

Technical information

EP1

Version 1.0, edition 01/2016

FOR THE SUPPLY OF THE TECHNOLOGICAL
EQUIPMENT FOR OIL SEED PRESSING BY A METHOD
OF

ONE-LEVEL PRESSING WITH EXTRUSION

with the capacity from 6 t to 672 t of seeds per day



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1. Introduction

Farmet Corporation provides development, design, production and sale of complex technological equipment for pressing and processing of vegetable oils and production of feed. It produces a wide range of screw presses, extruders, cookers and other machinery and equipment for pressing the oil seeds, covering a wide range of functions. Company Farmet has developed a range of technologies for oilseed pressing. This allows choosing an optimal solution according to the specific conditions and customer's requirements.

The usage of produced presses, extruders and other machinery and equipment, their modification and various ways of sequencing offers many possibilities for solving particular requirements for pressing, from small capacities for processing of special crops up to large pressing plants with the capacity of 1000 tons per day. The general overview and the main advantages are mentioned in the material "**Production of Vegetable Oils**".

The approach to the complex technology (plant) including differencing into individual operational sets is described the material "Plant Design for extrusion of vegetable oils", use only "**Plant Design Farmet**". In the enclosure we pass on the "**General Trading conditions**". We recommend reading these materials in detail before reading this technical information.

This technical information represents complex solution for operational set PS2 Pressing Plant for pressing of vegetable oils by a method of:

One – level pressing with extrusion

According to the required capacity this technology can be realized by using standard models of Farmet presses:

Types of used presses	Range of capacity (ton of seed /h.)	Range of capacity (ton of seed /day)	Range of capacity (ton of seed /year)
FL200	0.25 – 1.5	6 – 36	1980 – 11880
FS1010	1 – 7	24 – 168	7920 – 55440
FS 4015	4 - 28	96 - 672	31680 – 221760

2. Range of Solution

This technical information includes description of the technical solution of the operational set PS2 Pressing Plant, its range and possibilities of optional supplementary solutions – "Options". **Battery limits of the delivery** are defined in the Enclosure no.2; and you can find there the recapitulation of the offer content. Detailed specification is a part of the price offer, which will be processed based on your given information in the Enclosure no.7 – Specification.

The offered technological equipment of the press shop contains a set of machines and devices, which altogether provide effective pressing of vegetable oils from oilseeds. **The technology EP1 is intended for pressing the whole soy beans.** It is necessary to use two-level pressing with extrusion for pressing of sunflower and **rapeseed** (oilseeds with higher content of oil – more than 25%).

Due to the different properties of each kind of oilseeds; especially due to different oil content in them, it is necessary to optimize the technology for a particular kind of oilseed or a group of oilseeds. When

pressing other type of oilseed, the replacement of some components of presses (screws, inserts, weep holes).

For optimal processing it is necessary to use specific pre-treatment of the particular kind of oilseed. For example for processing of **soya** it is suitable to use dehulling and partial removing of hulls prior to pressing. In case of your interest in pressing other crops than stated in this offer, do not hesitate to contact us for concretization of the information.

The Subject of the offer is a complex supply of equipment and devices necessary for pressing of oil from oilseeds at the output parameters according to the Enclosure no.1 – Parametres.

The offered technological equipment includes:

- Machines and equipment in compliance with the text of this offer (equipment described as “OPTION” is not included in the basic offered price. Price of “OPTIONS” is stated separately or it will be specified after checking local conditions);
- Project documentation for processing the documentation for building permission;
- Project for implementing the technology
- Documentation of the actual state (in case that during assembly there are significant project changes)
- Technological electrical installation
- Computer control system and visualization of the process
- Accompanying documentation – the manual for using the technology and the particular machines or equipment; technological schemes and wiring diagrams, documentation of pressure tanks;
- EU Declaration of Conformity for all equipment used according to the EU rules for delivery in EU and EU directive declaration for the whole delivered technology when the investor ensures the participation with his general project engineer.
- Auxiliary steel constructions (brackets, holders and fasteners of conveyors, troughs and pipelines, hoppers and similar small constructions).

The Subject of the offered technological equipment does not include:

- The construction project – we expect co-operation with the general draftsman of the investor.
- Any construction works
- Technological floors, service platforms and bridges inside the building (if specified in the project documentation)
- Construction of manipulation and access paths, preparation of hoisting equipment in the places where heavyweight equipment is to be installed (an overhead crane is required for installation of giant presses FS4015)
- Transportation to the realization site
- Assembly
- Supply of the electric energy to the switchboards of the technology.
- Compensation of the reactive power (to be solved centrally for the whole plant)
- The source of steam - a boiler room producing the required amount of steam according to the parameter table
- Certification and eventual revision and approving outside the EU.
- General fire, electrical, hygienic and other approving and revision performed in accordance with the overall construction
- Chief assembly; putting into operation, and staff training is not included in the basic price. It is priced separately.
- Operational fluids for the supplied machinery and equipment (thermic and gear oils, etc.);

This offer contains only machines and equipment explicitly stated below.

3. Description of the Process and Technology

3.1. Principle of the Offered Technology

The offered technology of one-level pressing with extrusion contains mechanical and thermal treatment of oilseeds prior to pressing with the aid of extrusion so the releasing oil from the oilseed cells would be as much simplified.

Mechanical and thermal treatment of oilseeds is carried out in the extruder within a few seconds thanks to the influence of high pressure in the extruder chamber. Thermal exposition of the material is thus very short, only as necessarily needed for **elimination of anti-nutritional substances**; “**sterilization**” – destroying spores of microbes and moulds; and **transfer of protein and starches**. The final **expansion** at the output of the extruded disrupts cell structures and enables better flow of oil.

