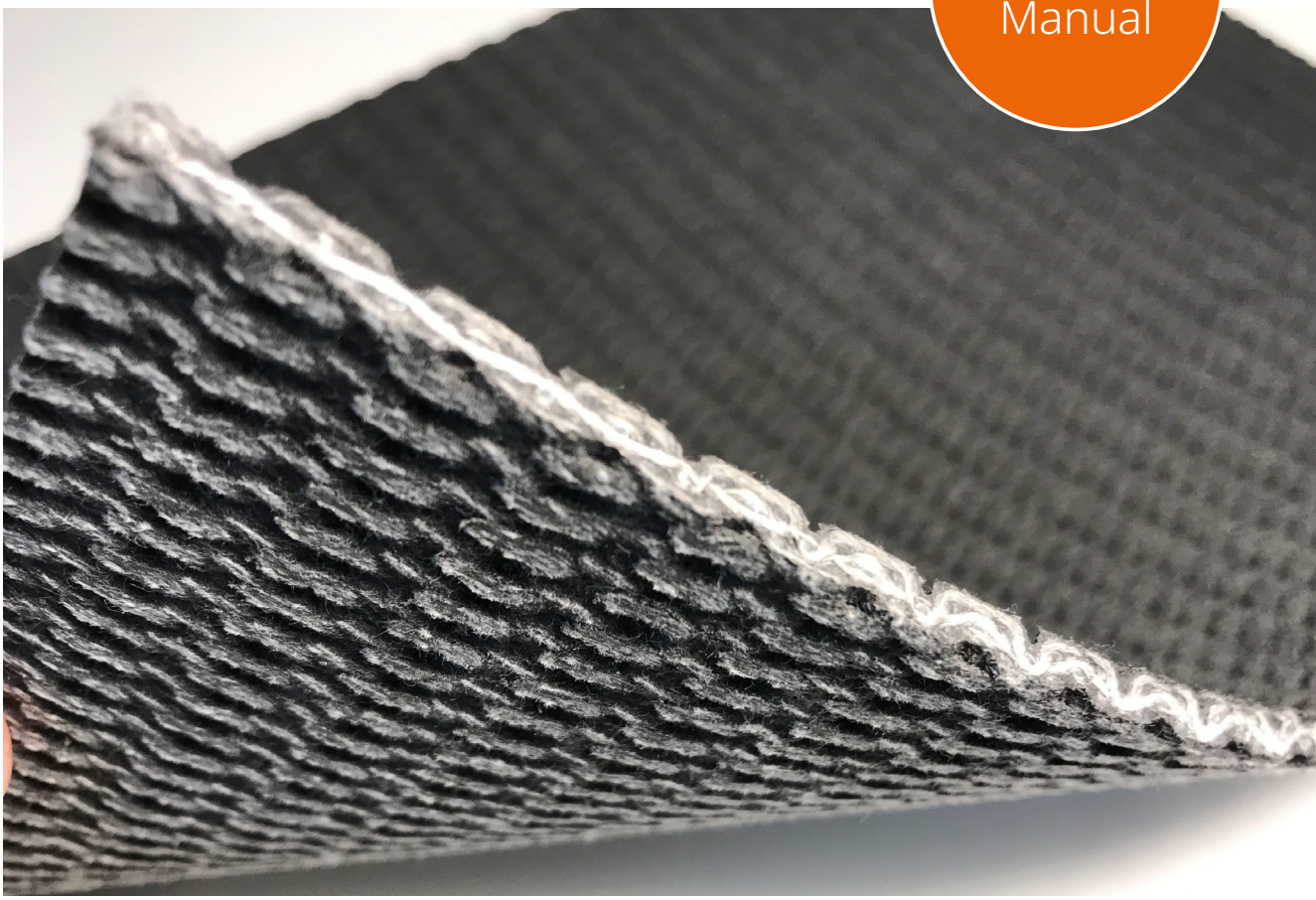
Ammeraal Beltech

EN

Technical Manual



Solid Woven Belts

Innovation and Service in Belting

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1. Introduction

Ammeraal Beltech is a global leader in middle and light weight conveyor belting. We provide service and solutions to help process and convey a wide variety of products. We have a solid base in close cooperation with customers and control over the full value chain: development, manufacturing, fabrication, sales, and service. The Ammeraal Beltech group and affiliated companies operate globally. We offer belting products and services to save our customers time and money. Whether our customers are conveying or processing products, Ammeraal Beltech has the right solution.

