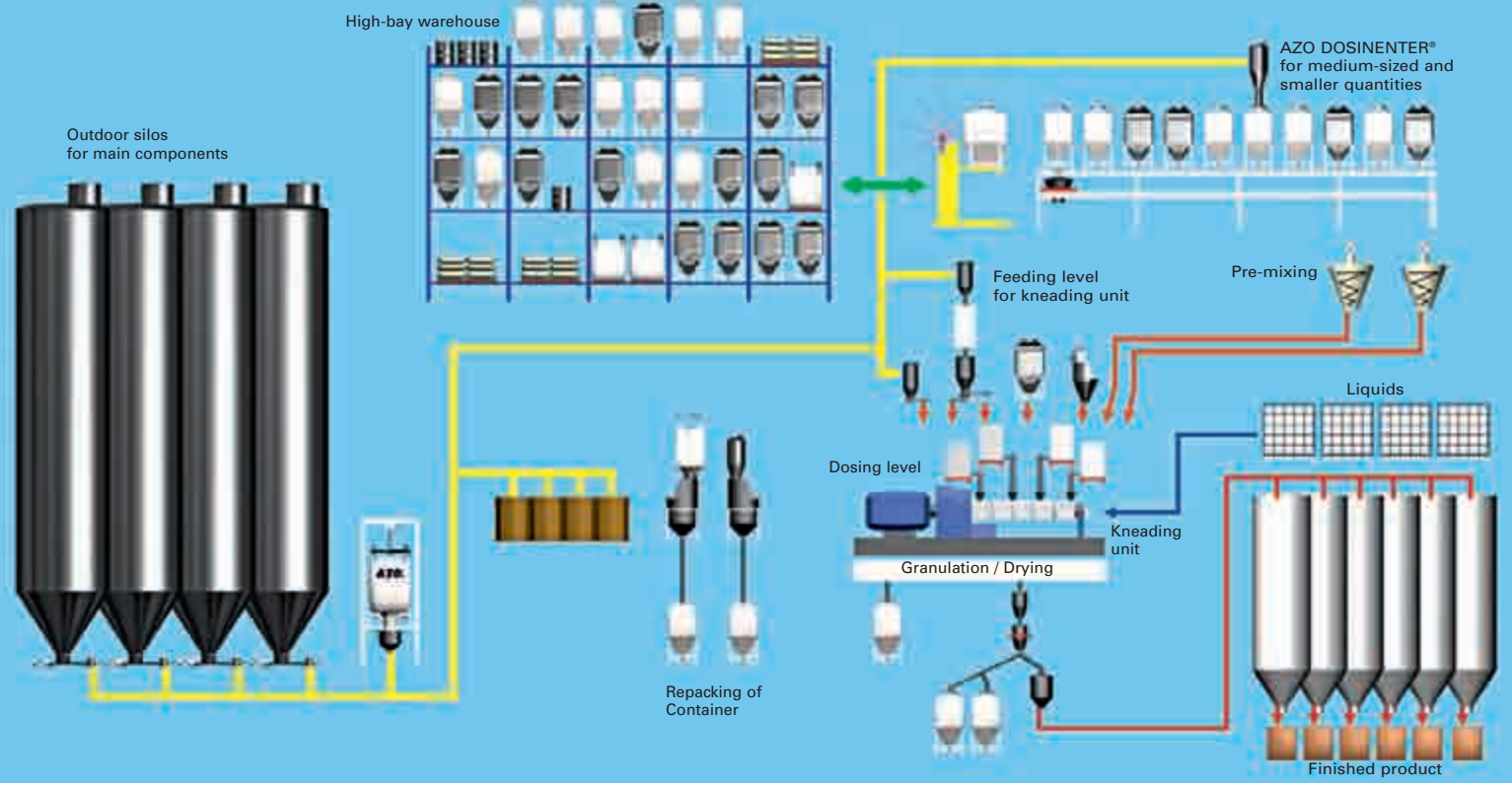


Zero-error strategy in the production of high quality cable compounds

THE SOLUTION





Material flow

Zero-error strategy in the production of high quality cable compounds

Our customer HUBER+SUHNER Excellence in Connectivity Solutions

The Huber+Suhner Group, with its headquarters in Herisau and Pfäffikon in Switzerland, is a leading global manufacturer of components and systems for electrical and optical connectivity for the communication, transportation and industrial sectors. The company's core expertise is in the field of radio frequency, fibre optics and low frequency.

