

# ValueFlex

## Basic Engineering I

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Process description sorting line



# 1. Process Flow - Overview

The process description refers to the process flow diagrams (PFD's) attached in the annex:

- PFD simplified
- PFD sorting
- PFD washing
- PFD water treatment
- PFD Extrusion + material handling

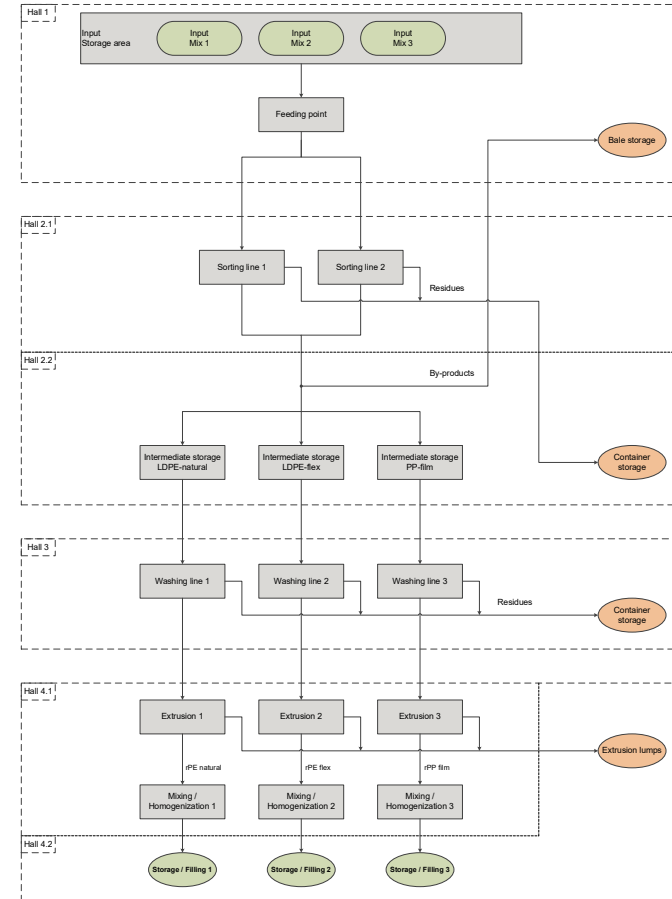
On the following pages, the process steps and the equipment are explained by using excerpts from the PFD's.

The Input material is stored as bales in Hall 1 and fed by Forklift to one feeding point where the bales are opened and dosed to the sorting part, which is placed in Hall 2.1 and is composed of two sorting lines, each consisting of two identically designed sub-lines. The main products ( PE-natural, PE-flex and PP-film) are stored in intermediate storage compartments in Hall 2.2 and fed to the subsequent washing lines. By-products are baled and stored in the input hall. Residues from the sorting process are stored in containers for disposal.

The washing part consists of three washing lines positioned in Hall 3 (one main line for each of the main products), which are identical in technological design but differ regarding capacity design. Residues are dewatered and stored in containers positioned in a centralized container storage area.

After washing, the film flakes are dewatered and transported to Hall 4.1 for Extrusion. After the extrusion, the products will be decontaminated and transported to Hall 4.2 where the granulates are homogenised in mixing silos.

The granulate products are transported into storage silos for pick up by silo trucks. As an alternative, storing and loading in Big Bags is also possible.

