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THE FORCE-DEFORMATION DEPENDENCY DETERMINDED EXPERIMENTALLY ON TRAPEZOIDAL ENVELOPED BELTS

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ABSTRACT
Like any other mechanical detail, the belts under the impact of the force suffer deformation. In this paper are treated the relative longitudinal deformations of some profiles of trapezoidal belts under the impact of the pertaining force. It is known that if belts undergo large longitudinal deformations from the impact of forces on its branches, then the contact pressure between belt and wheel decrease. This decrease of the contact pressure follows with the reduction of the transmitter's conveying ability. Therefore, determining the relative longitudinal deformation dependant on the force is important for other calculations on the conveying capacity of the belt, respectively of the trasmitter with trapezoidal belts. The paper shows a summary of the results obtained from experimental research for certain profiles of the aforementioned belts.
Keywords: trapezoidal belts, force-deformation.

1. INTRODUCTION
During the course of work of the transmitter with belts, respective forces operate on the branches of the belt. On the pulling branch acts force F1 whereas on the free branch because of the acts force F2. The condition must always F1> F2. The belt undergoes respective longitudinal deformation under the act of force. In order to determine the carrying capacity of the transmitter with trapezoidal belts, respcively of the belt as main detail of these transmitters, it is important to determine the cutting force F_k and the relative strech ε.

The cutting force depicts the longitudinal (axial) force acting on the belt, the value of which exceeds the belts durability and that is when the belt breaks.

There are two known ways to determine the cutting force and the streching:
- *method A, and*
- *method B.*

Static research based on method A give the force-deformation dependence on a part of the belt that breaks and is treated as a test sample.

Static research based on method B give the force – deformation dependence on the entire belt.

Therefore, this paper will deal with belts investigated according to method B.

2. STATIC RESEARCH BASED ON METHOD B

This research method is more accurate because the belt is placed in the research machine exactly as it is placed in the transmitter during work.
The research machine is schematically depicted in figure 1.

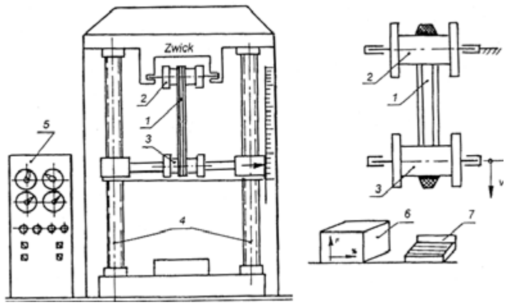


Figure 1. The machine for static research based on method B
1- Belt for research; 2, 3 – wheels; 4 – axis with trapezoidal threads; 5 – remote control; 6 – computer ; 7 – keyboard

The speed of movement of the lower wheel can be varied, but according to the standard for researching belts it is recommended that the speed be v_t = 50 mm/min.
The values for:

- Belt's active and breaking load
- Relative extension for the respective active force,
- Relative streching at the momment of breaking,
- Load needed for research start
- Preloading speed,
- Vt speed during testing,
- Ambient temperature, and
- Relative humidity.

can cab be read and printed from computer connected to the research machine.
In fig.2, 3 and 4 are presented force – deformation diagrams obtained from machine for research belts. Three different profiles (SPZ, SPA and SPB) are researched in three test scenarios until the breaking of the belt, but diagrams are shown only for three test samples respecitvely. Tabular resuls on εki longitudinal relative deformation (%) depending on the active force F_k (N) are given for all researched test samples. The results for the breaking force F_{ki} (N) and relative stretching at the moment of breaking ε_k(%) are obtained as well through these tests.