Huber+Suhner works closely with its customers to develop and produce high quality premium products. Its product range includes coaxial, fibre optic and copper cables, cable systems, connectors, antenna and lightning protection components. The company operates worldwide with 24 group companies and numerous agencies in over 60 countries. Huber+Suhner has invested around 30 million Swiss Francs in a new automated mixing

system for its facility in Witzberg in Pfäffikon. This expansion and modernisation project within its cable production, allows for special blends to be produced according to recipes developed in house for the company's cable insulation. The company can look back on decades of experience in material development and cable manufacturing. For instance, its extremely high quality Radox® cables have special insulation

with different properties including: resistance to heat, pressure, hydrolysis and weathering. They are also flame resistant and low smoke. The ability to produce these blends is an important core competence within Huber+Suhner's business strategy.

In the future Huber+Suhner will produce all formulations in its new plant.



The Pfäffikon plant festively decorated for the opening ceremony in 2011



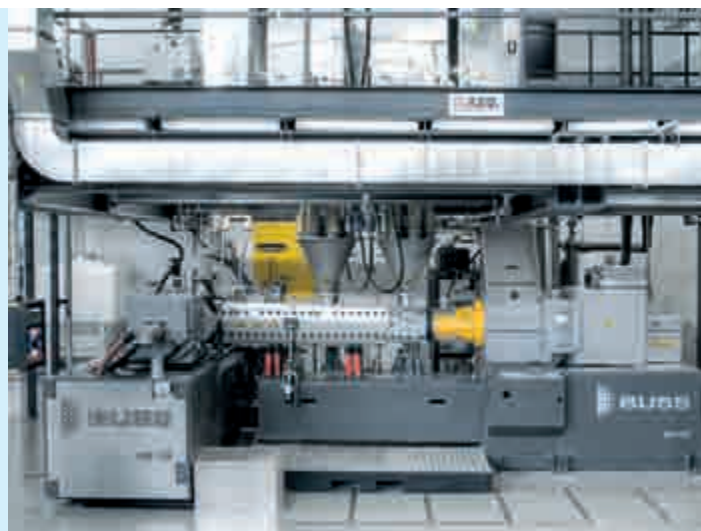
Fire resistant safety cable for use in the rail industry

An overview of the tasks

- 1. Automation of approx. 200 raw materials with extremely different properties – specifically the integration of medium-sized and small components into more than 20 recipes**
- 2. Doubling of capacity while maintaining ultra accurate dosing and weighing precision in the supply of large volumes**
- 3. Maximum flexibility with product changeover with easy to clean systems and very few production down times**
- 4. Residue-free and fast product change because of modular technology**
- 5. Automation of raw material preparation in one man per shift operation**
- 6. Low dust and ergonomic workplaces thanks to sealed systems**
- 7. Process transparency, production safety and documentation of all recipes**
- 8. Future-proof technology to ensure that the company can react quickly to new trends**

Key facts and figures on the system

- The system is split over five production levels
- Production capacity: 4,500 tonnes per annum
- Maximum capacity: 1,300 kg per hour
- Fabrication of 20 different plastic mixtures in a continuous 24-hour operation with a total of 12 production operators in 3 shifts
- Storage capacity: 4 outdoor silos and 13 indoor silos (expandable by 6 indoor silos)
- Storage capacity for small and medium-sized components: 1,200 high-bay storage units
- Control: Kastor production management system supplied by hsh-systeme für process-IT
- The machinery includes complete material feeding technology, mixer, compactor, kneading unit, logistics, ventilation, air conditioning and compressed air
- Rheology, blown film and MFI processes are used in the laboratory



