

## Timing belts in glass processing systems

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**Abstract** Paper present main problems connected with exploitation of timing belts in fast growing production and processing systems. Mechatronics systems in glass production are the fastest developed field of application of this belts, and the most demanding. The decision of this process demand knowledge about design of this type of gears.

### 1 Introduction

Thanks to progress in technology of glass processing there are a number of new applications of timing belts because of the rapidly increasing demand for glass products. Glass is used extensively in the construction industry, more and more widely in the automotive, electronics and furniture. Among manufacturers, the demand for more and more new production systems while limiting human presence in this hostile work environment. Aggressive environmental conditions such as glass dust, moisture, chemicals adversely affect the durability of production systems. This is a challenge for complex systems with high quality sensors, the regulations and controls. Some of them should be frequently cleaned and dismay others undergo exchange or recirculation. Mechatronic systems for glass processing is one of the fastest growing fields used gear timing belts. Many of these belts may not be exchanged and disposed of, may be subjected to the process of recycling. These applications require high accuracy of the belt. It is necessary to control geometric features, materials and supervision of the production process of belts. Is also very important condition of belts and wheels:-quality surface and provides material and preserving geometric features[11].

### 2 Timing belts in glass processing systems

The earliest applications were timing belts loading and unloading systems for the new glass and packaging. These are applications that transferred from other material handling systems present in the form of plates (Fig. 1).



**Fig. 1. Parallel conveying system.**

In the first applications, there is a need to change the properties of the dorsal side in contact with the conveyed material. The first typical application in glass processing, were washing systems. Belts in these systems support the glass and bring them to the bath, in the case of active drive systems washers brush and blowing systems. Further applications are edge grinding systems. It is one of the fundamental processes of glass, prevents the possibility of injuries or damage to other components. Relieves stress at the edges, which can cause cracking. There are several types of grinding and sanding are subject to complex shapes like car body parts. This shows the complexity of the process. Straps are used to have the movement of glass, holding, and to move and drive the grinding heads. Further elements of the glass processing systems to stations milling, sanding, drilling, and

painting. Separate groups of machines in glass processing systems in which there are timing belts are manipulators, one of these systems are common to most systems, packaging and storage [1,8].

### 3 Type of timing belts used in glass processing systems

Production systems within the industry may encounter many types of timing belts. There are some different shapes of teeth at a different location and width of the belt are made of different materials [2,3]. Equipment used in these systems have a maximum of a few years, so timing belts that are used to solve these last years. In the example you see a rapid development of engineering materials, these belts are the most advanced composite solutions. Depending on the operating conditions are there bands combined or made as endless. The technology of the belt production is also connected to the recirculation utility belt. Difficult working conditions and a significant length make these applications are used belts do not require additional guidance. Belts with teeth unevenly distributed across the width not coincide with the pulleys[9,10]. These are some of the most expensive seat, so is allowed to work belts, flat running the page is partially exploited. The most important problem of this system is the some quality of parallel belts. If they are from different production process on the conveyor they will have different linear speed(Fig.2). The difference in pretension force of cord and friction between belt and support is a big problem in regulation of such type of conveying systems.

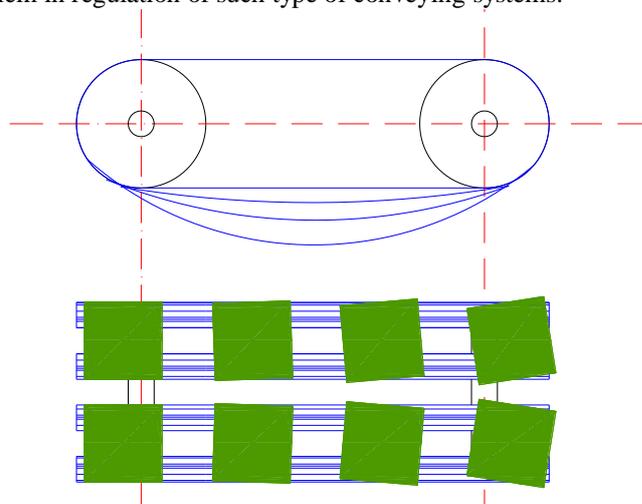


Fig. 2. Product twisting on conveying system because of mistake in timing belts.