The Solid Woven belt range is just one of the many high-quality products from Ammeraal. It is a belt range that has been developed to suit the upper range of middle heavy conveyor applications in a variety of industries like the logistic parcel industry, the automotive and metal industry, and the recycling industry.

Belts from the solid woven belt range are particularly robust. They are suitable to carry heavy loads and endure the daily abuse of products being thrown onto the belt much better than thinner regular two-ply synthetic belts.

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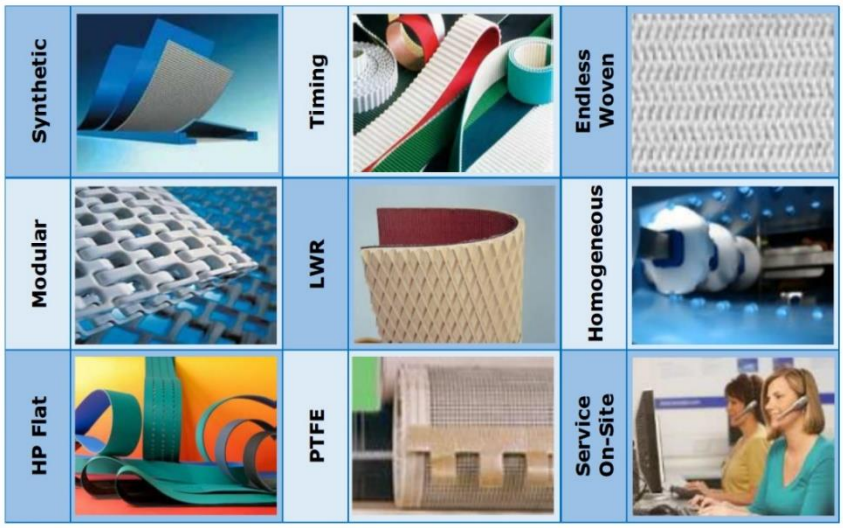
Image 1: Ammeraal Beltech offers a comprehensive belting range.



2. Belt construction

2.1. Carcass of the belt

The belt carcass of a Solid Woven belt consists of several layers of polyester warp and weft yarns that are interwoven into one thick ply of fabric, see image 2 and 3. This is why solid woven fabrics are also called interwoven fabrics or mono-ply fabrics. Solid woven fabrics come in several weave constructions, each with its own unique properties. We have one type of weave construction with 2 layers of weft yarns and another type with 3 layers of weft yarns.

Image 2: side view of a solid woven fabric, three layers of weft yarns

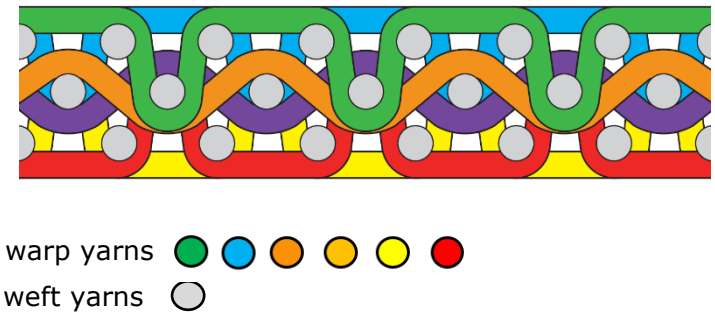
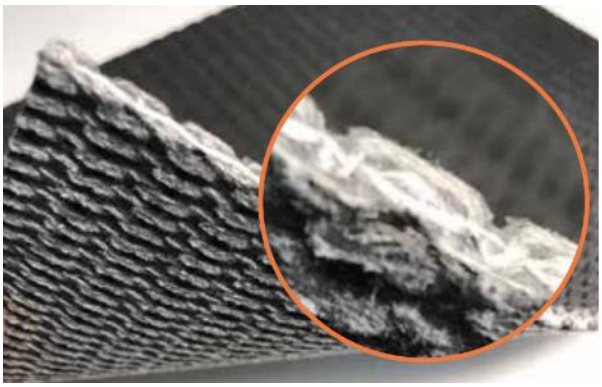


Image 3: an example of a solid woven fabric



General properties of solid woven fabrics:

