

Systems for

Inspection, Sorting and Analysis of XLPE and PP material in CV lines

SIKORA
Technology To Perfection



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For further information regarding SIKORA's product portfolio for quality control during the high voltage cable production, please refer to the catalog "Measuring and control technology for the production of high voltage cables".

Introduction

SIKORA AG is a leading manufacturer and supplier of innovative online measuring, control, inspection, analysis and sorting technology for the wire and cable, hose and tube, sheet, optical fiber and plastics industries. Worldwide, users of these measuring devices benefit from an increasing manufacturing quality, profitability and efficiency. Modern laser and X-ray technologies measure product parameters such as diameter, ovality, wall thickness and concentricity precisely and reliably. Moreover, innovative online inspection and sorting systems as well as offline systems for inspection and analysis of plastics pellets ensure the highest purity of the material.

Continuous control of production data is the basis for a repeatable process and helps to avoid wall thickness oversizes and allows a more efficient material usage. Every micrometer of insulation material that can be saved by the use of measuring and control technology makes production more economic and saves increasingly scarce resources.

SIKORA is headquartered in Bremen, Germany. Since 1973, the high-quality devices have been developed and manufactured at this site. When it comes to service and sales, SIKORA is globally active with subsidiaries in Brazil, China, France, India, Italy, Japan, Korea, Malaysia, Mexico, Poland, Turkey, the United Arab Emirates and the USA. In cooperation with more than 30 local representatives worldwide, SIKORA serves all customer demands for optimum quality control and productivity. In addition, international service locations assure fast and reliable customer support on site, any time.

Since 1993, SIKORA has met the requirements of DIN EN ISO 9001. The certification confirms SIKORA's focus on continuous improvement. Customer satisfaction is the primary objective.

Innovation, technological know-how, quality and service are the four pillars of SIKORA's company philosophy. A strong research and development team continuously works on the development of new technologies enabling manufacturers of high voltage cables to increase process reliability, efficiency and the ecological balance of their production lines.

Measuring technology for the highest material quality at the high voltage cable production

The purity of XLPE and PP pellets, as they are used for the insulation of medium, high and extra-high voltage cables as well as for onshore and offshore cables, is a decisive characteristic for the quality of the end product. Breakdowns that are caused during the discharge test, due to contaminated material, and field failures can easily cause high value losses in the six-digit range. Therefore, the use of pure material as well as the continuous detection and sorting of contaminated pellets before they can enter the extrusion process is of essential importance.

1 PURITY SCANNER ADVANCED – Quality starts with the purity of the material



PURITY SCANNER ADVANCED with
ECOCONTROL 6000

Online system for inspection and sorting of XLPE, PP and semi-conductor pellets

With the PURITY SCANNER ADVANCED, SIKORA provides an unrivaled, user oriented system for a 100 % online inspection with automatic sorting of XLPE and PP pellets. The system is used by cable manufacturers as well as by raw material producers.

Unique combination of X-ray technology and optical inspection

The PURITY SCANNER ADVANCED intelligently unifies X-ray technology with a dual-axis optical system. In this combination, the X-ray camera assures the detection of metallic impurities inside the pellet as well as on its surface. Thus, colored (e.g. black) pellets are reliably inspected. Contaminated pellets are detected and automatically sorted out in order to assure that only pure material gets into the cable insulation.

Typical features

- 100 % inspection and reliable sorting of plastic pellets
- Dual inspection: X-ray and optical cameras
- Detection of loose or included metallic impurities from 50 μm contamination size
- Detection of discolorations and black specks from 25 μm on colored plastic pellets or in transparent plastic pellets
- Automatic sorting
- Sealed system, optimal protection against external contamination like, e.g. dust
- Suitable for pellets of all kinds (e.g. XLPE, PP, semi-conductor)
- Throughputs from a few kilograms up to one ton per hour*

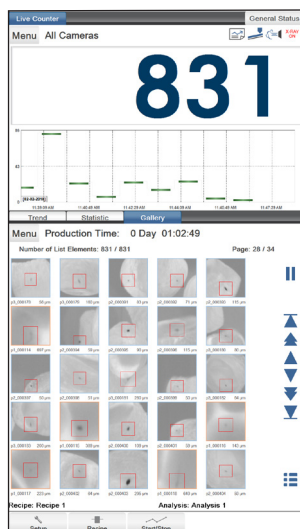
* See technical specification

Configuration of the system



The PURITY SCANNER ADVANCED is equipped with three optical cameras and a X-ray camera. Depending on the application, the system can be configured on specific request to product demands.

