the moving parts of the machine**
- **work with the machine in an insufficiently illuminated work area**
- **perform maintenance, cleaning, repair or adjustment when the device is running.**
- **remove or dismantle safety and protective equipment.**

- Before each use (putting into operation after shutdown), the operator must check the equipment in terms of completeness, occupational safety, occupational hygiene, fire safety and environmental safety.
- The operator is responsible for safety and for all damages caused by the operation of the device.
- At work, the operator shall comply with technical and safety rules given by the manufacturer for the equipment.
- The operator must prevent unauthorized persons from accessing the rotating parts of the equipment.



- Before putting the equipment into operation check its status. Devices exhibiting signs of damage must not be put into operation.

- The covers may only be removed or dismantled after the equipment is completely stopped and secured in the inactive state.



- When working (handling press cakes, adjusting machines and equipment, repair, etc.) it is necessary to wear a work suit, gloves, safety glasses, face shields, shoes with non-slip soles. While working on the hot parts of the machinery, use appropriate protective equipment and measures against burns and scalds.



- It is recommended to use ear protectors when working in the facility. This is a workplace with intermittent supervision and service.

- The operator must take care of order and cleanliness in the workplace, as well as of inspections and cleaning of functional elements.

- Before commissioning, check the status of transport routes for seeds and cakes, the cleanliness of outlets and vibrating sorters, and the permanent magnet. Next, check the cleanliness of the hoppers and slides along the path of the material to the presses. Remove any hard objects (steel) that could damage the interior of the press. Also check the transport routes of oil, i.e. oil pipes, tightening of the screws, hose clips, pump seals, etc..

- Before putting into operation, you also need to check the integrity of switchboards and cable lines, as well as the sensors and their functionality.
- Check and, if necessary, set the current-limiting security elements and check the direction of rotation of all the drives.
- If installation in the switchboard is necessary, all the machine below should be carefully covered in order to prevent a possible fall of the conductive parts (mainly scrap wires) into the electrical equipment.
- Check the correct position of the rake of the solids separator (it must not scrape the tub walls). If necessary, adjust it according to Chapter 7.7.8
- The delivery comes with a laser thermometer, which can read the temperature of the press segments, gearboxes and bearings, seeds, press cake, oil, etc.
- Also included is a set of basic tools for servicing the technology, as well as protective equipment - goggles and gloves.

8.2 SETTING UP OF THE DEVICE AFTER A PROLONGED SHUTDOWN AND BEFORE THE FIRST START-UP

- Before you run the technology verify functionality of all the drives with a short run of the pressing plant in service mode (using the touch screen by touching the icon of the drive and its starting and running for a short time, then turning off).
- Calibrate the dosing conveyor 1.10.3, the transporter 2.15.1 and 2.15.1.2.

8.3 PREPARATION

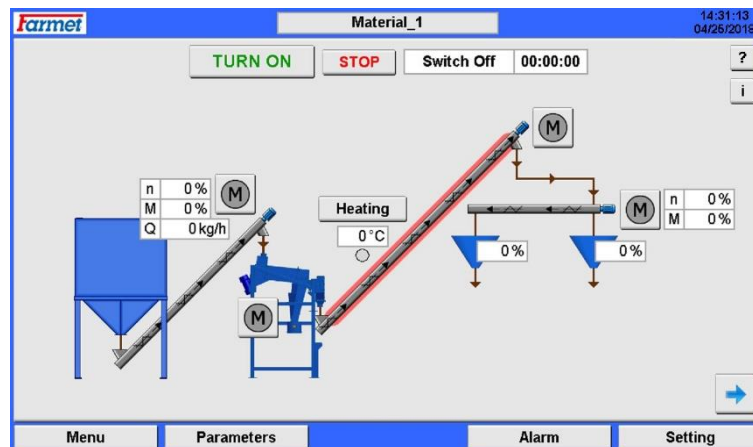


Figure 24 - Visualization screen of the operational set Seed preparation

The operational set "Preparation" starts automatically when you push the start button "START" and then confirm this choice. The shutdown is performed using the "SHUTDOWN" button and the subsequent confirmation of this choice. If, during operation, any problem requiring an immediate stop occurs, it can be done by clicking "STOP" and confirming this choice. The quantity of dosed material with the dosing conveyor is set in the Preparation parameters table. If the hopper above the dosing conveyor for the pre-press is filled above the operating value, the revolutions of the dosing conveyor will be automatically reduced so as not

to overflow the hopper. If the material level in the hopper is too high (approx. 90 %), all transport routes will be blocked.

