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PRESS


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# Tried and tested

Tomas Cerny, Schenck Process, Czech Republic, details the installation of reception, weighing, and feeding units at a cement plant in the tula Region of central russia.

**The continuing demand for increasing thermal substitution rates in order to reduce primary fuel costs through the use of alternative fuels (AFs) has resulted in a need for highly sophisticated systems with fully automated storage cranes and online fuel quality determination capabilities. Basic and cost-effective installations should not be neglected, however, as even innovation in the simplest, most understood elements of machinery can make a significant impact upon a plant's productivity.**

**A typical example of the latter is the high feed rate line for AFs at the Heidelberg Group's cement plant in Novogurovsky, in the Tula Region of central Russia. The plant began operation in 2011 as a greenfield project and used technology with a reduced environmental impact, as well as renewable energy sources. The AF line, which was commissioned in 2014, represented a straightforward solution for the need to continuously feed 150 m3/hr of wood chips into the burning process.**

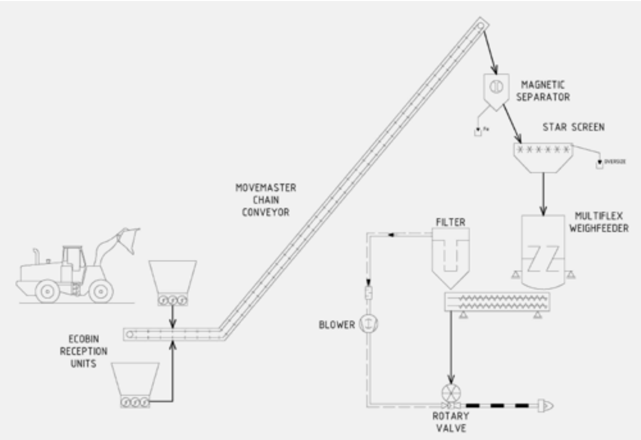


**Figure 1. Novogurovsky AF line flow sheet.**

**Figure 2. Feeding tower before cladding with a view of equipment.**

### Reception

The fuel to the line was supplied by a front-end loader and the reception point was formed by two EcoBin reception hoppers, which were each equipped with a triple screw feeder bottom. Both EcoBin reception units were connected to a common side inlet chain conveyor. The most significant advantage of this design is the reduced need for civil works, assuming the floor or road is designed for heavy-duty machines, such as front loaders. The solution also includes the local manufacturing of machinery parts. In this case, the material intake hoppers were manufactured according to the Schenck Process design and were installed over the screw troughs, which were fully assembled upon delivery.

The material storage and intake area was connected to the feeding section by an L-shape drag chain conveyor. In most applications, chain conveyors still offer the best cost-benefit ratio solution, largely due to the dust-tight operation and the possibility of elevating the material at steep inclinations. Chain conveyors are also well suited to materials with a low surface moisture content, as is the case at the Novogurovsky plant, and provide a long service life.

Although relatively dry, the shredded wood also demonstrated a common problem found in the handling of AFs: the poor flowing properties of many AFs can cause bridging over any obstacles in the material flow. Prevention of this requires the modification of the level measuring sensor and the creation of smooth hopper walls.

### Feeding tower

Before the fuel enters the feeding section, material screening can be advantageous. In pneumatic conveying, this is usually necessary in order to prevent pipeline blockages.

At the chain conveyor outlet, the material first enters a magnetic separator, which removes any ferro-magnetic particles. If waste wood is used as a fuel, this section is often highly exposed as large amounts of nails, staples, steel wires, and similar particles should be expected in the fuel. In the Novogurovsky plant, a drum type separator was used. The main advantages of this arrangement is the spillage-free construction, as well as compact dimensions. For the separation of oversized material, a star screen is frequently used. Star screens are the most commonly used equipment in the AF sector, particularly where particle size is below 150 mm.

The screened material enters in the hopper of the MultiFlex weighfeeder. MultiFlex is a dust-tight, highly accurate screw weighfeeder and is also a highly flexible dosing device in terms of its control range and material parameters. In more than 120 installations worldwide, it has delivered high accuracy and reliability, even with the low quality of AFs. The system consists of a feed and calibration hopper with internal agitators and dosing screws that are used to extract the material from the hopper and feed it into the process via a separate weighing circuit. The mass flow is determined by the sophisticated weighing of the

Figure 3. MultiFlex weighfeeder.

