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AVOCADO OIL EXTRACTION IN THREE-PHASE SYSTEM NEVER USED

Alfa Laval has developed and designed new processes and equipment that allow in a simple way the control of the process variables that affect profitability (which are maximum industrial performance with maximum oil quality). Equipment manufactured with excellent food-grade finish, low energy consumption, high reliability and very low maintenance costs.

General characteristics of the supply:

Supply and installation of machinery for continuous extraction of avocado oil in 2 phases for a maximum nominal capacity of 1800 kg/h. Line equipped with Decanter NX X4 with a production capacity up to 1800 kg/h of whole avocado with pitted processed fruit, but up to 1300 kg/h with whole processed fruit, depending on the humidity and characteristics of the incoming product.

Thermo-blender (3x)

Alfa Laval supplies Alfa Laval Italy's ATMOSPHERA® Round Malaxer blenders, each with a 650 kg capacity. Blending is a crucial step in the avocado oil extraction process, as it plays an important role in determining the quality and quantity of oil obtained.

The combination of time and temperature affects the enzymatic activity responsible for the release of the oil. Together with the amount of oxygen in contact with the paste, these factors greatly influence the final product obtained.

The beating process consists of a slow agitation of the olive paste while it is heated. This combination causes the release of microscopic drops of oil and the union of these, forming larger drops, which are easier to extract by physical processes, such as horizontal decantation carried out in the decanter. Both the mixing time and temperature are carefully controlled.



Technical data	ATMOSPHERA® module 650	
	mm	inches
Length (L)	1,928	76
Width (W)	890	35
Height (H)	1,402	55.2
Sound pressure level	< 70 dB	
Power Rating	2.07 kW	
Capacity	650 liters	

The second generation Alfa Laval "Atmosfera" blenders have been designed under the strictest efficiency and quality guidelines, manufactured entirely in stainless steel. The vessel containing the olive paste has an innovative cylindrical shape that

optimizes the blending process by eliminating dead spaces and maximizing the heat transfer area, ensuring rapid heating of the paste, reduced total blending time and lower energy consumption. Each mixing vessel is equipped with an independent jacket heating temperature measurement and control system. Both the elimination of dead spaces and the reduction of residence time have a positive effect on oil quality, maintaining the same or better extraction level in the process.

X Series decanter, model X4

This model is capable of processing more than 1,800 Kg/h. In addition, its exclusive design makes this equipment have a high oil extraction capacity (exhaustion). The proper regulation of the pomace extraction speed is possible thanks to the possibility of our decanters to adjust the differential speed automatically (from 12 rpm to 40 rpm) simply from a display, we can maintain the quality in the output oil according to the quantity and quality of the input mass, adapting the equipment to the process and not the other way around, so we can always work in a simple way in the most favorable situation to our interests of output oil quality.

Another characteristic of the X Series decanters is the high degree of cleanliness that is obtained in the oils, in a constant way. This facilitates and saves costs in the post-treatment systems of the oils, before taking them to the winery. We also add that there is no need to adjust the oil output levels to optimize the performance of the equipment. This allows a high availability, without downtime.

The equipment is completed with a high power epicyclic gearbox - 1.500Nm, which guarantees the maximum torque for the extraction at high differential speed. It is a highly energy efficient equipment, consuming half of the installed power in operation, with control of the two motors by

means of ABB frequency variators that allow us to regulate the differential speed of the pomace output with the equipment in process, without the need to stop it. Finally, it is important to highlight the ease of access, with a stainless steel cover, with hinges, and equipped with a very reliable mechanics, which translates into low maintenance costs due to mechanical failures.



Centrifugal Separator

Alfa Laval vertical centrifugal separators model UVPX 507 meet the highest standards of efficiency and functionality. In their design we have taken into account the most common customer demands:

- Optimal oil treatment without emulsification
- Minimal water consumption, gentle oil treatment,
- Maximum separation efficiency,
- Easy operation, simple maintenance, and maximum mechanical guarantee.