Heating of thermal oil in the seed conveyor

Heating of the thermal oil in the double-layered wall of the conveyor serves the purpose of temperature stabilization of the seeds if they do not satisfy the requirement for a minimum temperature for pressing (15 °C). Press the button "Heating" of the heating conveyor to start (or turn off) heating in this conveyor. Turning on is only possible if the conveyor is running so as to avoid burning of the material onto the conveyor walls. In the case of a shutdown of the conveyor, heating is automatically switched off. If there is a temporary blockage of the conveyor (for example, due to a clogged/overflowed hopper), the heating will temporarily turn off. After restarting the conveyor, the heating will start again as well.

8.4 PRESSING:

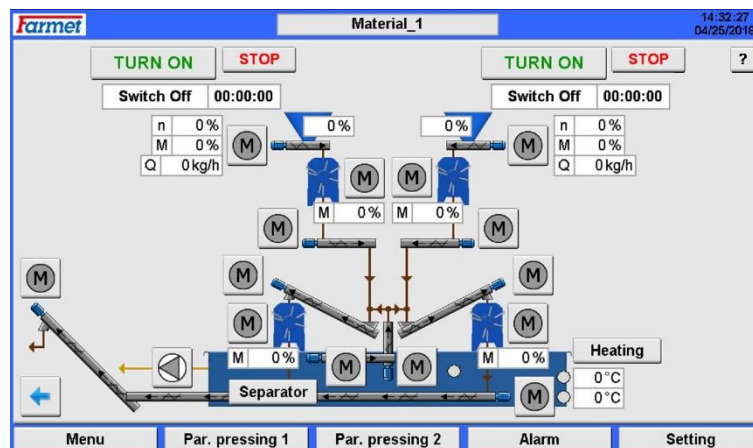


Figure 25 - Visualization screen of the operational set Pressing

The operational set "Pressing" starts automatically when you push the start button "START" and confirm this choice. The pressing process starts in several steps, so that the machinery is gradually warmed up (pre-press, extruder and final press). These steps are referred to "Start" and "Warm-up". After these steps the machinery enters the "Process" step, that is, a continuous operation at maximum performance. When ending pressing, the machinery enters the step titled "TERMINATION" which ensures that all material leaves the pre-press, the final press and all corresponding conveyors so that the machinery can be safely shut down. The transition between steps/states of pressing occurs automatically after the expiration of the time set for that particular step, or by using the buttons for start-up of the pressing stage and confirming the choice.

The "START" button can also be used to manually advance to the next step of pressing all the way to the step of "Termination", which ends with a progressive discharge of the material from all the conveyors and machines. If, during operation, any problem requiring an immediate stop occurs, it can be done by clicking "STOP" and confirming this choice.