- High strength
- High flexibility
- Excellent impact resistant
- Cut resistant
- Abrasion resistant
- Tear resistant
- Good lace retention

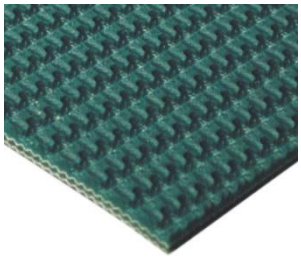
The range of different solid woven carcasses from Ammeraal Beltech consists of several types, each with a different maximum working tension. The maximum working tension of a specific solid woven belt is reflected in the belt name or description of the belt. For an explanation of the nomenclature, we refer to chapter 3.

2.2. Top cover and impregnation

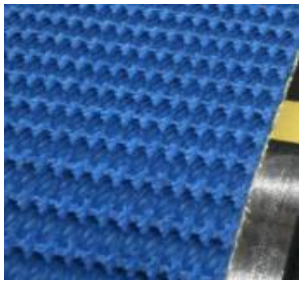
The carcass of every solid woven belt is completely impregnated with a PVC compound. This PVC compound connects all the polyester yarns into one compact and dense carcass. For applications that require the top side of the belt can be coated with a layer of that same PVC compound. The PVC top layer can further be embossed with profiles like a matt finish, mini grip, super grip or for example a horse shoe profile.

Image 4: mini-grip, supergrip and horse shoe profiles:

A34-Mini-grip



A42-Supergrip



S37-Horse Shoe

2.3. Bottom side

For roller supported conveyor belt application the PVC dip impregnated bottom side of solid woven belts can be left without further treatment. The friction of the impregnated fabric to the support rollers makes the support rollers turn when the belt is in motion. In the nomenclature of solid woven belts this type of bottom side is indicated with: **01**

An example: **Flexam SW120 01+S37 black**

The impregnated bottom side of a solid woven carcass can be brushed/sanded to reduce the friction in case of a slider bed support. In the nomenclature of solid woven belts this type of bottom side is indicated with: **00**

An example: **Flexam SW150 00+01 black**

3. Nomenclature and working tension

For European style synthetic belting it is common to rate a specific belt type to the amount of static belt tension required to elongate that belt 1%. Solid woven belts are also called American style belts. Ammeraal Beltech adopted the American way of naming our solid woven belts. For example, the 150 in the name of the belt type 58932 Flexam SW150 00+01 black indicates the working tension of that specific belt. Meaning Ammeraal Beltech advises a maximum working tension of 150 PIW or pounds per inch belt width (= 26 N/mm).

Conversion factor: **1 PIW = 1 lbf/inch = 1/5.71 N/mm**
1 N/mm = 5.71 PIW (lbf/inch)

The working tension of a belt is determined by the type carcass of the belt. The Ammeraal solid woven belt range consists of several different belt carcasses:

Table 1: belt carcass and working tension

		Working tension at 2% elongation	
Belt carcass	Layers of warp yarns	PIW	N/mm
SW100	3	100	18
SW120	2	120	21
SW125	3	125	21
SW150	3	150	26
SW200	3	200	35

For the full explanation of the nomenclature that Ammeraal Beltech uses for solid woven belts, we refer to the document Nomenclature Solid Woven Belting.

European style belts are rated to the amount of tension (N/mm) required to elongate the belt 1%. American style belting is rated to the allowed working tension (PIW).

3.1. Working tension and breaking strength

The working tension of a conveyor belt is defined as "the maximum safe belt tension that is commended by the belt manufacturer". For solid woven belt types the working tension is usually given in pounds per inch belt width at a belt elongation of 2%.

Exceeding the working tension of a belt does not mean that the belt will break. When determining the working tension of polyester solid woven bets is common to apply a safety factor of 10. Meaning the working tension is 10 times lower than the breaking strength. In other words: A belt carcass SW150 with a safety factor of 10 has a working tension of 150 PIW (=26 N/mm) and will have a breaking strength of 150 x 10 = 1500 PIW (260 N/mm) or more.

The splice is always the weakest point of a conveyor belt. Weather a hot splice a cold glued splice or belt fastener is used to endless the belt a splice will never be much stronger than 70% of the belt strength. It is common to assume that a proper splice has at least 50% of the strength of the belt material. Meaning a spliced belt with a carcass SW150 should be able to withstand a short-term peak load of 150 x 10 x 50% = 750 PIW (130 N/mm). A peak load occurs for example when the conveyor is started up when fully loaded.

