Description: N2 Separator

The installation serves to separate metal containing mixtures into pure fractions of metals as well as heavy and light plastics.

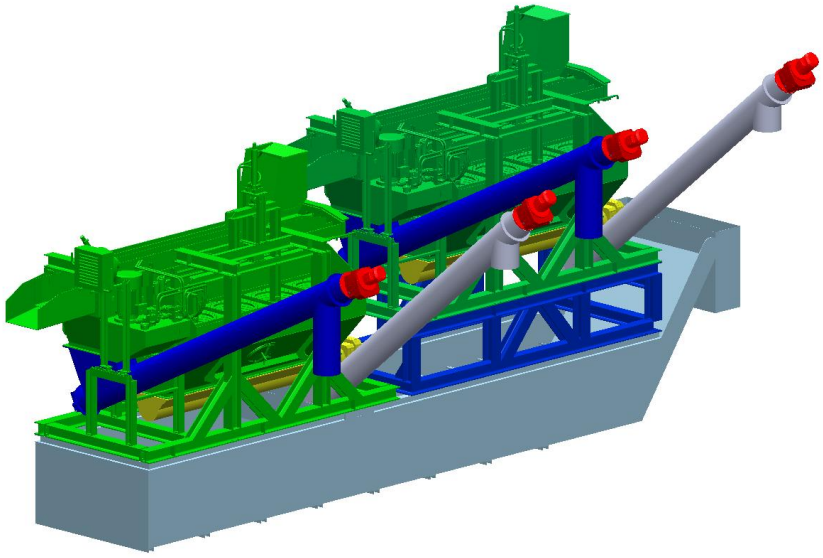

Fig 1: N2 Separator whole view

A modified jigging machine principle for water based separation of

- Metals out of metal plastics mixtures,
- Heavy and light plastics, and for
- Cleaning of mixed fractions,
- Enrichment of metal fractions

for various types of material in recycling, especially WEEE scrap and ASR.

Machine:

The installation serves to separate metal containing mixtures into pure fractions of metals as well as heavy and light plastics. This is a general and also tremendous improvement of efficiency in recycling processes. Using this technology, there is a substantial reduction of incineration and landfill costs. In other words, environmental loads due to emissions and landfilling can be significantly reduced.

Description of operation:

In a two-stage wet separation process, pre-treated material fractions are processed. The material comes from car shredders and/or other crushers as result of processing Electronic Scrap (WEEE) and Automotive Shredder Residuals (ASR).
The first process step is a separation into a metal fraction (heavy material side) and a metal-free fraction (light material side). The light material goes directly to the second stage where it can be separated into heavy and light plastics.

Capacity and performance:

The material throughput of the above described installation is about 6-8 t/h feeding material. The actually reachable values depend on type and properties of feeding material (particle size and shape) and on plant operation conditions as well.

Operation:

The aim is to run the installation in a one-shift mode. A certain period of time has to be planned for cleaning and maintenance purpose. Thus, the operation time per day can be calculated with 8 hours. The annual operation is 2.000 hours / year.

Material Transport and estimation of truck traffic:

The truck traffic is calculated based on these figures:

- Installed input capacity: 6 – 8 t / h
- Annual operation: approx. 2.000 h
- Bulk density in average: 0,3 t / m³.

It generates following operational data:

- Installed volumetric capacity per year: approx. 40.000 – 53.300 m³ / a
- Annual quantity of trucks (∅ 20 t / truck): 2.000 – 2.650 trucks / a

Plant components:

The installation design contains only separating steps and no integrated crushing operations. The feeding material composes of pre-treated fractions being delivered by truck (or produced on site). In general, it is temporarily stored. The appropriate storage volume, fire and environmental protection issues must be considered according to local legal requirements and must be provided on-site.

The material is fed by a box feeder with load capacity of 8 m³ and equipped with belt or screw conveyor. The separation optionally starts with a classical dry procedure based on magnets to take out ferrous particles and Eddy Current Separators to lift out non-ferrous metals. These components are commercially available and well proven in the market. The so separated metal fractions are temporarily stored in boxes to be removed by trucks. If it is necessary, a further separation cycle can be added with the same material in the same way.

A second separation step processes the residual material flow out of the first separator. It is a series connection of two identical separator basins. The procedure is based on a modified flotation jig plant with pure water as liquid (without any chemical or other additives). Each process stage is represented by one separator with a water volume of about 6,2 m³, the material feeder, and two material extractors. The operations of both stages are nearly identical.