The working flow rate is limited by the characteristics of the oil to be cleaned and the degree of cleanliness to be obtained. Our Alfa Laval SIGMA/Y Series decanters are characterized by obtaining very clean oils. With these oil characteristics, the working flow rate of the UVPX507 model can reach up to 700 l/h, to be taken to the storage. The final quality of the avocado oil depends on the level of purity obtained by the separator, which makes the UVPX 507 the ideal choice for purifying avocado oil

without emulsifying it. Unlike separators that work with back pressure at the outlet (use of centripetal), our equipment works in an open way, so no emulsion is produced, even if the oil contains a lot of vegetation water. Another very important advantage is that these equipments DO NOT HEAT THE OILS, as centripetal equipments do, even if they work at low flow rate.

Technical specification

Throughput capacity	2.7 m³/h
Feed temperature	max. 100°C
Operating liquid density	max. 1100 kg/m³
Discharge volume	7.5 l
Motor power	5.5 kW
Starting time	3.5 min
Stopping time, with brake/without brake	3.5/30 min
Vibration level, max:	New separator 7.1 mm/sec Used separator 9.1 mm/sec
Sound pressure	81 dB(A) ¹⁾

¹⁾ According to EN ISO 4871

SUPPLY AND INSTALLATION OF MACHINERY FOR CONTINUOUS EXTRATION OF AVOCADO OIL IN 3 PHASES FOR A MAXIMUM NOMINAL CAPACITY OF 1 800 kg/h:

I. WASHING AND DEBONING SECTION

This set is composed of the following elements:

A. RECEPTION AND WASHING MACHINE

This unit is designed to wash avocados and transport them to the next pitting section with a processing capacity of up to 1500 kg/h of fruit. Receiving and washing tank with elevator with tank dimension mm 1200x2500x1300 mm, made entirely of AISI 304 steel, satin finish.

The unit consists of:

- Hull shaped plate with 3 manholes;
- Tubular legs support with adjustable feet;
- Elevator partially positioned inside the basins consisting of PP belt conveyor with loaders 101 mm H, 300 mm W H sc., Elevator 1 800 mm;
- Stainless steel drive shaft supports;
- Water inlet placed at the beginning of the basin through a control valve;
- Distribution nozzle with adjustable angle to push the product into the elevator fed by a recirculation pump, which draws water through a cassette filter with two grids;
- final "rain" with nozzles, water discharge through two overflow pipes;
- Total discharge of the tank by ball valve 2";
- Blower for bubbling water through a perforated grate at the bottom of the basin, complete with anti-siphon pipe;

Consumption: Electric power 2,4 kW.

B. AVOCADO PITTING MACHINE

This unit is designed to remove the pit and skin from the fresh, ripe avocado. This process is essential for extra virgin avocado oil and will create the highest quality avocado oil. It is possible to process up to 1 500 kg/h of perfectly ripe, medium-sized avocado into approximately 1 000 kg of avocado paste.

The machine consists of:

- Receiving hopper equipped with conveyor to feed the machine;
- Pre-crusher in the feeding area with n. 4 knives;
- Set of n. 4 beaters with food grade rubber;
- Grid with 10 mm diameter holes;
- Avocado paste outlet by DN80 connection;
- Washing system on top of the grill with ¾"G connection;
- Machine cover with safety switch;
- Belt drive.
- N. 1 interchangeable grate with hole diameter to be defined.

The machine is completely made of stainless steel Aisi 304, excluding some parts that are in rubber, nylon or other sanitary materials.

Consumption: Electric power 11 kW.

C. ELECTRICAL PANEL

Stainless steel electrical panel. Interlocking safety doors allow for complete internal inspection. Wiring connections to our machines are included.

Unit manufactured in accordance with CE regulations.

Unit consists of:

- magneto-thermal switches
- on/off buttons
- warning lights
- washing and deboning section sequence interlocks

II. KNEADING SECTION

This set is composed of the following elements:

A. U 500 DOUGH PUMP

Single-screw pump with adjustable flow rate for the distribution of the dough to the following mixers. The single-screw pump guarantees continuous feeding.

The machine is composed of:

- Stainless steel rotor
- Food-grade rubber stator
- Motor-driven mixer with 1.5 kW motor with flywheel

B. PASTE LOADING AND DISCHARGE COLLECTORS FOR KNEADERS ATM (manual type with pump) for the transfer of dough from the mill to each kneader and for the discharge from each kneader to the feed pump to the decanter.