Innovative transport system

The pellets are fed into the system through a sealed vibration feeder. In order to ensure the highest purity, all materials, that get into contact with the pellet stream, are made of abrasion resistant stainless steel, perfectly encapsulated and designed to operate with overpressure.



Monitor image of detected faults by the PURITY SCANNER ADVANCED:

-  Metallic contamination detected by X-ray camera
-  Black specks, discolorations, cross contamination detected by optical cameras

Integration of the system in the production line

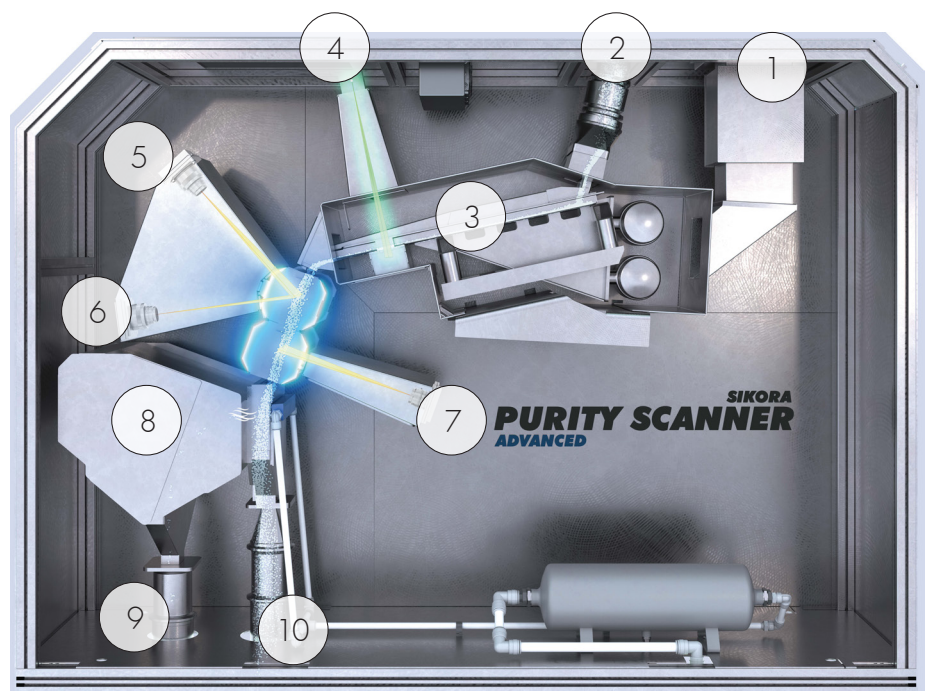
The devices are designed for throughputs from a few kilograms up to one ton per hour* and are easy to integrate into existing feeding systems. Cable manufacturers install the PURITY SCANNER ADVANCED on the conveying path between material feeding and the hopper of the extruder. The feeding of the material is done by gravity or via a vacuum conveyor.

Visualization and analysis

The PURITY SCANNER ADVANCED is combined with the powerful processor system ECOCONTROL 6000. Via the ECOCONTROL 6000, the PURITY SCANNER ADVANCED is comfortably operated. Thus, an additional user interface is not required. Besides, the combination of both systems permits a professional data analysis.

* See technical specification

Overview about the system components



- | | | | |
|---|---|-----|--|
| 1 | Fine filter/overpressure system for integrated clean room | 5-7 | Optical inspection: black and white camera |
| 2 | Material feed | 8 | Sorting unit |
| 3 | Stainless steel vibration chute | 9 | Rejected material |
| 4 | X-ray inspection | 10 | Clean material |

Technical Data

PURITY SCANNER ADVANCED

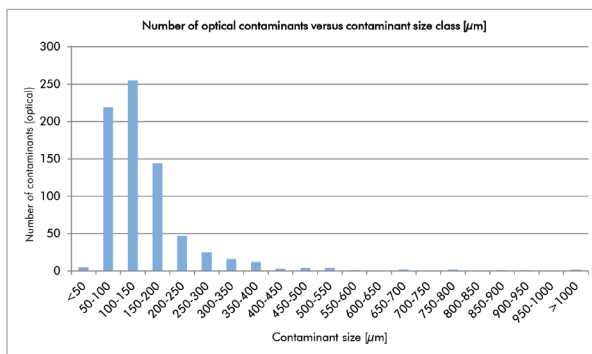
Professional Data Analysis (PDAM)

The Professional Data Analysis Management (PDAM) provides a statistical evaluation of detected contamination, sorted by size and frequency, as well as an image gallery of the pellets that have been detected by the optical cameras as well as the X-ray camera.

