Technical Manual

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INTRODUCTION

A History of Excellence

The Dunlop name is recognised throughout the world as being synonymous with quality and this is certainly the case when it comes to Dunlop conveyor belts. Dunlop Conveyor Belting is part of Fenner Dunlop Conveyor Belting Worldwide, the world's leading conveyor belt manufacturer. With twelve manufacturing plants on five continents, the Fenner Dunlop Group provides the most complete range of top quality conveyor belts in the world.

Established in 1921, Dunlop Conveyor Belting (Europe) has an unrivalled history of product excellence and development that has been built up over many generations. In the Netherlands, Dunlop Conveyor Belting specialises in the manufacture of industrial rubber conveyor belting. Our products are widely recognised as being the world standard for quality and reliability.

Conveyor belt installations have been used for moving a wide variety of goods and materials for many decades. They continue to provide the fastest, safest, most effective and economical method of transportation over relatively long distances; often in areas where space is limited and operating under some of the most adverse conditions imaginable.

The conveyor belt plays an integral role in the efficient operation of every conveyor system and has to be able to cope with an enormous variety of stresses and demands. Every conveying installation and the conditions that it is required to operate in is, of course, different. This means that the correct choice of belt type and cover quality is crucial.

Selecting a conveyor belt requires careful calculation, planning and consideration in order to achieve not only the optimum conveying capacity but also the longest possible operational lifespan of the belt and the minimum amount of production time lost due to avoidable repair and maintenance to the conveyor system itself.

There are several important technical 'rules', values and calculations involved when selecting a conveyor belt. This also applies to installing new belts, so that they operate at maximum efficiency; their day-to-day operation, care and maintenance and the identification and correction of problems.

To create this manual we have drawn upon the enormous experience and knowledge that has been accumulated over many years by the people of Dunlop Conveyor Belting. It has been deliberately designed to provide essential information in an easy-to-understand format for our customers, agents and distributors, regardless of their level of technical expertise.

Throughout this manual you will find both basic and more advanced technical data, together with explanations and guidance on a wide cross-section of subjects that will help in calculating and selecting the best possible belt as well as making accurate calculations and technical checks on belt installations that are already in operation. It will also enable the reader to provide the care and maintenance needed to optimise operational lifespan and minimise lost production.

OUTLINE OF A CONVEYOR BELT

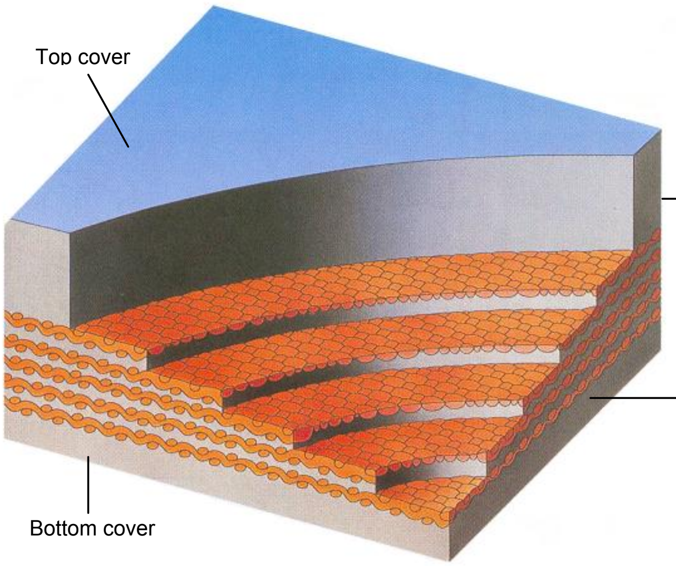


Diagram of a conventional multi-ply conveyor belt

The carcass

The carcass is arguably the most important part of a conveyor belt because not only does it have to absorb tremendous tensile stresses and strains it also has to convey the material placed on it. At the same time, it has to cope with a many different mechanical and thermal demands. Typically, a carcass contains layers of specially woven fabrics with rubber inner-plies or other materials such as steel cords embedded in the rubber. It is the carcass that provides the inherent characteristics of a conveyor belt such as its tensile strength and elongation (elasticity or 'stretch' under tension).

The cover

In most cases, the carcass is protected on both sides by a rubber outer layer. This is commonly referred to as the 'cover'. The purpose of the rubber cover is to actually protect the carcass from damage. There are several types or 'qualities' of cover, each of which is designed to contain specific properties. The quality characteristics of the cover grade largely determine the ability of the belt to withstand damaging effects such as wear caused by abrasion, ripping, tearing, heat, cold and the many other potentially harmful effects caused by fire, moisture, oil and other chemical reactions. The actual specification and quality of the cover largely depends on the materials the belt is required to carry and the surrounding operating conditions. A more detailed explanation of the different types of cover qualities and their strategic importance is provided later in this manual.

Comparison of the characteristics of (various) fabrics

A wide range of basic materials is used for belt reinforcement. Depending on the application, the elasticity is an important feature of a belt. Therefore there is a choice of different reinforcement materials. Experience has shown that the most reliable and adaptable all-round combination has proven to be Polyester (E) yarns in the warp (longitudinal) and Nylon (P) yarns in the weft (transverse) directions. Belting textiles using this construction are commonly referred to as EP fabrics.

EP fabrics are particularly suitable for handling high tension and absorbing high or heavy impact. They are highly resistant to chemicals; impervious to moisture and have low elongation (elasticity) at high working tensions. The fabrics are classified according to their longitudinal tensile strength. Fabric strengths ranging from 63 N/mm up to and including 630 N/mm are generally available.

Characteristics	Designation and evaluation of the fabric				
	P	E	EP	D	F
Tensile strength	++	++	++	+++	++
Adhesion	++	++	++	++	++
Elongation	-	++	++	+++	+++
Impervious to moisture	+	++	++	++	+
Impact resistance	+	-	+	+	++

- = moderate + = good ++ = very good +++ = excellent

Designation	Basic material
P	Nylon (synthetic yarns)
E	Polyester (synthetic yarns)
EP	Polyester-Nylon (synthetic yarns)
F	Steel fabric FERROFLEX
D	Aramide (synthetic yarns)

Number of plies

A typical multi-ply carcass can consist of between two to six plies in the required tensile strength. For elevator belting, three to six plies can be necessary due to the risk of tearing at the bucket holding bolts. The technological advances made by Dunlop in recent years has led to a reduction in the number of plies for some constructions but at the same time achieving higher tensile strength and better mechanical properties. This had led to the introduction of the highly successful UsFlex®, Dunloflex® and Trioflex® belt constructions.

Aramid fabrics

Aramid fabrics are wholly synthetic and over recent years aramid fabric has been used for the development of a carcass for applications where both high strength and low elongation are required. The carcass is built on the “straight warp” principle. Power transmission is effected trough the longitudinally placed aramid cords; on either side of the aramid cords there are transverse nylon cords. The aramid and nylon cords are held in place by a binder yarn. For further information on Dunlop Staramid®, please refer to the latest Dunlop Product Range brochure.

Steel fabrics

There are two Ferroflex constructions available – ‘FIW’ and ‘FSW’. Both have a tension layer composed of longitudinal steel cords through which power transmission is effected. The FIW carcass has a single transversal layer of steel cords on top of the longitudinal steel cords, whereas the FSW has two transversal layers of steel cords situated at both sides of the longitudinal steel cords. The transverse steel cords reinforce the belt and also protect against impact and tears, providing excellent reliability and durability. Due to the reduced elongation of the steel fabric, it is particularly suitable for long distance conveyors. The steel fabric is also very well suited to function in high heat applications.

CONVEYOR BELTING DESIGNATION

Dunlop conveyor belts are designated as follows:

Example	100 m	800 mm	S 500/4	4+2 mm	RA
Belt length					
Belt width					
Belt type					
Tensile strength of the belt					
Number of plies					
Top cover thickness					
Bottom cover thickness					
Cover quality					
Other special types and quality designations are possible.					

Belt length

The belt length is usually stated in meters (m), either open or endless. An open belt length means the circumference of an installation plus the extra length required for splicing. The endless belt length is the length of the belt in the neutral line, measured according to the EN ISO 16851.

Belt width

Belt widths are usually stated in millimetres (mm) but sometimes in meters. Preferred widths are internationally standardised although other belt widths are available on request.

Standard widths in mm:

300, 400, 500, 600, 650, 800, 1000, 1200, 1400, 1600, 1800, 2000 and 2200

The permitted tolerances on standard belt widths according to international standards are:

Belt width	300-500 mm	± 5 mm
Belt width	600 or wider	± 1 %

Nominal tensile strength

The nominal tensile strength figure indicates the ‘resistance at break’ in N/mm and is internationally standardised to meet the R 10 series.

125	160	200	250	315	400	500	630
800	1000	1250	1600	2000	2500	3150	(N/mm)

Number of plies

When a conveyor belt carcass is composed of several tensile layers, the individual layers are characterised by the following standardised sequence:

63	80	100	125	160	200	250	315	400	500	630 N/mm

The nominal strength of the belt carcass is the result of the combined strength of the individual layers. The number of plies is omitted in belt types where the carcass is defined by the Dunlop belt type description; for example Dunloflex (two plies) and Trioflex (three plies).

Belt thickness

The total belt thickness of the belt is the sum total of both the top and bottom covers and the thickness of the carcass. For actual values please refer to the section of this manual regarding relevant individual belt types. The permitted tolerance of the total belt thickness according to international standards are:

Belt thickness up to and including	10 mm:	± 1 mm
Belt thickness over	10 mm:	± 10 %

COVER QUALITIES

There are four primary types of cover quality; abrasion, heat, oil & fat and fire resistant. A fifth type of cover quality, cold resistant, is also sometimes necessary although this need is limited to extreme environments with consistently sub-zero temperatures.

Abrasion (Wear) Resistant Covers

The wear resistance quality of a conveyor belt is one of the major factors that determines its life expectancy and ultimately the truest test of its value for money. For the engineers and technicians at Dunlop, the objective is to always supply belts that provide the lowest possible “lifetime cost”.

As a general rule, 80% of conveyor belt surface wear usually occurs on the top cover of the belt with approximately 20% of wear occurring on the bottom cover. Wear on the top cover is primarily caused by the abrasive action of the materials being carried, especially at the loading point or ‘station’ where the belt is exposed to impact by the bulk material and the material is effectively ‘accelerated’ by the belt surface. Belt cleaning systems such as scrapers can also cause wear to the top cover surface.

Wear on the bottom cover is mainly caused by the friction contact made with the drum surface and idlers. The rate and uniformity of this type of wear can be adversely affected by many other factors such as misaligned or worn drums and idlers set at incorrect angles. Factors such as unclean environment, where there is a build up of waste material can cause added wear on both the top and bottom covers of a belt.

Contrary to popular belief, short belts (below 50 meters) usually wear at a faster rate than long belts due to the higher loading frequency. This is because the belt passes the loading point more frequently compared to longer length belts. For this reason, the selection of the correct type of cover quality and thickness of shorter length belts is even more important than usual.

The two most important characteristics are resistance to tear and abrasion. Tear strength is important where sharp objects are being transported such as rocks, metals for recycling and timber that can cause cutting and gouging.

Abrasion resistance is especially relevant where fine materials such as aggregate, sand and gravel are being carried, because these materials tend to create a highly abrasive effect in a similar way to sandpaper when they fall onto the belt.