The heart of the mixing plant: the compounder

Mixing building from top to bottom

The new mixing building is 20 metres high and extends over four floors. The height is needed to ensure that the material flow, as well as the production process, runs from top to bottom (vertically) when producing the plastic mixtures. It was very important to minimize distances and optimise the production processes. Four 18-metre high outdoor silos are located outside on the northwest side of the building along with 13 indoor silos to store raw materials and finished granulates inside of the building. It is possible to expand by adding six more silos. To optimise the processes, the silo storage area is located directly adjacent to the truck loading ramps. All the functional areas are located very close to each other in the new mixing plant to ensure short distances and optimised production processes.

The Huber+Suhner mixing plant is equipped with state of the art machinery and the very latest in logistics technology. Manufacturing processes can be

optimised thanks to the automated warehouse that extends to the entire height of the building. The raw materials, which are delivered in different containers, are manually repacked into standardised containers that can be automated (DOSITAINER®, DosiBox®). These containers are then temporarily stored in the high-bay warehouse and automatically taken out when required and placed on the DOSINENTER®. A batch can now be prepared based on the specific recipe. After the mixing process, this batch is transported to the heart of the production process, the kneading unit. This process chain guarantees the very best quality and production reliability.

Capacity has been significantly increased from previous production levels thanks to the use of AZO technology. The floor layout in the new plastic mixing plant has been designed to ensure that a second production line can still be installed and operated in the future.

»With this investment we are affirming our long term commitment to the Swiss site and in the Pfäffikon plant and we will continue to be one of the major employers in the region. The new systems enable us to push the limits of material technology, thereby further reinforcing the innovative strength of our company to support our customers.«

Urs Kaufmann, CEO
Huber+Suhner AG, Pfäffikon ZH



Outdoor silos for large volume storage

Clean product supply with automatic access to all components

The AZO solution in detail

Storage and product feeding of large and medium-sized components

Base materials are delivered by silo trucks directly into the outdoor silos to cope with the large throughput of the plant, although the silos can also be filled by a big bag feeding station. The base materials make up around eighty percent of the plastic, with a number

of different additives and fillers added to it. Each of the four outdoor silos has a capacity of 105 cubic metres and to prevent the penetration of moisture, the silos are fitted with a head space drying. Further raw materials can be fed from octabins. Bulk materials are conveyed by pneumatic conveying systems to the gravimetric, continuous dosing systems above the kneading unit

(compounder). A compactor roller is installed upstream of the continuous dosing systems that is used to condition the dry, fine powder. DosiBoxes® can also be pneumatically filled directly on the DOSINENTER® if higher throughputs are required. The special vacuum conveying systems permit simple, dust-free product intake and also guarantee cleanliness at the supply point.

Repacking of sacks, cartons, drums and big bags

Additives are delivered in big bags, sacks, cartons or drums. Then they are recorded centrally, barcoded and placed on the intake roller conveyor to the high-bay warehouse. From this point the containers are stored automatically. The high-bay warehouse has nine storage levels that extend to the



Silo head space drying



Vacuum conveying system for the feeding of the compactor roller



Feeding hopper with empty bag compactor and additional receiver for pneumatic filling



Clean feeding of medium-sized components from octabins by means of vacuum conveying systems

»We have automated the supply of raw materials to such an extent that one person in each shift is capable of managing the entire batch supply.«

Martin Kaspar, Head of HF Mixtures
Huber+Suhner AG, Pfäffikon ZH

full height of the building. The products are first repacked into standardised containers, DosiBoxes® and DOSITAINER® to ensure smooth automated processing and these are then automatically placed on the DOSINENTER® if required. A combination big bag and sack unloading station and a sack unloading station with receiver are used for the repacking process. A central aspiration system ensures

that minimal dust results from the loading of the different containers. The filled DosiBoxes®/ DOSITAINERS® are stored again in the high-bay warehouse and are registered in the control system so they can be automatically used later in the process.