Solids separator

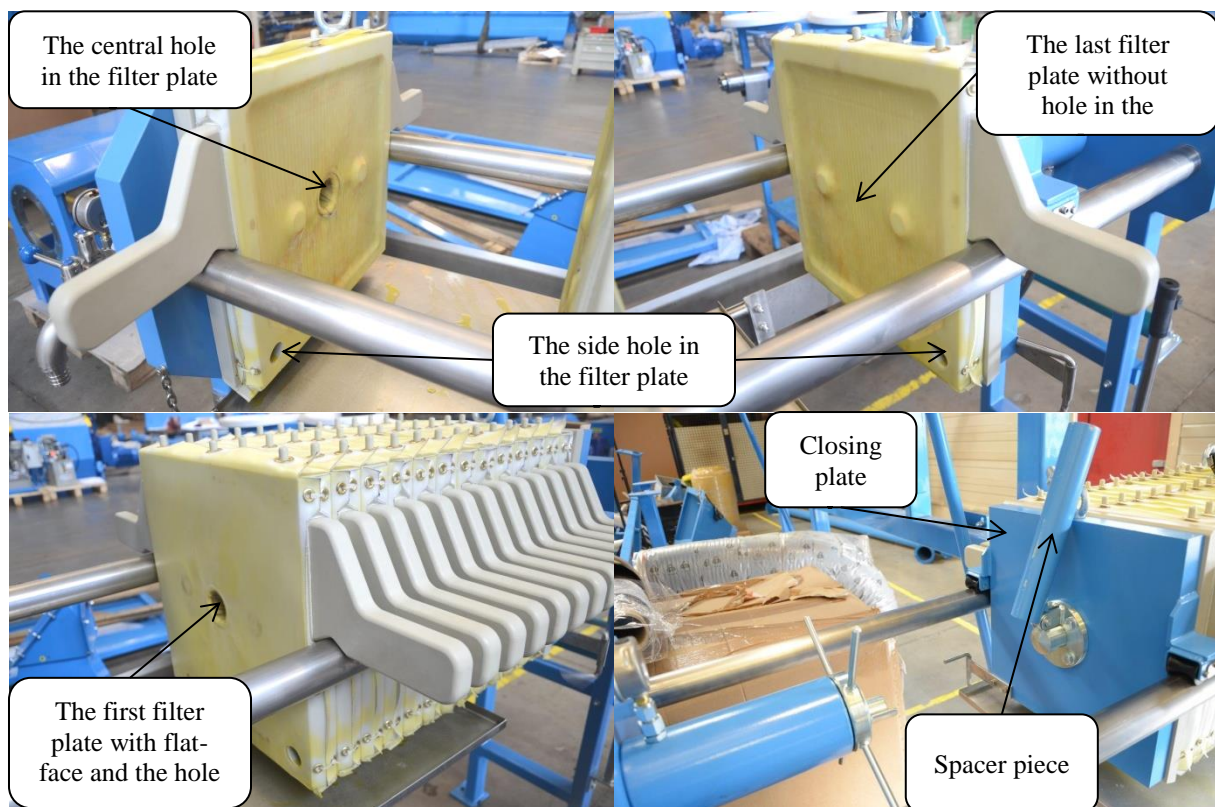
The solids separator starts automatically together with the operational set Pressing (at the step “Process”). To stop and restart the separator, use the button “Separator” on the control screen of the operational set Pressing.

Heating the oil in the sedimentation tub

Heating the oil in the sedimentation tub is regulated independently from the operational set Pressing. Startup and shutdown of the heating is carried out using the "Heating" button on the control screen of the operational set “Pressing”.

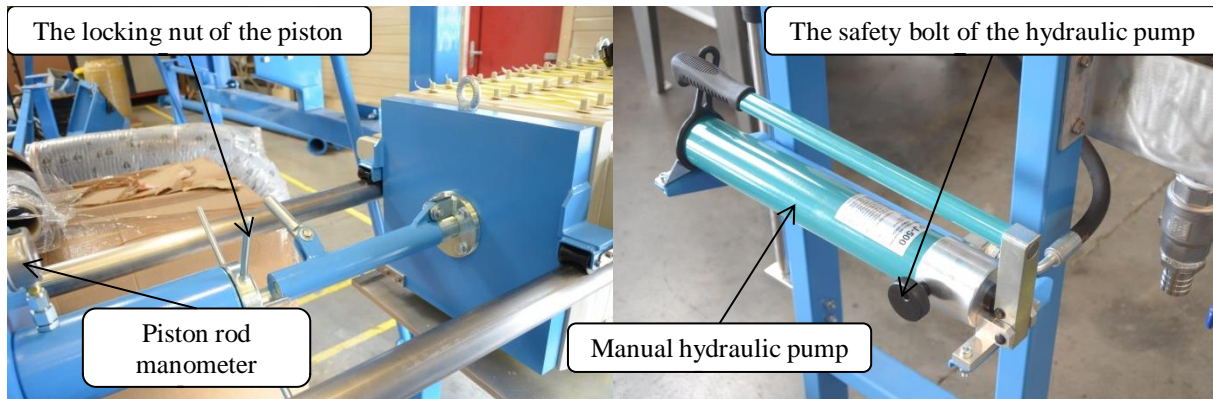
8.5 FILTRATION

8.5.1 Fitting the filter with filter cloths



- Fit the filter housing with new or cleaned filter clothes. **Attention!** The last cloth does not have a central hole.
- The first and last of the filter plates are different from others and are not interchangeable.
- Filter plates should be mounted in such manner that the side holes of the filter plate correspond.