Cover thickness

The actual thickness of the cover is an important consideration in actual belt selection. Generally speaking, the more abrasive the material being carried and the shorter the conveyor, the thicker the cover should be. However, covers that are *too* thick can potentially cause other problems. In principle, the difference in thickness between the top cover and the bottom cover should not exceed a ratio of more than 3 to 1.

The thickness of top and bottom cover is stated in millimetres (mm). The permitted tolerances of the cover thickness according to international standards are:

Cover thickness up to and including	4 mm:	- 0.2 mm
Cover thickness over 4 mm:		- 5 %

Heat Resistant and Fire Retardant Belts – The Difference

Dunlop has developed a wide range of belts that are capable of resisting even the most destructive elements of both heat and fire. It is important to point out that there is a significant difference between resistance and fire retardation. In basic terms, heat resistant belts are designed to carry materials at high temperatures with a minimum of aging whereas fire retardant belts are constructed using materials that, for safety reasons, do not continue to burn once they have been ignited and the source of the flame has been removed.

Heat Resistant Covers

Conveyor belts that are used to carry materials at high temperatures as well as belts used in high temperature environments, such as elevator belts in the cement industry, are exposed to an accelerated ageing process resulting in hardening and cracking of the rubber surface caused by the heat. However, this process can be significantly delayed by selecting the quality of cover best suited for the specific conveyor application and the environment that it is operating in.

The selection of the correct cover quality can become much more complicated depending on the nature of the materials being carried. For example, fine materials usually cause a greater concentration of heat on the belt surface because of the lack of air circulation between the hot material particles. In the case of sinter for example, the actual temperature of the material can be extremely high, but because it is a coarse material there is better air circulation between the particles.

Generally speaking, belt covers that have a high resistance to heat have a lower resistance to wear and tear. The Dunlop solution to this dilemma has been to develop covers that have a combination of both heat and wear resistance resulting in a much longer operational lifespan.

Extreme conditions

High temperatures can have a seriously damaging effect on the actual belt carcass itself, because heat can cause damage to the adhesion between the cover and the carcass and also between the inner plies contained within the carcass. This is commonly referred to as 'delamination'. Choosing the correct thickness of the cover is essential because the cover acts as a barrier between the heat source and the carcass. The most critical area is the splice (joint) because this is invariably the weakest point in any conveyor belt.

Industries where heat resistant belts are commonly used include the cement industry, recycling plants, the steel industry, foundries, the chemical industry and the petrochemical industry. Dunlop customers are always encouraged to discuss their specific needs with our team of specialists to help to find the most cost effective solution.

Oil and Fat Resistant Covers

Conveying materials that contain oil and fat can have a very detrimental effect on the performance and life expectancy of a conveyor belt because it penetrates into the rubber causing it to swell and distort, often resulting in serious operational problems.

Oil and fat resistance can be divided into two sources; vegetable and animal oils and fats mineral oils. Dunlop use a very special compound formula in the ROM cover grade quality, which is specifically designed to resist the penetration and therefore the damaging effects of animal and vegetable oils and fats. Mineral oils are the most aggressive and therefore demand a particularly high level of protection. To resist highly aggressive mineral oils, Dunlop has also developed a special compound formula the extremely successful ROS cover quality.

In some situations that involve products with high concentrations of animal and vegetable oils, the use of the superior resistance provided by the ROS cover grade quality is strongly recommended. Covers that are both oil resistant and fire retardant are also available from the Dunlop range. For further information, please refer to the ‘Fire Retardant Covers’ section of this manual.

Belts using oil and fat resistant covers can be found in many different industries including the chemical & fertilizer industry, wood, paper & pulp, sugar & food, transhipment and recycling plants.

Fire Retardant Covers

Fire retardant belts are primarily needed for internal transportation within buildings and also in tunnels and mines where safety is naturally of paramount importance. Because fire safety is such a very important issue, there are numerous safety classifications and international standards.

There are many different tests used to measure performance against the various international standards. The basis of most of these tests involves the use of samples of belt and exposing them to naked flame, which causes the samples to burn. The time it takes for the belt sample to self-extinguish or the amount of belt actually remaining after the flame has been removed is then measured.

For normal industrial applications the EN ISO 340 standard is applicable. This standard makes the distinction between flame retardation with covers (K) and flame retardation with or without covers (S).

Dangerous environments

Fire retardant belts are used extensively in many industries including mining, wood, paper & pulp, sugar & food, recycling and chemical & fertilizer plants. In some environments where coal dust, gas, fertilizer or other combustible materials are involved, it is essential that the conveyor belts being used cannot create static electricity that can ignite gases and dust in the atmosphere.

A very important safety feature of all Dunlop belts with rubber covers is that they are anti-static and conform to EN ISO 284 international standards and therefore can be used in ATEX classified surroundings.

Dunlop Cover Quality		DIN quality	EN/ISO quality	Permissible temp. °C* min.	cont.	max.	Base polymer	Technical Features
Abrasion resistant	RA	Y		-30	80	100	SBR	High abrasion resistance for normal service conditions.
	RS	W	D	-40	80	90	NR/SBR	Extra wear resistance to meet the demands of conveying highly abrasive materials.
	RE	X	H	-40	80	90	NR	Excellent resistance to cuts, impact, abrasion and gouging resulting from large lump sizes of heavy, sharp and high drop heights.
Heat resistant	Betahete	T		-20	150	170	SBR	Heat resistant for materials at moderate temperatures.
	Starhete	T		-20	180	220	IIR	Increased heat resistant for materials at controlled high temperatures.
	Deltahete	T		-20	200	400	EPDM	Superior heat resistant for heavy-duty service conditions, up to 400 °C for a short period (coke, clinker etc.)
Oil and fat resistant	ROM	G**		-20	80	90	SBR/NBR	Oil and fat resistant for most products with animal and vegetable oils and fats.
	ROS	G		-20	80	120	NBR	Oil and fat resistant for products containing mineral oils.
Fire retardant	BVX	K/S***		-20	80	90	SBR	Fire retardant for the transport of inflammable and explosive materials such as coal dust etc. According to EN 20340.
	VT	VT		-20	80	90	CR/SBR	Highly fire retardant quality both for under and above ground.
	BV ROM	K/S***		-20	80	90	SBR/NBR	Same features as ROM and also fire retardant. According to EN 20340.
	BV ROS	K/S***		-20	80	90	NBR	Same features as ROS and also fire retardant. According to EN 20340.

* For elevator belts other values apply. For low ambient temperatures please ask for information regarding our Coldstar range.

** In some cases (with products containing high concentrations of animal and vegetable oils) ROS should be selected.

*** K = fire retardant with covers S = fire retardant with or without covers
Other cover grade qualities for special applications are available upon request.

BELT RANGE

Multiply Belting

Dunlop has a wide range of textile conveyor belts, they are available in a Dunloflex®, Trioflex®, Superfort®, and Usflex® range. See for the specifications page 25 and 26 and for more detailed information the individual product brochures.

Aramid Belting

The Staramid belt range has been specially developed for use on very long conveyors. It has a synthetic carcass with low elongation properties compared to belts with a Polyester-Nylon carcass. The Staramid belt range is available in strengths from 630 until 2000 N/mm. See for the specifications page 26 and 28.

Steel reinforced Belting

The Dunlop steel reinforced belt range is covered by the Ferroflex IW and SW. See for the specifications page 23 and 24 and fore more detailed information the individual product brochures.

Slider belting

Slider belting is used on those installations where the idlers in the top part have been replaced by slider plates of wood, metal or plastic.

Slider belting is most commonly used in the transportation of individual items and packages. Dunlop slider belts have a special rubber layer that provides the necessary transverse rigidity to create the flat, even surface needed to efficiently transport individual items packed in cardboard, Hessian, paper and plastic. The low friction polyester fabric used on the bottom of the belt provides both high wear resistance as well as low power consumption properties. Rufftop and Fishbone profiled covers are often used on slider belts to provide the surface grip needed to avoid slippage when steep inclines are involved.

Slider Belt types

	GB-Extra	**GB-Standard**
Belt width *	Max. 2000 mm with smooth top cover	Max. 2000 mm with smooth top cover
	Max. 2000 mm with Rufftop profile	Max. 2000 mm with Rufftop profile
		Max. 1150 mm with Fishbone profile
Carcass	S 400/3 ** 2 plies and 1 slider ply	S 250/2 ** 1 ply and 1 slider ply
Top cover	Smooth, 2.0 mm thick	Smooth, 1.5 mm thick
	Rufftop, 3.5 mm thick	Rufftop, 3.5 mm thick
		Fishbone, 3 mm thick
Friction factor	Average 0.2	
Cover quality	Quality RA/ROM/ROS, other qualities on application	
Belt edges	With cut (sealed) edges	
Splicing	Cold or hot cured or mechanical fasteners	

* Belt widths indicated are maximum production widths.
** Other types are available on application.

Pulley diameters

	GB-Extra	GB-Standard
Working tension T_1 up to 60%	160 mm	125 mm
Working tension T_1 over 60%	200 mm	160 mm

Weights and thicknesses

Belt type	Cover thickness including profile	Thickness (mm)	Weight (kg/m²)
GB-Standard S 250/2	Slider belt 1.5 mm + 0 mm Smooth	5.2	5.7
GB-Standard S 250/2	Slider belt 3.5 mm + 0 mm Rufftop	7.1	6.4
GB-Extra S 400/3	Slider belt 2.0 mm + 0 mm Smooth	5.8	6.6

Maximum slope angle

Material to be conveyed	Rufftop profile	Fishbone profile
Wooden cases	40°	30°
Tiles	40°	30°
Paper sacks	35°	30°
Hessian sacks	35°	35°
Plastic crates, dry	40°	30°
Plastic crates, wet	25°	25°

Elevator Belting

Elevator belts are used for conveying bulk materials vertically using metal, plastic or rubber buckets that are bolted onto the belt. The dimensions and methods of fastening of the buckets have been defined in standards.

Belt widths

Elevator belts are available in standard widths up to and including 2200 mm.

Carcass

The textile carcass consists of three up to six plies of synthetic Polyester-Nylon fabric (EP). EP-fabric is impervious to moisture, has a low elongation and a high tensile strength. The choice of belt type and number of plies depends on the required tensile strength and bolt holding ability.

The steel carcass consists of one layer of steel warp cables and two layers of steel weft cables one at each side of the warp. This provides excellent resistance to the tear-force generated by the bolts of the buckets and fasteners. A steel reinforced carcass is mainly used for high heat applications, to prevent excessive elongation.

Pulley diameter

The minimum pulley diameter depends on the thickness of the carcass and the kind of reinforcement material. The head pulley is generally lagged.

Minimum pulley diameter for Superfort elevator belting

Number of plies	SUPERFORT	Pulley diameter (mm)
3	S 400/3 S 500/3 S 630/3	315 400 400
4	S 500/4 S 630/4 S 800/4 S 1000/4 S 1250/4	500 630 630 800 800
5	S 630/5 S 800/5 S 1000/5 S 1250/5 S 1600/5	630 800 1000 1000 1200
6	S 1000/6 S 1250/6 S 1600/6	1000 1200 1400

The Ferroflex FSW construction is particularly suitable for elevator belts, especially for use in the cement industry in combination with the heat resistant Deltahete cover grade quality. The FSW reinforced belt can be supplied with cable free zones to make the installation of buckets and fasteners easier and to create a dynamically stronger belt splice. Both constructions are available in all Dunlop cover qualities.