Owing to the extrusion, the seed is optimally ready for pressing; and at the same time the pressing cakes gain the highest possible quality as feed for livestock. Thermal exposition is decreased only to the necessarily needed level and no chemicals are used (such as solvents in extraction). Obtained feed has excellent nutritional value.

For gaining oil from oilseeds there is a worldwide use of screw presses and of a process of so-called separating screw pressing. Screw presses are multi-level. The pressed material is gradually being pressed thanks to a change of the shape of the screw flight at particular stages. Due to the incurred pressure oil is gradually drained through weep holes in the strainer of the press. The change of the shape of the screw flight in particular stages (pressing geometry) and setting the width of the weeping holes enables optimizing of the process for particular kinds of oilseeds.

3.2. Description of the Technology

(See the technological layout PS2 in the Enclosure no.3.)

The operation set PS2 is in this offer delivered as a complex, fully functional group, including all machines, the necessary conveyors, pumps, electrical wiring and control system.

The delivery starts with the **intermediate bin 2.00**, which provides supply of seeds for several hours of the operation of the pressing plant. There, where is the danger, that the temperature of the pressed seeds can fall below 15°C (in winter time), we recommend to add the **OPTION Temperature stabilization of seeds 2.00.2, 2.00.3**. The seed is continually transported (automatically controlled) from the intermediate bin 2.00 through the **magnetic separator** of metal parts 2.20.2 into the **extruder 2.40**. This transport way of the seed can be supplemented as the Option with **the OPTION Seed Cleaning 2.05**, where it is possible to choose the **Entry aspiration 2.05.1**, the **Vibratory screen 2.05.2**. and possibly also the **Destoner 2.05.3**.

Further, it is possible to add the **OPTION Continuous seed weighing 2.10**. For processing of sunflower (possibly also for soya) we recommend the **OPTION Dehulling and separation of hulls 2.15** – see standalone Technical information.

It is advisable to crush the soya seeds before entering the extruder by the **seed crusher 2.18** (the Option), which helps disrupting the oilseed cell structure and thus easier flow through the extruder.

Extruded material is transported by the **conveyor 2.40.4** into the **press 2.45**. This conveyor is open so that steam can evaporate. This steam is released after the output from the extruder (expansion). The steam blast is quite intense, therefore a part of this offer is also **local aspiration of the output of the extruder 2.54**, which retains significant amount of the steam.

Treated seeds are gradually pressed in the screw press and oil is drained through weep holes. The outgoing oil contains mechanical particles (solids) and therefore it has to be further processed by

separation and filtration. The separation process is a part of PS2, while filtration is described in the standalone Technical Information PS3 (AFF).

Variants of the solids separation:

In case of EP1 technology with small presses FL200 (see TI COMPACT), the presses are placed above common retaining tank, which serves as a central separator at the same time. Solid particles fall to the bottom and the sediment is carried out from the bottom by a slow-running chain conveyor and transported back to pressing. For small capacities, it is then possible to use filtration on leaf filters with manual regeneration. This is the preferred solution, which is described in details in the TI COMPACT. However it is also possible to use automatic filtration (see TI AFF), nevertheless for small capacities of the FL200 presses the automatic filtration is more investment-demanding.

Large presses (FS1010 and FS4015) have integrated retaining tanks. Oil with the solids is carried out from the press tank with a screw conveyor into the central separator. The central separator has to be placed in a floor under the presses; oil is raked out from the presses and gravity-fed into the central separator. Here, sedimentation takes place and a slow-motion chain conveyor takes solids out of the bottom, separated it from oil and forwards the solids to repeated pressing.

At the FS1010 presses, separation of solids can be solved by means of separator integrated within the press, which retains the roughest particles. The press tank is equipped by a stirrer to prevent sedimentation of the solid particles. The sieve separator separates the roughest solid particles from oil. Oil is then pumped by an integrated pump into PS3 Filtration. In such a case, the central separator does not need to be used.

Processing the pressing cakes:

Pressing cakes are transported from presses by the **gathering screw conveyor 2.65** into PS4 “Transport ways of pressing cakes”. Pressing cakes from the press can even reach the temperature of more than 100°C. Water evaporates there and thus creates aggressive environment supporting corrosion. The standard design of the collective conveyor of pressing cakes is stainless steel coat with active aspiration. Pressing cakes at the output of the final press have a shape of leaves, with thickness ranging from 1mm for medium presses FL200 up to 5mm for giant presses. These leaves are then broken by the integrated breaker. The resulting shape is given mainly by the features of the particular oilseed and it also depends on its moisture level, temperature, etc.

If granulation of the pressing cakes is required, it is possible to use the **OPTION 2.75. Granulation of the pressing cakes**, which utilizes an independent granulator. This should be lined right after the press, as it takes advantage of the increased temperature at the output of the press and good mouldability of the pressing cakes. It is also advantageous to add the **OPTION Moisturizing of pressing cakes** before the granulation, so that together with obtaining the required shape also the moisture level can be adjusted to the optimal level. Added water is introduced into the whole volume of the pressing cakes within the granulator, which is the best for optimal shelf life. This OPTION does not include separation and re-granulation of fines.

For presses FS1010 and FL200, it is possible to use the **OPTION Integrated granulator 2.45.9.** Granulation is carried out by means of additional terminal part of the press with additional granulation screw segment and reinforced pressing cakes chute with granulation plate. Such granulation integrated right into the press is of low energetic demand, as it uses increased temperature of the pressing cakes at the output of the press and their good mouldability. It is however necessary to take into consideration, that fine leaves or irregular shapes may appear where the pressing cakes pass between the granulation plate and the main shaft (up to 10% of the pressing cakes volume). When processing material of very low moisture level (below 5%), the mouldability of the material significantly decreases and therefore the integrated granulator cannot be used. Such situation occurs mainly at technologies, where the material is deliberately dried out, such as the technologies WP1/WP2. Its application with the EP1/EP2 technology

is possible with certain care and regular checking of moisture level of the pressing cakes, frequent inspection of the granulator and following of the overall load of the press.