- After mounting the last cloth move filter plates and the closing plate towards the inlet and outlet of oil and lower the spacing element.



- Secure the manual hydraulic pump with a locking screw and use this pump to close the filter at a pressure of 40 MPa (read the pressure value on the filter manometer).
- After the closure of the filter at the pressure of 40 MPa, secure the piston by a locknut and release the locking screw of the manual hydraulic pump so the pressure in the hydraulic circuit drops.

! **Attention!** The piston of the filter must not be pressurized during the course of filtration, else a rapid wear of the functional parts of the hydraulic system would occur.

8.5.2 Activation of Filtration

Attention: The filter is controlled manually and as such requires regular maintenance by the staff.

Before you run filter filling or filtration, the filter must be sufficiently compressed by the filter piston. Check the temperature of the oil in the tub. Heat the oil so that the filtration can more effectively. The higher the temperature of the oil will be, the better will filtration perform. In the case of canola and sunflower oil we recommend heating at least up to 40 °C, which will ensure the dissolution of waxes, which would otherwise soon obstruct the filter cloths and thus prevent further filtration. Soya-bean oil must be heated to 60 - 75 °C to ensure the dissolution of the acids in the oil that would otherwise immediately clog the filter cloths. At such high temperatures of the oils, ensure proper work safety according to local regulations.

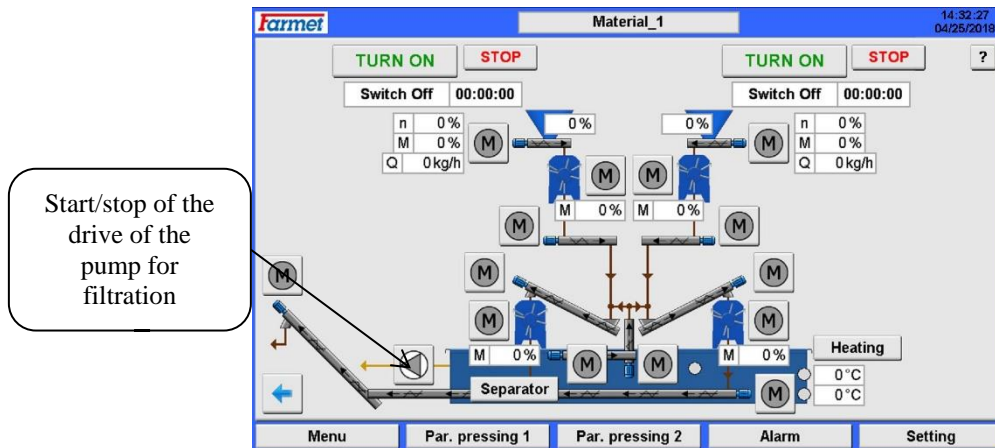


Figure 26 - The position of the buttons to start and stop the filtration pump and the dispensing pump

Filter filling

The pump 3.10.2 draws oil from the separating tub 2.30.1 into the filter 3.10.3. At the outlet of the filter there are two valves: a valve for oil return into the tub, and a valve for dispensing the filtered oil into storage tanks. To achieve high quality filtration process it is necessary to first fill the surface of the filter cloths with a layer of fine solids.