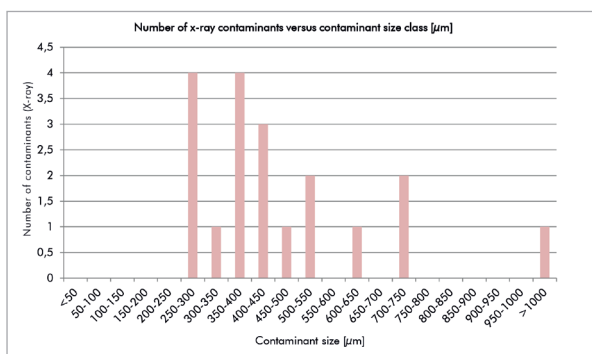
All data are automatically saved and available in MS Excel format as well as an image file together with information such as time and batch number.

PDAM features at a glance:

- Image gallery of detected pellets with contamination
- Statistics of size and frequency of detected contamination
- Trend overview for visualizing the chronological sequence
- Selection of size classes
- Automatic data storage



Size class statistics of contaminants detected by optical cameras



Size class statistics of contaminants detected by X-ray camera

Application Fields

- Cable production
- Plastics/raw material production
- Compounding/Masterbatch
- Profile and sheet extrusion
- Plastics processing
- Outsourced sorting

Inspection Methods/Sensor Technologies

X-ray and optical cameras

Smallest Detectable Contamination Size

X-ray: 50 µm (cube 3D), 50 x 50 x 50 µm
Optical: 25 µm (square 2D), 25 x 25 µm

Throughput

Depending on geometry and specific weight of the material to be inspected, there are throughputs possible from a few kilograms up to one ton/hour* per device. A combination of devices allows for the inspection and sorting of higher throughput capacities.

Permissible Ambient Temperature

+ 5 to + 45 °C

Air Humidity

max. 95 % (without condensation)

Interfaces

RS232, USB

Optional: industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profibus-DP, CANopen, DeviceNet), LAN, OPC DA/UA

Power Supply

3 ph 400 V AC (± 10 %), 50/60 Hz (± 3 %); 2,700 VA
Compressed air supply: min. 6 bar / max. 8 bar / Air quality class 3 (ISO 8573.1)

Dimensions

2,068 x 1,499 x 641 mm
(width x height x depth)

* This refers to a system with optical inspection. Systems that combine optical and X-ray technology provide a throughput up to 600 kg/hour per device.

Your benefits

- Separation of metallic contamination and black specks
- Reduced risk of high voltage flashovers and reduced failures in the field
- Reduced material waste in the production of cables
- Avoidance of complaints and repairs of already installed cables and reducing cable joints
- Extension of the product life time of the cables
- Increased safety for producers, processors and customers

2 PURITY CONCEPT Systems – Maximum purity testing by strong technologies



PURITY CONCEPT V



PURITY CONCEPT X

Offline inspection and analysis of plastic samples

With the groundbreaking models of the PURITY CONCEPT Systems, SIKORA offers the versatile potential of its systems for offline inspection, analysis and evaluation of plastic samples in the area of Non Destructive Testing (NDT). Equipped with X-ray technology (X) or optical camera (V), the systems are to be used, depending on the application, for process control, offline sample testing as well as incoming goods inspection. The PURITY CONCEPT Systems detect contamination down to a size of 50 µm. Regarding the integrated technologies, SIKORA draws on several decades of experience in the cable industry.

PURITY CONCEPT X

The PURITY CONCEPT X, based on X-ray technology, detects and analyzes for example metallic contamination both on the surface and inside of pellets and sample test sheets.

