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[ijirset@gmail.com](mailto:ijirset@gmail.com)

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# Design of Conveyor Belt used for Capsule Sealing Machine

Shivam Yadav, Prashant Devane, Sushant Bhawar, Aakash Kawatkar, Dr. Shyamsing Thakur  
UG Student, Dept. of Mechanical Engineering, D. Y. Patil College of Engineering, Akurdi, Pune, India  
UG Student, Dept. of Mechanical Engineering, D. Y. Patil College of Engineering, Akurdi, Pune, India  
UG Student, Dept. of Mechanical Engineering, D. Y. Patil College of Engineering, Akurdi, Pune, India  
UG Student, Dept. of Mechanical Engineering, D. Y. Patil College of Engineering, Akurdi, Pune, India  
Dept. of Mechanical Engineering, D. Y. Patil College of Engineering, Akurdi, Pune, India

**ABSTRACT:** This paper refers to the selection of timing belt drives used for conveyor system. A timing belt is a crucial component used in conveyor systems to ensure precise and synchronized movement of various items or materials. The conveyor belt is the linchpin orchestrating the precise movement of products throughout the manufacturing process. Critical design elements include meticulous material selection, structural design, automation integration, safety measures, and reliability. The dimensions, construction, and structural integrity of the conveyor belt will be optimized to facilitate smooth and continuous pod movement. It is designed with toothed pulleys and a flexible belt that has evenly spaced teeth along its surface. This toothed design allows the timing belt to securely grip the pulleys, preventing slipping or misalignment during operation. The timing belt used in conveyor systems must be chosen based on the specific requirements of the system, such as the load capacity, speed, and distance. Additionally, the material used for the timing belt should be durable and resistant to wear and tear, as it will be subjected to constant friction and tension. When selecting a timing belt for a conveyor system, it is important to consider the specific operating conditions and requirements of the system. Factors such as the load capacity, speed, and distance will dictate the type of timing belt that is most suitable for the application.

## I. INTRODUCTION

When selecting a timing belt for your conveyor system, it is crucial to consider the specific requirements and operating conditions. The load capacity, speed, and distance will all play a significant role in determining the most suitable timing belt for your application. Additionally, the material of the timing belt must be carefully chosen to ensure durability and resistance to wear, and tear caused by friction and tension during operation. In addition to the aforementioned factors, the design and tooth profile of the timing belt are equally important. It is essential to ensure that the timing belt securely grips the pulleys and prevents slipping or misalignment. By carefully considering these factors, you can select the appropriate timing belt to ensure precise and synchronized movement of items or materials along your conveyor system.

Timing belts work simultaneously at both high and low speeds and are particularly suited to acceleration and braking applications aided by their low mass. In the group of transmission drives, timing belts are synchronous driving components. They obtain their high-power capacity by means of low losses when combined with the corresponding toothed pulleys.

Their excellent performance in start-up or braking operations is a result of the interaction between the timing belt and the pulley. Every flexible elastomer tooth function in between the pulley teeth's hard flanks. The torque reversal will also alter the loaded flanks of the belt teeth in mesh with the pulley with each drive reversal from beginning to braking and vice versa. If drive systems have high levels of acceleration and braking, or if they are required to be precisely positioned at high speed, then timing belts must be of primary interest to the designer. Foundations are gentle and without shock loads, thanks to the elasticity of the belt teeth. Timing belts concurrently benefit upstream and downstream driving components and have relatively benign running characteristics. The timing belt offers slip-free, synchronous motion transfer and incorporates all the benefits of traditional belts (flat, wedge, and Vee-ribbed belts), including high allowable speeds and low noise operation. The fact that timing belts have a wide range of uses and don't require lubrication when used heavily and continuously makes it easier to integrate them into technological drive solutions for mechanical and precision engineering.