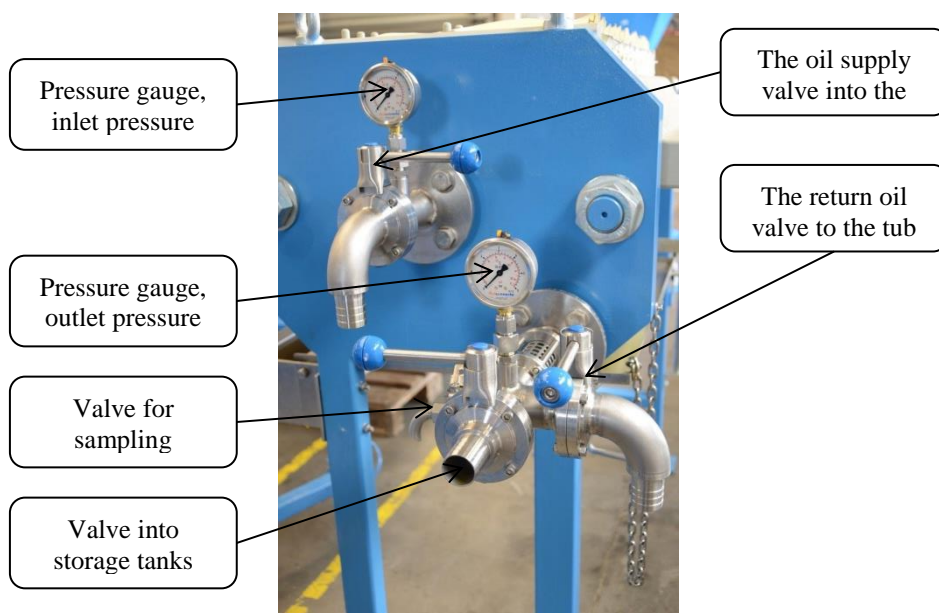


Figure 27 - Position of the filter valves

- Before filter filling, close the **valve leading to the storage tank** and then open the **valve of the oil supply to the filter** and the **valve for oil return into the tub**
- ! • The pump 3.10.2 is started manually via the touch panel when there is enough oil for filtration and the valves are properly set on the right pipes.
- ! • The oil pump should not run on empty, i.e. never, without the minimum oil level in the separation tub; otherwise, damage could be incurred

- The pipe contains sight-glass, through which you may observe the purity of the oil flowing out of the filter. Once the oil starts flowing clean, proceed to the step of “filtration”, without interruption of oil pumping. The process of filter filling normally takes approx. 1 minute.



Filtration must be carried out only from the upper valve of the sedimentation tub. The lower valve is only used for purging the bath (long-term shutdown technology, without the use of pumps and the subsequent filtration).

Filtration



The filling stage smoothly transitions into the filtration stage; do not turn off the pump drive during the transition; the layer of the sediment on the filter cloth might be disrupted. There must always be enough oil in the separation tub during the course of the filtration process. The oil pump should not run on empty, i.e. never without the minimum oil level in the separation tub; otherwise, damage could be incurred.

The filter pump is designed to filter and push the oil into IBC containers right after the filter. The area behind the filter must therefore be of any piping or structures, which would reduce the capacity of filtration due to pressure losses after the filter.

- Prior to initiating filtration, open the **valve leading to the storage tank** and close the **valve for oil return into the tub** (the pump must be running during the transition from the filling phase to the filtration phase)
- Filtration should run at a constant flow rate without pressure shocks and without air suction.
- During the process, filtration performance gradually decreases. After a reduction in the flow of filtered oil to a low value (in the experience of the operator) stop the filtration.

8.5.3 Termination of filtration

Stop the filtration when the pressure in the filter is approaching that in the by-pass valve (approx. 10 - 12 bar), or as soon as the oil flow rate is nearing the inflow of oil coming from the presses into the sedimentation tub. This indicates that the space between the filter frames is full and cannot allow further filtration. In the event of a shortage of oil in the sedimentation tub and the pressure in the filter is not nearing the value of pressure of the bypass valve, you can abort the filtration by shutting down the pump and continue filtering when you oil has been replenished from the presses.



- When you reach the pump working pressure 10 - 12 bar is always necessary to immediately shut down to prevent unnecessary wear or destruction of the working mechanism of the pump.



Note: If filtration is aborted prematurely, with the space between the filtration frames not being full, then during the opening of the filter, oil will squirt or flow from the filter, which would not happen were the space filled with filter cake.

- Turn off the pump 3.10.2 and wait for the pressure on the pressure gauge of the filter to drop.
- Secure the locking screw of the manual hydraulic pump and pressurise the piston rod until it is possible to easily loosen the lock nut of the piston rod (usually at 40 MPa), **maximum of 60 MPa**.
- Loosen the lock nut of the piston rod and lower the spacing element.
- Collect the contents of the filter housing into a drainage bowl, pour the oil into a bucket and empty it into the sedimentation tub.