In case that the pressing cakes are the final product, it is necessary to ensure their cooling and storage. **Should hot pressing cakes be stored in higher layers, there is a danger of their autoignition!** Therefore, we recommend the **OPTION Cooler of the pressing cakes 2.85**, which secures cooling down to temperature not more than 20°C above the ambient temperature. Optionally, it is possible to add the **OPTION Moisturizing of pressing cakes 2.70** before the cooler.

Other consequent operational equipment is described in individual Technical information (see TI / AFF, Dehulling and Separation of Hulls, Granulation of Hulls, Storage of Press Cakes, Storage of Oil, Degumming).

3.3. Control and Process Visualization

Farmet Corporation has invented a system of intelligent control and visualization

FIC Farmet Intelligent Control

This system has been described in detail in the Enclosure no. 5.

3.4. Auxiliary Equipment

Cooling of the press shaft

Presses FS1010 or FS4015, which operate in the hot-pressing mode (within technologies of EP2, CWP or WP2) and presses within the technology EP1, are equipped with a system of cooling of the press shaft. The customer should provide a source of cold water or order this source as the Option. No shaft cooling is required for the FL200 presses.

Aspiration of water vapour

When heating up oilseeds in the extruder, water contained in oilseeds partially evaporates. Evaporation takes place during the output of the seed from extruders and presses. The output of extruders, conveyor to the final press, final press, output of the final press, pre-press, output of the pre-press and the collecting conveyor of the pressing cakes are fitted with forced aspiration. A ventilator and air-conditioning pipeline leading to the place of evaporation are parts of the device. Neither connection to the overall air-conditioning of the building nor the passage out of the building is included. Condensate is drained into the pressing cakes or into the sewer based upon the local situation.

Dust aspiration

All equipment and transport ways are designed and sealed so that the emission of dust is decreased.

4. OPTIONS

It is possible to add these **OPTIONS (recapitulation)**:

2.00.2 Thermal stabilization of seeds – electro including the source

In order to maintain the quality of pressing capacity it is necessary that the temperature of the seed entering into the press is not lower than 15°C. This Option ensures heating of the input seed of approx. 20°C (in winter period from -5°C to +15°C) using the electrical boiler, which is a part of this Option. This OPTION can be also used for warming for higher temperatures, such as from +10°C to about +25°C, but due to lower thermal gradient temperature increase by 20°C is no more reached. For small capacities with presses FL 200 are directly used electrically heated conveyors with thermal oil filling.

2.00.3 Temperature stabilization of seeds – steam without the source of steam (For presses FS1010 a FS4015)

This OPTION is equal to 2.00.2, but using a steam-heated conditioner instead. The source of steam is not a part of this Option.

2.05 Oilseed cleaning

This option serves mostly for protection of technology and increasing durability of pressing mechanism, allows to process even slightly non-standard material. We require clean oilseed with parameters according to the agreement for setting the plant to work and for guarantee tests. The Option can be chosen in the following scope:

2.05.1. Initial Aspiration

This stage of cleaning is suitable especially for sunflower seed, where a big amount of dust in the seed is already present. Dust is aspirated before the entrance to the cleaning screens. It prevents sticking in the following steps of cleaning.

2.05.2. Vibration screen cleaner with aspiration

Screen grader separates larger impurities (stones, straws etc.) and lighter impurities (dust, sand etc.). Impurities of size similar to seed can't be separated by this stage of cleaning which is especially important for crops with bigger oilseeds (sunflower, soybean). Light impurities are separated by aspiration at the output of cleaner.

2.05.3 Destoner

Destoner secures separation of heavier impurities, mostly stones. It works on a principle of different densities of material and thus it can also separate particles of similar size to seeds, that is especially appropriate for crops with bigger oilseeds (sunflower, soybean).

2.10 Continuous oilseed weighing at the input to PS2

Continuous tensometric scales provide information about the processed amount, it means about the immediate output of the technology.

Precision of the weighting is 1-1,5%.

2.15 Dehulling and separation of hulls (for sunflower)

It removes a part of hulls prior to the pressing. This decreases the content of fibre in pressing cakes and they become more valuable feed with higher content of proteins. Dehulling of sunflower has a positive influence on oil yield as well as on oil quality (it lowers the content of pigment and wax). Detailed description of technology Dehulling and separation of hulls is given in the respective Technical Information

2.15 Granulation of hulls

It follows-up the OPTION Dehulling and separation of hulls.

This technology serves for processing of sunflower hulls into the form of granules (pellets), which are more suitable for handling, storing and subsequent utilization of hulls. Granulation considerably decreases volume of hulls and thus decreases requirements for storage capacity as well.

This technology is closely described in the standalone Technical Information (TI GS).

2.18 Crushing of seeds

Seeds are being crushed by a mill. Crushing improves the process of extrusion and can increase the total capacity of the pressing line – see the Enclosure no.1 – Parameters. The use of crushing is not necessarily needed.

2.40.2 Steam heated extruder chambers

This Option contains supply of working chambers of the extruder in the double-coating design with the possibility of steam heating (max 0.6MPa). This sufficient input of the heat provides good regulation (the system of control and regulation of the chamber temperature is a part of this Option); and bigger stability of the extrusion process. At the same time **it increases the output** of the extruder – see the Enclosure no.1 – Parameters. A part of the heat is provided through steam and not by friction. This increases measured service life of the working parts. If the steam is produced by cheaper source than electrical energy, this kind of energy will be cheaper and thus this Option decreases measured operational costs.