Typical features

- Non Destructive Testing (NDT)
- Innovative concept for comprehensive analysis requirements (inspection of pellets, flakes, sample test sheets)
- Laboratory operation, incoming goods inspection
- X-ray or optical inspection and analysis
- Quality control and documentation

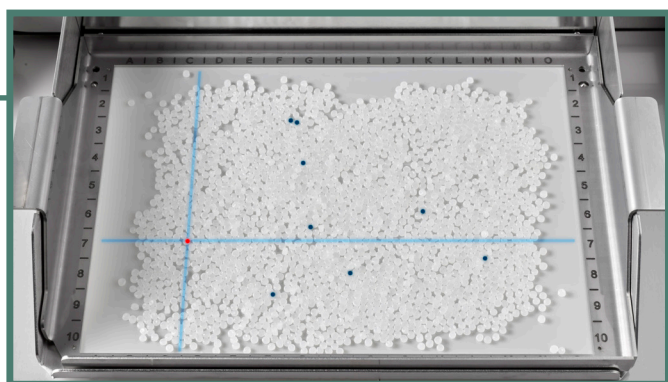
PURITY CONCEPT V

The PURITY CONCEPT V combines the advantages of a light table with an automatic offline material control. With an optical camera, the PURITY CONCEPT V inspects and analyzes any colored and transparent plastic test samples, like e.g. pellets, flakes and sample test sheets. In transparent material, contamination can also be detected inside the sample.

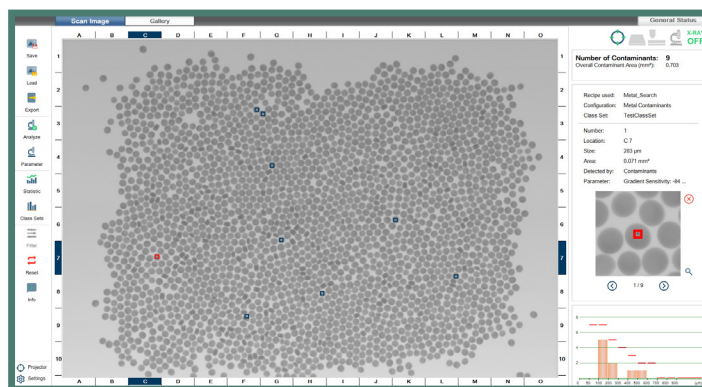
Innovative measuring principle

For the inspection of small quantities, the test material is spread on a sample tray, moved to the inspection area and automatically inspected with the respective camera system within seconds. A projector highlights contaminated material in color directly on the sample tray (here in blue). Pellets with a contaminant are simultaneously shown on the monitor, including the size of the contamination, and marked (blue squares). Individual

pellets with a contaminant can be selected and zoomed in (red square). At the same time, they are optically visualized on the sample tray by the cross hairs. A clear allocation of the contamination and follow-up inspection are possible at any time and do not have to be done manually by the operator. Thus, the system contributes significantly to quality control and process optimization.

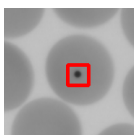


Sample tray with material samples (here pellets)

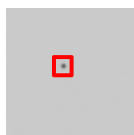


X-ray camera image of pellets on monitor (PURITY CONCEPT X)

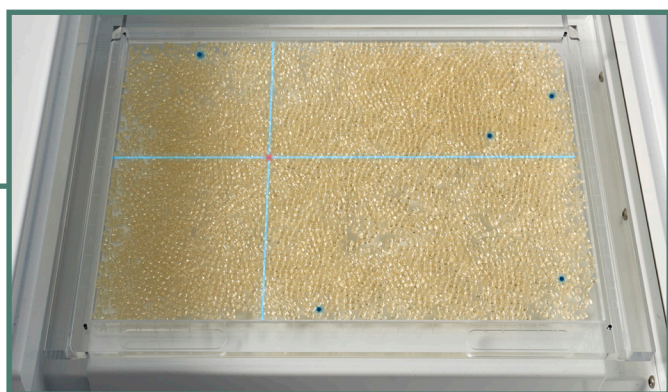
Examples of detected contamination by means of X-ray technology:



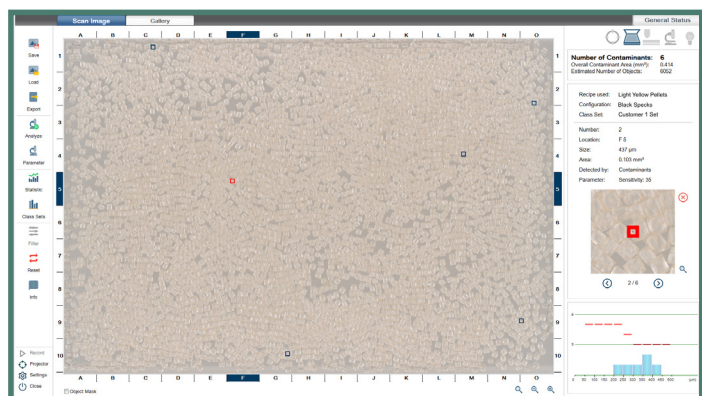
Pellets



Sample test sheet

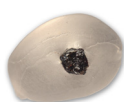


Sample tray with material samples (here pellets)