Minimum pulley diameter for Ferroflex elevator Belting

Number of plies	FERROFLEX	Pulley diameter (mm)
1 warp/2weft	FSW 500 FSW 630 FSW 800 FSW 1000 FSW 1250 FSW 1600 FSW 2000	500 500 630 630 800 800 1000

Cover quality

Elevator belts are available in all Dunlop cover qualities.

Cover thickness

According to the service conditions 1.5 mm up to 4 mm, normally both covers have the same thickness. Other thicknesses are available on application.

Belt edges

Textile reinforced elevator belts are supplied with heat sealed edges as standard. They can also be supplied with moulded (rubber) edges. Steel reinforced elevator belts are supplied with moulded (rubber) edges.

Holes

Elevator belting can be provided with holes punched at the factory**.**

Elevator belt clamps and fasteners

Failure of an elevator belt can be catastrophic, both in terms of physical risk and also the serious loss of production time. It is therefore essential that only top quality steel fasteners are used. Dunlop has introduced a range of fasteners designed for use in elevators.

Replacing an elevator belt is a more highly skilled process compared to conventional conveyor belt replacement so it is equally important to use engineers who are experienced in this field.

PACKAGING FOR TRANSPORTATION

Despite their strong construction and durability, conveyor belts can still be damaged during transit due to incorrect or careless handling and off-loading. To help minimise the risk of damage during transit Dunlop use three different kinds of packaging – edge protection, plastic foil and wooden drums.

Examples of Dunlop packaging

CORRUGATED SIDEWALLS AND CLEATS

In order to increase belt capacity, corrugated sidewalls can be fitted. Used in combination with rubber cleats, it is possible to transport material at a high angle of incline.

Side wall Types

Type	Min. drive pulley (mm)	Min. tail pulley (mm)	Min. reversed bend pulley (mm)
DW 80	250	250	315
DW 120	400	400	500

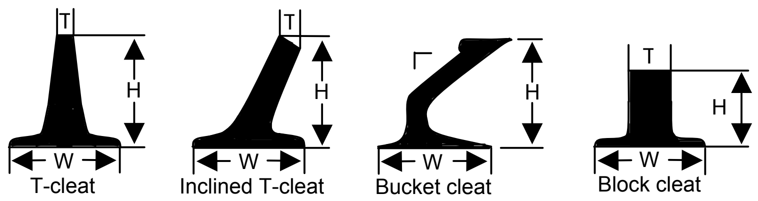
Rubber cleats

In order to increase the angle of incline to over 30° rubber cleats are vulcanised onto the conveyor belt using cold splicing materials. The size and the pitch of the cleats depend on the quantity and type of materials to be carried.

Rubber quality

Corrugated sidewalls and cleats are available in wear resistant quality. Other qualities are available on request.

Profile sketch



Constructions and dimensions

Form	Designation	Dimensions (mm)			Weight (kg/m)	Min. drive pulley (mm)
		H	W	T		
T-cleats	T 15/20	15	20	8	0.18	200
	T 21/41	20	40	5	0.28	200
	T 25/36	25	36	11	0.52	250
	T 40/70	40	70	4	0.69	250
	T 60/80	60	80	4	1.03	250
	T 75/80	75	80	10	1.66	315
	T 80/90	80	90	4	1.54	315
	T 100/100	100	100	4	1.99	400
Inclined T-cleats	TS 50/65	50	65	7	0.78	250
	TS 70/80	70	80	6	1.19	315
	TS 75/80	75	80	6	1.32	315
Bucket cleats	B 80	85	80	-	1.74	315
	B 110	110	80	-	2.74	400
Block cleats	TB 25/11/36	25	36	11	0.49	250
	TB 50/25/80	50	80	25	2.10	315
	TB 75/10/80	75	80	10	1.83	315

CAPACITY OF SMOOTH SURFACE CONVEYOR BELTING

The capacity of conveyor belting with a smooth surface depends on the theoretical load section and the belt speed. The load section is a function of the troughing of the belt and the surcharge angle. When conveying up inclines the load section may be different and this can be calculated by using the correction factor. Irregular loading of the installation and spillage of material can be compensated for by the conversion factor k.

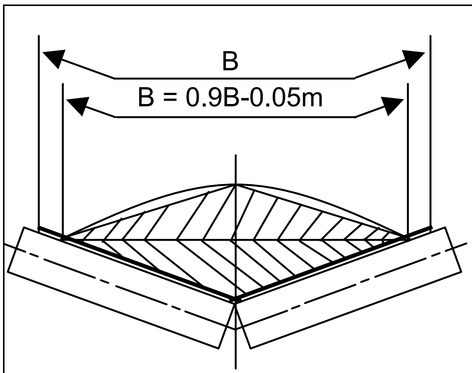
Formulae

Effective volume capacity $\boxed{Qv = Qth \cdot \varphi \cdot k \cdot v}$ m^3/h

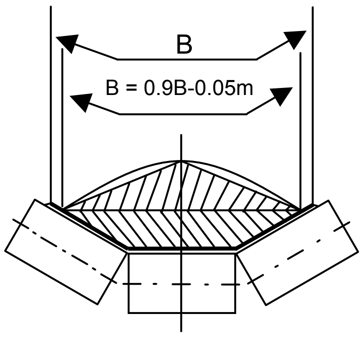
Effective mass capacity $\boxed{Qm = Qv \cdot \rho}$ t/h

A guide to the formula symbols

Q_{th}	m^3/h	Theoretical capacity (values in the table)
φ	-	Correction factor for inclined conveying, smooth belting
φ_1	-	Correction factor for inclined conveying, profiled belting
k	-	Conversion factor for irregular loading k = 0.75 – 0.85
ρ	t/m^3	Density of the material carried
v	m/s	Belt speed



Troughing angle 20°



Troughing angle 30°

Theoretical capacity Q_{th} (m^3/h)

v (m/s)	Belt width (mm)		Belt width (mm)						
	400	500	500	650	800	1000	1200	1400	1600
1.00	44	70	74	131	206	342	480	690	920

Correction factor φ

Slope angle of the installation	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°
φ	1.00	0.99	0.98	0.97	0.95	0.95	0.91	0.89	0.85	0.81	0.76

The values in this table are valid for horizontal conveying and a surcharge angle of 10°.

CAPACITY OF PROFILED CONVEYOR BELTING

The maximum angle of incline of a smooth conveyor belt varies between 10° and 22°, dependent on the type and conditions of the material carried. Inclined conveyor belting with profiles achieves angles of inclination between 25° and over 40°. To obtain the most favourable circumstances, the selected width of profile should be equal to the width of the load stream. Under these conditions, capacity may be calculated using the same formulae as for smooth surface belting.

Formulae

Effective volume capacity $\boxed{Qv = Qth \cdot \varphi_1 \cdot k \cdot v}$ m³/h

Effective mass capacity $\boxed{Qm = Qv \cdot \rho}$ t/h

Correction factor φ_1

Slope angle of the installation	15°	20°	25°	30°	35°	40°
Slightly rolling and coarse materials	0.89	0.81	0.70	0.56	-	-
Sticky materials	1.00	0.93	0.85	0.68	0.58	0.47

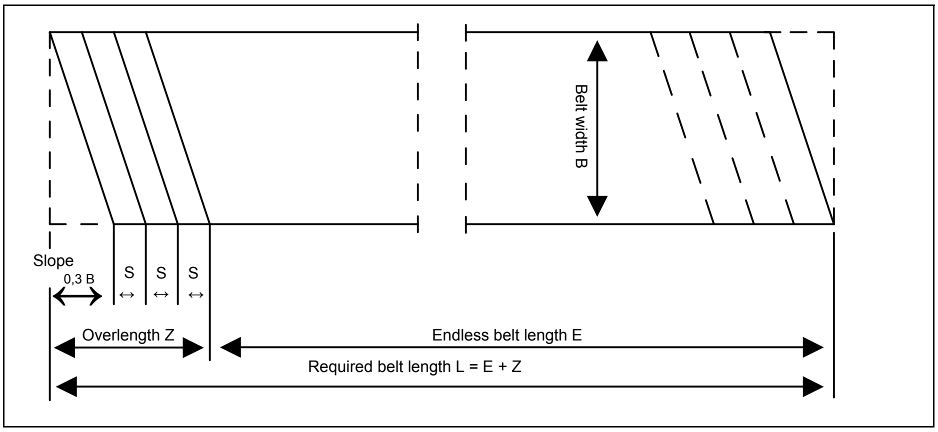
The values in the table are based on belt speeds of 1 m/s and a troughing angle of 20°.

Theoretical volume capacity Qth (m³/h)

Belt width (mm)	Angle of surcharge	CHEVRON profile	Qth (m³/h)	HIGH CHEVRON profile	Qth (m³/h)
400	0 5 10 15 20	C 330/16	25 33 40 49 58	-	-
500	0 5 10 15 20	C 430/16	43 56 68 85 100	HC 450/32	48 63 78 94 110
600	0 5 10 15 20	C 530/16	65 86 106 128 151	HC 450/32	42 57 72 88 105
650	0 5 10 15 20	C 530/16	65 86 106 128 151	HC 450/32	42 57 72 88 105
650	0 5 10 15 20	-	-	HC 600/32	88 115 141 160 189
800	0 5 10 15 20	C 650/16	71 96 120 148 175	HC 600/32	78 105 132 160 189
1000	0 5 10 15 20	C 800/16	138 184 230 277 326	HC 800/32	149 196 244 293 345
1200	0 5 10 15 20	C 1000/16	118 164 210 258 308	HC 1000/32	235 307 384 461 542
1400	0 5 10 15 20	-	-	HC 1200/32	348 454 562 673 789
1600		-	-	HC 1200/32	348 454 562 673 789

ADDITIONAL LENGTH FOR SPLICES

Splice configuration for step splices



Formula symbols

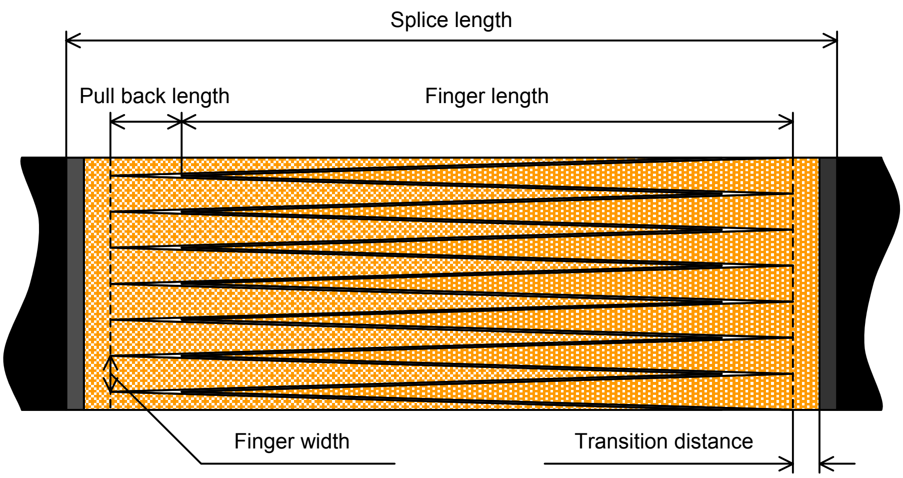
S	(mm)	Step length, see table
B	(mm)	Belt width
Z	(mm)	Additional length for splice
n	-	Number of plies

Formulae for additional length

Splice type	Additional length for splice (mm)
Normal step splice	Z = (n-1) • S + 0.3 • B
Overlap splice	Z = n • S + 0.3 • B

Further information can be found in our Splicing instructions for Multiply belting

Splice configuration for finger splices



Formula for additional length

Additional length for splice = Finger length – Pull back length

Further information can be found in our Splicing instructions for UsFlex belting.

