

Commercial offer about the PET washing line, capacity 1000 kg/h



This industrial high-technology line is suited for recycling of highly contaminated PET-bottles into PET flakes with a very high degree of purity.. The degree of innovation of this line is very high compared to the recycling technologies currently used today. The system described below is unique in many aspects and delivers the best results under lowest operating costs possible.

Such lines are currently successfully used world wide (Europe, USA, Saudi Arabia, Japan, etc.).

The main key behind their success is a unique patented technology of “**Controlled Friction**”, which enables to reach very high degree of purity of the final product on the one side and to minimize the costs on the other side.

Basic working principles of the line

- The line's design allows continuous 24/7 (24 hours, 7 days a week) work with minimal processing and maintenance cost. It is possible to wash highly contaminated material to very high degree of purity (bottle to bottle quality). It is possible to adapt the washing quality of the process to reach the desired result.
- *Early contaminate removal:* Since contamination causes machine wear, reduces throughput and affects product quality, it is essential to remove as much contamination as economically possible early in the process.
- Modular design makes the line flexible and easy to adapt to the working environment, it is possible to change the order of the machines, to add new ones, etc.
- If the demands for quality of the final product are not very high, with minimal additions it is possible to make **two separate** washing lines (**1000 kg/h each**) out of this one.
- The line is very reliable, is made with very high amount of steel. All machines are very robust and made out of thick metal, special alloys and heat treatment in order to reduce wear, make them more stable and decrease the maintenance costs.
- All wearable parts can be easily accessed and replaced.
- Multiple sequential washing, rinsing, and floating, drying steps.
- Centrifugal drying, is **more efficient**, than the drying by hot air, because it also removes the chemicals and dirt dissolved in the water, which is not possible during the hot-air drying, where some contamination usually remains on the surface of the flakes after the water disappears.
- **No steam** is required during the washing process, resulting in significant energy savings;
- Less caustic soda or other chemicals significantly reduce costs and increase the efficiency of the water treatment system;
- **No water heating** is needed for the washing process, only cold water is used by the system. This results in additional energy savings and further reduces operating costs of the facility.
- Washing machine is an electronically driven device, where the operator states the amount of friction for the flakes, from almost zero to the maximum amperage allowed by the motor. The residence time, the amount of the material going in, the amount of water, its temperature and the degree of friction can be changed according to the contamination degree. The whole process is displayed on the color TFT sensor display.

Main characteristics of the end product

• Small fraction (< 0,5 mm)	• %	• < 0,3
• Flake size	• mm	• 6-12 mm
• PH	• -	• $7 \pm 0,5$
• Moisture content	• %	• < 0,7
• Chemical contamination (wash residuals)	• ppm	• < 50
• Floatable contamination	• ppm	• < 60
• PVC	• ppm	• < 30
• Glue	• ppm	• < 10
• Metals	• ppm	• < 20
• Other non-melting particles	• ppm	• < 45
• Glass	• ppm	• < 5

Main elements of the line

Number	Name
1	Inclined conveyor belt
2	Sorting conveyor belt with metal detector
3	Inclined conveyor belt on wheels for feeding the material into the granulator
4	Wet granulator with extraction screw
5	Rinse-Dryer №1
6	Pneumatic conveying system
7	Label Separator with 2 cyclones
8	Buffer tank with agitator and extraction screw
9	Sink-float tank №1
10	Washing machine №1
11	Rinse-Dryer №2
12	Pneumatic conveying system
13	Sink-float tank №2
14	Washing machine №2
15	Dryer
16	Pneumatic conveying system
17	Electrical panel

1. Inclined conveyor belt

Delivers the bottles to the sorting conveyor, completely out of stainless steel. (made in Finland),

- Length 7m,
- Width 0.8m
- Variable height
- Self-cleaning PVC belt, white color, 2mm thick
- Motor with gear box, “Lenze” (made in Germany)

2. Sorting conveyor belt with variable speed and metal detector (made in Finland)

- Length 10m,
- Width 1,2m
- Variable height
- Self-cleaning PVC belt, white color, 2mm thick
- Motor with gear box, “Lenze” (made in Germany), variable speed.
- Metal detector “Mesutronic”, (made in Germany),

When the metal is detected, both conveyor stop and the signal lamp flash. The operator can remove the corresponding bottle from the belt.