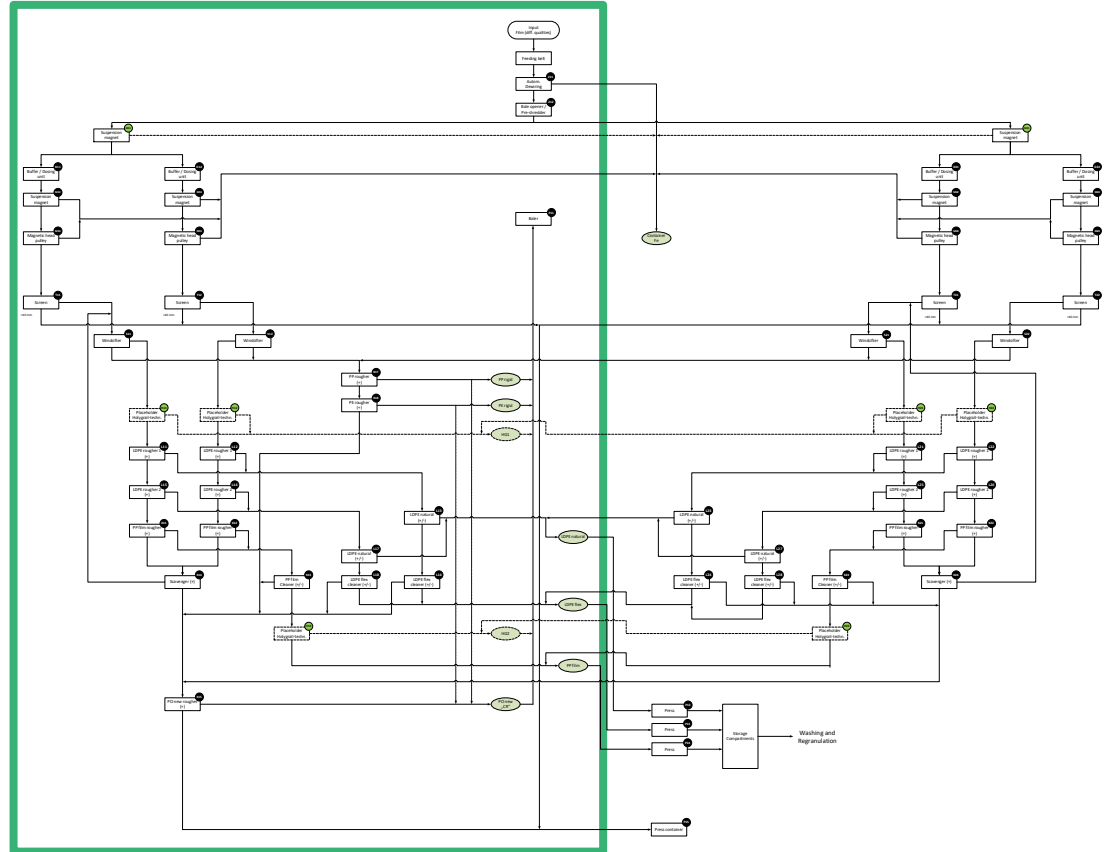


# 1. Process Flow – Sorting line

The process description refers to the process flow diagram (PFD) attached in the annex. On the following pages, the important process steps and the equipment are explained by using excerpts from the PFD.

The feeding concept is designed in one line. After the feeding concept the material stream is divided into four lines. The products and by-products of the four lines are collected together in the particular bunkers. The residues of all four lines are directly fed to a press container.

The two lines are equal in terms of process steps and equipment and therefore, to keep it simple, only one feeding line is considered in the process description.



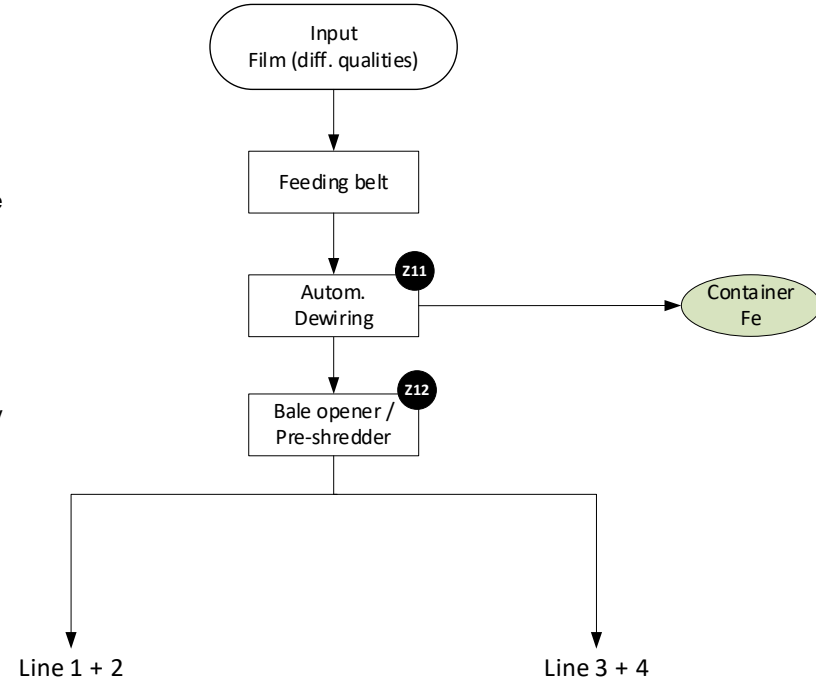
## Feeding and Dosing

### Feeding:

- In a first step the bales are automatically dewired.
- After the dewiring the bales are loosened by a bale opener or a pre shredder.
- An optional suspension magnet can remove remaining wires from the bales upfront the Buffer/Dosing units.