Step length and finger length

SUPERFORT	Step length S (mm)
S 250/2	160
S 315/2	200
S 400/3	160
S 500/3	200
S 500/4	160
S 630/3	250
S 630/4	200
S 630/5	160
S 800/3	250
S 800/4	250
S 800/5	200
S 1000/3	315
S 1000/4	250
S 1000/5	250
S 1000/6	200
S 1250/4	315
S 1250/5	250
S 1250/6	250
S 1600/4	315
S 1600/5	315
S 1600/6	250
S 2000/4	350
S 2000/5	315
S 2000/6	315
S 2500/5	350
S 2500/6	315
S 3150/5	350
S 3150/6	350

FERROFLEX Aramide splice	Finger length (mm)
F 500	100
F 630	100
F 800	100
F 1000	100
F 1250	100

FERROFLEX Finger splice	Finger length (mm)
F 500	400
F 630	500
F 800	630
F 1000	800
F 1250	1000
F 1600	1250
F 2000	1600

USFLEX Finger splice	Finger length (mm)
UF 400/1	320
UF 500/1	400
UF 630/1	500
UF 800/1	630
UF 1000/2	710
UF 1250/2	860
UF 1600/2	1250

USFLEX Step splice	Step length S (mm)
UF 1000/2	400

DUNLOFLEX	Step length S (mm)
D 200	160
D 250	200
D 315	200
D 400	250
D 500	250
D 630	315
D 800	315

TRIOFLEX	Step length S (mm)
T 400	160
T 500	200
T 630	250
T 800	250
T 1000	315
T 1250	315

ROLLED BELT DIAMETERS

Conveyor belts are normally coiled onto plastic or wooden cores or drums for transportation. Core diameters will be dependent on belt type.

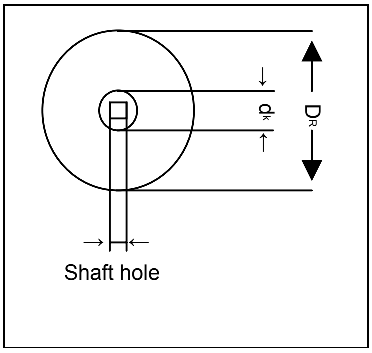
Core diameter dk (mm)	Shaft hole (square) (mm)	Application
250 400	110 205	General, stock belting Wide and heavy belting

Formula

The roll diameter can be calculated using the following formula:

$$D_R = \sqrt{1.27 \cdot d \cdot L + d_k^2}$$

D_R	(m)	=	Roll diameter
d	(m)	=	Belt thickness
d_k	(m)	=	Core diameter
L	(m)	=	Belt length



The roll diameter can also be taken from the following table:

Roll diameter (m)

Length (m)	Belt thickness (mm)													
	5	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
20	0.44	0.46	0.49	0.52	0.54	0.56	0.58	0.61	0.63	0.65	0.67	0.69	0.70	0.72
30	0.50	0.54	0.57	0.61	0.64	0.67	0.69	0.72	0.75	0.77	0.80	0.82	0.84	0.87
40	0.56	0.61	0.65	0.68	0.72	0.76	0.79	0.82	0.85	0.88	0.91	0.94	0.96	0.99
50	0.62	0.67	0.71	0.76	0.80	0.84	0.87	0.91	0.94	0.98	1.01	1.04	1.07	1.10
60	0.67	0.72	0.77	0.82	0.87	0.91	0.95	0.99	1.03	1.06	1.10	1.13	1.17	1.20
70	0.71	0.77	0.83	0.88	0.93	0.98	1.02	1.06	1.10	1.14	1.18	1.22	1.26	1.29
80	0.76	0.82	0.88	0.94	0.99	1.04	1.09	1.13	1.18	1.22	1.26	1.30	1.34	1.38
90	0.80	0.87	0.93	0.99	1.04	1.10	1.15	1.20	1.24	1.29	1.33	1.38	1.42	1.46
100	0.84	0.91	0.98	1.04	1.10	1.15	1.21	1.26	1.31	1.36	1.40	1.45	1.49	1.53
120	0.91	0.99	1.06	1.13	1.20	1.26	1.32	1.38	1.43	1.48	1.53	1.58	1.63	1.68
140	0.98	1.06	1.14	1.22	1.29	1.36	1.42	1.48	1.54	1.60	1.65	1.71	1.76	1.81
160	1.04	1.13	1.22	1.30	1.38	1.45	1.52	1.58	1.64	1.71	1.77	1.82	1.88	1.93
180	1.10	1.20	1.29	1.38	1.46	1.53	1.61	1.68	1.74	1.81	1.87	1.93	1.99	2.05
200	1.15	1.26	1.36	1.45	1.53	1.61	1.69	1.76	1.83	1.90	1.97	2.03	2.10	2.16
220	1.21	1.32	1.42	1.52	1.61	1.69	1.77	1.85	1.92	1.99	2.06	2.13	2.20	2.26
240	1.26	1.38	1.48	1.58	1.68	1.76	1.85	1.93	2.01	2.08	2.16	2.23	2.29	2.36
260	1.31	1.43	1.54	1.64	1.74	1.83	1.92	2.01	2.09	2.16	2.24	2.31	2.39	2.45
280	1.36	1.48	1.60	1.71	1.81	1.90	1.99	2.08	2.16	2.25	2.33	2.40	2.47	2.55
300	1.40	1.53	1.65	1.76	1.87	1.97	2.06	2.15	2.24	2.32	2.41	2.48	2.56	2.63
320	1.45	1.58	1.71	1.82	1.93	2.03	2.13	2.22	2.31	2.40	2.48	2.57	2.64	2.72
340	1.49	1.63	1.76	1.88	1.99	2.09	2.19	2.29	2.38	2.47	2.56	2.64	2.72	2.80
360	1.53	1.68	1.81	1.93	2.04	2.15	2.26	2.36	2.45	2.54	2.63	2.72	2.80	2.88
380	1.57	1.72	1.85	1.98	2.10	2.21	2.32	2.42	2.52	2.61	2.71	2.79	2.88	2.96
400	1.61	1.76	1.90	2.03	2.15	2.27	2.38	2.48	2.58	2.68	2.78	2.87	2.95	3.04

SAFETY FACTORS

The safety factors at stationary and non-stationary use indicate the relation between the theoretical tensile strength of the splice and the belt tension. The advised minimum safety factors are according to the international standards. They take into account (amongst other) the dynamical splice fatigue, unevenly distribution of forces over the belt width, and possible splice strength reduction due to external circumstances.

BELT ELONGATION

Elastic Characteristics

When in operation, a conveyor belt undergoes constant load changes. These load changes cause the belt to stretch. The belt elongation is on one hand determined by these loads, and on the other hand determined by the elastic characteristics of the carcass and by the permanent elongation of the carcass. These are absorbed by the tensioning system.

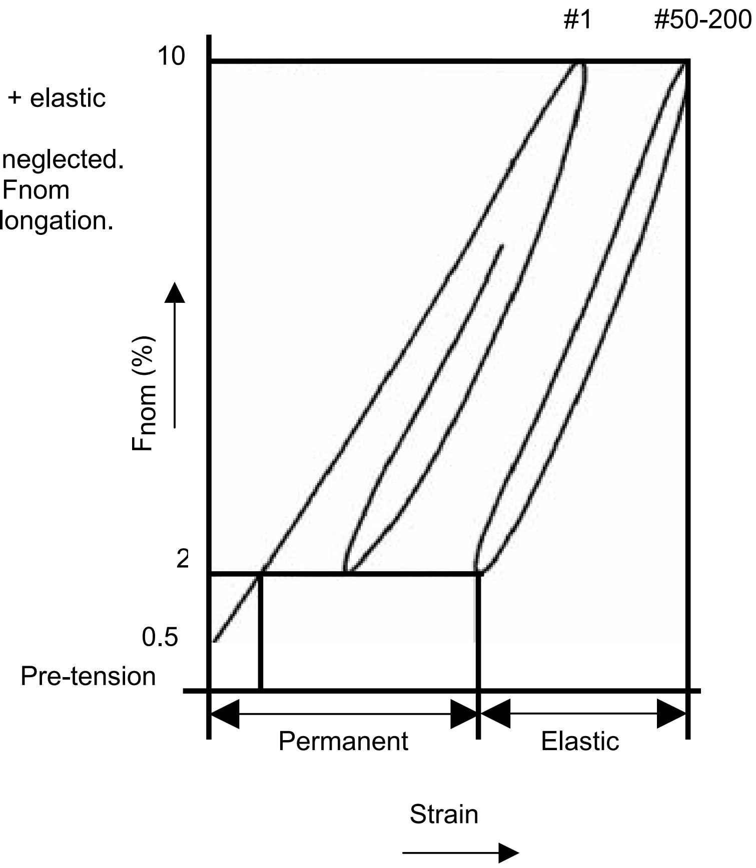
Stress-Strain Curve

The elongation behaviour of a belt can be determined with the aid of a stress-strain curve. The test piece is subjected to a pre-tension of 0.5% of the nominal tensile strength of the belt.

It is then subjected to a test program of 200 load cycles between 2% and 10% of the nominal tensile strength of the belt. This load cycle corresponds to a belt in use, running at its minimum stationary safety factor.

Total elongation = permanent + elastic

- Elongation at 0.5% Fnom is neglected.
- Elongation between 0.5-2% Fnom
  is added to the permanent elongation.



QUICK CALCULATION

Determining the belt tensions in use and the appropriate belt strength involves detailed calculations of the conveyor system. For such calculations you are welcome to contact our Application Engineering Department.

To make a quick approximate calculation of the maximum belt tension at start up, and the appropriate belt strength, Dunlop has developed a unique miniature formula system. This formula system is valid for standard conveyors with direct drive and a rubber lagging of the drive pulley. This easy to use formula system requires only the following data:
1) The installed motor power
2) The belt speed
3) The belt width

The maximum belt tension at start up can be calculated with:

$$\boxed{F = \frac{3.2 \times P}{v \times B}}$$

F = Belt tension at start [N/mm]
P = motor power [kW]
v = belt speed [m/s]
B = belt width [m]

When the belt tension is determined with the first formula, the appropriate belt strength can easily be determined by the second formula:

$$\boxed{TS = F \times \frac{5.4}{\eta}}$$

η = splice efficiency
TS = tensile strength [N/mm]

The splice efficiency can be taken from the following table:

Belt type	Number of plies	Splice type	Splice efficiency
DUNLOFLEX	2 2	2 ply-step 1 ply-step	1.00 0.50
TRIOFLEX	3 3	3 ply-step 2 ply-step	1.00 0.67
SUPERFORT	2 3 4 5 6	1 ply-step 2 ply-step 3 ply-step 4 ply-step 5 ply-step	0.50 0.67 0.75 0.80 0.83
USFLEX	1 and 2 2	Finger 1 ply-step	0.90 0.50
STARAMID	1	Bridge splice	0.90
FERROFLEX	1 1	Bridge splice Finger splice	0.90 0.90

For the final selection of the belt strength, the outcome should be rounded off to the next higher standard belt strength. Belt tension is only one of the factors that determines the minimum belt strength. Factors like load support, impact resistance and elongation can also determine the minimum required belt strength. Our Application Engineering Department can help you with the optimum belt selection.