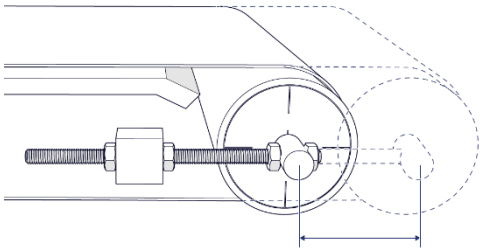
4. Conveyor design

The rules for designing a conveyor for a solid woven belt as basically no different than for a European style conveyor belt. Due to the weave pattern a solid woven belt will have a higher relaxation than a typical European style belt. This means a solid woven belt will elongate more than a European style synthetic belt would, operating at the same percentage of its working tension. Solid woven belts need to be installed with a pretension (=elongation) between 0.5% and 2 %. Therefore, we advise a take-up system with a longer tension way for Solid woven belts than for European style belts.

Table 2: advised take-up length

belt style	advised take-up length in % of belt length, for a 180° degrees take up system
European	1.0%
American or solid woven	1.5%

Image 5: 180□ take-up system



Solid Woven belts have a higher relaxation value than European style belts. Therefore, we advise a longer take-up length.

5. Endlessing

5.1. Mechanical fasteners

Solid woven belts can be endlessed by hot splicing or with a belt fastener. One of the characteristics of this type of belt is that the fastener retention or fastener tear-out strength is high in comparison with European style belts. Belts can be supplied with a belt fastener already fitted; this makes it easier for a customer like an end user to install the belt themselves.

There are many different types of belt fasteners available in the market. One of the possible belt fasteners to endless a solid woven belt is a Clipper hook fastener from Flexco, see image 6 and table 3. When choosing a fastener one should mind things like the belt thickness, minimum pulley diameter the belt fastener material.

Image 6: Clipper hook fastener

Table 3:
Flexco Anchor/ Clipper hook fasteners
HT = High tension steel

Flexco Anchor / Clipper type	Belt thickness range in mm	Minimum pulley diameter of the fastener in mm
#2HT	3.2 to 4.1	51
#3HT	4.1 to 5.6	76
#4HT	5.6 to 6.4	102
#4 1/2HT	6.4 to 7.1	102
#5HT	7.1 to 7.9	127

5.2. Hot splicing

The use of metal belt fasteners often proves to be abrasive for a slider bed and the pulleys of the conveyor. Further is not uncommon for fasteners to cause damage to the product being conveyed. A hot splice gives the highest joint strength possible and has a smooth joint area. When considering belt scrapers, ploughs, and deflectors a hot splice is superior to belt fasteners. Ammeraal PVC solid woven belts can be endlessed with the Ammeraal Maestro press. For every solid woven belt there is a splice specification available.

6. Belt selection

Ammeraal Beltech developed the PPLESC-tool to help choosing the right belt for a specific application. PPLESC is the abbreviation of the factors playing an important role when selecting a conveyor belt.

For conveyors with a center-to-center distance over 50 meters is advised to make a technical belt calculation. This makes it possible to select the belt with the carcass strong enough to deal with the total belt force occurring in working conditions. With the belt calculation tool AmCalc from Ammeraal Beltech one can calculate important application values like: required driving force, pre-tension force and total driving force. The total driving force divided by the belt width gives the working tension of a belt application. This value should be lower than the maximum working tension of the belt of your choice.

An example:

required driving force	*= 18.598 N*
pre-tension force	*= 20.341 N*
total belt force	*= 38.939 N*
belt width	*= 1.200 mm*
total belt tension	*= 32,4 N/mm*

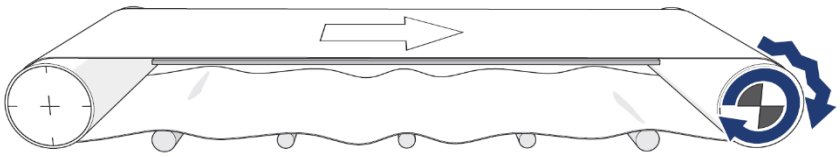
The total belt tension or working tension of this application is 32.4 N/mm. In table 1 for belt carcass and working tension we find that a solid woven belt with carcass SW200 is the belt choice for this application.