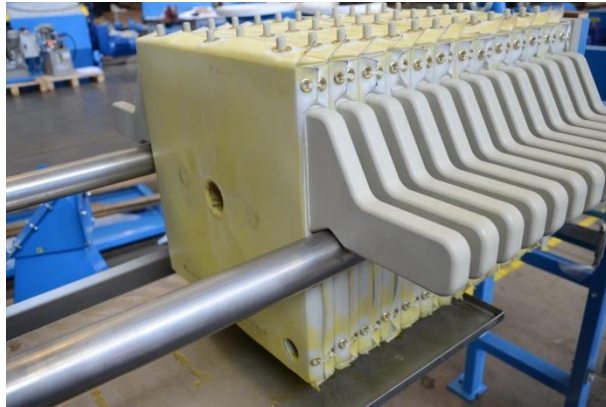


Figure 28 - Filter cloths

8.5.4 Cleaning the filter

- Clean the cloths with a spatula (a plastic scraper, which is included in the delivery) into the prepared container. The filter cake from the plates and filter cloths can be added into the hopper, located on the conveyor for press cake.
- Clean the holes between the filter plates.
- Clean the seating surfaces of the filter frames – any dirt between frames can cause untightness, leading to unwanted leakage of oil from the filter onto the floor.

8.6 OPERATING DEFECTS

The table below describes how to troubleshoot issues that may arise during the operation of the equipment. The equipment must always be properly installed and used in accordance with this user manual. In case of doubt regarding the use of the equipment, contact the Service Center.

Table 10 - Troubleshooting

Failure	Possible cause	Solutions
No material coming from the dosing conveyor for seeds	Grate magnet clogged up	Close the opening in the temporary container, remove the grate magnet and clean it.
Oiling up of the press	refer to Manual for Press FL 200	
Failure of the circuit breaker of the conveyor engine	Blockage of the conveyor and engine overload	Remove the service cover and clean the conveyor
Low filtration performance	Low oil temperature or high oil viscosity and the presence of undissolved waxes	Heat the oil in to at least 40-60 °C by turning on the heating
	Clogged filter cloths	Clean the cloths
	Low filtration pressure	Check the tightening of the spring of relief valve, maximum operating pressure 10 - 12 bar.
	Blocked entry to the pump	Clean the input pipe of the pump
	Airlock in the pump	Ensure that oil is coming into the pump
	Closed valve on the oil pipe	Open the valve

9. MAINTENANCE AND REPAIRS

- Operation, maintenance and repair of the equipment can only be performed by persons qualified to do so, see Chapter A.4 and those designated by the supervisor.
- Servicing or repair of the equipment may only be done when the equipment is at rest, i.e. turned off.
- When handling the equipment using lifting equipment, the operator or the repairman must proceed according to Chapter C.
- When performing maintenance of the individual components of the pressing plant, follow the user manuals for individual machines and equipment.

9.1 GENERAL INSTRUCTIONS



Any work on the device may only be done when turned off and secured against accidental startup. Place the label reading "DO NOT START, MACHINE UNDER REPAIR" on the main power switch of the equipment.

- When performing maintenance or repair of any kind, you must comply with safety regulations stated in the points A to D.
- Always disconnect the device from the grid (main power switch).
- Check whether the chosen method is safe, whether the right tools and equipment are available.
- ! Check and tighten all the screws and other assembly connections on the equipment after first 50 hours of operation, after that, perform regular checks.
- All lubrication points should be lubricated according to the lubrication plan for each device.
- When repairing the equipment, use only original spare parts, appropriate tools, and protective equipment.
- Keep the equipment clean, especially the parts that are heated up.
- ! During adjusting, cleaning, maintenance, and repair of the equipment you must secure the parts which could threaten the operator by falling or some other movement.
- All work must be performed conscientiously, by thoroughly trained staff only. If the intervals for maintenance, inspection, and repair are not exactly set in the documentation, they depend on the experience of the operator. Therefore, there is no generally valid instruction or timetable for such work.
- Before dismantling/removing parts, mark relative position of the components.
- ! Always check the function of a re-assembled unit, especially whether the moving parts are not jammed, or whether the necessary allowances are present, etc.
- During repair, make sure that no tools or parts have fallen into the equipment. Every object that has fallen into the equipment, gearbox or motor must be removed - otherwise it could cause a breakdown of the entire equipment!

- No modifications or interventions except for replacement of broken parts with spare parts can be done to equipment of this technological electrical installations without the manufacturer's knowledge.
- If the switchboards are equipped with forced ventilation, the ventilation filters need to be periodically cleaned or replaced - any cleaning or replacement must be carried out when the main switch is off
- All the level sensors and meters must be kept clean and adjusted when necessary, according to the supplied instructions, in order to stay fully functional
- Periodically check the tightness of screws and connections of electrical equipment.