### Dosing:

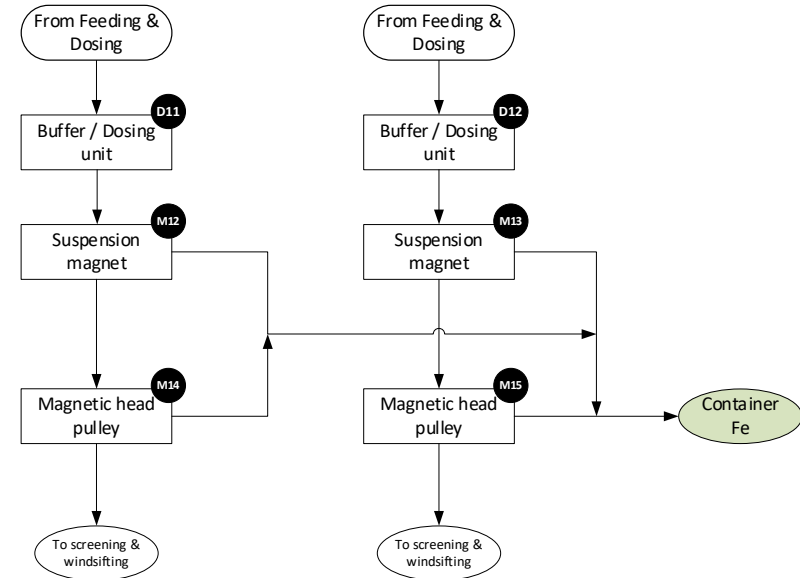
- The loosened material is then divided into four lines and is fed to Buffer/Dosing units.
- The task of this aggregate is to provide some buffer and to feed the plant continuously and steady with material.



## Metal separation

### Ferrous separation:

- Remaining wires and other ferrous metals are separated by two magnetic separators.
- In a first step a suspension magnet is used for this task.
- The second separation step of the ferrous metals is carried out with a magnetic head pulley.
- The separated ferrous metals are then collected together with the wires from the bale dewirer in a container.



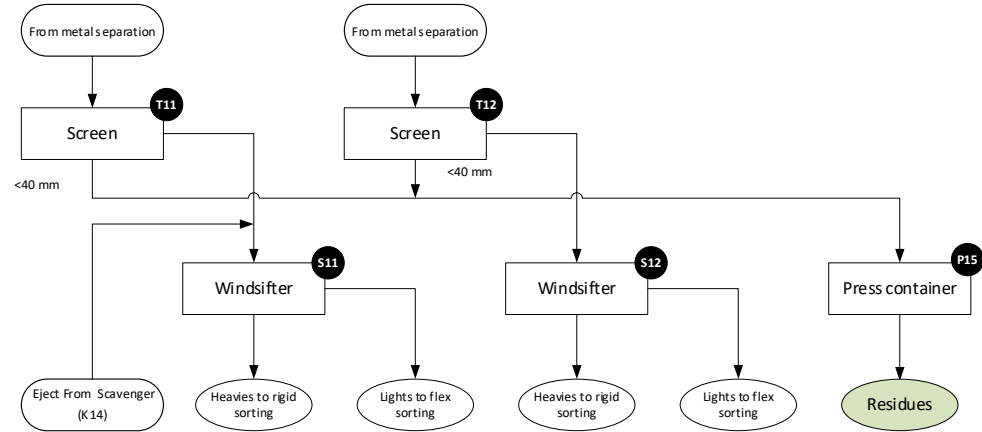
## Screening & Windsifting

### Screening:

- To optimize sorting conditions in the subsequent process a drum screen is used to separate fines.
- The drum sieves are equipped with sieve trays with a mesh size of 40 mm.
- The fines (<40 mm) are collected together with the other residues in a press container.
- The material >40 mm is fed to the next process step (windsifting).