Sensitivity of the metal detector can be adapted according to the desired results.

3. Inclined conveyor belt mounted on wheels with brakes.

Delivers the sorted PET-bottles, to the granulator. The belt is made out of the thick rubber with pads, green, and 3.5mm thick. Conveyor has a metal-free zone. An additional metal detector can be installed on it. The conveyor is mounted on wheels with brakes to gain an easy access to the granulator when needed.

4. Wet granulator with extraction screw



Manufacturer Inan Plastic, Model IM 70/125. The machine granulates the incoming PET bottles. The usage of water in the granulation process decreases the noise level and

reduces the wear of the blades. Besides that the usage of water enables a certain type of pre-washing. Some amount of dirt, labels, etc. is being detached from PET. The rinsing process, which comes next, removes all the dirt, which has been detached during the granulation. This way a big amount of dirt is taken out of the system immediately after the granulation. This simplifies the further process significantly and reduces the wear of the equipment.

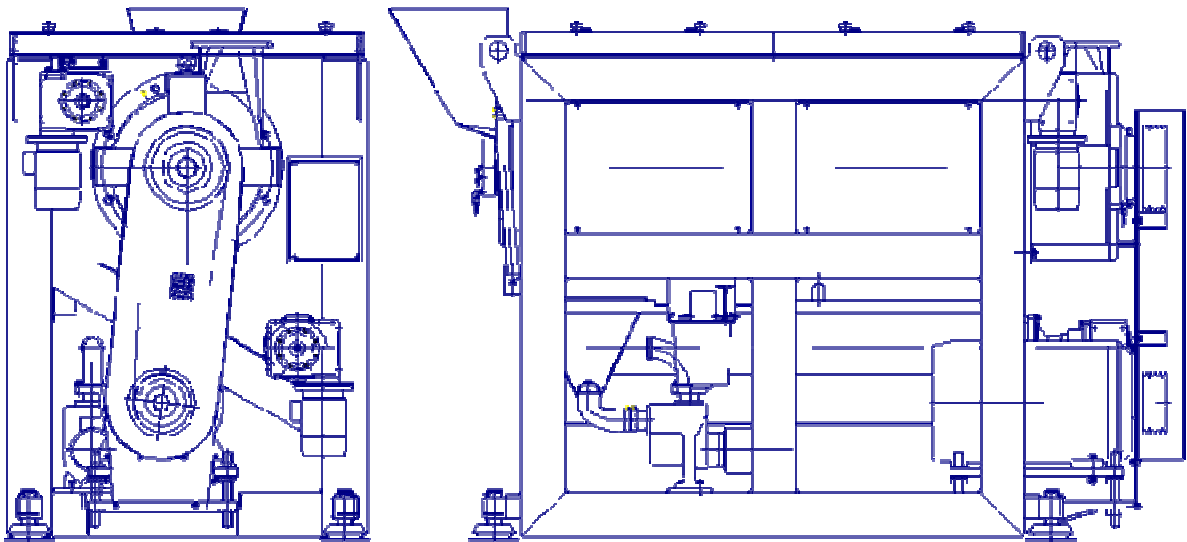
The design of the rotor reduces the heating effect during the granulating process and combined with the water cooling of the bearings makes the 24 hours a day work possible.

The screen and the blades can be easily accessed. The hydraulic system enables to open the feeding hopper with one button touch.

The granulator has 6 anti-vibrating pads “Gerb” (Germany).

Technical Data	
Quantity of rotor blades	: 15
Quantity of stationary blades	: 6
Width of the rotor	: 1250 mm
RPM of the rotor	: 425
Rotor Diameter	: 700mm
Main Motor	: 75 kW
Blade Material	: DIN 2379
Screen Size	: 12 mm
Hydraulic Pump Motor	: 1,5 kW
Cooling System	: Water Cooling of the Bearings
Weight	: 7500 kg
Motor of the Extraction Screw	: 3 kW
Quantity of security switches	: 2
Length (together with the screw)	: 4800 mm
Width	: 1915 mm
Height	: 4895 mm

5. Rinse-Dryer №1



The purpose of the rinse-dryer is to clean the flakes from loose dirt.