7. Belt installation

On conveyors that have the required take-up length of 1.5% of the belt length a relaxed solid woven belt can be tensioned enough to be driven free of slip and with an acceptable belt sag when operating at the advised working tension.

Conveyors that have a take-up length shorter than advised could run out of tension way when re-tensioning a solid woven belt that is relaxed. The belt will start to show belt sag in the return part and even start to slip on the drive drum. In chapter 7.1 and 7.2 we discuss two option we have for fitting belts on conveyors with a relative short take-up length.

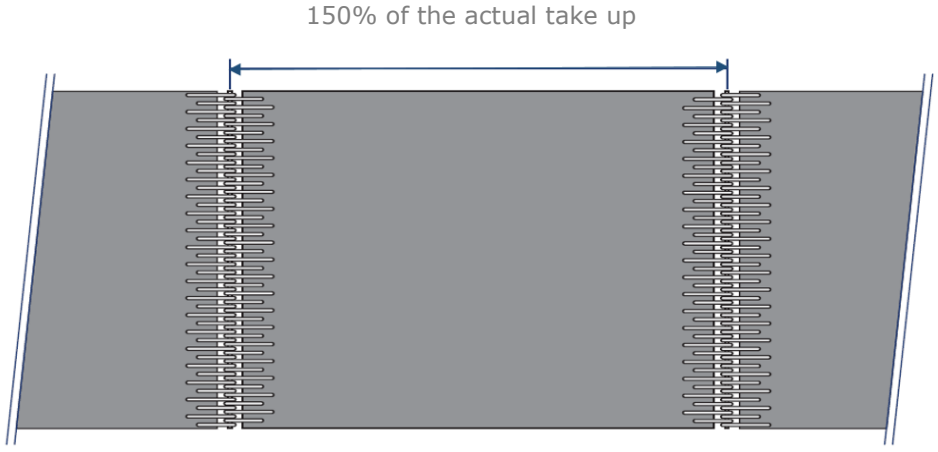
Image 7: belt sag and belt slippage



7.1. Supply a belt with a Dutchman

For conveyors with a center-to-center distance over 50 meters and a relative short tension way is advised to supply the belt with a so-called Dutchman. A Dutchman is a short belt section with belt fasteners. If a belt shows unacceptable belt sag or the belt has slippage on the drive drum, the Dutchman can be taken out and the belt can be re-tensioned. We advise a Dutchman length of 150% of the actual take up length.

Image 8: Dutchman length



7.2. Supply a belt too short

For fitting solid woven belts on conveyors that have a short take-up length it is not uncommon for Solid Woven belts to be supplied shorter than the minimum installations length. In that case when endlessing the belt at installation the ends of the belt will have to be pulled together by using belt clamps and ratchets the belt ends can be pulled together and held in position while the belt is being endlessed.

Image 9: Fexco belt clamps

8. Summary

- Make a technical belt calculation for conveyors with a length of 50 meters or more.
- Belt carcass selection: the working tension of the belt must be equal or greater than the calculated total belt tension.
- The working tension of, for example the 58932 Flexam SW150 00+01 black = 150 pounds per inch width (PIW) or 26 N/mm.

		Working tension at 2% elongation	
Belt carcass	Layers of warp yarns	PIW	N/mm
SW100	3	100	18
SW120	2	120	21
SW125	3	125	21
SW150	3	150	26
SW200	3	200	35

- Advised to pre-tension a solid woven belt between 0.5% and 2% of the belt length.
- Advised take-up length (180) for solid woven belts is 1.5% of the belt length.
- When faced with a short take-up length:
  - Install a belt that is too short and pull the ends together with belt clamps.
  - Or use a Dutchman with a length of 150% of the actual take-up length.
- PVC solid woven belts can be endlessed with the Ammeraal Maestro press. Ask for the
- Advised belt fasteners

Flexco Anchor / Clipper hook fastener
HT = High Tension steel

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#5HT	7.1 to 7.9	127

9. References documents and brochures

- Nomenclature Solid Woven Belting
- Technical belt data sheets
- Synthetic belting engineering guide
- Tracking and Tensioning document
- AmCalc calculation – software
- PPLESC-tool
- Cleaning instructions