Composed by:

- INOX DIN 65 piping for loading and DIN 80 for unloading connected to each kneader. The piping is composed of INOX couplings and fittings and sections of phthalate-free food-grade rubber tubing to ensure ease of assembly and disassembly.
- Exclusive Alfa Laval butterfly valve in manual INOX steel for the filling and discharge of each mixer (two each mixer (two for each mixer)).

C. ATMOSPHERA 650 DOUGH MIXER (3x) for optimal dough mixing.

The Atmosfera module is a special Alfa Laval patent developed to completely renew the kneading concept. Compared to the traditional dough mixer, the Atmosfera Module (optional) can guarantee total airtightness and a much higher heat exchange efficiency, with consequent energy savings. The heat exchange surface, 20% larger than that of traditional mixers, allows a reduction in the time the dough remains in the tanks and in the energy cost for heating.

Each machine is composed of:

- Cylindrical tank in stainless steel of 630 liters.
- Double-layer glass inspection window with internal LED light and anti-fogging system for an optimal visualization of the dough.
- Central kneading helix with external auger to keep the heat exchange surface clean and renewed.
- Special shaft design for optimal kneading.
- Stainless steel helical cavity for dough heating water circulation.
- Stainless steel piping with spray nozzles for washing and dilution of the dough in the mixer. the mixer
- Dough temperature detection probe for each mixer. The probe measures the dough directly in the kneading bowl.
- Adjustable feet for easy installation and floor cleaning
- Circulation pump connected to the thermoregulation system for independent control of the bowl temperature
- Overpressure prevention system in the heating jacket, consisting of
- 2 pre-calibrated safety valves, one located at the hot water inlet of the jacket and the other at the in the jacket and the other at the end of the jacket.
- 1.1 kW geared motor.

D. U 500 DOUGH PUMP

Single-screw pump with adjustable flow rate for the distribution of the dough to the following mixers. The single-screw pump guarantees continuous feeding.

The machine is composed of:

- Stainless steel rotor
- Food-grade rubber stator
- Motor-driven mixer with 1.5 kW motor with flywheel

III. EXTRACTION SECTION

This set is composed of the following elements:

A. DECANTER MODULE NX X4 BCC

for continuous separation of oil from vegetable water and pomace. The decanter can work in three phases (three outlets) or in two phases (two outlets). For two-stage processing an auxiliary kit (optional) is required. Alfa Laval three-stage processing is carried out with low dilution water consumption (ARA SYSTEM), due to the unique design of the decanter with short cone drum and variable dynamic pressure (VDP), thanks to the easy continuous regulation of the differential speed (VS), i.e. the difference in rotational speed between the drum and the internal conveying screw of the solids. Both the VDP and VS concepts are also very efficient in two-stage processing as they allow a fast and continuous adjustment to suit the different types of product. The machine is composed of:

- Feeding device in INOX steel.
- Stainless steel rotating parts cover, easy to open for inspection and cleaning.
- Rotating drum (4 400 rpm) in forged stainless steel AISI 316 with outlets for pomace, oil and vegetable water. Liquid outlets are adjustable with interchangeable plates.

- Exclusive drum design for solids discharge with outlets that limit energy consumption and interchangeable tungsten plates for protection against abrasion.
- AISI 316 stainless steel auger for solids conveying mounted inside the drum.
- Coating of the screw conveyor with high resistance material against abrasion (TM11 exclusive ALFA LAVAL) applied to the plasma.
- Epicyclic reducer (GEAR BOX) exclusive ALFA LAVAL design.
- Safety device against machine overfeeding.
- 15 kW main motor equipped with inverter to reduce consumption at start-up.

B. BCC CONTROL SYSTEM (Basic Core Controller)

allows the automatic adjustment of the working conditions programmed by the operator to guarantee the best performance of the machine. Touch screen interface with 7" display (Multi-functional touchscreen 800 x 480 pixels), IP55 for an optimal regulation of the process parameters. X20 CPU type CP1484, Intel with Ethernet, Ethernet with memory card and I/O cards Programmable Compact Flash program memory required for operation of the CPUs. Differential speed control of the auger is carried out by means of a 7.5 kW back drive motor driven by an inverter.