Color camera image of pellets on monitor (PURITY CONCEPT V)

Examples of detected contamination by means of optical technology:



Black speck



Color contamination



White spot



Discoloration
(yellowish, bluish)



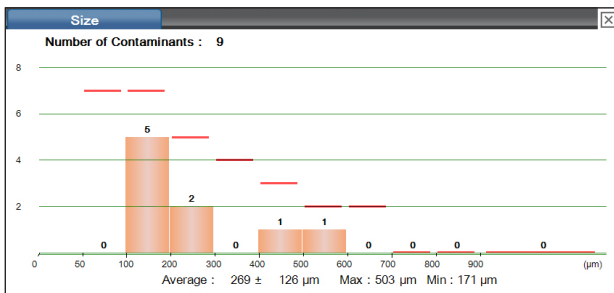
Discoloration (greyish)

Visualization and analysis of measuring values

PURITY LAB is an analysis software for the visualization and detailed evaluation of detected contamination. The data provides users with comprehensive information about the process and the material quality.

The PURITY LAB software includes the following features:

- Image gallery with all detected contamination
- Statistics regarding size, area and number of the detected contamination
- Import function of previously recorded image material for follow-up analysis
- Comprehensive export functions (images, parameters and statistics)



Integrated test certificate for material release

The PURITY CONCEPT Systems provide a test certificate with all information about the inspected pellets as well as a summarization of the test results. Thus, they provide the prerequisite for material release and delivery to the customer.

PURITY CONCEPT Systems
Test Report
V 1.0

SIKORA
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Gallery:

PURITY CONCEPT Systems
Report
V 1.0

SIKORA
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Device: PURITY CONCEPT X (SN: 1905/0919-015) 11.10.2019

Testing Laboratory	Customer
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Product Info	
Product Name:	White pellets
Object Shape:	Pellets
Batch No.:	R6768234
Article No.:	6768230
Delivery Quantity (kg):	1000
Packaging:	Octabin
Number of Probes:	10
Number of Tested Probes:	1
Weight of Probe (g):	100
Probe Name:	P1026-1
Tested by:	Mr. Meyer
Test Date:	11.10.2019

Results	
Recipe:	Metal Search
Class Set:	High Quality Level
Number of Contaminants:	9
Contaminant Area (mm²):	0.754

Result: Passed

Statistic

Number of Contaminants : 9

Average : 269 ± 126 µm Max : 503 µm Min : 171 µm

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Technical Data

PURITY CONCEPT Systems

Measuring Principle

PURITY CONCEPT X: X-ray technology

PURITY CONCEPT V: optical CMOS Line Scan color camera

Application

Pellets, flakes and sample test sheets

Detectable Contamination

PURITY CONCEPT X: metallic contamination, inhomogeneities, cavities

PURITY CONCEPT V: contamination and black specks in transparent material, respectively, on the surface of translucent and colored material