BELT CHARACTERISTICS

SUPERFORT

Belt type	Carcass thickness (mm)	Carcass weight (kg/m²)	Pulley diameters* A (mm)	B (mm)	C (mm)	Min width** (mm)	Max. belt width (mm) for satisfactory load support with material weight in t/m³:** <0.75	0.75-1.5	1.5-2.5	2.5-3.2
S 250/2	2.1	2.5	200	160	125	300	650	500	400	
S 315/2	2.3	2.6	250	200	160	400	650	500	400	
S 400/2	2.8	3.2	315	250	200	400	1000	800	650	
S 400/3	3.0	3.5	315	250	200	400	1200	1000	800	
S 500/3	3.2	3.6	400	315	250	500	1200	1000	800	
S 500/4	3.9	4.5	400	315	250	500	1400	1200	1000	800
S 630/3	4.0	4.5	400	315	250	500	1400	1200	1000	800
S 630/4	4.2	4.7	500	400	315	650	1600	1400	1200	1000
S 630/5	5.0	5.8	630	500	400	800	2000	1800	1600	1400
S 800/3	4.5	5.1	500	400	315	650	1600	1400	1200	1000
S 800/4	5.2	5.8	630	500	400	650	1800	1600	1400	1200
S 800/5	5.3	6.0	630	500	400	800	2000	1800	1600	1400
S 1000/4	6.2	6.9	630	500	400	800	2200	2000	1800	1600
S 1000/5	6.6	7.4	800	630	500	1000	2200	2200	2000	1800
S 1000/6	6.5	7.4	800	630	500	1000	2200	2200	2000	1800
S 1250/4	6.7	7.6	800	630	500	1000	2200	2200	2200	2200
S 1250/5	7.8	8.7	800	630	500	1000	2200	2200	2200	2200
S 1250/6	8.0	8.9	1000	800	630	1000	2200	2200	2200	2200
S 1600/4	8.4	9.4	1000	800	630	1200	2200	2200	2200	2200
S 1600/5	8.5	9.6	1000	800	630	1200	2200	2200	2200	2200
S 1600/6	9.5	10.5	1000	800	630	1200	2200	2200	2200	2200
S 2000/4	9.7	10.7	1000	800	600	1200	2200	2200	2200	2200
S 2000/5	10.7	11.9	1200	1000	800	1200	2200	2200	2200	2200
S 2500/5	12.2	13.5	1400	1200	1000	1200	2200	2200	2200	2200
S 2500/6	13.0	14.4	1400	1200	1000	1200	2200	2200	2200	2200
S 3150/5	14.5	15.2	1600	1400	1200	1200	2200	2200	2200	2200

DUNLOFLEX

Belt type	Carcass thickness (mm)	Carcass weight (kg/m²)	Pulley diameters* A (mm)	B (mm)	C (mm)	Min width** (mm)	Max. belt width (mm) for satisfactory load support with material weight in t/m³:** <0.75	0.75-1.5	1.5-2.5
D 200	2.7	3.1	250	200	160	400	800	800	
D 250	3.0	3.6	250	200	160	400	1000	800	650
D 315	3.2	3.7	250	200	160	500	1200	1000	800
D 400	3.7	4.3	315	250	200	500	1400	1200	1000
D 500	4.1	4.7	315	250	200	650	1400	1200	1000
D 630	4.5	5.0	400	315	250	650	1600	1400	1200
D 800	4.8	5.5	500	400	315	650	1600	1400	1200

TRIOFLEX

Belt type	Carcass thickness (mm)	Carcass weight (kg/m²)	Pulley diameters* A (mm)	B (mm)	C (mm)	Min width** (mm)	Max. belt width (mm) for satisfactory load support with material weight in t/m³:** <0.75	0.75-1.5	1.5-2.5	2.5-3.2
T 400	4.4	5.3	400	315	250	650	1800	1600	1400	1200
T 500	5.0	5.9	500	400	315	800	2000	1800	1600	1400
T 630	5.5	6.5	630	500	400	800	2000	1800	1600	1400
T 800	6.0	7.2	800	630	500	800	2200	2000	1800	1600
T 1000	6.5	7.8	800	630	500	1000	2200	2200	2000	1800
T 1250	7.2	8.1	1000	800	630	1000	2200	2200	2200	2000

USFLEX

Belt type	Carcass thickness (mm)	Carcass weight (kg/m²)	Pulley diameters* A (mm)	B (mm)	C (mm)	Min cover thickness	Min width** (mm)	Max. belt width (mm) for satisfactory load support with material weight in t/m³:** <0.75	0.75-1.5	1.5-2.5	2.5-3.2
UF 400/1	2.4	2.6	315	250	200	4 + 2.5	650	1600	1400	1200	1000
UF 500/1	3.3	3.7	400	315	250	6 + 3	800	2000	1800	1600	1400
UF 630/1	3.4	3.9	500	400	315	6 + 3	800	2200	2000	1800	1600
UF 800/1	4.0	4.5	630	500	400	6 + 3	800	2200	2200	2000	1800
UF 1000/2	6.5	7.2	800	630	500	8 + 3	1000	2200	2200	2200	2200
UF 1250/2	6.8	7.7	800	630	500	8 + 3	1000	2200	2200	2200	2200
UF 1600/2	10.3	8.7	1000	800	630	8 + 3	1200	2200	2200	2200	2200

STARAMID

Belt type	Carcass thickness (mm)	Carcass weight (kg/m²)	Pulley diameters* A (mm)	B (mm)	C (mm)	Min width** (mm)	Max. belt width (mm) for satisfactory load support with material weight in t/m³:** <0.75	0.75-1.5	1.5-2.5	2.5-3.2
SD 630	2.2	2.3	630	500	400	650	1400	1200	1000	800
SD 800	2.4	2.6	630	500	400	650	1600	1400	1200	1000
SD 1000	2.6	2.9	800	630	500	800	1800	1600	1400	1200
SD 1250	2.7	3.2	800	630	500	800	1800	1600	1400	1200
SD 1600	2.9	3.7	1000	800	630	800	2000	1800	1600	1400
SD 2000	3.6	4.5	1000	800	630	1000	2000	2000	1800	1600

FERROFLEX

Belt type	Carcass thickness (mm)	Carcass weight (kg/m²)	Pulley diameters* A (mm)	B (mm)	C (mm)	Min width** (mm)	Max. belt width (mm) for satisfactory load support with material weight in t/m³:** <0.75	0.75-1.5	1.5-2.5	2.5-3.2
F 500 IW	3.2	5.7	500	400	315	500	1600	1400	1200	1000
SW	4.7	7.3	500	400	315	800	2200	2000	1800	1600
F 630 IW	3.2	5.9	500	400	315	500	1600	1400	1200	1000
SW	4.7	8.1	500	400	315	800	2200	2000	1800	1600
F 800 IW	4.5	8.6	630	500	400	650	2200	2000	1800	1600
SW	5.4	9.5	630	500	400	800	2200	2200	2000	1800
F 1000 IW	4.5	9.3	630	500	400	650	2200	2000	1800	1600
SW	5.4	10.4	630	500	400	800	2200	2200	2000	1800
F 1250 IW	6.0	12.2	800	630	400	800	2200	2200	2200	2200
SW	7.1	13.2	800	630	400	1000	2200	2200	2200	2200
F 1600 IW	6.0	13.5	800	630	400	800	2200	2200	2200	2200
SW	7.1	14.6	800	630	400	1000	2200	2200	2200	2200
F 2000 SW	7.1	16.0	800	630	400	1000	2200	2200	2200	2200

* Diameter for belt loads form 60% up to 100%. For lower loads a smaller diameter can also be suitable.

** The load support of a belt is a factor of the belt width, belt strength and bulk material density.

The table indicates the limits for correct load support based on three idlers of the same length set at 30°.

CARE & MAINTENANCE

Provided that the most suitable belt type has been selected, the potential operational lifespan of a conveyor belt will primarily depend upon five key factors:

- Proper storage conditions prior to use.
- Correct belt alignment.
- Efficient loading conditions.
- Adequate cleaning.
- Ancillary equipment

Proper storage conditions

When storing rubber belting consideration must always be given to the actual storage conditions. Various factors can have a detrimental effect on the belting. The ideal ambient storage temperature should be between 10° to 20°C. Prolonged exposure to temperatures below 4°C, or in excess of 30°C will almost certainly have an adverse effect on the belt.

Other important factors include humidity and exposure to sunlight and ozone. Contact with any type of oil, solvent or corrosive liquid should be avoided at all costs. The belt should be stored in an upright position and remain in the manufacturer’s packing until required for use.

Conventional packaging materials such as wooden drums, Hessian, cardboard and plastic foil do provide some protection against direct or indirect sunlight, ozone and contamination by liquids. When off loading rolls or drums of belting, skids, a forklift truck or a crane should always be used. Belts should *never* be dropped or rolled off the transportation vehicle.

Correct belt alignment

Training (aligning) of a conveyor belt

The accurate ‘training’ of a new belt is extremely important and a close study of the following points is highly recommended. Incorrect tracking or running off-centre is invariably due to the following causes:

1. Pulleys may not be mounted level and square to centre line of conveyor. The belt will run off the slack side.
2. Idlers may not be correctly aligned.
3. Pulleys may have a worn surface.
4. The belt may not ‘trough’ sufficiently to provide proper contact with the horizontal centre idler of trough idlers
5. The belt may not be straight.
6. The belt may not have been joined (spliced) straight and square.
7. The belt may not be loaded centrally. An off-centre load will cause the empty side to run off.
8. The belt may be exposed to the effects of wind turbulence.
9. The belt may drag against projecting stationary parts.
10. The tripper may be askew because of clearance between rails and wheel flange.

When fitting a belt, special care should be taken to make certain that the following requirements are met:

- All pulleys must be set up with shafts parallel and square to centre line of conveyor.

- All idlers must be lined up exactly and square to centre line of conveyor. The belt must be joined (spliced) straight and square.

Starting the conveyor

When starting up the conveyor, the belt may track more or less off centre, even if pulleys and idlers have been lined up reasonably well. Incorrect tracking of the empty belt is usually due to a combination of causes 1, 2, 3, 4, 5 and 6 mentioned above.

Assuming that the pulleys and idlers have been lined up as well as practicable and that the belt has been joined properly, bad tracking will have to be corrected by the slewing of the idlers until the belt is centred.

It is important to remember that a belt cannot usually be aligned correctly using guesswork. Methodical procedure and patience are absolutely essential and gradual corrections will eventually have to be made over a period of several days or possibly longer. Over-adjustment is almost certain to occur if hasty or excessive corrections are made, with the result that trouble-free running is very unlikely to be achieved.

Re-aligning a belt – General Principles

A useful tip when trying to guide a belt towards the centre (from either the left or the right) is to think of the belt as a packing case that is moving on a set of rollers. If the packing case (belt) needs to move towards the right hand side because the belt is running to the left then the left end of the roller should be advanced or the right end be shifted back.

In exactly the same manner, if the belt is running to the right of the centre line (looking in the direction of travel) and needs to be shifted towards the left hand, the idlers in question need to be slewed out of centre so that the right side is moved forward or the left side brought back.