Liquid storage with plastic and metal containers



Big bag discharge station with integrated feeding hopper and central aspiration system

»We require ultra flexible solutions because of having around 200 raw materials and 20 recipes to produce the desired properties of our products. We have now automated all medium-sized and smaller components using intelligent modular technology and interchangeable containers which gives us the ability to produce batches automatically and accurate to the gram.«

Martin Kaspar, Head of HF Mixtures
Huber+Suhner AG, Pfäffikon ZH



DOSINENTER® for the weighing of additives accurate to the gram

DOSINENTER® – Fully automatic weighing and supply of medium-sized and small components

Compilation of additive batches

The DOSINENTER® has a total of 17 stations which are used for DosiBoxes®, DOSITAINERS® and a micro dosing unit. AZO DosiBoxes® are standardised plastic containers with a volume of 1,000 litres and are ideal for raw materials with good flow characteristics. The containers themselves have no discharge aids although the mobile scales have a device that assists with discharge depending on the flow

characteristics of the respective raw material. Small and medium-sized components with difficult flow characteristics are stored in stainless steel DOSITAINERS® that have a volume of 1,000 litres each. DOSITAINERS® have an integrated dosing screw and are positioned on docking stations with discharge device to support material discharge. The drive for the screw is built into the docking station. A micro dosing unit is

another module that can be positioned on the DOSINENTER®. It is a loss in weight system that permits precise dosing of small quantities of a component. Following input of the production order, the process control system monitors the current raw material supply and initiates the action to bring the correct container from storage. The automatically guided fork truck brings the container to its pre-determined position on the

DOSINENTER®. By means of its radar system, the unit aligns itself to the reflectors arranged in the room and positions the container millimetre precisely into the discharge base on the DOSINENTER®. Mobile scales travel to the storage bins, dock onto them and collect the quantities of raw materials exactly according to the recipe in the control system. Once all the components required for the recipe have been weighed, the scales



Micro dosing module



DosiBox® made of plastic



DOSITAINER® docking station



Supply point for pre-weighed batches



Mobile scales of the DOSINENTER® with docking systems for DosiBoxes® and DOSITAINERS®

»A zero-error strategy applies to the production of the highest quality cable compounds in line with Huber+Suhner's corporate philosophy.«

Martin Kaspar, Head of HF Mixtures
Huber+Suhner AG, Pfäffikon ZH

Additive mixing

travel above a discharge point in the floor, dock on it and discharge the entire batch into a container mixer located underneath. The DosiBoxes® and DOSITAINERS® remain on the DOSINENTER® as long as the product is needed in the recipe and then return to the high-bay warehouse or are re-filled.

The mixing of the pre-weighed raw materials puts extremely accurate demands on the technology. Optimum mixing homogeneity, short mixing times, avoidance of the raw materials heating up during the mixing process and avoidance of the mixture adhering to the walls when it is discharged are all key tasks. The covers and mixing vessels are connected by grounding cables to conduct away any possible electrostatic charge.

The temperature on the motor shaft is also monitored to detect any possible overheating immediately. The homogeneous mixture emptied into gravimetric, continuous dosing units and is supplied to various kneader zones so that it can be heated or kneaded for a corresponding length of time according to the recipe. The base material and other components are also supplied to the kneader via the continuous

dosing systems. There are special liquid dosing systems available for liquids stored in containers, which dose the liquids directly into the kneading unit.