### Windsifting:

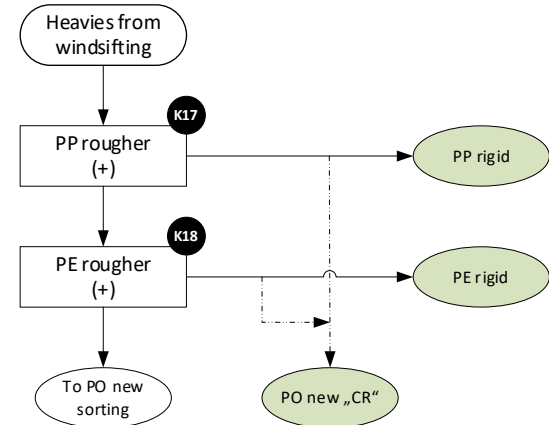
- The windsifters are used to separate light material.
- In this specific case of sorting flexible the main task for the windsifter step is to remove remaining heavy material, like rigid plastics, from the flexible material.
- After windsifting the products heavy materials (rigids) and light materials (flexibles) are further treated in different process steps.
- In addition to the material from the drum screen, material for the scavenger step from the flexible sorting is also fed to the windsifter step.



## Rigid sorting

### Rigid sorting:

- The heavies of the windsifter are sorted by type of plastic by two NIR separation machines connected in series.
- The NIR sorters are connected in series and sort out positively the rigid plastic PP and PE. PP- and PE-rigids are then baled as separate product fraction.
- As an alternative, the products can be transported into the PO new “CR” product stream.
- The Drop fraction of the Rigid sorting is fed to the “PO new sorting” process section.

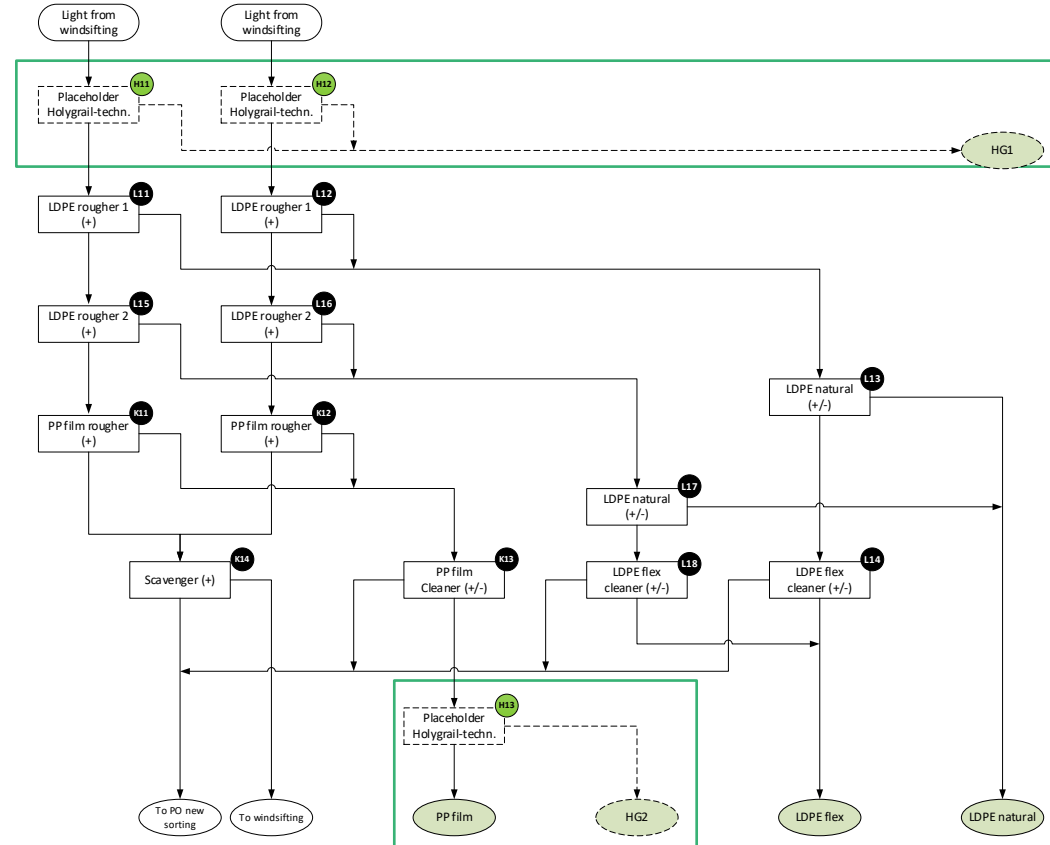


# 1. Process Flow – Sorting line

## Flex sorting – Holygrail (optional)

### Holygrail technology:

- In front of the flexible sorting and after the PP film cleaning stage, sorting units utilising the Holy Grail technology can be retrofitted to generate additional product fractions.