To identify where such correction needs to be made, the most accurate method is to look along the edge of the travelling belt (in the direction of travel) so that it is easy to see the curving along the belt edge due to the belt travelling off centre. Having established where such a curve exists, a precise adjustment can be made as follows:

Avoid over-adjusting

After each adjustment it is important to observe the effect for a sufficiently long period to allow the belt to travel at least once around the full length of the conveyor before the next adjustment is being made. This is necessary because very few belts are manufactured or spliced perfectly straight. This means that there is always a certain amount of ‘weaving of the belt‘ to be expected at each idler and the position of the belt at any one idler must therefore be judged as the *average* position of this weaving.

Training a belt should always begin on the return belt beginning at the head or driving pulley, following the direction of the belt travel. Having centred the return belt, the top belt is trained, starting at the tail pulley and proceeding in direction of belt travel towards head or driving pulley.

If the top belt runs so much out of centre that it cannot be run for any length of time, it will be necessary to roughly train the top belt before training the return belt. In such a case, the top belt should only be trained so far that it can be run without risk of damage to belt edges after the return belt is centred, followed by the training of the top belt as previously described.

Alignment when loaded

Having trained the empty belt, the belt should be expected to run satisfactorily when it is loaded. If this is not the case then it is almost certainly due to the material not being fed centrally on to the belt. In such a situation the correct thing to do is to modify the feed chute so that the feed on the belt is well centred. This can be achieved by changing the shape of the chute or by introducing deflecting plates or bars.

Belt troughing

New belts that have a heavy construction (significant thickness in proportion to width) will not trough so well at first. When empty, heavy belts may rest almost entirely on the outside of the side rollers and have very little contact with the centre horizontal roller. The side rollers do not have sufficient line contact with the belt to guide it properly. For this reason, when a new belt is started and some difficulties are experienced in training the new belt when empty, it is better to simply train the belt sufficiently in order that running without damage to the belt is possible.

The belt should then be run under load for several days and gradually be trained until the belt runs true. It is generally found that a few days running under load will eliminate initial stretch and make the belt troughing easier. This will create better contact with the side rollers and will help to track the belt.

Efficient loading conditions

When in service, most belt wear occurs at loading points. Wear factors include feed direction relative to belt movement, belt speed, material characteristics and the impact of lumps and other heavy objects on the belt. In order to create efficient loading conditions that minimise wear on the belt surface the following guidance should be applied:

- Loading should be central with the material feeding at same speed and in same direction as belt travel.
- Reduce the free fall of material at loading point as much as possible.
- Cushion lumps by screening out fines in front of the toe of the chute.
- Use impact idlers to absorb the impact energy of the lumps.
- If skirting is used then it should be kept clear of the belt. At loading points the distance between skirt boards and the belt should increase in the direction of travel to prevent trapping. The delivery should be divergent in belt running direction.
- Ensure the delivery chute is not choked.

Adequate cleaning

It is very important that adequate means are provided for belt cleaning, particularly where materials are damp or sticky and have a tendency to build up on pulleys or return idlers and therefore cause the belt to run out of line.

Brushes

Dry materials may be removed from the belt with rotating bristle or rubber vane brushes driven at a higher surface speed than the belt. The brushes do tend however, to wear rapidly, require constant maintenance and are likely to clog if used with moist, wet or sticky materials.

Scrapers

Scrapers are normally mounted adjacent to the head pulley. Care should be taken to ensure that the scrapers are held against the belt surface with only sufficient pressure to remove the material without causing friction (abrasion) damage to the belt. With sticky materials, it is usually necessary to apply a scraper between the head and snub pulley. Water jets can be used to spray water onto the surface of the belt to help release the material from the belt surface before wiping with a rubber scraper.

Ancillary equipment

Ploughs

Ploughs should be placed immediately in front of the tail pulley or other pulleys on return run in order to prevent material being carried between the belt and pulley.

Skirt boards

The use of skirt boards is an accepted practice used to centre and settle the material on the belt as it leaves the loading point. The skirt boards should be vertical or inclined slightly outward at the top and set approximately one-sixth of the belt width in from each edge. Initially the opening is two-thirds of the belt width and then tapers out in the direction of belt travel. Generally speaking, the length should be four to five times the belt width in length to enable sufficient centring and settling of the load.

The skirt board should never be brought down tight against the belt surface. There should always be a substantial clearance (approximately 25 mm minimum), which is then closed with a rubber strip. The clearance between skirt boards and belt should increase in the direction of belt travel to allow freeing of any trapped material.

Screen bars

Incorporating screen bars into the back plate or chute when handling lumpy materials mixed with fines will allow the fines to fall through first and form a bed or cushion to help absorb the impact and minimise damage to the belt cover.

V-slots

A ‘V’ slot cut in the bottom of the chute is another effective method that can be used to allow fines to fall on the belt before the lumps.

Decking

Decking fitted between the top and return of a belt will catch the spillage of excess material from the top run. Although it might not be considered necessary for the entire length of the conveyor it is especially desirable at the loading point.

Self-aligning idlers

The efficiency of self-aligning idlers depends upon their freedom of movement so good maintenance is essential.

Efficient care and maintenance procedures

The belt itself should be inspected for cover cuts, gouges, abrasion, edge wear and exposed carcass at regular intervals. Both top and bottom covers of the belt should be inspected. The frequency of inspection will depend on the type and severity of service.

Damaged Carcass

Carcass fractures, tears and rips will worsen rapidly unless immediate repairs are carried out. If repair plates are used as an emergency (short term) solution then a permanent vulcanised repair or re-splice should be undertaken as soon as possible unless the belt has only a limited service life remaining.

Factors effecting belt life

The lifetime of a belt is invariably determined by wear, aging or mechanical accidents. Wear of the top cover depends on:

- Conveyor length
- Belt speed
- Transported material: size / shape / hardness
- Inclination angle of the conveyor at the loading point
- Scraper type
- Loading angle (velocity component of the material in belt direction)
- Loading direction (in line or square)
- Fall height of the material
- Cover quality

There are several other factors that can influence the abrasion of the top cover but which are more difficult to quantify because they can easily vary during the lifetime of the belt. These additional factors include:

- Pressure of the scraper blades on the belt
- Humidity of the material (depending on climatically conditions)
- Influence of (extra) pulleys (counterweight/tripper)
- Reversible belts
- Level of maintenance
- Cover aging due to heat, ozone and direct sunlight (UV rays)
- Chemical influences of the transported material on the top cover

With so many different individual and combined factors it is almost impossible to accurately predict the lifetime of a belt related to cover wear abrasion. The most accurate estimation is normally gained by analysing the history of belt lifetime on a particular conveyor together with a correction for the cover quality and cover thickness.

MATERIAL CHARACTERISTICS

Material	Bulk Density ρ (t/m³)	Surcharge Angle B (°)	Maximum Angle of Inclination Smooth Belts				Recomm. Dunlop Quality
				height of profiles 6 mm	16 mm	32 mm	
Alum	0.80 - 1.04	25	17	-	-	-	-
Aluminium, coarse	0.95 - 1.05	15	20	-	-	-	-
Aluminium, fine	0.70 - 0.80	6	20	-	25	30	-
Aluminium - Oxide	1.12 - 1.92	15	17	-	25	30	RS
Aluminium - Silicate	0.78	-	-	-	-	-	-
Aluminium - Sulphate (granular)	0.86	20	17	-	-	-	-
Aluminium - Turnings	0.11 - 0.24	-	-	-	-	-	-
Ammonium - Chloride (crysalline)	0.83	15	15	-	-	-	RA
Ammonium - Nitrate	0.72	25	23	-	-	-	RA
Ammonium - Sulphate, dry	1.10	10	15	-	-	-	-
Ammonium - Sulphate, granulated	0.72 - 0.93	15	15	-	-	-	RA
Ammonium - Sulphate, wet	1.30	15	17	-	-	-	-
Anthracite Coal	0.90	15	17	20	35	40	-
Apples	0.35	15	10 - 12	-	-	-	-
Asbestos ore	1.30	20	18	-	-	-	-
Asbestos, shred	0.32 - 0.40	15	22	-	-	-	-
Ash, caustic salt	0.81	-	-	-	-	-	-
Ash, coal - dry 80mm and under	0.56 - 0.64	10	18	-	-	-	RA - RS
Ash, coal - wet 80mm and under	0.72 - 0.80	25	20	-	30	35	RA - RS
Ash, fly	0.45 - 0.80	15	15	-	25	30	-
Ash, fly coal slack	0.64 - 0.72	15	15	-	25	30	RA - RS
Asphalt	1.00 - 1.30	-	-	-	-	-	-
Asphalt, binder for motorways	1.28 - 1.36	-	-	-	-	-	-
Asphalt, broken	0.70	-	-	-	-	-	RA
Asphalt, paving	1.30	30	20	-	-	-	RA
Bagasse	0.13	30	25	-	-	-	RA
Bakelite, fine	0.48 - 0.64	-	-	-	-	-	-
Ballast, broken	1.50 - 1.80	15	20	22	35	40	-
Barium carbonate	1.15	-	-	-	-	-	RA
Barley	0.60 - 0.70	5	12	20	30	35	RA
Barytes, coarse grained	2.4 - 2.9	-	-	-	-	-	-
Barytes, powdered	1.9 - 2.3	20	18	-	-	-	-
Basalt	1.6 - 2.3	15	17	-	25	30	RE - RS
Basalt lava	2.30	15	17	-	20	25	RE - RS
Bauxite, broken 80mm and under	1.20 - 1.36	20	20	-	25	30	RE - RS
Bauxite, earth broken	1.09	20	18	-	25	30	RE - RS
Bauxite, raw	2.55	15	20	22	35	40	-
Beans	0.85	10	12	-	-	-	RA
Beet pulp	0.40	15	14	-	25	25	RA
Beets	0.65	15	12	-	20	30	-
Bezonite, raw	0.54 - 0.64	-	-	-	-	-	-
Bicarbonate	0.65	20	15	-	-	-	RA
Bituminous coal, fine or nuts	0.90 - 1.00	15	18 - 20	22	30	35	-
Bituminous coal up to 50mm	0.80	20	24	20	35	40	RA - BV
Blast furnace slag, broken	1.30 - 1.60	15	15 - 20	-	25	30	-
Blast furnace slag, granulated, damp	1.50	15	18	-	25	30	RA - RS - RAS
Blast furnace slag, granulated, dry	0.50 - 0.60	10	15	18	25	30	RA - RS - RAS
Bone meal	0.90	20	15	-	-	-	-
Bones	0.60	20	17	-	-	-	-
Borax, coarse	0.96 - 1.04	15	15	-	25	30	RA
Bran	0.25 - 0.30	10	12	-	25	30	RA
Brown Coal briquettes	0.65 - 0.85	20	15	-	-	20	-
Brown Coal, dry	0.65 - 0.80	15	20	22	30	40	RA
Calcium carbide	1.12 - 1.28	15	18	-	25	30	RA
Calcium oxide	0.70	20	18	-	-	-	RA
Carbon pellets	0.35	5	15	20	25	30	RA
Carborundum up to 80mm	1.60	10	15	-	-	-	RS
Casein	0.60	15	15	-	-	-	-
Cast Iron swarf	2.08 - 3.20	20	22	-	-	-	RA
Cement, clinker	1.20 - 1.30	15	18	-	30	30	RE - RS
Cement, dry	1.20	10	20	22	30	30	-
Cement Mortar	2.00	10	8	-	-	-	-
Chalk, broken	1.35 - 1.45	15	17	-	30	30	RA
Chalk, pulverised	1.10 - 1.20	15	15 - 18	-	30	30	RA
Charcoal	0.35	15	20	-	25	30	RA
Chestnuts	0.80	5	8 - 10	-	30	40	-
Chrome Ore	2.00 - 2.24	10	17	-	-	-	RE - RS
Clay, calcined	1.28 - 1.60	15	18	20	30	40	RA - RS
Clay, dry	1.60	15	15	-	25	30	-