Automatically guided fork truck for the automatic handling of raw material containers



High-bay warehouse for the temporary storage of medium-sized and small components



»We conducted a large number of conveying, discharge and dosing tests at AZO's Technical Centre in Osterburken due to our somewhat complex raw materials. We ascertained, to our great satisfaction, that all the promised functions were maintained in practice.«

Martin Kaspar, Head of HF Mixtures
Huber+Suhner AG, Pfäffikon ZH

Finished product silos with filling connector

State of the art mixing and conveying technology

Continuous feeding of the compounder

The kneading unit

The supplied raw materials are mixed together on a molecular level in the compounder, also known as the kneader. The kneader essentially consists of the kneader shaft, the housings, a shaft for the discharge extruder and the screen changer and the nozzle plate. 46 temperature sensors are distributed along the entire length of the compounder and an online rheology measurement is performed at the extruder outlet. This results in high

quality plastic mixtures that can be processed in the cable production department to produce insulation and sheaths. The 8.5-ton kneading unit is located on the ground floor of the building and is just as state of the art as the raw material supply section.

Sampling and quality control

After compounding, the product is granulated, cooled and then dried. Samples are continuously and

automatically taken. This simplifies the production operator's work and guarantees processes that comply with the process specification. There are no operator related sources of error anymore. Automated sampling can be performed throughout long periods including during the night shift on a 24-hour operation. This provides a representative average over the entire duration of production. The parameters "Sample quantity" and "Sample cycle" are entered into the process control system for the respective recipe and are

transmitted to the sample collector at the start of a production order. The sample weight is approximately 1.5 kg per sample. Half of the subsequent analysis is performed online in the mixing plant while further analysis is conducted on cross linked samples in the physical laboratory. Following recording of the throughput, the finished products can be filled directly into containers or boxes or stored in the finished product silos.



Continuous feeding of the kneader



Throughput recording and sampling of the finished compound



AZO®MULTIAIR dense-phase conveying system for the gentle conveying of the finished granulate



»With intelligent process visualisation we are now able to use automatically guided transport vehicles in the DOSINENTER® section without the need for camera surveillance.«

Martin Kaspar, Head of HF Mixtures
Huber+Suhner AG, Pfäffikon ZH

Central control and visualisation system

Process control and visualisation system Kastor – the plant assistant

Gentle conveying of the finished compound

The finished products are conveyed extremely gently into storage silos by the AZO®MULTIAIR dense-phase conveying system. As the finished granulate is hygroscopic, the silos are equipped with a head space drying. To prevent the product from compressing in the silo the product is continuously circulated out of the silo and back to the silo again. Discharge is further aided by a vibrating basket. The lump breakers positioned underneath

ensure that no large agglomerates enter the filled finished products.

Filling

The finished granulate is poured out of the storage silos into boxes that travel under the silo outlets with an electric manual lifting truck. The filled orders are processed by means of scales integrated into the lifting trucks and connected by WLAN to the control. The finished products are now ready for dispatch to the respective production sites.

Process control in the mixing plant

The Kastor process control, manufactured by hsh-systeme für prozess-IT, follows a prescribed production process depending on the plastic mixture ordered. It controls the quantity and form of storage of the raw materials needed before the start of production and provides the corresponding repacking orders when needed. Orders are issued and monitored or carried out by the process control throughout

the entire production process at the different workstations. The entire production process is continuously visualised and logged.

The main functions are:

- Process and batch traceability
- Visualisation
- Logging of the batches
- Optimisation of batch size
- Recording of all storage movements
- Generation of repacking orders
- Management of recipe parameters
- Audit trail



Operator terminal with barcode scanner in the finished product filling section



Operator terminal, PDA with barcode scanner



Conclusion:

»We have opted for a plant system that is flexible and future proof to enable us to react easily to new trends and further extend our market lead. Our intention is not to enter the mass market but to further extend our quality based lead in the cable applications niche market and open up new markets. We need the right partner for this: **The close working relationship between our process engineers, AZO and hsh has created a mixing plant for the manufacture of cable compounds that is currently unique worldwide.**«

Martin Kaspar, Head of HF Mixtures
Huber+Suhner AG, Pfäffikon ZH

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Right to the point.