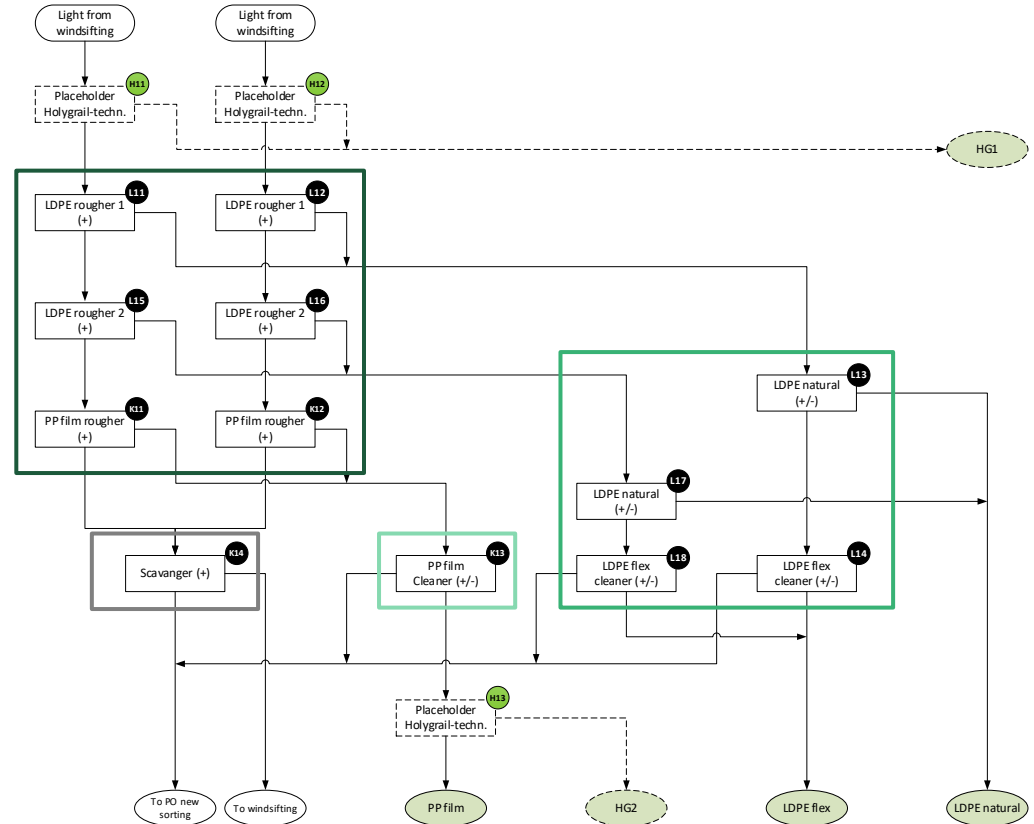




## Flex sorting

### Flex sorting:

- The flexible sorting is also done by NIR separation machines and these machines also mainly work with the same principle as in the sorting of rigid material.
- Problematic for the sorting of flexibles is, that the high belt speeds of the acceleration conveyor cause a movement of the flexibles on the belt resulting in incorrect discharging of materials. To prevent this, NIR separation machines in the flex sorting process section have a special design. An additional air flow above the acceleration conveyor ensures that the movement of the flexibles on the conveyor is minimized.
- The process section of flex sorting can be divided into four parts:
  - Roughing (-)
  - LDPE sorting (-)
  - PP sorting (-)
  - Scavenging (-)