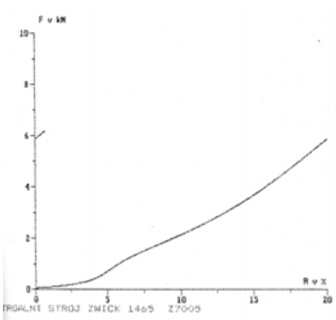


Figure 2. Diagram force – deformation for SPZx737 L_p (Test sample-1)

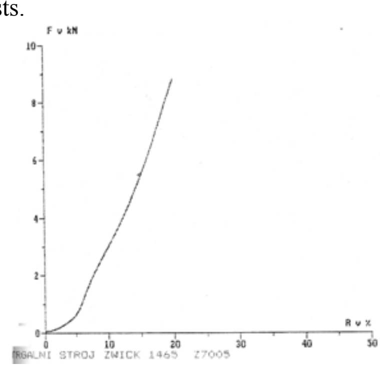


Figure 3. Diagram force – deformation for SPAx982L_p (Test sample -2)

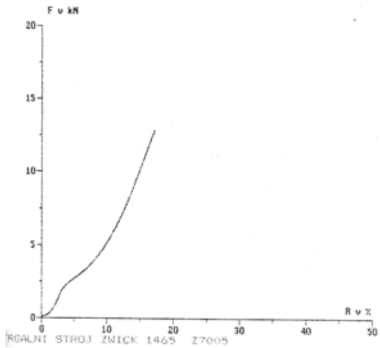


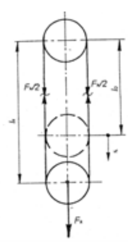
Figure 4. Diagram force – deformation for SPBx2000 (Test sample-3)

In table 1 are presented the results obtained from lab research on the dependence of the longitudinal deformation of the belts depending on the acting force. Results are shown for three different belt profiles (SPZ, SPA and SPB). Each profile is tested through test samples in three test scenarios (1,2,3).

Table 1. Results from tests in pulling (force - deformation) for various belt profiles

		Sample	Acting force F (N)					Breaking force	Streching at the breaking point	The number of cord threads
			500	1000	1500	2000	5000	F_{ki} (N)	ε_k (%)	z
SPZx 737L_p	Relative stretcε_k ε_k (%)ε	1	4.41	5.73	7.46	9.44	18.12	6190	20.73	5
		2	4.16	5.48	7.15	9.12	17.88	6310	20.78	5
		3	4.09	5.47	7.15	9.14	17.89	6090	20.24	5
SPAx 982L_p	Relative stretch ε_k (%)	1	4.27	5.64	6.50	7.49	13.91	9080	20.02	7
		2	4.39	5.81	6.65	7.62	14.03	8830	19.73	7
		3	6.57	8.80	10.10	11.60	21.08	9180	30.08	7
SPBx 200L_p	Relative strech ε_k (%)	1	1.12	1.63	2.09	2.65	7.91	12490	14.70	8
		2	0.96	1.39	1.82	2.37	7.84	12380	14.54	8
		3	1.53	2.24	2.72	3.32	9.72	12860	17.10	8

Table 2. Results from lab tests in pulling for breaking force and relative stretching at the breaking point

Belt profile	Sample	Breaking force F_{ki} (kN)	Average breaking force F_k (kN)	Relative stretch ε_{ki} (%)	Average relative stretch ε_k (%)	Experiment conditions	Experiment scheme
SPZx737L_p	1	6.31	6.197	20.583	20.583	- speed v_t = 50mm/min - temperature t_a = 23°C - humidity φ_r = 52%	
	2	6.19		20.73			
	3	6.09		20.24			
SPAx982L_p	1	9.08	9.03	20.02	23.277		
	2	8.83		19.73			
	3	9.18		30.08			
SPBx2000	1	12.49	12.577	14.70	15.447		
	2	12.38		14.54			
	3	12.86		17.10			

3. CONCLUSION

Lab research shows the results presented in graphical and tabular form, which are important for other calculations such as straining and carrying capacity.

The resented diagrams show the force – deformation dependence, which varies for different belt profiles. In Tables 1 and 2, are given the values of relative longitudinal deformations for the respective acting force.

From the diagrams and tables can be concluded that at the beginning of the acting of the force, relative longitudinal deformations increase faster than force. This is because small forces are handled by the rubber and the wrapping textile. With further increase of force, its action passes onto the pulling layer where the threads have undergo very small streching and cause the belt to be strechted very little under the action of large forces. The values given for the breaking force and stretching in the breaking point are significat variables used in practical calculations of transmitters with belts.

4. REFERENCES

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[2] Prospektet e IGK "BALLKAN" Suharekë.

[3] Standardet ISO dhe DIN për rripa trapezorë.