It is a horizontal type machine.

The machine is divided into 2 sections. First section consists out of the solid stainless steel basket, where material spins together with water at a very high speed (2500 RPM). Due to the friction among the flakes, basket, the pads and the rotor certain washing also takes place here, in addition to rinsing. In the second section, the flakes are separated from water during the centrifugal drying process. (Please see the introduction page about the advantages of the centrifugal drying over the conventional drying method using hot air).

All inner parts, where contact with water occurs, are made out of stainless steel. The rotor and the pads are made out of special steel, hardened.

<u>Technical Data</u>	
Quantity of the pads	:50
Length of the rotor	:2050 mm
RPM of the rotor	:2500
Diameter of the rotor	:450 mm
Main motor	:37 kW
Screen	:2 mm
Water pump	:0,75 kW
Weight	: 2500 kg
Length	: 2500 mm
Width	:1600 mm
Height	:2050 mm

6. Pneumatic conveying system

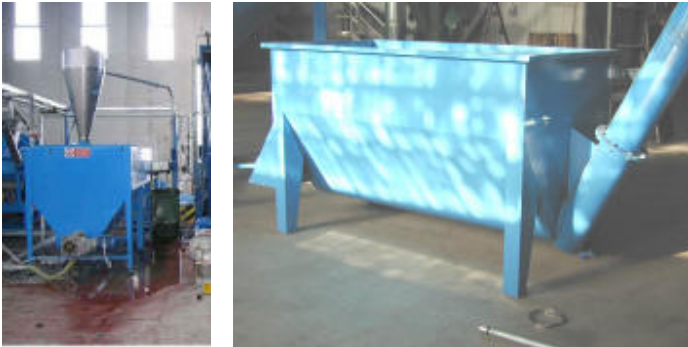
The purpose of the system is to transport the flakes from the rinse-dryer to the label separator. The cyclones represent a stable construction with thick walls, made out of stainless steel.

7. Label separator with two cyclones



Out of the rinse-dryer the flakes go to the label separator via the pneumatic conveying system. Label separator is a stainless steel construction with a blower on top. The air-flow can be adjusted in order to reach the desired results. It separates the paper labels (and other light fractions) from PET. The flakes fall down to the buffer tank, while the labels are taken away into the second cyclone via an air-flow.

8. Buffer tank with agitator and extraction screw



Stainless steel tank, where flakes are temporary stored, before they go to the washing line. Agitator homogenizes the material and transports it in the direction of the extraction screw, where the flakes are extracted. The speed of the extraction screw is adjusted automatically (via PLC) according to the working state of the washing machines.

9. Sink-float tank №1



Made out of stainless steel. PET flakes enter the sink-float tank via the screw conveyor. At the end of this screw conveyor an agitator takes the incoming flakes and **“sprays”** them under the surface of the water with a very high speed. The strong agitation lets the flakes into the tank to mechanically remove air from flakes surface. **The spaying principle** makes the process **more efficient** and delivers a very **high degree** of separation.

PET flakes are sinking down to the bottom of the tank and are being transported to the end of it. The floatable fraction goes to the end of the tank with the water flow, created by the water pump. It reaches a dewatering auger, and is extracted with the help of the screw conveyor. PET flakes remain on the bottom of the tank and are moved towards the lower end of the tank with the help of the special screw conveyor. After that they are extracted via an extraction screw and forwarded to the washing machine.

The sink-float tank has an additional service tank with two water pumps to make the water level and flow constant all the time, which is important for the separation process.

10. Washing Machine №1



This machine uses two main components of successful washing process, mainly temperature and friction in an optimal way. During the washing process, due to the friction, water heats up and almost reaches the boiling point.