### 4 Influence of production technology on the quality of timing belts

The basic problem of producing belts is suitable structure considering the properties of the polymers used in the manufacture of belts (Transition shrinkage, deformation after the initial cycle of work, deformation under pressure). Mechatronic vehicles place high demands on the accuracy of performance and quality of the materials from which the belt is made [4,5]. The materials currently used in the manufacture of timing belts are compounds, in which natural or synthetic polymer is a dominant component. It can therefore be assumed that the properties of the strips are determined by the characteristics and structure of polymers and their ingredients. Polymers are distinguished from among other plastics that are made up of macromolecules of ultra high molecular weight. These macromolecules are formed through joining together identical molecules called mers in a chain length in excess of several times the diameter thereof. The shape of the macromolecule that is characteristic for a particular polymer, it is often assumed that a characteristic of plastic, and they are classified into: a linear, branched and crosslinked. Next to the polymer present in the plastic additives, among which can be distinguished: fillers / talcs, carbon blacks, metal powders, fibers, etc. /, carriers, plasticizers, stabilizers, pigments, blowing agents, flame retardants, thixotropic agents. Also in the chemical structure of the polymer, in addition to primary carbon dioxide, hydrogen, there are elements such as oxygen, chlorine, fluorine, silicon and sulfur. By introducing additional elements can lead to a new species of polymers, characterized by altered properties such as heat resistance, chemical, electrical conductivity, and above all other mechanical properties. The carbon atoms and hetero atoms are linked in chains main forces also called valence kowalentnymi or nuclear. These bonds are classified as bond-order. Next to them, the polymers are binding the second row, called Van der Waals bonds between the polymer chains. The energy of these bonds has a number of effects, among which stand out are: dispersion forces, dipole strength and impact strength of hydrogen bonds. Dispersion forces are the larger the closer are polymer chains which means that they are dependent on temperature and the presence of solvents.

Internal friction inside the twisted teeth causes a significant portion of the energy dissipation. The increase in temperature affects the mechanical properties of the material causing deterioration of the coupling in the central part of the belt. The material at an elevated temperature is higher due to both the deformation and bending terminal [6]. Problems deformation of teeth trying to solve using composite fibers in the teeth, fabric covering, or by turning off the central part of the belt of engagement with the wedge shaped as the leading type belts Batken. The deformation of such a belt is considerable, the wedge is placed below the support layer and is subjected to compressive stresses. Part of the problem is solved by increasing the clearance between the teeth of the belt and the wheel, but the situation is getting worse feedback. As a result, strips, teeth unevenly distributed across the width shall not transfer higher torques and are used to solve the problem of driving lane and reduce noise emissions. Gears of such work by emitting less noise. By increasing the ratio porycia by conjugation is involved at the same time greater number of teeth, and there is no belt teeth hitting heads with head gear teeth [7].

## 5 Exploitation of timing belts

The use of mechatronic systems, glass processing in harsh working bands in which the effect of additional layers on the dorsal changed stiffness and mass [8]. And the increase of each structure displacement accuracy requirements [8]. Therefore, the replacement cover must not impair the surface condition (Fig.3.). This requires special attention to the condition of the belt led to recycling and appropriate approach to the process of refining. Very often the teeth are damaged or cord in the preparation of the dorsal side of the re-lamination. After placing a new layer to grind its dorsal side. In case of excessive machining of the belt is too narrow, and is not suitable for use.

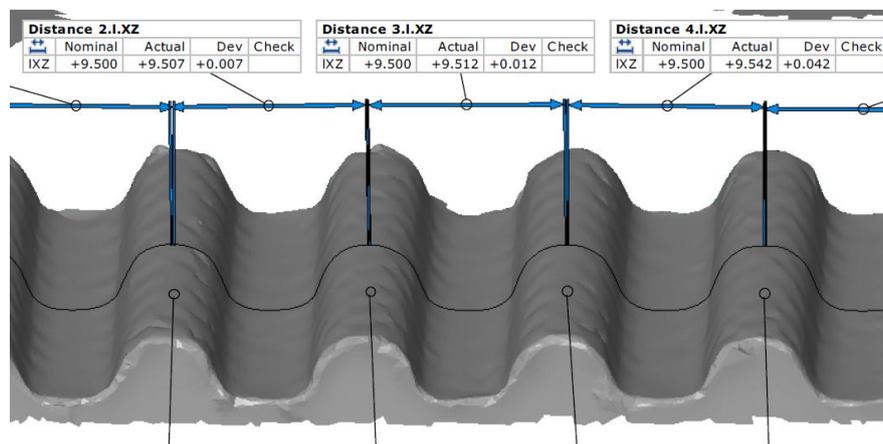


Fig. 3. Measurement of surface of Timing belts after exploitation.

Belts ensuring the accuracy of displacement to 0.5% on the meter movement. This changes during operation, and therefore it is essential to the supervision of the technical condition of the running surface of the belt.

## 6 Conclusions

Mechatronic production system is a challenge for modern belt drive solutions. Increasing the thickness of the belt and the choice of specific materials of the composite belt affects its performance characteristics. The intersection of cord belts combined, results in a significant reduction in the width of the active runway. An important criterion for assessing the functional timing belts of propulsion machinery and conveyors is the criterion of sustainability. Persistence of these elements, energy dissipation is related to the efficiency and security of the entire system. Transmission of the timing belt is considered to be very accurate drive and presupposes that the timing belt accurately reflects the geometrical form adopted in the standards. The operation of this type of transmission, problems associated with belt and accuracy of wheel wear and their volume during operation. This results in inaccurate movements and position of individual elements of the belt, which in mechatronics transport can become a cause not only malfunction, but the damage to the system. Quality recirculation accuracy of the new backing layer is directly reflected in the accuracy of the conversion of rotational movement of the gears on the surface of the belt line. In systems where several parallel running belts is particularly important.

### Acknowledgments

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