2.40.3 Dosing of water into the extruder

The Option includes a frequency controlled dosing pump and grouting nozzles for dosing water into the enter part of the extruder. This is good to use is the input seeds are over-dried and their own moisture would not be sufficient to carry out the extrusion – moisture lower than 8%.

2.45.9. Integrated granulator

This OPTION consists of an additional device mounted directly at the terminal part of the press, using the drive of the main press shaft. It includes a different terminal part of the press, a granulation screw segment and granulation plate with openings, through whose the material is being pushed and consequently cut by a cutting knives. This way the pressing cakes will be formed into the shaft of pellets of 10mm diameter. Content of non-granulated particles (fine dust, irregular particles) is possible up to 10% of the overall volume.

This OPTION is available only for presses FL200 and FS1010. It can be used for materials of moisture above 6%; i.e. it is not recommended for hot-pressing technologies, where the independent granulator is the choice (see the OPTION 2.75.).

In the standard version, no special conveyor for hardening of the pellets in considered; the pellets are taken away by standard screw conveyors.

2.45.6 Integrated separator of solid particles (only for presses FS1010)

In case of presses FS1010, separation of solid particles can be solved by using integrated separator, which collects the roughest particles. The press tank is equipped with stirrer to prevent sedimentation of light solid particles. The sieve separator from oil separates rough solid particles and then the oil is pumped by an integrated pump into PS3 Filtration.

By choosing this Option, the pumpability of oil is facilitated already in the collection tank of the press FS1010, which allows the installation of the press on the floor without the need to construct a technological floor for presses, which in turn reduces the costs for construction solutions.

In such case, central separator is not used, and therefore the Option is a choice between central and integral separator and does not cause the increase in price.

2.50 Set of special tools and devices

It is used for maintenance and setting of the presses and extruders of the particular type. Tools included here have to be permanently available for carrying out warranty service and adjustments (once set is sufficient for the whole factory and given press line).

This OPTION should always be chosen and supplied for new installations!

2.52 Stainless steel design – press tank, pipeline

We recommend this Option in case of increased demands on obtained oil, which should be used for food industry. The Option includes stainless press tank and pipeline from the food-grade materials.

2.55 Source of cooling water for the press shaft (for final presses FS1010 and FS4015)

Significant heat occurs in the press by friction of the pressed material. This is carried away by cooling of the centre of the shaft so that the press is not overheated. This Option provides a source of cold water for these purposes.

2.70 Moisturizing of pressing cakes - spraying

This OPTION enables optimization of moistening of press cakes to the required value. This OPTION consists of an adjustable dosing pump and a set of injecting nozzles. Measurement of moisture is not a part of this Option. Moisture has to be measured continuously by a “manual” measuring (this device is not a part of the Option) and based on measured moisture the dosed amount is to be adjusted by changing revolutions of the dosing pump using a frequency changer.

Water dosing is possible in a scope from 0 to 8% of a mass share of water and press cakes. Amount of water, which can be dosed, is limited to a maximum absorbing ability of the pressing cakes. If too much water remains on the surface of the pressing cakes, it can initiate a development of moulds.

Volume is determined by management of volume dosing pump using system FIC in correlation to required per-cent additive and actual amount of processed material.

2.71 Dosing of additives in the injected water

This Option allows dosing of additional agents into the water which is being sprayed onto the pressing cakes. It is e.g. addition of soaking agent for better moistening of press cakes or anti-microbial agents for disinfection and prolongation of press cakes' storability. Water solutions are dosed automatically into moistening nozzles. Volume is determined by management of volume dosing pump, using system FIC in correlation to required per-cent additive and actual amount of processed material.

This option can be installed several times for dosing of various additives (e.g. soaking agent, antibacterial agents)

2.75. Granulation of pressing cakes

This OPTION consists of a granulator, a conveyor of pressing cakes into the granulator and a conveyor for hardening of the pellets before the cooler. Output of the granulator is fitted with aspiration. The granulator is to be placed before the cooler, right after the presses, where increased temperature of the material facilitates its granulation. The granulator is intended only for granulation of still warm pressing cakes right after pressing. It is recommended to cool the pellets down after granulation.

2.85 Cooling of pressing cakes

This Option contains transport of pressing cakes from the gathering conveyor under presses into the cooler (The estimated location placement of the cooler is max. 10m); and the counter-flow cooler and air conditioning system.

This OPTION ensures cooling to temperature no more than 20°C above the ambient temperature. The OPTION is designated for use in mild climate.

2.94 Set of wear parts

Set includes wear parts for first period of operation (approximately for the first year of operation of the pressing shop). The period of wearing out and their change is dependent on the processed seed and on the operation of equipment.

In particular, it includes last screw and insert, input insert of presses, set of inserts and working screws for extruders, V-belts and of presses and extruders.

Detailed list will be specified for each specific offer.

2.95.1 Frequency changers for main drives of the presses (for presses FL200 and FS4015 only)

Presses FS1010 are equipped with frequency changers on the main drive as a standard. More detailed description is mentioned in TI FIC – see the attachment.

Option is intended for technologies with the level of automation CLEVER.

2.95.2 Frequency changers for main drives of the extruders

The technologies EP1, EP2 do not include frequency control of the main drives of extruders as a standard, but this can be added with this OPTION. With frequency control you will get higher level of control and protection of extruders. This OPTION is not necessary for standard operation of the pressing shop.

2.96 Basic equipment of laboratory

This OPTION includes laboratory devices and tools necessary for the successful setting into production and optimization for required parameters.

It includes:

1. NIR analyser, which serves for a quick assessment of moisture and oiliness of seeds and for an assessment of moisture and oiliness of press cake as well. Furthermore, it allows specifying a content of fibre and crude protein in a press cake.
2. Laboratory grinder.
3. Manual weight for calibration of transporters.
4. Manual touchless thermometer.

