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Synthetic Woven Tapes (SWT) For Load-Handling Devices in Construction

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ABSTRACT: The questions of application of textile load-grabbing slings at loading and unloading operations, their advantages and disadvantages are presented. Studies were reported.

KEYWORDS:cargo handling devices, textile synthetic tapes.

I. INTRODUCTION

Due to the development of production of high-strength synthetic fibers, the use of textile slings has become available for various construction projects, factories, enterprises of the construction industry. At present, textile slings are becoming more and more popular load-grabbing devices. The lightness, flexibility and high load capacity of this type of sling allows you to solve many problems in the field of lifting and moving goods, which until recently were considered impossible.

According to the material of manufacture, both steel slings and slings made of synthetic textile tapes, which are the most versatile, are used in construction production.

Due to its flexibility, synthetic textile slings are less prone to deformation.

Textile slings quickly acquire their original shape. This fact directly affects the service life; textile slings it is much higher than steel rope. The polymer material from which they are made is almost unfamiliar with such a property as "fatigue" [1].

In some cases, they are the only possible device for strapping and strapping cargo. To a greater extent, this applies to goods in need of careful handling.

Due to the appearance on the market of inexpensive textile slings made of polyester or polypropylene woven tapes, the industry has mastered the production of modern multi-turn means of slinging and tightening cargo belts. These materials are resistant to moisture, heat, light, have high frost resistance, are not exposed to chemicals, oils and organic solvents. The main advantage of textile belts and ropes is a small weight, do not intertwine and do not tangle with each other, wear-resistant, easy to clean when dirty, able to withstand loads up to 100 tons., and this makes them indispensable for slinging or securing heavy loads, without damaging the surface.

II. RELATED WORK

So let's highlight the main advantages of woven ribbons and ropes [2]:

- cargo safety: loads (especially those with soft edges or carefully prepared surfaces) are less damaged when lifting. This property is the best characteristic of SWT, as they carefully bend the product and do not spoil;
- light weight: SWT is much lighter than metal. This property is especially noticeable when working with heavy-duty slings. It is easier to move the sling itself, it is easier to get under the load, it is easier to cling to the crane hook. In addition, textile slings can save not only human resources, but also the time spent on loading and unloading;
- safety: SWT does not have burrs, sharp edges and protruding damaged wires, resulting in injury. As a result-savings on the payment of temporary disability and reducing downtime in the workplace;
- high wear resistance and resistance to deformation: SWT, compared with metal, have greater wear resistance to multiple bends and extensions in one place;
- SWT less susceptible to deformation changes, the impact of abrasive materials, the impact of many chemicals (acids, alkalis, oxidizers, seawater);

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- compactness: SWT is easy and convenient to roll and store. Metal slings can not be folded neatly, as they have springy properties, they are very difficult to move from place to place. All these disadvantages are deprived of textile slings. They can be rolled up as you like, while they do not straighten and do not intertwine with each other;

- it should be separately noted that currently textile synthetic materials for technical purposes are covered with light-returning (SV) coatings with SV threads. SWT with such coatings are resistant to the influence of external aggressive environment, are not afraid of the sun, are protected from the influence of water, oil, oils, solvents, chemically active substances. [3].

III. TEXT INPAINTING

The use of SWT is relevant, both in the construction of point buildings and in the construction of linearly extended utilities. So, on figure-1.the so-called SWT slings “towels” used in the laying of pipelines are presented.

Figure-1. Laying of pipes by means of synthetic textile tapes

Along with the above advantages SWT has disadvantages:

"they're afraid of open fire;

- can get through burns from liquid metal droplets formed during welding;

- for them, high concentrations of alkalis and acids are dangerous, which, with prolonged exposure to them, cause damage;

- artificial SWT fibers lose their qualities under the influence of ultraviolet radiation;

- STL is not resistant to cuts.

Despite these disadvantages, the main advantage of safety should be noted the fact that when the rupture of the SWT due to the location of the main load-bearing fibers, is destroyed in the direction of the application of force, while the behavior of the steel rope sling in the same situation is "unpredictable" and can lead to an accident.

World experience in the use of textile slings confirmed their extreme reliability in operation in the most difficult conditions.

Proceeding from all stated it is surely possible to claim that production and wide application of textile slings in all listed spheres of managing will give to the country innovations and considerable advantages.

We are conducting research on the formation of the fabric structure and weaving structure of synthetic tapes and ropes from local raw materials for load-grabbing devices in construction. A number of experimental and production works were carried out on synthetic yarns, weaving ribbons and spinning ropes made by us from local primary and secondary raw materials. The deformation characteristics of individual threads, tapes and ropes, also made in local conditions, are investigated.

Preliminary results showed that polymers produced in Uzbekistan can be used to produce lifting belts and ropes.

It is not difficult to justify the desire of man in all periods of development of society to mechanize the processes and facilitate the work of man to lift and move weights. Everything new that is created in the last two centuries is immediately "tried on" to lifting and transport equipment, turning it into a kind of integral indicator of the technical level of society [10]. In addition, the operation of lifting and transport equipment (PTO) can not be considered separately from the load-grabbing devices.

In various areas of life, including in construction, the share of the use of synthetic woven ribbons and ropes (STLC) is increasing. In particular, due to the development of production of high-strength synthetic fibers in such

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developed countries as Russia, USA, Germany, Austria, Finland, the Netherlands, Sweden, etc. significant progress has been made in the creation and production of heavy-duty lifting slings from STLK, and on this basis in improving the ergonomics and safety of installers, the safety of transported goods, reducing the labor and material intensity of the cargo.