Material	Bulk Density ρ (t/m³)	Surcharge Angle B (°)	Maximum Smooth Belts	Angle of Inclination height of profiles 6 mm	16 mm	32 mm	Recomm. Dunlop Quality
Clay, dry	1.60 - 1.80	15	28	20	30	35	-
Clay, dry, lumps	0.96 - 1.20	15	15	20	30	35	RA - RS
Clay, wet	2.00	15	20	-	25	30	-
Clay, wet	1.80 - 2.00	15	15 - 18	20	30	40	-
Coal	0.95	10 - 15	10	-	-	30	-
Coal, anthracite up to 3mm	0.95	20	18	20	35	35	RA - BV
Coal dust	0.06 - 0.11	10	5	-	-	-	RA
Coal, pelletized	0.32 - 0.40	-	-	-	-	-	-
Cocoa beans	0.55	10	12	-	-	-	RA
Cocoa powder	0.50	5	20	-	25	30	RA
Coffee beans, green	0.55	10	12	-	25	30	RA
Coffee beans, raw	0.45 - 0.65	5	5	-	25	30	RA
Coffee beans, roasted	0.30 - 0.45	5	5	-	25	30	RA
Coke breeze up to 7mm	0.40 - 0.56	20	20	-	-	-	RA - RS - BV
Coke, loose	0.37 - 0.56	20	18	-	35	35	RE - RS
Coke, petroleum calcined	0.56 - 0.72	20	18	-	-	-	RA
Coleseed	0.65	5	15	20	25	30	-
Compost	0.80	15	15	20	25	30	ROM - ROS
Concrete, stone	2.08 - 2.40	-	-	-	-	-	-
Concrete, wet (Readymix)	1.76 - 2.40	-	-	-	-	-	-
Concrete with gravel	1.80	10	18	20	25	30	-
Concrete with limestone	2.00 - 2.20	15	10	22	27	32	-
Copper ore	1.92 - 2.40	15	15	-	-	-	RE - RS
Copper sulphate	1.20 - 1.36	15	15	-	-	-	RA
Copra flakes	0.40 - 0.60	10	17	-	-	-	ROM - ROS
Cork, broken	0.10 - 0.20	15	15	-	25	30	-
Cork, fine	0.20 - 0.25	15	17	-	25	30	RA
Cork, granulated	0.19 - 0.24	10	17	-	25	30	RA
Cornmeal	0.60 - 0.65	10	15	20	25	30	-
Cotton seed	0.4 - 0.5	20	15	-	-	-	-
Cotton seed flock	0.35	-	-	-	-	-	-
Cryolite, dust	1.20 - 1.44	-	-	-	-	-	-
Cryolite, Lumps	1.44 - 1.60	-	-	-	-	-	-
Dicalcium Phosphate	0.69	-	-	-	-	-	-
Disodium Phosphate	0.40 - 0.50	-	-	-	-	-	-
Dolomite, broken	1.60	15	10	-	30	35	-
Dolomite, pieces	1.44 - 1.60	15	17	-	30	35	RE - RS
Earth, dry	1.60	10	15	20	25	40	-
Earth, excavated dry	1.12 - 1.28	10	17	20	30	30	RA
Earth, wet	2.00	15	20	25	30	45	-
Earth, wet loamy	1.60 - 1.76	15	20	23	30	30	RA
Ebonite up to 13mm	1.04 - 1.12	-	-	-	-	-	-
Felspar, broken	1.6	20	18	-	25	30	RS
Felspar, lump size 40-80mm	1.44 - 1.76	-	-	-	-	-	-
Felspar, screened to 13mm	1.12 - 1.36	-	-	-	-	-	-
Fertilizer	0.90 - 1.20	15	20	25	30	35	-
Filter cake	1.15	10	15	-	-	-	-
Filter mud	0.60 - 0.80	10	12	-	-	-	-
Fishmeal	0.55 - 0.65	5	14	25	30	30	MORS-ROM
Flaxseed	0.70 - 0.75	5	14	20	30	35	MORS
Flourcalcium 40-80mm	1.76 - 1.92	-	-	-	-	-	-
Flourcalcium, screened	0.56 - 1.68	-	-	-	-	-	-
Flourspar	2.50	15	17	-	25	30	RE - RS
Fly ash	0.45 - 0.80	15	15	-	25	30	-
Foundry waste	1.12 - 1.60	-	-	-	-	-	-
Fruit	0.35	10	15	-	-	-	-
Fullers earth, dry	0.48 - 0.56	10	15	-	-	-	RA
Fullers earth, oil filter, burnt	0.64	-	-	-	-	-	-
Fullers earth, oil filter raw	0.56 - 0.64	-	-	-	-	-	-
Fullers earth, oily	0.96 - 1.04	20	20	-	-	-	RA
Glass, broken	1.30 - 1.60	15	18 - 20	-	-	-	-
Grain	0.60	-	12	-	-	-	RA
Granite, 40-50mm lumps	1.36 - 1.44	-	-	-	-	-	-
Granite ballast	1.40 - 1.80	15	15	-	25	30	-
Granite, broken	1.52 - 1.60	-	-	-	-	-	-
Granite, screened, up to 13mm	1.28 - 1.44	-	-	-	-	-	-
Graphite flock	0.60 - 0.65	10	15	-	-	-	RA
Graphite, pulverized	0.45	5	15	-	-	-	RA

Material	Bulk Density ρ (t/m³)	Surcharge Angle B (°)	Maximum Angle of Inclination Smooth Belts	height of profiles 6 mm	16 mm	32 mm	Recomm. Dunlop Quality
Grass seed	0.22	5	15	25	25	30	RA
Gravel	1.44 - 1.60	-	-	-	-	-	-
Gravel, dry	1.40 - 1.50	10	17	-	30	35	RA
Gravel, wet	1.80 - 1.90	15	18	-	30	35	RA
Green fodder	0.35	20	10 - 15	-	25	30	-
Ground nut kernels	0.35	10	14	18	20	25	ROM
Ground nuts, with shells	0.30	10	14	20	25	30	ROM
Ground nuts, without shells	0.35	18	12	-	20	25	-
Guano, dry	1.12	-	-	-	-	-	-
Gypsum, broken	1.35	15	15	-	25	30	-
Gypsum, burnt	1.80	10	15	-	25	30	RA
Gypsum mortar	1.20	10	-	8	-	-	-
Gypsum, pulverized	0.95 - 1.50	10	18	22	30	30	RA
Gypsum, sieved	1.45	15	17	-	25	30	RA
Household refuse	0.80	10	15 - 20	20	25	30	-
Husks, dry	0.45	22	20	-	-	-	RA - ROS
Husks, wet	0.90	22	20	-	-	-	RA - ROS
Iron Ore, broken	2.00 - 4.50	15	18	25	30	35	RS - RAS
Iron Ore, crushed	2.16 - 2.40	-	-	-	-	-	-
Iron Ore, pellets	5.00	5	12	-	20	25	RS - RAS
Iron Oxide, pigment	0.40	-	-	-	-	-	-
Iron turnings (Swarf)	2.00	-	-	-	-	-	-
Kaolin, broken	1.00	20	19	-	-	-	RA
Kaolin clay up to 80mm	1.00	20	19	-	-	-	RA
Kaolin, pulverized	0.70 - 0.90	30	20	-	-	-	RA
Kieselguhr	0.17 - 0.22	5	15	-	-	-	-
Kiln Brick	1.60	17	17	-	25 - 30	25 - 30	RA - RS
Lactose (milk sugar)	0.51	-	-	-	-	-	RA - RS
Lead - Arsenate	1.15	-	-	-	-	-	-
Lead Ore	3.20 - 4.70	15	17	-	25	30	RA
Lead - Oxide	0.96 - 2.40	15	15	-	25	30	RA
Legumes	0.85	5 - 10	8 - 10	-	-	20	-
Lime, hydrated	0.60	15	15	-	-	-	RA
Lime, lumps	1.20 - 1.36	-	-	-	-	-	-
Lime, pulverized	1.00 - 1.20	5	20	22	25	27	-
Lime, slaked	0.64	-	-	-	-	-	-
Lime up to 3mm	0.96	15	18	-	25	30	RA
Limestone, Broken	1.40 - 1.50	15	18	22	30	35	RA - RS
Limestone, dust	1.30 - 1.40	5	15	-	25	30	RA - RS
Linseed	0.72	5	12 - 15	20	30	35	-
Linseed cake	0.75 - 0.80	10	15	-	-	-	-
Magnesite	3.00	15	17	-	-	-	-
Magnesite, fine	1.04 - 1.20	-	-	-	-	-	-
Magnesium chloride	0.52	20	20	-	-	-	RA
Magnesium oxide	1.90	10	17	-	25	30	RA
Magnesium sulphate	1.10	10	16	-	25	30	RA
Magnetite	3.00	15	17	-	-	-	-
Maize	0.70 - 0.75	5	10 - 12	-	25	30	-
Maize, shelled	0.70	10	10	-	25	30	BV - ROM - BVO
Malt, dry	0.30 - 0.50	5	15	20	25	30	-
Manganese dioxide	1.28	-	-	-	-	-	-
Manganese ore	2.0 - 2.3	25	20	-	-	-	-
Manganese sulphate	1.12	10	15	-	-	-	-
Manure	1.10	15	20	25	30	30	ROS
Marble, broken	2.70	15	15	-	25	25	-
Marble, crushed, up to 13mm	1.44 - 1.52	15	17	-	25	25	RA - RS
Marl, dry	1.20 - 1.30	10	17	-	25	30	RA - RS
Meal	0.60 - 0.70	5	20	22	30	35	-
Molybdenite, powdered	1.71	15	18	-	-	-	RA
Mortar, cement	2.00	10	-	-	20	-	RA
Mortar, Gypsum	1.20	10	-	-	20	-	RA
Mortar, Lime	1.70	10	8	-	20	-	-
Moulding sand, core sand	1.04	15	20	-	-	-	-
Moulding sand, knock-out	1.45 - 1.60	10	18	-	-	-	-
Moulding sand, prepared	1.30 - 1.45	10	20	25	30	35	-
Mushrooms	0.40	10	15	-	25	30	-
Nickel Ore	2.40	-	-	-	-	-	-
Oats	0.55	5	15	20	25	30	RS
Oil Sand	1.50	15	15	-	25	30	-