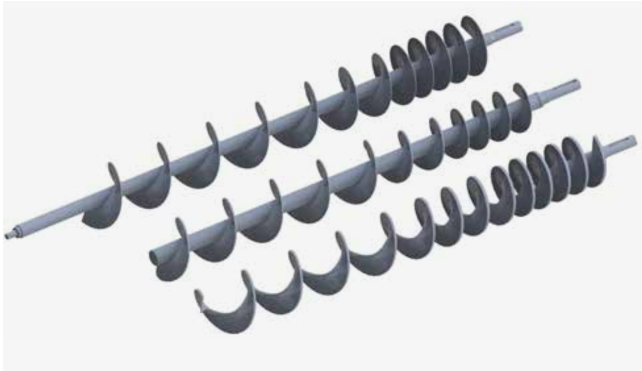

Figure 4. Options for screw conveyor based machines, from top: standard screw, loose screw, shaftless helix.

mass inside the hopper and the dosing screws. The mass flow can be continuously checked through on-stream calibration. Accuracy with deviation better than 1% can be reached in the vast majority of installations. To obtain this high accuracy, it is mandatory to weigh the complete feedtrough. Using Schenck Process' load cells (which have a sensitivity of 2.85 mv/V), alongside pendulum mounts, allows for accurate measurements to be taken, even with a high dead load in the trough.

The Novogurovsky plant's maintenance team also used the DISOCONT® weigh control unit. The unit measures the load cell signal and controls the entire MultiFlex. There is no need for any programming of the local PLC and signals are available for the plant control system, for example to visualise the feeding.

The MultiFlex weighfeeder is equipped with a filter over the outlet of the screws, in case there is any need to connect to a pneumatic transport, as found at the Novogurovsky plant. The leaked air from the downstream rotary valve is dedusted in the filter and the outcoming air is led away by the suction of the blower in order to prevent any undesired odour from the waste-derived fuel.

**Innovation on the simplest equipment**

Although the equipment used in the Novogurovsky plant might seem simple, even in such machinery innovation and development still takes place.

The EcoBin reception unit and the MultiFlex weighfeeder are machines based on screw conveyor techniques. The standard conveying screws are anchored on each end with bearings, and these are the most known technology. However, the shaft in the middle reduces the chamber size and exists as an obstacle for the material outflow. In AF applications, the free ends of the screws usually suffer from long strips of material becoming wrapped around them, decreasing the discharge cross-section further.

These problems are removed when shaftless helixes are used. The absent shaft makes the conveying area obstacle free and allows for larger particle sizes. However, helixes are more sensitive to fatigue and damage from oversized lumps and materials that tend to stick to the trough. Those materials that tend to lift the helix are also problematic due to very low radial stiffness of the spring-like element. Additionally, manufacturing helixes is more costly and onsite repairs are very complicated. Recent tests and site applications have shown that a mixture of both principles is advantageous. So-called loose screws in overhang installations have proven very good performances, even for very difficult materials, such as a low quality RDF.

In 1920, Arnold Redler patented the en-masse conveying principle, and Schenck Process follows this conveyor optimisation process for AFs.

The most significant improvement in the field of chain conveying is the patented additional tensioning system, which is connected to an external chain tension pointer. This tension optimisation paddle is typically installed in the bottom bend of the conveyor, but can be installed in a straight section, if additional tension is needed there or if the conveyor simply has no bottom bend. The problem with tensioning chain conveyors is slightly more complicated than perhaps initially indicated. The inclined sections of a chain are tensioned by the chain's weight. However, in low inclined conveyors or in the long horizontal bottom sections of a machine, reaching optimal tension is difficult. Therefore, following a detailed calculation of the forces in the machine, the machine layout is likely to need adjusting and/or the size and position of the additional tensioning system may need addressing. Maintaining proper tension in the chain strand is one of the key factors influencing the chain's lifetime and the overall efficiency of the machine.

The tension optimisation system features an outside indicator showing the operations staff the current chain

**Figure 5. Shaft-free solution for chain conveyor trailing wheels.**

tension. Connected to a limit switch, it also sends signals to the control system in case of under-tension, chain rupture, or over-tension (caused by chain jumping a tooth on the sprockets). Other developments in AF applications include trailing wheels. Schenck Process currently uses a solution without a connecting shaft (Figure 5), which prevents problems with material wrapping at this point.

**Conclusion**

The shredded wood installation in the Novogurovsky plant has proven, following several years of commercial operation, that AF lines can be simple and cost effective, while securing high AF substitution rates. The plant demonstrated improved operational performance and reliability using the Schenck Process equipment. During the preparation phase of using AFs, the equipment was used to feed other lumpy fuels, such as shredded tyres. These trials were authorised and requested by the authorities to evaluate the environmental impact of these fuels. The Schenck Process equipment could process all tested types of fuels without any problems.

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