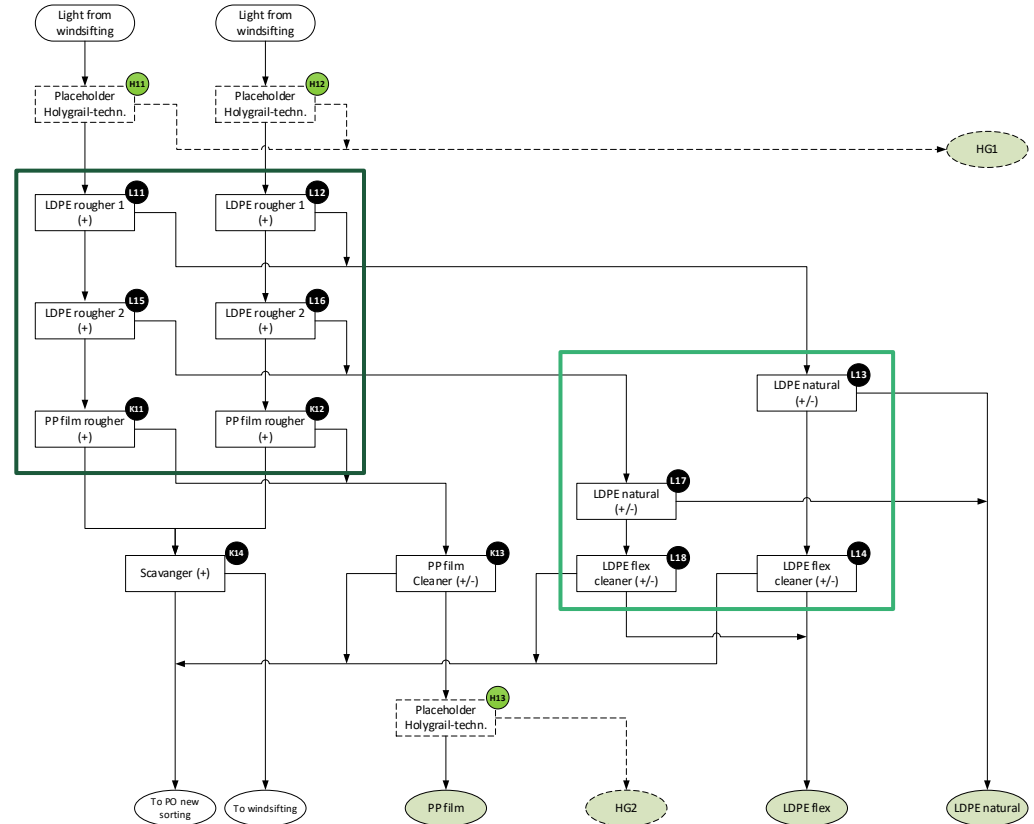
## Flex sorting

### Roughing:

- The material stream is fed to a three stages of NIR machines. The first and the second NIR stage sort out LDPE films in a positive mode. The product is then fed to the LDPE sorting section.
- The third NIR stage sorts out PP films in a positive mode. The product of this stage is directly fed to the PP sorting section.
- The passage of the three NIR stages is fed to the scavenger stage.

### LDPE sorting:

- The ejected LDPE film of the production stage is subsequently resorted by color in two steps.
- Both steps are switchable to positive and negative sorting, but the first step is initially designed as positive and the second step as negative sorting.
- In the first step transparent LDPE film (LDPE natural) are sorted out and fed to the LDPE natural bunker.
- In the second step everything except colored LDPE films (LDPE flex) are ejected. The colored LDPE films are fed to the bunker LDPE flex.
- The ejected material of the second step of the LDPE sorting is fed to the process section "PO new sorting".