## II. LITERATURE REVIEWS AND PAST RESEARCHES

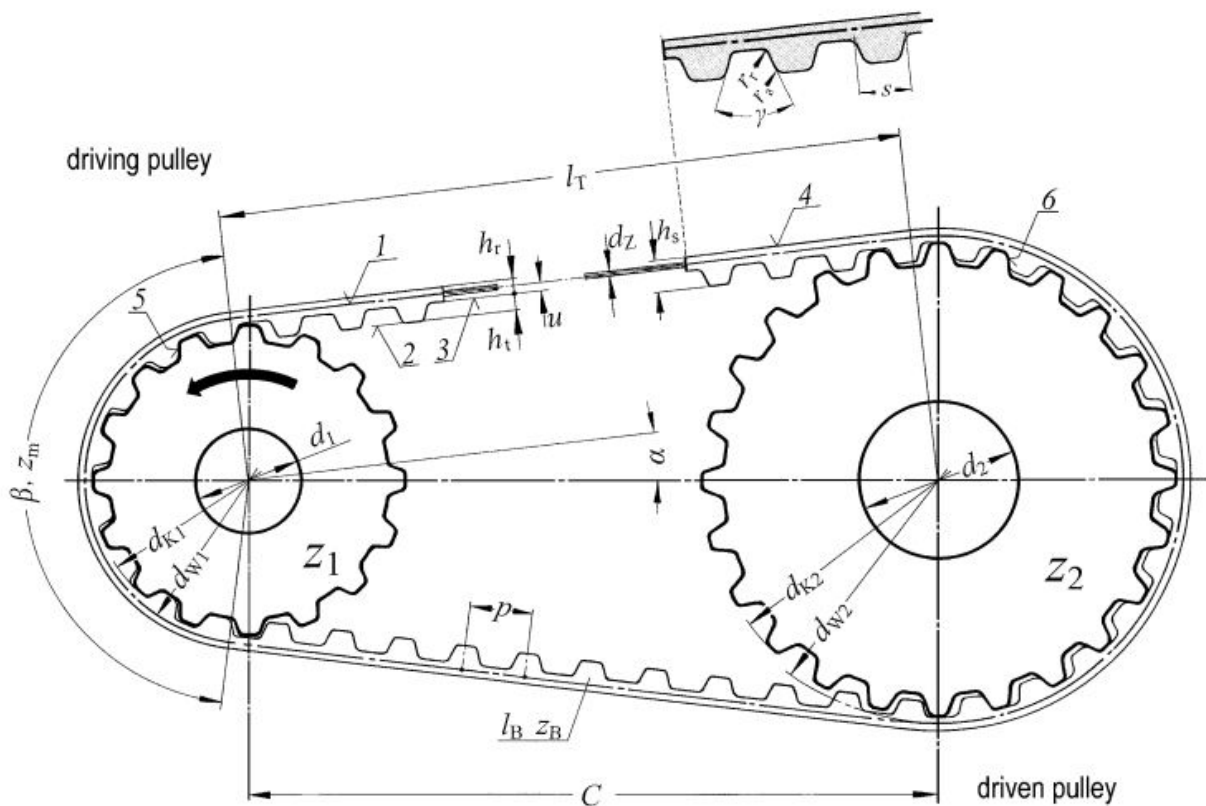
The integration of microtechnology with micro-controllers is discussed, but the study lacks detailed analysis of challenges and solutions related to conveyor systems in microtechnology. Performance metrics such as speed, accuracy, load capacity, and reliability are not covered. This study emphasizes the design and analysis of a belt conveyor system for coal processing, focusing on stress analysis and finite element analysis. However, it overlooks the impact of start-stop cycles, fluctuating loads, energy efficiency, and lacks real-world case studies.

The various studies done in the past focus on optimizing the weight of critical components in belt conveyor systems through geometrical modeling and finite element analysis. It compares various analysis results to ensure safety, with a primary emphasis on reducing roller dimensions for weight reduction.

The study examines operational parameters of plate conveyors for transporting food, identifying issues like slip and decreased efficiency at higher inclination angles. It suggests further research on using the OEE indicator to locate bottlenecks and improve dependability, as well as optimizing speed and angle for efficiency.

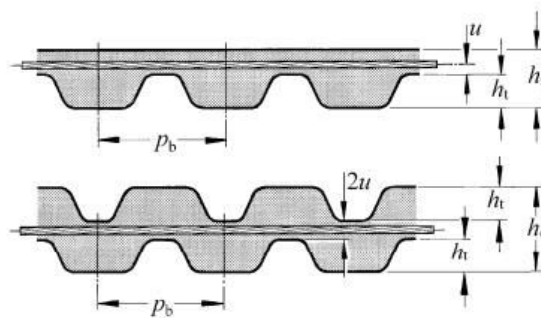
## III. METHODOLOGY

### A. Design of Timing Belt



### B. Belt Profile

High Power Profile AT Detailed Specifications and Considerations for Selecting the Ideal Timing Belt



Pitch designation	$p_b$	$h_s$	$h_t$	$h_d$	$u$
AT3	3.0	1.9	1.1	-	0.18
AT5	5.0	2.7	1.2	3.6	0.60
AT10	10.0	5.0	2.5	6.7	0.85
AT15	15.0	6.5	3.8	9.8	1.1
AT20	20.0	9.0	5.0	12.4	1.20

The AT section timing belt is an evolution of the metric T section timing belt, including a trapezoidal teeth design and metric pitch. They have steel or Aramid tension members and are composed of polyurethane. In comparison to the conventional metric T profile, they have a broader tooth section and noticeably stronger tension members. High-strength timing belt for applications requiring precise positioning and power transmission High tooth shear strength (up to 45% greater than normal T-series and Imperial pitch belts) High strength tension members (up to twice as strong as conventional T-series and Imperial pitch belts) Increased tension member spring rate for better repeatability and shorter settling time

- Less backlash (the maximum accuracy may be achieved with zero backlash pulleys).
- Design of bifilar tension members for accurate tracking

### C. Detailed Specifications and Considerations for Selecting the Ideal Timing Belt

When it comes to selecting the ideal timing belt for your conveyor system, there are specific specifications and considerations that need to be taken into account. These include the load capacity, speed, distance, material, design, and tooth profile of the timing belt.