A set of small tools and equipment.

Options: Crushing of seeds, Temperature stabilization of seeds and Steam heated extruder chambers have an influence on the total output of the technology by providing heat necessary for

extrusion in a different way than by friction in the extruder or possibly by using cheaper source of energy (e.g. nature gas) – see the Enclosure no.1 – Parametres. This has an influence on higher measured service life of the wear parts of the extruder. Choosing these Options will definitely pay off.

Options - all of these Options are delivered including the electrical wiring necessary for their function and its connections to the system of operation, visualization and control. (This is not valid for standard solution with presses FL200).

Option prices specified in the price offer are only valid when ordering together with the PS2 technological order at the same time. Costs for additional supplies are usually much higher, and must be calculated according to the particular situation.

Please pay specific attention to the choice of Options and overall specifications at the beginning of your investment plan. Please fill in and send us the specification according the Enclosure no.7 – Specification for processing the Price Offer.

5. Equipment Parameters

The table in Enclosure no. 1 - Parameters states basic parameters of the output, quality, space and energy requirements. These are indicative data for the standard verified solutions, and some of these data can be adjusted according to specific requirements of a particular investment intention. To achieve the performance and quality parameters it is necessary both - a start-up procedure of the technology (several weeks) and a stable operation.

The decisive parameters are the capacity of technology (the quantity of oilseeds processed per unit of time) and a number of pressed oil. In the definition and understanding of these parameters, especially in the practical setting; there have been many inconsistencies and mistakes. For this reason these parametres are clarified in the material “**Production of Vegetable Oils**”.

5.1. Parameters of the Input Oilseeds

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 has not been set a single methodology. It is necessary to avoid the following:

- Charred oilseeds (odour, dark colour, hard)
- Atypically light colours indicating unripeness
- Mouldy oilseeds and 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 starts, and this causes deterioration of the quality of oil)

Impurities - For storing and trading with oilseeds, there are limits of dirt content given by local regulations and standards. Most often, 2% of impurities are considered to be the threshold, which is also the maximal content of impurities at the entry into the technology. However, even these 2% may cause problems with service life of wear parts, damages and decrease of oil yield. Therefore, we always strongly recommend the **OPTION Oilseed cleaning**.

The OPTION Oilseed cleaning as a part of this technology is not intended to replace quality after-harvest cleaning of the oilseed, but serves as an auxiliary cleaning for protection of the technology; it also helps to increase the service life and to reach the best parameters of pressing.

The OPTION Oilseed cleaning makes possible to process even a slightly non-standard material in case of emergency. If the OPTION Destoner is not chosen, it is necessary to guarantee that the entering seed will not contain herd particles (stones, pieces of concrete, sand ...).

Moisture - of the input seeds is very important parameter for pressing with extrusion and it significantly influences the parameters of pressing and extrusion. For majority of oilseeds, there are standardized levels of storage moisture (see Table A below). For effective pressing yet lower moisture is highly recommended. For example, for rapeseed we recommend moisture level below 7%. Higher moisture level causes increased plasticity of the material inside the press and poor oil flow and increased formation of solids in the oil. Extruder in such a case has to heat up too much water (water has high specific thermal capacity). That causes decrease of productivity of the whole technology.

On the contrary, too low moisture level (for soya below 8%) causes overheating of the press and also worsens the pressing parameters.

For extruder pressing, stability of the moisture level is important as well. Fluctuation of moisture (even within the permitted levels according to Table A) will cause fluctuation of the extrusion parameters and repeated re-setting of the extruder will be necessary.

If it is assumed to process seeds with the moisture lower than 5%, we recommend using the Option **“Dosing water into the extruder”**.

Temperature of the input oilseed influences the initial temperature in the extruder. The extruder can be set (by choosing inserts and mechanical setting of the nozzle) to process seeds of various temperatures. However, fluctuation of temperature of the input seeds means continual changes of setting. When having temperatures of seeds lower than 15°C and mainly in combination with higher moisture of the seed, the heat provided by the extruder could not be sufficient for the correct process of extrusion with the full power. The yield of oil in the first level would be small.

Where there is the danger of the temperature falling below 15°C or of temperature fluctuation (if seeds are delivered from far away stores and they can get frozen during the transport in winter months); we recommend ordering the Option **“Temperature stabilization of seeds”**.

The Options **“Temperature stabilization of seeds” and Steam heated extruder chambers”** significantly decrease the dependence of the technology on the temperature changes of the surrounding environment.

If the temperature of the seeds and environment is satisfactory, these Options increase the capacity of the technology – see the Enclosure no.1 – Parameters.

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 A there are standard values for seeds of many kinds. The technology is optimized for these values for the particular kind. If the oiliness is lower in reality, but in the range of effective pressability according to the table A, the technology will press oil. The parameter “maximal residual fat in pressing cakes” will be kept, however the yield will be lower.

If the oiliness is higher than stated medium, the yield will rise, but the parameter “maximal residual fat in pressing cakes” (see the Table B) can slightly worsen (big amount of oil does not have the time to be drained from the press) This quality worsening should not be higher than 0.2% of the increase of the residual fat in pressing cakes per every 1% of higher content of oil in the oilseed above the medium limit stated in the following Table A.

Table A - Input parameters

Oilseeds	Max. moisture for storing	Medium moisture recommended	Range of moisture for efficient pressing	Oiliness medium at medium moisture	Oiliness Range of effective pressability
Rape	Not suitable for processing with EP1				
Sunflower	Not suitable for processing with EP1				
Soya	12 %	10 %	9 – 12%	19 %	17 - 22 %

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

5.2. Output Parametres After Pressing

Capacity of technology is rated as a throughput of oilseed at the entry to the technology. In case that the OPTION Dehulling and separation of hulls is used, it is understood as the throughput before the dehulling.