- Automatic regulation of the differential speed of the auger in differential speed mode (Dn control).
- Automatic adjustment of the differential speed of the auger in torque control mode (T)
- Possibility to regulate drum speed
- Control of overload, belt displacement, overspeed and alarm recording
- Possibility to set maintenance frequency alarms
- Fully programmable low speed decanter rinsing
- Graphical display of process parameters (drum speed, differential speed, torque)
- Possibility to control the decanter remotely

C. NX X4 DECANter MODULE ACCESSORY SET

For the services necessary for the regular operation of the decanter. The set consists of:

- 1 single-screw pump Mod. FMS25/4 with stainless steel body and rotor and food-grade rubber stator for conveying the extracted oil to the feed container of the vertical centrifuge. Pump equipped with 0,35 kW electric motor.
- 1 single-screw pump Mod. FMS25/4 with stainless steel body and rotor and food-grade rubber stator for conveying vegetable water to the storage or to the feed container of the vertical centrifuge. Pump equipped with 0,35 kW electric motor.
- Two-section liquid collection tank mounted laterally to the decanter to facilitate control and cleaning operations.
- The tank is made of stainless steel and consists of:
 - INOX steel double vibrating filter mounted on rubber buffers for the separation of fine solids and liquids. Vibrating motor 0,25kW
 - PVC flow meter with thermometer and solenoid valve connected to the feed paste pump for dilution water control and regulation.
- Pomace discharge hopper for the connection of the decanter to the solid transport auger
- Base block for the correct operation of the decanter on the pavement

**D. HORIZONTAL MOTORIZED SCREW CONVEYOR FOR POMACE TRANSPORT
3 PHASES**

Consisting of:

- Open tubular structure.
- Conveyor auger in stainless steel, length 5 m.
- Safety kit for a 5 m long horizontal auger system against accidental opening of the auger covers.
accidental opening of the auger covers
- 2,2 kW motor.

E. 3-STAGE POMACE TRANSPORT ELEVATOR SCREW CONVEYOR

for the formation of the pomace pile coming from the three-stage process (three outlets).

Consisting of:

- Open tubular structure.
- Conveyor auger in stainless steel, length 5 m.
- Safety kit against accidental opening of the auger covers.
- 2,2 kW motor.

F. ELECTROMAGNETIC MASS FLOWMETER.

Consisting of:

- Electromagnetic flowmeter, highly reliable for the measurement of the real flow rate to the decanter. to the decanter
- Display with instantaneous and accumulated flow measurement.
- Includes installation kit at the pump outlet.
- Allows real control of the working flow rate at any time. Avoids production production errors due to pump capacity failure and allows a better adjustment of the process, which will result in a higher yield.

CENTRIFUGAL SEPARATION SECTION

This assembly is composed of the following elements:

**G. VERTICAL SHAFT CENTRIFUGAL SEPARATORS MODEL UVPX 507 WITH
AUTOMATIC DISCHARGE FOR SEPARATING**

AUTOMATIC to separate the oil from the turbid.

The machine includes:

- Solid cast iron frame, in two parts, equipped with vibration dampers.
- AISI 304 stainless steel covers
- Forged stainless steel (ASTM 51) rotating vessel, specially designed for high speed, X-ray tested
- Automatic sediment discharge device
- Mineral oil lubrication
- Rotating components mounted on heavy duty bearings
- Mechanical clutch
- 5.5 kW electric motor

H. DECANTING TANK for the collection of oil from the decanter.

Consisting of:

- Stainless steel tank (200 l capacity).
- Valves for separator feeding.

I. OIL TANK 60 L

for the collection of oil from the vertical oil separator.

The tank, entirely made of stainless steel, is composed of:

- Triangular section tank
- Manual emptying valve
- Wheels for easy moving

IV. THERMAL SECTION

This assembly is composed of the following elements:

A. THERMAL GROUP

to prepare hot water and heat the mixer, consisting of:

- POVX 12 x 12 plate heat exchanger
- Safety thermostat
- System water filter
- Thermostatic valve
- 0.55 kW hot water pump
- Cold water pump 0.55 kW
- Control panel

V. ELECTRICAL SECTION AND ACCESSORIES

This set is composed of the following elements:

A. MAIN CONTROL PANEL

for the control of the mill section, mixers (up to 4 units), decanter, separator, thermal group panel and the temperature controls of the paste of each mixer, including the heating circuit.
heating circuit.

Consisting of:

- Electrical components for command and control by luminous signaling and protection of the motors. the motors.
- Digital voltmeter.
- Digital ammeter for the control of the decanter, separators and presses.
- Hour meter.