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Technical Article
Technical Article Content Pulled from the NIBA Belt Line Newsletter

Equating Rated Belt Tension to System Requirements

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Beltline Reprint March 2004

In the conveyor belting industry, it is well known that a thorough understanding of an application's data is preferable (if not always possible) in order to make a proper belt selection. The reason is clear—we want to know that the selected conveyor belt will operate properly in its environment.

We will typically perform the following calculations during our belt selection process:

Effective Belt Tension (TE) – The sum of the tension required to move the empty belt, the tension required to move the belt horizontally, and the tension required to move the load.

Slack Side Tension (TS) – Additional tension required to prevent belt slippage on the drive pulley.

Operating Tension (TO) – Sometimes called Allowable Working Tension, it is the sum of the TE and TO divided by the width of the belt. This figure will generally be expressed in "pounds per inch width," and is used to select a proper belt construction.

Maximum Total Tension (TO-MAX) – the maximum total tension a system can generate given the nameplate horsepower of drive, drive factor, width of belt, and belt speed.

A more detailed discussion of these calculations can be found in the NIBA Engineering Handbook, or from belting manufacturers.

Why are considerations of tension so important to the proper running of a conveyor belt?

Because we want to know that sufficient tension can be employed to allow the belt to conform to the pulley crowns, thereby providing the best tracking possibilities for the belt. We also want to utilize the proper tension to make sure the belt can be driven without slippage on the drive pulley. In order to maximize belt operation, we must match up the requirements of the system with the rated tensions of the belts we are considering.

In light and medium weight belting applications, there are differences between domestic (U.S.) and European manufacturers, and how they express the ratings on their respective belt styles.

It has been commonplace over the years for U.S. manufacturers to rate their belts according to Allowable Working Tension, Rated Tension, Maximum Rated Tension, etc. The European manufacturers chose to rate their belts according to the amount of tension required to elongate the belt 1 percent.

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How are these ratings different, and what must be considered during belt selection? First, we must understand that the rated tensions of a U.S. manufacturer may indicate the upper limit of a particular belt style (checking with the manufacturer is recommended). For example, a 125 pound solid woven PVC belt has an upper limit of 125-pounds per inch width. This figure is meaningful as it tells us that we cannot exceed this rating. The manufacturer can provide the elongation percentage at the maximum rated tension.

The European rating of 1 percent elongation at a certain force is generally not an upper limit (again, confirm this with the manufacturer). In most cases the European styles can be subjected too much more force (tension), resulting in maximum elongations of 1.5 to 2 percent or more. The manufacturer can provide the upper limit information for their belt styles.

Typical conveyor belt constructions are a combination of fabrics and compounds. When placed under tension, a conventional conveyor belt will elongate (stretch). Conveyor systems compensate for this elongation by the use of takeups. Many systems allow for 1 to 1.5 percent of total belt length in their takeups. More takeup allowance is always welcome.

By recognizing the tensions inherent in any conveyor system, we can determine the maximum forces to which our belt will be subjected. Being able to compare the elongation properties of the belt to the available takeup on the system can further expand the possible solutions for a given application.

Does this mean that one way is better than another? Absolutely not. It emphasizes the fact that the best belt selection process takes into consideration the rated force/elongation properties of a belt, the tensions it will be subjected to, and the amount of available takeup on the system. It also confirms that including the manufacturer in your selection process may expose you to more opportunities than might be indicated by simply looking through a catalog. Make use of all the tools at your disposal in the belt selection process.