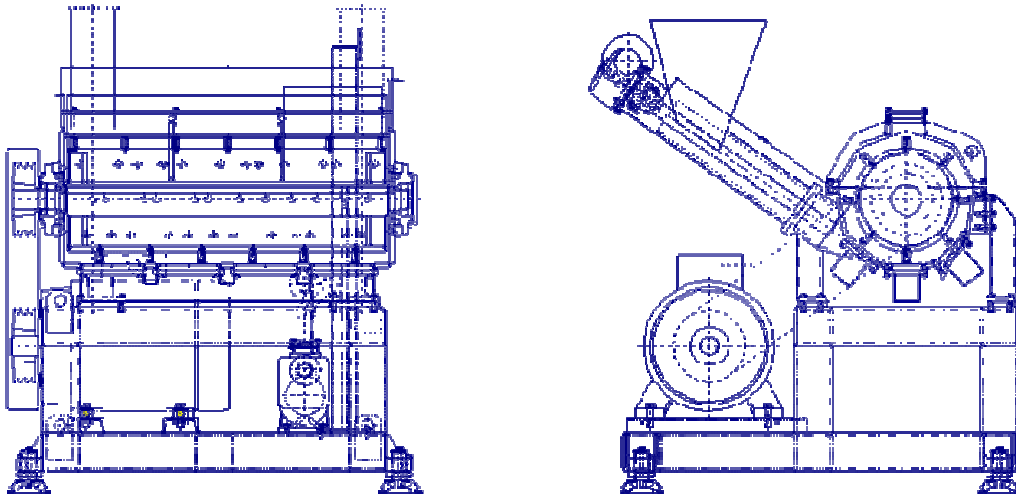
This design allows us to reach **two targets simultaneously**: creating friction to scratch the flakes' surface and generating hot water by friction itself.

The washing machine makes all the friction required to get the flakes clean. It keeps the material under friction all the time. The residence time, the amount of the material going in, the amount of water, its temperature and the degree of friction can be changed according to the contamination degree. The whole process is displayed on the color TFT sensor display. The washer generates heat by itself (no additional water heating or steam is required) and it is continuous like all other machines in the system.

It is an electronically driven device, where the operator states the amount of friction for the flakes, from almost zero to the maximum amperage allowed by the motor.

The feeding hopper is dimensioned according to flake size (and volume) and receives any quantity of material coming from the system, keeps it inside under friction for minutes, not seconds, while generating the heat that helps to detach sticky dirt, glue and everything else from the surface of plastics.

The working chamber is made out of anti-wear manganese steel. The friction rods can be replaced in less than one hour.



The main innovations of the washing process include but are not limited to the following:

- No steam is required during the washing process, resulting in significant energy savings;
- Less caustic soda or other chemicals significantly reduce costs and increase the efficiency of the water treatment system;
- No water heating is needed for the washing process, only cold water is used by the system. This results in additional energy savings and further reduces operating costs of the facility; and
- The system is continuous.

<u>Technical data</u>	
Length of the rotor	:1150 mm
RPM of the rotor	:1800
Diameter of the rotor	:500mm
Main motor	:112 kW
Water pump	:0,75 kW
Weight	: 2200 kg

11. Rinse-dryer №2

The dirt, separated during the first washing stage together with the remains of the chemicals (if they are used on the previous stages) is finally removed by fresh water. The design and the working principle is exactly the same as by the rinse-dryer №1, which is described in the section 5. The dry flakes are being transported with the help of the pneumatic transport system to the next stage.

12. Pneumatic conveying system

Fully identical to the system, described in the section 6. On this stage the flakes are 95-98% clean. The next stages are needed to achieve the 99.5-99.9 % level.

13. Sink-float tank №2

Fully identical to the system, described in the section 9. The remaining light fraction is finally removed during this stage.

14. Rinse-washing machine №2

Fully identical to the system, described in the section 10, except for the main motor (75 kW). The final washing with clean hot water takes place. The additional target, which is being achieved here is a complete removal of all chemicals, from PET flakes (like caustic soda, surfactants, etc.) if they were used during the washing process.

15. Dryer

Fully identical to the system, described in the section 10, except for the 2 section design. The centrifuge delivers a flake with less than 0.6% moisture content with a screen with 2 mm holes. (Please see the introduction page about the advantages of the centrifugal drying over the conventional drying method using hot air).