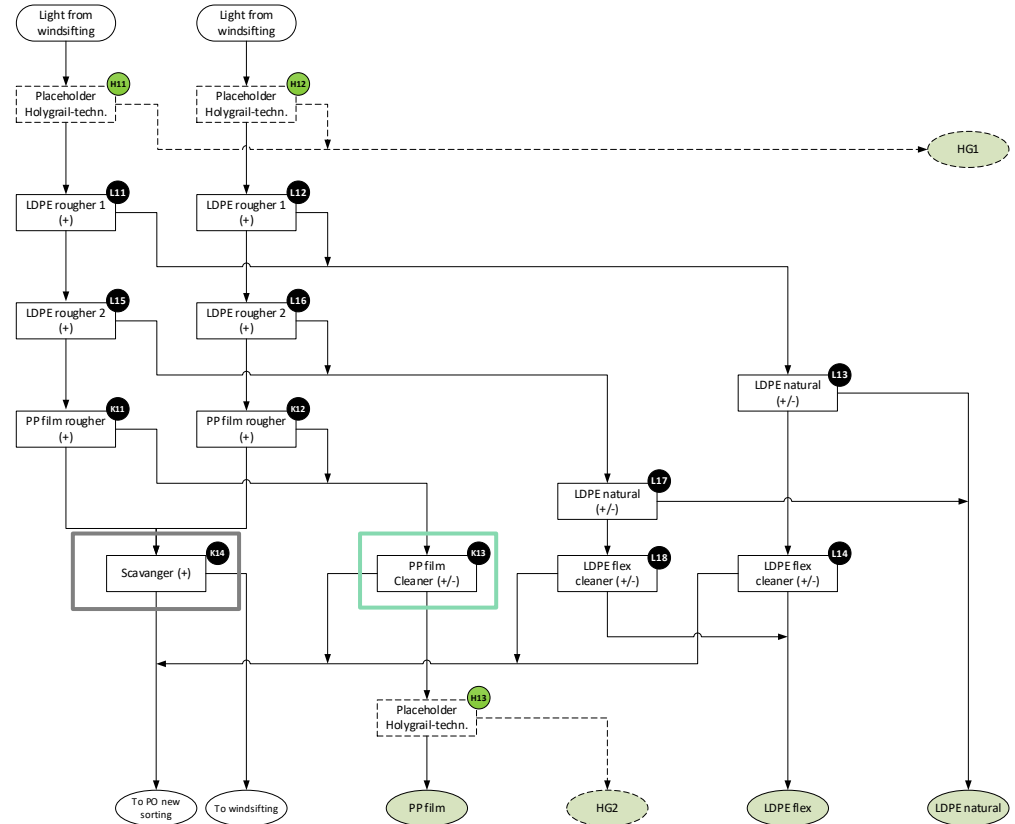
## Flex sorting

## PP sorting:

- To increase the product purity the PP film is resorted in a negative mode. Everything except of PP films is ejected.
- This machine can also be switched to a positive operation mode.
- The passage (PP film in negative operation mode) is fed to the PP film bunker.
- The ejected material is fed to the process section "*PO new sorting*".

### Scavenging:

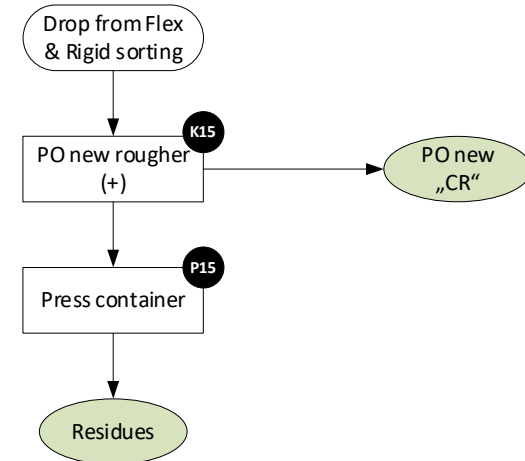
- Remaining LDPE and PP films in the passage of the production stage are sorted out with another NIR in the scavenger stage.
- The scavenger NIR operates in a positive mode and LDPE and PP film are sorted out and are fed back upfront to the windsifter.
- The passage of the scavenger stage is fed to the process section “*PO new sorting*”.



## PO new sorting

### PO new sorting:

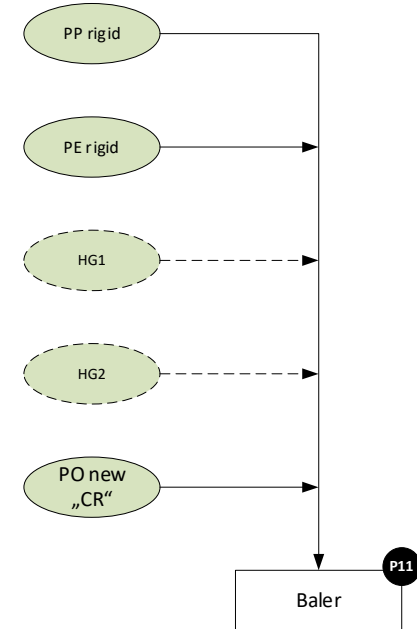
- The drop fractions of the scavenger, the PP-sorting, the LDPE-sorting and rigid sorting are transported to an additional NIR machine, where POs are sorted out in a positive mode.
- The drop fraction of the PO new rougher is transported together with the residues of the other process sections to a press container.
- The ejected material of the NIR machine is transported to a bunker and pressed into bales by a baling press.



## Baling by-products

### Baling

- The produced by-products of the plant are temporarily stored in bunker belts and can then be pressed into bales successively.



## Baling products

### Baling

- The produced products LDPE natural, LDPE flex and PP films are each fed to a separate press to increase the bulk density and are stored afterwards in storage compartments.
- Out of the storage compartments, the products are fed to a pre-shredder upfront the respective washing lines.