#### Load Capacity:

The load capacity of the conveyor system determines the amount of weight or force that the timing belt needs to support. It is essential to choose a timing belt that can effectively handle the anticipated load without compromising performance.

#### Speed and Distance:

The speed and distance at which the conveyor system will operate are crucial factors in determining the type of timing belt required. Higher speed or longer distances may necessitate a different type of timing belt to ensure smooth and efficient operation.

#### Material:

The choice of material for the timing belt is vital in ensuring durability and resistance to wear and tear. Depending on the specific application and environmental conditions, materials such as rubber or polyurethane can offer varying levels of durability and temperature resistance.

#### Design and Tooth Profile:

The design and tooth profile of the timing belt are integral in maintaining secure gripping of the pulleys and preventing slipping or misalignment. Whether it is a trapezoidal or curvilinear tooth profile, the selection should be based on the specific needs of the conveyor system

#### D. Types of Cores

Another important factor to consider when choosing a timing belt for your conveyor system is the type of core used in the belt construction. Timing belts can have different core materials, such as aramid, steel, or fiberglass. Each core material offers specific benefits in terms of strength, flexibility, and elongation characteristics.

##### Aramid Core Timing Belts:

Aramid core timing belts, also known as Kevlar timing belts, are known for their high strength-to-weight ratio and excellent resistance to elongation. These belts are suitable for applications that require minimal stretch and high tensile strength. They are also resistant to cuts and abrasion, making them ideal for demanding industrial environments.

##### Steel Core Timing Belts:

Steel core timing belts are reinforced with steel cords for added strength and stability. These belts offer high tensile strength and minimal elongation, making them suitable for heavy-duty applications with high loads and torque requirements. Steel core timing belts are also resistant to stretching and offer excellent dimensional stability, ensuring consistent performance over time.

##### Fiberglass Core Timing Belts:

Fiberglass core timing belts are known for their flexibility and resistance to elongation. They offer high tensile strength and excellent dimensional stability, making them suitable for precise positioning and conveying applications. Fiberglass core timing belts are also resistant to moisture and have low thermal conductivity, making them suitable for a wide range of operating conditions.

**Cutting Blade:** In Shredder machine, the cutting blades are the workhorses. Mounted on opposing shafts that spin towards each other, these blades are like rows of sharp teeth. As the material enters the shredding chamber, it gets caught between these intermeshing blades. The powerful rotation of the shafts forces the blades to rip and tear the material, effectively shearing it into smaller pieces. This shearing action continues until the material reaches the desired size, transforming bulky scrap into manageable pieces for further processing or recycling.

**Spur Gear:** In a Shredder machine, spur gears are the unsung heroes that synchronize the powerful chomping action. These gears, resembling interlocking cogwheels, are mounted on the ends of each shredder shaft. As the motor drives one gear, it meshes with the teeth of the opposite gear, forcing the other shaft to rotate at the same speed and direction. This synchronized rotation ensures the knives on each shaft intermesh precisely, delivering clean and efficient shearing of the scrap material.

## IV. CONCLUSION

Timing belts are the perfect choice for conveyors that carry fixtures due to their precision and reliability in positioning and conveying applications. The use of timing belts ensures that the fixtures are accurately positioned and transported along the conveyor system without slippage or misalignment. This is essential for maintaining the integrity of the fixtures and the overall efficiency of the production process.

The high load capacity of timing belts allows them to effectively handle the weight of fixtures without compromising performance. Additionally, their resistance to environmental factors such as temperature fluctuations, exposure to chemicals, and abrasive materials makes them a durable and dependable choice for fixture-carrying conveyors.

In terms of maintenance, timing belts require minimal upkeep, making them a cost-effective option for conveyor systems carrying fixtures. Their efficient power transmission and low coefficient of friction contribute to reduced wear on the pulleys, further extending the lifespan of the timing belts and minimizing maintenance needs.

By selecting the right timing belt with a suitable core material and considering factors such as load capacity, environmental conditions, and maintenance requirements, you can ensure that your conveyor system effectively transports fixtures with precision, reliability, and longevity.

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