Smallest Detectable Contamination Size

X-ray: 50 µm (cube 3D), 50 x 50 x 50 µm

Optical: 50 µm (square 2D), 50 x 50 µm

Permissible Environmental Temperature/Pellet Temperature

+ 10 to + 40 °C

Interfaces

USB

Optional: LAN

Power Supply

PURITY CONCEPT X: 230 V AC (alternatively 100 V AC or 115 V AC) ± 10 %, 50/60 Hz

PURITY CONCEPT V: 100 - 240 V AC ± 10 %, 50/60 Hz

Dimensions

PURITY CONCEPT X: 1,309 x 831 x 1,882 mm

PURITY CONCEPT V: 1,090 x 575 x 921 mm

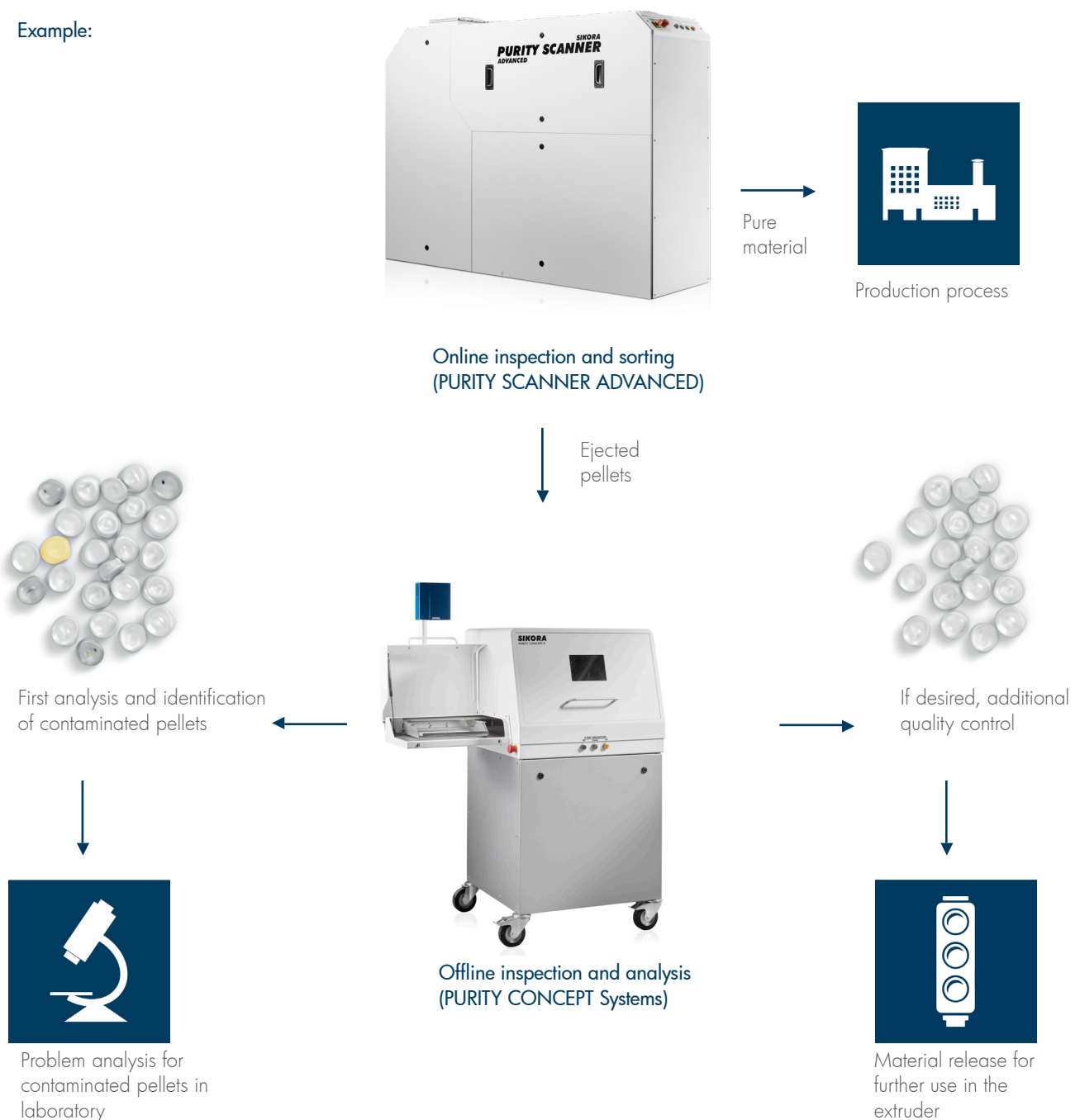
(width x depth x height)

3 Perfectly combined: online inspection and sorting as well as offline inspection und analysis of pellets

For a comprehensive inspection and analysis of pellets, SIKORA recommends the combination of the PURITY SCANNER ADVANCED and PURITY CONCEPT Systems. After the PURITY SCANNER ADVANCED has detected and automatically sorted out contamination online, the contaminated pellets are analyzed offline by a model of the PURITY CONCEPT Systems. In a qs test, the sorted good fraction is released for delivery.

This perfect interplay of online and offline inspection, sorting and analysis allows for a detailed control of the purity of the plastic material. A high purity degree of XLPE and PP pellets results in the reduction of additional material and production costs for remanufacturing and repairing cables that failed the discharge tests as well as an important improvement of the efficiency of the cable production line. Besides, valuable information in order to avoid future contamination are generated from the analysis.

Example:



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Certified according to
DIN EN ISO 9001

Technical data is subject to change