For sunflower, capacity of a technology is rated for using the OPTION Dehulling and separation of hulls.

If the OPTION Returning of filtration cake (a part of PS3) is used, capacity of the technology will be slightly decreased (depending on the quantity of filtration cakes to be returned for re-processing, practically no more than by 8%).

According to our experience, the quality of pressing is the best described by the parametre “**Residual fat in pressing cakes**” (percentage ratio of oil in pressing cakes). Our custom is to state it when counted on the moisture of pressing cakes 10 %. Usually achieved values are stated in the table B if keeping the input quality of the seed as it is described above.

Table B – Output parameters

Oilseeds	Residual fat in pressing cakes in moisture 10 %	Residual fat in dry mass %	Yield at medium oiliness %	Remainder of oil in pressing cakes in % (oiliness - yield)
Rape *	-	-	-	-
Sunflower *	-	-	-	-
Soya	6 – 8 %	6,67 – 8,89	13,93 – 12,07	5,07 – 6,93

* Rape and sunflower seeds are not suitable for one-level pressing with extrusion. If requested, we will be pleased to send you the information explaining the terms above.

In practice evaluations have often been mistaken by confusing parameters “**Residual fat in pressing cakes**” (as a percentage of oil from the weight of the pressing cakes) and the parameter “**Remainder of oil in pressing cakes**” (calculated as oiliness minus the yield, which is in fact the volume of oil in pressing cakes but related not to the weight of pressing cakes but to the weight of the incoming oilseed!)

For clarity, see Enclosure no. 6 - Material balance, where all these parameters are stated.

6. Requirements for Installation and Operation of the Technology

In order to provide conditions for installation and operation of the technology, the customer must count with ensuring further stated terms and conditions. Provided parameters are referential and it is necessary to concretize them during designing the project study or project preparation of the technology implementation

6.1. Premises for Installation

Parameters. Spaces for installation of the technology must correspond to the requirements of the project documentation; the floor must be even, firm and of sufficient bearing capacity, made of non-porous and non-dusty material.

In accordance with the project documentation, there might be necessary to prepare corresponding adjustments (trenches in the floor, passages through walls, etc.), possibly also technological floors and constructional adjustments for facilitation of installation, maintenance and servicing of the technology (access paths, passages). When the giant presses FS4015 are to be used, the overhead crane over the presses is necessary for installation and maintenance.

Minimal temperature of 0°C must be secured during operation of the technology.

Besides of the pressing shop itself, it is usually necessary to create much large area for storing the oilseeds, pressing cakes and oil. Logistics - i.e. the way of supplying seeds, dispatching pressing cakes and oil, plays also an important role. This must be solved during designing the project study. For more details, please, see the material “Plant design”.

6.2. Energy

Electrical energy – technological device uses voltage system 3+PEN/3 + N + PE, AC 50Hz, 3 x 400 / 230 V. The installed electric input is presented for each capacity in the table in the Enclosure no.1. – Parameters, where is the estimated paralleling is stated.

Steam – it serves for seed heating in the cooker and/or in the steam heated extruder chambers. Estimated consumption of the steam is stated in the table in the Enclosure no.1 – Parametres. The range of the input pressure of the steam is 0.6 MPa. A part of the delivery is a reduction valve for the working pressure of the cooker 0.8 MPa and the conditioner 0.3MPa.

6.3. Operational Media

The operational set PS2 Pressing Plant does not require any other operational media.

Water – the technology EP2 does not require water input. For the needs of sanitation, the customer should bring water supply into the spaces of the pressing shop (water line with a tap for hose connection).

For connection of OPTIONS (Moisturizing of pressing cakes, Dosing of water into extruder, topping up the cooling circuit, etc.), it is necessary to ensure water supply.

Cooling water – it serves for cooling main shafts of presses and for stabilization of their temperature. Estimated consumption of the cooling water is stated in the table in the Enclosure no.1 – Parametres. If you choose the Option “Cooling of presses” the cooling water will be provided in a close circuit by this chosen source.

6.4. Specific Consumption per 1 ton of Processed Oilseeds

Type	Unit	Consumption per 1 ton of seed in PS2	For technology:
El. energy (without Options)	kWh/1ton	124	EP1-(FE1000+FS1010) (At throughput 2t/hr)
		120	EP1-(FE4000+FS4015) (At throughput 6t/hr)
El. Energy for the Option Crushing of seeds	kWh/1ton	5	
Steam 0.3MPa for the Option Thermal stabilization of seeds	kg/1ton	26	
Steam 0.6MPa for the Option Steam heated extruder chambers	kg/1ton	15	
Cooling water 15/35°C	l/1ton // kWh	260 l // 6 kWh	

* informative data for processing of soy of initial temperature of 20°C, moisture level 10%.

6.5. Laboratory

In order to operate the technology, it is necessary to regularly find out the parameters and to check the setting in accordance with the results.

For successful commissioning and securing quality of technological settings, we offer the basic tools and equipment along with delivery of technology; see the **OPTION Basic equipment of laboratory**. Alternatively it is possible to use one's own or contractual laboratories. In order to operate and set up the technology it is essential to ensure at least the following laboratory tests:

Pressing:

- Measuring of moisture level and oiliness in the entering oilseed, pressing cakes (possibly also in hulls);

The most suitable are analytical instruments with short time of processing the results within about 30 minutes, with a possibility of verification by means of classical methods of extraction and drying within approx. 24 hrs.

For the OPTION:

- Fibre content in the pressing cakes – within approx. 24 hrs.
- Fat content in the hulls – within approx. 24 hrs.