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Ore, Copper	1.92 - 2.40	15	15	-	-	-	RE – RS
Ore, Iron	2.00 - 4.50	15	18	25	30	35	RS - RAS
Ore, Lead	3.2 - 4.7	15	17	-	25	30	RA
Ore, Manganese	2.0 - 2.3	25	20	-	-	-	-
Ore, Zinc	2.40	15	15	-	25	30	-
Overburden	1.7	15	17	-	-	-	-
Peas, dried	0.70 - 0.80	5	14	18	20	25	RA
Peat, dry	0.32 - 0.80	15	15	25	25	30	-
Peat, wet	0.65 - 1.00	15	12	-	25	30	-
Phosphate, broken	1.20	15	15	-	25	30	-
Phosphate, fertilizer	0.96	-	-	-	-	-	-
Phosphate, sand, cement	1.36	-	-	-	-	-	-
Phosphate, pulverized	0.96	-	-	-	-	-	-
Phosphate rock, broken	1.35 - 1.45	15	15	-	25	30	-
Plaster	1.70	10	15	-	20	-	RA
Portland cement	1.50	20	18	-	30	30	RA
Portland cement, loose	0.96 - 1.20	15	15	-	-	-	RA
Potash	1.35	10	17	20	25	30	RA - RS
Potash	1.10 - 1.60	10	20	-	30	35	-
Potash, broken	1.20 - 1.35	-	-	-	-	-	-
Potash salts, sylvite etc	1.28	-	-	-	-	-	-
Potassium (Saltpetre)	1.22	-	-	-	-	-	-
Potassium chloride pellets	1.92 - 2.08	-	-	-	-	-	-
Potassium sulphate	0.67 - 0.77	-	-	-	-	-	-
Potatoes	0.75	15	12	-	20	25	RA
Pulp, dry	0.20 - 0.25	15	15	-	25	30	-
Pulp, wet	0.40	15	12	-	25	25	-
Pumice stone	1.20	15	17	-	25	30	-
Pumice stone sand	0.70	10	15	20	25	30	-
Pyrites, Iron lump size 50-80mm	2.16 - 2.32	-	-	-	-	-	-
Pyrites, Iron Sulphide	2.00 - 2.50	15	15	-	25	30	-
Pyrites, pellets	1.92 - 2.08	15	15	-	25	30	RA - RS
Quartz, broken	1.60 - 1.75	15	17	-	25	30	-
Quartz, lump size 40-80mm	1.36 - 1.52	-	-	-	-	-	-
Quartz sand	1.70 - 1.90	15	17	20	25	30	RA - RS
Rape seed	0.80	5	12	15	25	25	-
Rice	0.70 - 0.80	5	8	12	20	25	RA
Roadstone, Broken (Porphyry)	1.50 - 1.70	15	20	22	30	35	-
Rock salt	1.00 - 1.20	10	15	-	30	35	-
Rubber, dust	0.60 - 0.65	10	20	-	25	30	-
Rubber, pelletized	0.80 - 0.88	10	20	-	25	30	RA
Rubber, reclaim	0.40 - 0.48	10	20	-	25	30	RA
Run of mine coal	0.80 - 1.00	15	18	22	35	40	-
Rye	0.70 - 0.80	5	15	20	30	35	RA
Salt, coarse	0.70 - 0.80	10	17	-	30	35	RA
Salt, common, dry	0.64 - 0.88	-	-	-	-	-	-
Salt, common, fine	1.12 - 1.28	10	17	25	30	35	RA
Saltpetre	1.10	5	15	20	25	30	-
Saltpetre	1.70	10	16	-	-	-	RA
Sand and gravel, dry	1.50 - 1.80	10	18	20	30	35	RA
Sand and gravel, wet	1.80 - 2.10	15	20	25	30	35	RA
Sand, dry	1.30 - 1.60	10	17	20	25	30	RA
Sand, foundry, prepared	1.44 - 1.60	20	17	-	30	35	RA
Sand pebble, dry	2.00	5	15	20	25	30	RA
Sand, wet	1.60 - 2.00	15	20	25	35	35	RA
Sandstone	1.36 - 1.44	15	17	-	30	35	RA - RS - RAS
Sawdust	0.20 - 0.30	20	18	20	25	25	ROM
Sewage Sludge	0.64 - 0.80	-	15	-	-	-	RA - ROS
Shale	2.70	15	18	-	25	30	RA - RS - RAS
Shale, broken	1.44 - 1.60	-	-	-	-	-	-
Shale dust	1.12 - 1.28	-	-	-	-	-	-
Shale, lump size 40-80mm	1.36 - 1.52	-	-	-	-	-	-
Sinter, blast furnace, dry	1.50	15	15	-	25	30	-
Slag, blast furnace	1.50	15	-	25	30	-	-
Slag, blast furnace, broken	1.28 - 1.44	10	15	-	25	30	RA - RS - RAS
Slag, porous, broken	0.60	15	15	-	25	30	-
Slate, broken	1.40 - 1.55	15	17	-	25	30	RA – RE

Material	Bulk Density ρ (t/m³)	Surcharge Angle B (°)	Maximum Angle of Inclination Smooth Belts	height of profiles 6 mm	16 mm	32 mm	Recomm. Dunlop Quality
Soap beads or granules	0.24 - 0.40	10	12	18	25	-	RA
Soap flakes	0.15 - 0.35	10	18	22	25	30	RA
Soda	0.90 - 1.20	-	17	-	20	25	RA
Soda ash, heavy	0.88 - 1.04	-	-	-	-	-	-
Soda ash, light	0.32 - 0.56	-	-	-	-	-	-
Sodium Bicarbonate	0.65	-	-	-	-	-	-
Sodium nitrate	1.12 - 1.28	-	-	-	-	-	-
Soot	0.40 - 0.75	5	15	20	25	30	-
Soya beans	0.80	15	18	-	-	-	ROS
Steel trimmings, shredded	1.60 - 2.40	-	-	-	-	-	-
Stone, broken, small	1.50 - 1.80	15	15	-	25	30	-
Stone, large, sized	1.40 - 1.60	15	15	-	20	25	-
Stone, sized	1.55 - 1.70	10	15	-	22	27	-
Sugar cane, raw	0.88 - 1.04	10	19	22	25	-	RA
Sugar, granulated	0.60 - 0.80	5	15	20	25	-	RA
Sugar, powdered	0.80 - 0.96	0	12	16	20	25	RA
Sugar, raw	0.90 - 1.50	15	20	20	25	-	-
Sugar-beet	0.70	18	18	-	-	30	RA
Sugar-beet, sliced, damp	0.40	15	18 - 20	-	25	30	-
Sugar-beet, sliced, dry	0.20 - 0.25	-	18	-	25	30	-
Sugar-beet, wet	0.88 - 1.04	-	-	-	-	-	-
Sulphate, ferrous	0.80 - 1.20	-	-	-	-	-	-
Sulphur, broken	1.30	15	17	20	30	35	RA
Sulphur, pulverized	0.90	5	19	25	30	35	RA
Table Salt	0.80	10	20	25	30	35	-
Tile, hard	2.00	-	-	-	-	-	-
Tile, soft	1.60	-	-	-	-	-	-
Titanium, washed	0.96 - 1.12	15	17	-	-	-	RA - RS - RAS
Tomatoes	0.90	10	10 - 12	-	20	30	-
Wheat	0.75	10	14	20	30	35	ROM
Wheat, flour	0.55 - 0.65	5	20	22	30	35	-
Wood chips	0.30 - 0.40	-	15	-	20	-	-
Wood chips, wet	0.60 - 0.85	10	20	-	20	-	-
Wood shavings	0.16 - 0.48	5	12	18	20	25	RA - ROM
Zinc Ore	2.40	15	15	-	25	30	-
Zinc Ore, burnt	1.60	-	-	-	-	-	-
Zinc Ore, crushed	2.56	15	17	-	25	30	RA - RS - RAS
Zinc Oxide, heavy	0.48 - 0.56	15	17	-	20	25	RA
Zinc Oxide, light	0.16 - 0.24	-	-	-	-	-	-
Zinc Sulphate	3.70	15	17	-	25	30	RA

USEFUL DATA

Conversion factors (to 3 decimal places)

LENGTH				
Feet	x	0.304	=	metres
Inches	x	25.4	=	millimetres
Metres	x	3.280	=	feet
Metres	x	39.370	=	inches
FORCE/LENGTH				
Pounds force per inch	x	0.175	=	Newton/millimetre
Newton/millimetre	x	5.710	=	pounds force/inch
Kg/cm	x	0.980	=	Newton/millimetre
TEMPERATURE				
Degrees Fahrenheit	=	$\frac{9}{5}$ (°C) + 32		
Degrees Centigrade	=	$\frac{5}{9}$ (°F – 32)		
PRESSURE				
Bar	x	10	=	Newton/cm²
Bar	x	100	=	Kilonewton/cm²
Bar	x	14,5	=	Pounds/inch² (psi)
BELT STRENGTH				
PIW	x	1.75	=	N/mm
(Based on safety factor of 10 f.e.		PIW 440	=	800 N/mm)

CONVEYOR BELT QUESTIONNAIRE

Conveyor reference number and location:

CONVEYOR BELT CURRENTLY INSTALLED			
Belt length	m	Belt width	mm
Tensile strength	N/mm	Number of plies	
Top cover thickness	mm	Bottom cover thickness	mm
Cover/Belt quality		Belt thickness	mm

CONVEYOR DETAILS			
Conveyor length	m	Total height	m
Belt speed	m/s	Max. inclination angle (deg.)	
Troughing angle (degrees)		Capacity	ton/hr
Idler spacing carrying side	mm	Idler spacing return side	mm
Idler diameter carrying side	mm	Idler diameter return side	mm
Drive pulley diameter	mm	Kind of pulley lagging	
Tension pulley diameter	mm	Tensioning system	
Tail pulley diameter	mm	Available take-up length	m
Bend/snub pulley diameter	mm	Location tensioning system	

Please state if any of the following is applicable and where possible describe:

Number and type of scrapers	
Length of the skirting boards	m
Tripper height	m

DRIVE SYSTEM			
Installed motor power	Kw	Coupling system	
Where is the drive situated		Angle of wrap (degrees)	

MATERIALS CARRIED			
Kind of material		Lump size	mm
Density	t/m^3	Max. temp.	^{o}C
Fall height	M	Average temp.	^{o}C

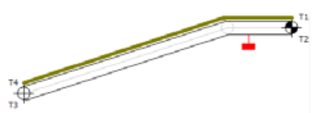
OPERATING CONDITIONS			
Minimum temperature	^{o}C	Is the conveyor covered?	
Other remarks			

CONVEYOR PROFILE


Horizontal ☐


Inclined ☐


Inclined combi 1 ☐


Inclined combi 2 ☐

ELEVATOR BELT QUESTIONNAIRE

Elevator reference no. and location:

ELEVATOR BELT CURRENTLY INSTALLED			
Belt length	m	**Belt width**	mm
Tensile strength	N/mm	**Number of plies**	
Pulley side cover thickness	mm	**Bucket side cover thickness**	mm
Cover/Belt quality		**Belt thickness**	mm

ELEVATOR DETAILS			
Elevator height	m	**Capacity**	ton/hr
Bucket weight	kg	**Belt speed**	m/s
Bucket pitch	mm	**Drive pulley diameter**	mm
Bucket volume	litre	**Tail pulley diameter**	mm
Bucket width	mm	**Drive pulley lagging**	
Number of bucket rows		**Tensioning system**	
Number of holes/bucket		**Available take-up length**	m
Number of rows/bucket		**Kind of loading**	
Hole diameter	mm		

DRIVE SYSTEM			
Installed motor power	Kw	**Coupling system**	
Motor management			

MATERIALS CARRIED			
Kind of material		**Lump size**	mm
Density	t/m^3	**Max. temp.**	^{o} C
Presence of oil or grease		**Average temp.**	^{o} C

OPERATING CONDITIONS			
Minimum temperature Environment	^{o} C	**Is the elevator ventilated?**	
Other remarks			