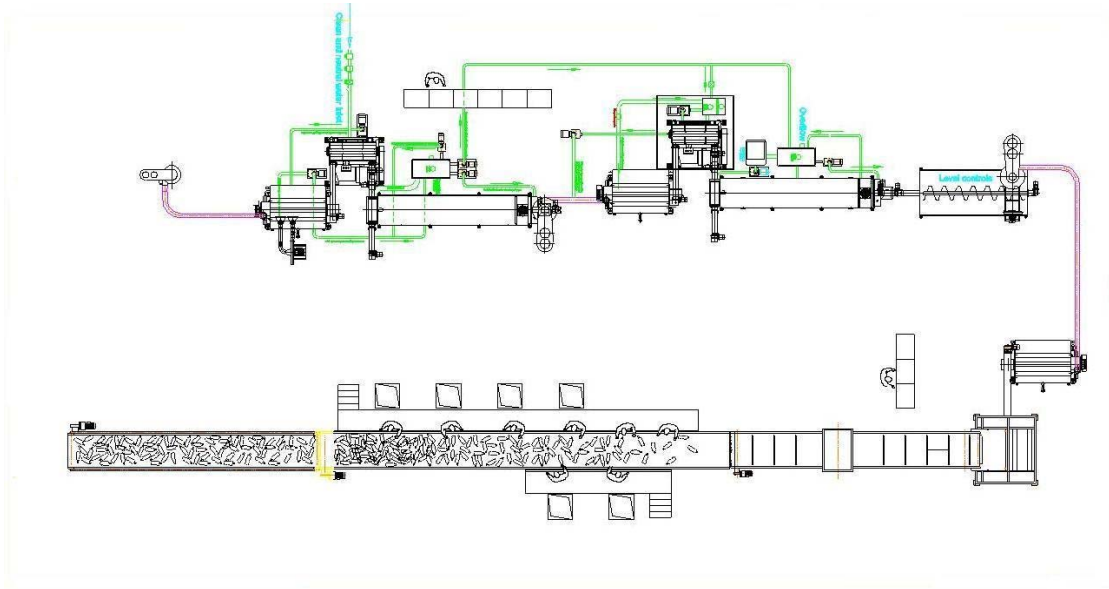
16. Pneumatic conveying system with the cyclone to fill the big-bags

Fully identical to the system, described in the section 6.

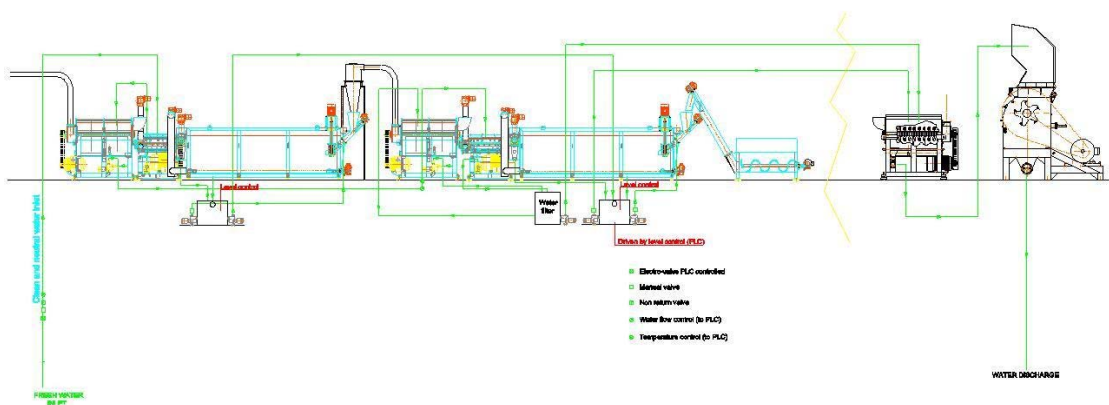
17. Electrical panel

Contains all the electrical elements needed like contactors, relays, safety devices, drive inverters, PLC with the color sensor display to control the washing process and change the washing parameters if needed. The PLC enables an automatic start and stop of the system in a right sequence.

Layout of the line



Washing part of the line



18. Notes

In order to successfully install and run this PET washing line the following work needs to be done.

- Balancing: the washing equipment is new, two rinse-dryers and one dryer must be balanced on the Customer's side.
- The software for the PLC must be updated, to reflect the new configuration of the line.
- Assembling of the line
- Wiring
- Piping

Two inclined conveyors, the sorting conveyor and the granulator are in used condition (3 months). The overall working condition is very good. The washing line is new and has never been used.

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