In the first step, metals fall down to the bottom of separator 1. The average density cut appears with approx. 1.6 kg / dm³. Special equipment extracts the material from there to be stored or treated in a further way. (see fig. 2)

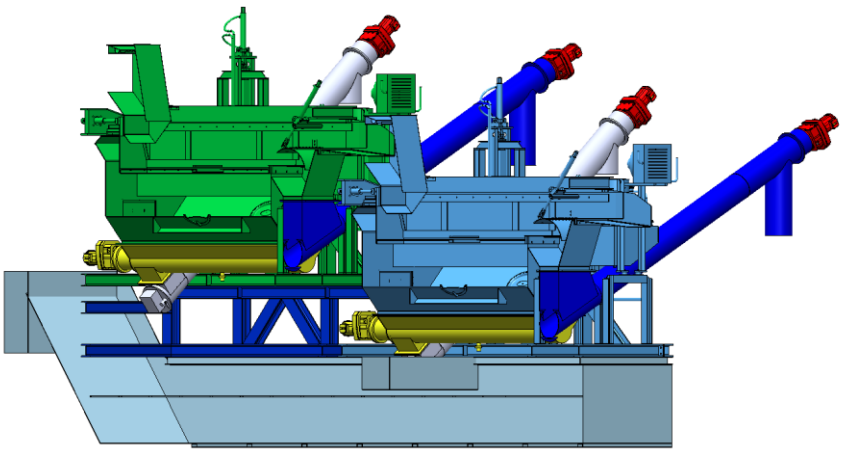

Fig 2: N2 Separator gross-sectional view

The light fraction (≤1.6 kg / dm³) of the first separator is at the same time input flow for the second basin. Herein, all density related lightweight particles are located.

The second in-line separation step divides the incoming flow into a heavy and a light fraction based on the same principle, but with the density cut of approx. 1,1 kg/dm³.

Both resulting flows out of the second separator have to be dewatered. It is done by special dewatering screws and an additional dewatering screen on the light side.

The entire process water volume (approx. 22 m³) circulates in order to not wasting precious resources. In addition, two water pumps and a sedimentation basin (approx. 25 m³) are part of the circulation loop. With this design, all process water can be gathered in case of stopping the operation. A screening layer on the bottom of the basin separates the very fine particles out of the flow. The screen passage goes directly to the sedimentation basin underneath the separator. The fine sedimentation material can be taken out by a continuously working extractor device. The fines are stored in a big bag or a box.

All actuator movements being necessary for separation are executed by a hydraulic system. The electrical control is done by a SIMATIC S7300 with PROFIBUS (Siemens) where all required electrical input and output signals are connected with. A power supply, frequency converters for motors, alarm sensors, and supervision touch panels complete the control and monitoring system.

Type of materials:

Input materials:

- Mixture of plastic materials with content of metals, 12.000 – 16.000 t / year
- Fresh process water approx. 3 m³ / day based on a 8 hours daily operation as compensation of the extracted water volume due to water losses taking out the solids

Intermediate, by-, and final products, in total 12.000 – 16.000 t / year:

- Metal fraction
- Heavy plastics fraction mostly containing flame-retarding plastics if there is no pre-sorting when extracting harmful and other substances
- Light plastics fraction (ABS, PP, PS, etc.)

Additional results by possible further process steps:

- For the metal fraction: separation into stainless steel, copper, PCBs, etc.
- For the heavy plastics: refuse derived fuel or material recycling (if pre-sorted WEEE-scrap is available)
- For the light plastics: flow decomposition into ABS, PP, and PS based on waterless processing (e. g. by KM's technology)

Refuses:

- Slurry if feeding material is very dusty. Depending on the type of input, the slurry goes to an incineration plant or to recuperating smelter processes.

Type and degree of emissions (air pollution, noise, vibrations)

During normal operation, there are no environmentally influences in terms of risky emissions like air pollution, noise, vibrations, light, heat and radioactive radiation. Regarding noise emission in a normal operation, the measured values are clearly below 80 dB (A).

Actions to reduce environmental related emissions:

The above mentioned noise emission level has no impact on industrial sites in the neighborhood, especially because of a design being executed as in-house installation. Furthermore, there is no concern at all regarding the operating personal.

Actions to provide an economical and efficient use of energy:

The installed power of the entire plant is approx. 95 kW. This is trend-setting in consumption of energy reaching comparable separation results. The absence of traditional crushing, screening, and classifying keeps the needed energy amount low.

An elevated effort in installations is not required; investments can be saved.
Operating costs can be held on an extremely low level.

Process water safety concept:

For safety reasons in the very improbable case of leakage (e. g. due to a pipe burst), there is a catch basin installed on the floor. This construction secures a gathering of all process water with a safety factor of 1,13 related to the maximum circulating water volume.

Machine characteristics are subject to change without notice.

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