In the world, research works are carried out aimed at improving the strength, durability and durability of STLC. Use of slings from STLK became available for all spheres of managing. They are becoming increasingly popular load-grabbing devices. The lightness, flexibility and high load capacity of this type of sling allows you to solve many problems in lifting and moving goods, which until recently were considered impossible. In some cases, they are the only possible device for strapping and strapping cargo. To a greater extent, this applies to goods in need of careful handling.

IV. EXPERIMENTAL RESULTS

The analysis of the conducted researches has shown that in the field of application of synthetic woven load-grabbing slings and ropes in construction, on air,– ship,– auto and railway transport, in warehouse economy, etc. very interesting and important positive results have been achieved. However, specific indicators of their application remain very low. In our country, this figure is 2-3% (and this is due to foreign construction firms and companies). Whereas in Russia this figure is 20%, and in Germany 60%. Specific indicators of the use of steel ropes, the basis of which is laid since the 1950s correspond to the time, and over the past, more than half a century, technology, materials and everything else has gone much further. These specific indicators of ropes still remain, and the level of compliance with these indicators is in contradiction with materials and do not meet modern requirements [11]. In this context, metal slings, depending on the weight and complexity of the configuration of the transported goods, should gradually give way to synthetic tapes and ropes. And they are known to be made of synthetic fibers.

Among the many common materials for synthetic fibers, one of the most popular is polypropylene and polyethylene produced by UGCC with a capacity of 83 thousand tons. per year [12].

Individual enterprises and workshops of private enterprise mastered the production of ribbons and ropes on low-power machines. However, they are used for various economic purposes. They have not been tested and examined, their deformation properties have not been studied. Our tests of 4 types of these products showed breaking forces from 3 to 10 kN, which is not applicable for load-handling devices (GZP). Today, two fundamentally different types of textile slings are used, both in terms of manufacturing technology and in terms of additional devices used (hooks, koushi, earrings, rollers, loops, carabiners, clamps, etc.): ribbon and round-string.

Our researches: - deformation properties of fibers and threads from local raw materials; - weaving structure of tapes; - designs of spinning of a rope; - the choice, calculation and rational operation of synthetic tapes and a rope for GZP as a part of the hoisting and transport equipment (PTO) open possibilities of release of a domestic product for production of load-grabbing slings. Research of deformation and operational properties of synthetic yarns, woven tapes and braided ropes is conducted at the faculty of construction of Ferpi. The first group of materials studied is twisted synthetic threads based on local polypropylene and polyethylene. Their deformation characteristics are studied on the device "GuntGamburg, 20WP-300" with computer equipment. Experimental technical characteristics of twisted threads are presented in table.1.

In comparison, these characteristics are not inferior to the known characteristics of filaments obtained from such common polymers of foreign production as: - Rusar, SVM (Russia); - Kevlar, Duneema (USA); – Twaron (Netherlands); – Technora (Japan); – Spectrum (Germany); – Trevo (Sweden) [12]. The only material “Duneema " type DM-20 tensile modulus is much higher, and the melting point is lower than that of polypropylene and polyethylene. However, in comparison with polymers used for these purposes, these indicators do not reduce the performance of materials.

Technical characteristics of twisted synthetic threads. Table 1.

Polymer filament material	Linear density, Tex.	Elongation at break, %	Fracture stress ,GPA	The modulus of elasticity in tension, GPA
Polypropylene ПП FR–170 H	98	11,6	0,75	9,8
Polyethylene ПЭ MF–5000	86	10,4	0,89	9,2

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The second group of materials under study includes woven tapes. Tape single-layer width of 6 cm made of the considered in the table. 1. materials on the proposed weaving schemes. Their technical characteristics are presented in table.2.

Specifications of single-layer fabric tape. Table 2.

Conditionally adopted the ribbon type	Breaking load, кН	Breaking load, %	Elastic modulus of the tape, кН	Composition
СТЛ ПП	42,0	13,4	44,0	ПП–100%
СТЛ ПЭ	45,0	15,5	32,0	ПЭ–100%

As can be seen from the table, the tapes we have made can withstand loads already 4 times higher than the produced tapes.

The third group studied is 8-spun ropes made according to the proposed schemes of weaving, and which are tested by a similar technique applied to the tapes. Their technical characteristics are presented in table 3.

Specifications 8 spun braided rope. Table 3.

Conditionally adopted the ribbon type	Breaking load, кН	Elongation at break, %	Elastic modulus of the tape, кН	Composition
СПК ПП	16	15,2	20	ПП-100%
СПК ПЭ	19	17,5	16	ПЭ-100%

V. CONCLUSION

All three groups of studied materials and products are currently tested for long-term strength and creep. Threads, tapes and ropes are also tested for performance characteristics such as melting, frost resistance, resistance to sunlight (ultraviolet), moisture and water. Along with experimental work investigates pricing issues, production costs, etc.

Thus, the work carried out to improve the weaving design of ribbons and rope weaving schemes allowed to increase the breaking loads of ribbons and ropes relative to those produced in local conditions by 4-5 times. Of course, this indicator of breaking load relative to the Russian indicator - up to 60 tons. – significantly low. However, according to calculations, when the breaking load reaches at least 20 tons. and improvement of other characteristics of tapes and ropes and their wide introduction for GZP in construction and in various branches of activity the effect from reduction of cost of GZP and, as a consequence - ensuring import substitution, reduction of labor costs, safety of rigging works, under the obligatory condition of careful and cultural treatment of these materials will be achieved. Along with the above, the study of the entire variety of brands of synthetic materials, textile and spinning schemes is aimed at obtaining the most reliable information for comparison and analysis of the deformation and performance properties of these materials.

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