Other laboratory tests can be required at requests of customers or national control authorities. These requirements can exceed the scope of aforementioned tests and it is necessary to proceed in accordance with applicable laws, regulations and standards or according to signed contracts.

7. Operation and Maintenance PS2

The technology PS2 has been designed for continuous operation with automatic control and permanent control by the operating personnel. The technology requires trial operation and conditioning of the equipment (see the General Trading Conditions). The technology of pressing and extrusion is based on creating pressure by mechanical friction in the inner parts of the press (screws, lamellas, chambers); therefore it is necessary to count with operational wear. It is necessary to count with carrying out regular cleaning. We recommend carrying out shutdown and complete cleaning of the technology at least once every 6 months.

For production of screws we use the highest quality materials and procedures, still it is necessary to count with replacement of worn screws and inserts of presses and extruders (also by projectile disks of hullers if used). The service life of screws is significantly dependent on the processed raw material and its purity (Be aware of abrasive dust and sand. We recommend the Option Cleaning).

We recommend studying all obtained documents Farnet, which supplement information stated above, mainly all enclosures, the document “Plant Design“ and “Production of Vegetable Oils“.

Thank you for your interest in our products.

Team of specialists, Farnet Corporation

Enclosures:

1. Parameters of technological equipment
2. Definition of the battery limits
3. Technological layout PS2
4. Dispositional layout
5. Control and Visualization FIC (electronically separated file)
6. Material balance (electronically separated file)
7. Specification for processing the price offer (electronically separated file)
8. General trading conditions (electronically separated file)

Enclosure no. 1: Parameters EP1-x(FE4000+FS4015)

Main used equipment	Unit	EP1-1 (FE4000+FS4015)	EP1-2 (FE4000+FS4015)	EP1-3 (FE4000+FS4015)	EP1-4 (FE4000+FS4015)	EP1-5 (FE4000+FS4015)	EP1-6 (FE4000+FS4015)	EP1-7 (FE4000+FS4015)
Extruders FE 4000	Piece	1	2	3	4	5	6	7
Preses FS 4015	Piece	1	2	3	4	5	6	7
Requirements for intallation PS2	Unit	EP1-1 (FE4000+FS4015)	EP1-2 (FE4000+FS4015)	EP1-3 (FE4000+FS4015)	EP1-4 (FE4000+FS4015)	EP1-5 (FE4000+FS4015)	EP1-6 (FE4000+FS4015)	EP1-7 (FE4000+FS4015)
- min.height of ceiling (without Options)	m	6.5	6.5	6.5	6.5	6.5	6.5	6.5
- area (without Options)	M ²	250	480	700	920	1120	1300	1500
- electric installed load (usage 0.8) (without Options)	kW	665	1330	1990	2650	3310	3960	4610
- cooling water 15/35°C	l/min	1040	2080	3120	4160	5200	6240	7280
- operational staff per shift	Workers**	2	3	3	3	4	4	4
- number of trucks for the basic delivery	Piece	3	4	6	8	10	12	14
Chief assembly: Week / Worker	weeks /workers	4/2	4/2	4/3	5/3	5/3	6/3	6/3
Delivery date FCA	Months	6	6	7	7	8	8	9
Parametres of the technology***	Unit	EP1-1 (FE4000+FS4015)	EP1-2 (FE4000+FS4015)	EP1-3 (FE4000+FS4015)	EP1-4 (FE4000+FS4015)	EP1-5 (FE4000+FS4015)	EP1-6 (FE4000+FS4015)	EP1-7 (FE4000+FS1010)
Soya 19% / 10%	t/hour - t/day	4 – 96	8 – 192	12 – 288	16 – 384	20 – 480	24 – 576	28 – 672
- capacity in the oilseed	t/year	31 680	63360	95040	126720	158400	190080	221760
- production of oil (Yield 12,55%)	t/hour - t/day	0,48 – 11,6	0,97 – 23,2	1,45 – 34,7	1,93 – 46,3	2,41 – 57,9	2,90 – 69,5	3,38 – 81,1
	t/year	3825	7650	11474	15299	19124	22949	26774
-production of pressing cakes (res. fat 8% / moisture10%)	t/hour - t/day	3,46 – 83,1	6,93 – 166,2	10,4 – 249,3	13,85 – 332,5	17,32 – 415,6	20,8 – 498,7	24,24 – 581,85
	t/year	27430	54860	82291	109721	137151	164581	192011

All given data is indicative. Output parameters depend on the type and quality of the material and other conditions. The producer has the right to make changes without previous warning.

Capacity data DO NOT include potential losses during Seed cleaning

Capacity data are assessed without consideration of the OPTION Returning of filtration cake (see this OPTION in the file PS3 Filtration)

* The figure shows the oiliness / moisture of treated seed. The annual capacity is calculated for 330 days of operation.

** The number of workers is indicative and depends on local conditions. The employee performs supervision and occasional intervention and in most cases serves other parts of the technology PS1 – Seed storage, PS3 Filtration, PS4 Transport Ways of Pressing Cakes and the Storage of pressing cakes. For security reasons; we recommend the presence of at least two employees per shift. It is therefore appropriate to build a common control room for all technologies.