9.2 REMOVAL OF SEDIMENT FROM HEAT EXCHANGE SURFACES OF THE SEDIMENTATION TUB.

Sediment from the heat exchange surfaces can be removed using the integrated rakes. Removing the sediment increases the efficiency of heating of oil in the sedimentation tub.

- Place the auxiliary lever into the hole in the movable lever.
- Several movements to the right and to the left will remove sediment from the heat exchange surfaces
- Repeat on the opposite side of the sedimentation tub

9.3 THE LUBRICATION PLAN AND REFILLING OF THERMAL OIL INTO THE TUB AND THE HEATED CONVEYOR

Lubricating plans for individual components of the pressing plant with oil filtration are listed in their respective user manuals.

The volume of the thermal oil in each of the 2 double-walled segments of the tub is 8.5 L. Refill the oil via the upper front opening, where the emergency thermostat is screwed in. First, remove the thermostat, its reservoir, then the screw in the middle of the double wall and pour in the oil until the overflows through the check opening. Then return everything to its original state. For more information read the manual for the tub.

The volume of thermal oil in the heated conveyor is 23 L. Drain the oil by the bottom drain opening, seal the opening by a cap and fill in 23 L of oil using the upper-side filling hole. Seal the back opening with a cap, insulate the conveyor properly which can now be effectively used again.

Refill the oil only when the device is switched off and when the oil in use has cooled down.

9.4 DISASSEMBLY AND ASSEMBLY OF THE PARTS OF THE EQUIPMENT

During the disassembly and assembly use caution when handling the equipment follow the instructions in the manuals for each device.

Maintenance of technological equipment conforms to the local rules of operation, which are elaborated by the operator/supervisor, but also to the general safety regulations in accordance with the applicable legislation, and guidelines for the maintenance and repair listed in the instructions for use supplied with individual machines and equipment.

Removing the pressing apparatus (the shaft with screws) from any of the presses FL may be done with the universal auxiliary mounting platform (OPCE). The platform is equipped with wheels; in the case of service FL it should be placed against the press FL. Use the hoist to move the press shaft first onto the platform and then on the ground.

9.5 MAINTENANCE RULES

The equipment mainly requires carrying out the prescribed checks and revisions in accordance with the relevant legislation. All regulation in terms of fire safety must be complied with. All work on the device may only be performed by qualified personnel and must be carried out when the equipment is turned off secured against accidental startup.

Any repairs, modifications and other works on the wiring may only be executed by authorized persons with a corresponding electrical and technical qualification.

Special attention should be given to regular checks and tightening of all screw connections as well as lubrication of all lubrication points.

All work on the equipment requires using appropriate tools and protective equipment.

Before starting work it is necessary to reliably prevent any foreign and particularly metal objects from falling into transport routes or working parts of individual machines.

After the completion of the work, you should always check the traffic routes from the perspective of possible foreign objects and perform a functional test.

9.5.1 Wiring

The switchboard and the electrical equipment must be regularly checked and revised (the recommended intervals for revisions of the wiring are once every two years; for service inspection and adjustment - twice a year). If the switchboards are equipped with forced ventilation, the ventilation filters need to be periodically cleaned or replaced - any cleaning or replacement must be carried out when the main switch is off Periodically check the tightness of screws and connections of electrical equipment.

Electrical wiring may only be repaired by an expert or company with appropriate permission valid in the country of the operator. **Improper interference with the electrical wiring can be life-threatening, and is strictly prohibited!**

9.6 IDENTIFICATION AND SOLUTION OF THE AREAS, SPACES AND ACCESS ROUTES FOR THE DISMANTLING OF THE EQUIPMENT AND ITS NODES

In the event of a necessary disassembly of individual devices and their nodes, there are suitable areas marked in the drawing section. To manipulate a device that is not located on the ground floor, use the walking platform where the devices are located. The platform is accessible from a ladder.

9.7 THE NECESSARY ADJUSTMENTS OF BUILDING STRUCTURES

For regular maintenance and repair there are no necessary modifications for building structures.

9.8 ACCESSIBILITY AND CONDITIONS OF INTERCHANGEABILITY OF PARTS AND NODES

Spatial arrangement ensures free access to each machine to allow for regular maintenance, adjustment and repair. The spaces required for the maintenance and repair of conform to the requirements laid down in Technical conditions of used machinery and equipment.