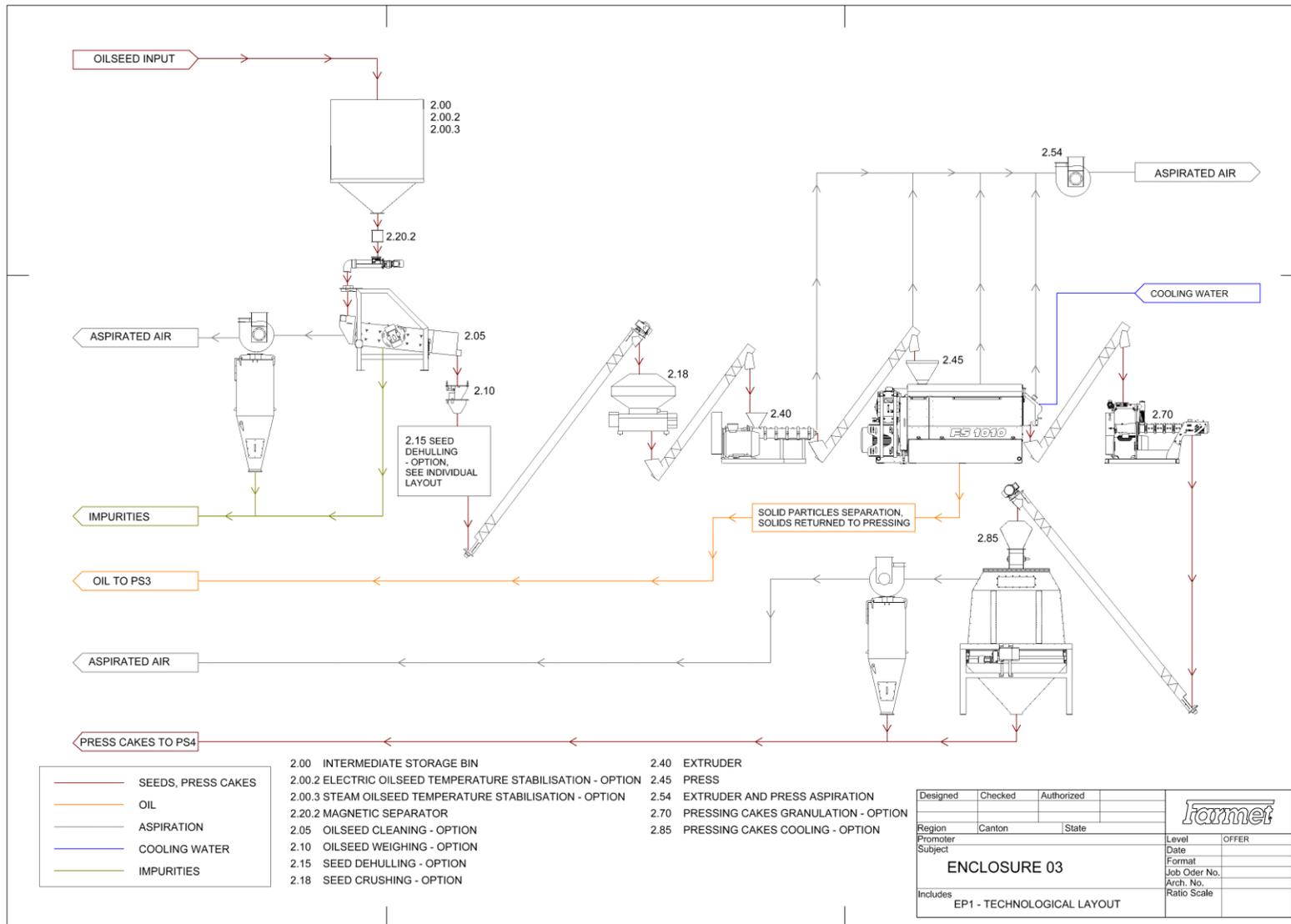
*** The capacity data are valid for the temperature of the seeds and the surrounding environment min 15°C. The given data are valid for the technology without Options. When using the Options Crushing of seeds, Temperature stabilization of seeds and Steam heated extruder chambers, it is possible to calculate with increase in Capacity by 10% for each Option.

Enclosure no.2: Battery Limits of the Delivery PS2

	From point of delivery – A part of Farnet PS2 according to this information are:
Entry limit of raw material	Oilseeds from PS1 – Input intermediate bin of oilseeds. Customer provides filling of this bin. The intermediate bin must be continuously filled up. Sediment and filter cake from PS3 – this transport way is not included (it is in PS3)
Output limit of products	Pressing Cakes: Output conveyor behind the final presses up to the distance of 3m from presses or 3m long conveyor under the cooler of pressing cakes if the Option “Cooling of Pressing Cakes” has been chosen. Other transport ways of pressing cakes are parts of PS4. Oil: A part of the delivery is an oil pump in the press tank and oil pipeline into the max. distance 10m from the last press. In common cases this is enough for connection to PS3 – Filtration.
Limits of energy connection	Electrical energy – customer provides main input to terminals in the switch box, set 3+PEN/3+PE+N, AC 50Hz, 400/230V, compensation of any idle current. Cooling Water – for cooling the gear and the shaft of the press (by the final press). Customer brings cooling water into the area of the pressing plant.
Limits of media connection	Water - Technology PS2 does not require. For sanitation needs, customer provides an outlet in the technology installation area that is fitted with a cap – hose connection. Hot Water – not required
Limits of air-conditioning system	Farnet provides only local aspiration from places of evaporation to ventilators. Ventilators are placed by presses and steam heaters; outlet from the building is not solved. Air-conditioning of the building is not a part of this offer.
Limits of solution of measurement and regulation system	Farnet provides equipment, measuring and regulation of the delivered technology PS2. If other operational sets are delivered together with PS2, then unified control and visualization is provided.
Limits of solution of subsidiary constructions and technological stores	The delivery includes all auxiliary steel constructions for installation of the technology PS2. The delivery does not include technological floors, if required (i.e. for solutions with presses FS4015, solutions with central separator or with multi-stack steam cookers).

Dimensions, parameters and properties in the battery limit points and their exact placement will be specified in the project documentation.

Enclosure no.3: Technological Layout EP1-1(FE4000+FS4015)



Enclosure no. 4: Dispositional Layout, Illustrative Scheme EP1-3(FE4000+FS4015)