During maintenance and repair work you may only use original spare parts.

9.9 PRINCIPLES OF TECHNOLOGICAL PROCEDURES AND CONDITIONS FOR CARRYING OUT MAINTENANCE AND REPAIR OF SELECTED DEVICES

The following text describes the main principles relating to the building construction and spatial arrangement of the technology. These principles must be dealt with in detail in the documentation of operating rules.

9.9.1 The sanitary cleaning system for the equipment - devices and pipes for vegetable oil

Vegetable oil is mostly possible to be stored long-term (several months). Thus, when obeying the essential operational and public health rules, it is not necessary to carry out the cleaning too often, usually once a year during the planned downtime or before a downtime which lasts for more than 14 days.

Cleaning of the apparatuses and tanks which are equipped with access holes or openable apparatuses can be performed either mechanically with a hot water rinse, or chemically with a 3-5% sodium hydroxide solution. The pipeline and closed apparatuses can be cleaned only chemically with a 3-5% sodium hydroxide solution.

Mechanical cleaning

Mechanical cleaning uses hot water under pressure from a WAP device, with detergent. This system is used for the cleaning of all vessels, i.e. tubs below the presses, mixing tanks, filters, and storage tanks. Before you start cleaning, the containers should be completely drained and left to cool down. The openings should be opened to properly air the inside of the vessel. A

worker equipped with safety equipment, i.e. face shield, rubber apron, rubber gloves and rubber boots, enters the vessel through an opening and uses the WAP device to spray the ceiling, walls and the bottom of the vessel with hot water. This water is collected at the bottom of the tank, from which it must be drawn out to sanitation tanks (not included in the delivery; commonly a mobile tank or IBC container is used for this purpose). For storage tanks with an integrated pump, the removal of collected water can be done directly by this pump.

It is therefore appropriate to place the sanitation reservoir, into which the water is pumped, somewhere in the facility. Water consumption is low with the high-pressure cleaning, therefore, a plastic container – IBC with a capacity of 1 m³ will suffice in smaller warehouses (tanks 20 m³). This waste water is then taken away for disposal at a waste water treatment plant or is disposed of according to local conditions.

If the cleaning does not totally eliminate all the films and stains (fatty acids, ketones, or aldehydes) from each of the surfaces, mechanical cleaning with a scraper must be carried out. After thorough washing of the containers with water, the staff will use a scraper to wipe the films/stains off the walls.

Cleaning is recommended at least once a year.

Chemical cleaning

The reservoir for oil can be sanitized by a 3-5% sodium hydroxide solution (NaOH). The NaOH solution is prepared in a designated container. This sanitizing tank must be connected to the circuit between oil storage tanks, and the sanitizing solution is left to circulate through the dispensing pump oil. Regarding the size of the tank, one option is to rinse with hot water under high pressure. For such purpose you can use a WAP device.

The effectiveness of the sanitizing solution is strongly dependent on temperature. The pump can be additionally equipped with a heat exchanger, or even with a heating electric boiler. The sanitizing solution will thus be continuously heated up automatically and the entire process will be most effective, decreasing also the consumption of water and sodium hydroxide.

After the end of the sanitation, the sanitizing solution should be transported into a water treatment plant or neutralised by acid and released to the sewers (according to local conditions).

After the sanitation it is necessary to flush out the tank and remove any remaining water.

When cleaning the tub 2.30.1, keep in mind that there is a surface coating RAL 5015, therefore you must use only those cleaning detergents which will not damage the coated surface of the tub. Cleaning must be carried out using a WAP device in the way that you use a foil to hermetically cover the switchboard, drives, and sensors.



Figure 29 - The pressing plant ready for cleaning by a WAP device

9.9.2 Maintenance of transport routes of seeds and press cake

Access to the conveyors is provided from the installed platforms and footbridges, or a separate platform on a forklift truck, or another elevated work platform must be used.

All conveyors must be checked regularly. In the event of a build-up of dust or stuck material, these layers must be mechanically removed.

Conveyors - lubricate bearings regularly

9.9.3 Maintenance and repair of the FL presses

For repair and maintenance of the presses there are access and handling areas at each of the presses. For the purpose of handling heavy parts, the delivery counts with:

- an access site for a fork-lift truck for the disassembly of the transmission

