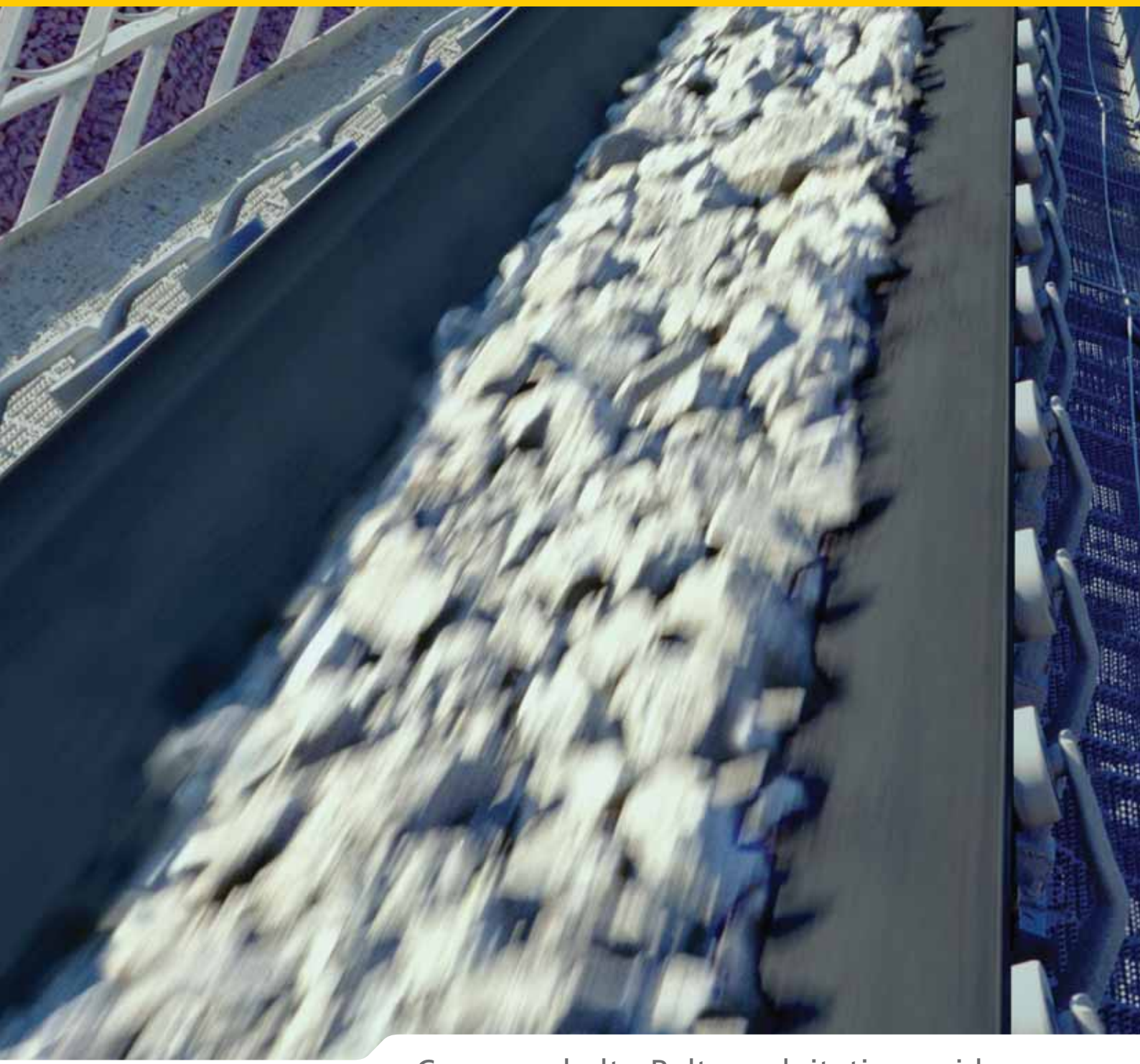

Conveyor belts. Belts exploitation guide.

ZGB

the belts for every conveyor

The range of products

IMPORTANT FOR YOU DEAR USER!

ZGB S.A. – ONE OF THE FEW PRODUCERS IN THE WORLD WHICH HAS ALL PRODUCTION TECHNOLOGIES OF TEXTILE BELTS

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ZGB S.A. began their own activity in the year 1945.
In 1983, we began to build the very modern factory in Bytom–Łagiewniki, which was equipped with the latest machines and devices brought from England, Germany and Italy. In July 1988 we started the production.
The modern technology and the high qualified technical and engineering personnel produces products on high world level.
The solid care for the quality of our products and the care for the protection of the environment contributed to obtain the certificates of Quality System according to ISO 9001 standard and the Environmental Management System that fulfils the ISO 14001 standard.

ZGB S.A. – one of the biggest producers of conveyor belts in Europe has at its disposal the wide offer of conveyor belts for: mining, energy, cement, metallurgic, mineral, building industry, the sugar factories and others.

ZGB S.A. is the company which steers its own policy of the activity into the Customer's side, to fulfil their expectations and to know their preferences. We are flexible for any expectations of our customers in the range of price level, terms of payment and conditions of delivery and the service. Our customers have at their disposal computer–aided system selecting the belts which enables to offer the belts adjusted precisely to the customer's needs.

ZGB S.A. is open for co–operation, exchanging the experiences and proposals of our trade partners. Our staff is always ready to assist the customers in the range of technical advises respecting fitting the belts, optimalization of exploitation and making joints.

- We possess the latest professional computer programme of selection of the belts to the conveyor – QNK–Pro.
- In the operating period we assure the full service.
- We hold the solid contact with the User by monitoring the production process; we assemble all information and suggestions of our receivers.
- ZGB S.A. guarantees the top quality.

Conveyor belts

Application of belts

Textile - rubber conveyor belts are used to transport of loose materials in lumps and pieces at ambient temperature ranging from -25 to +60°C.

Belts are most often used in:

- mineral raw materials mines,
- quarries of the coal,
- cement industry,
- paper industry,
- sugar factories,
- agriculture,
- power stations,
- quarries.

The construction of belts

The belt consists of textile- rubber carcass and rubber covers. The carcass can consist of 2 up to 6 plies made from synthetic fabrics „P" — polyamide or „EP" — polyamide–polyester, jointed by interlayer mixture. Covers and edges protect the carcass from damages, the activity of weather conditions and from the activity of chemicals. The destination and the kind of transported material indicates the kind of cover of the belt. The covers are made in class 1, 2, 3, A, AA – classes of ZGB S.A. and D, H, L – according to PN-EN ISO 14890:2004.

Series of belts of the type Z

Number of plies	Tensile strength, [kN/m]	on the fabric „P"		on the fabric „EP"		Belts width [mm]
		The thickness of the carcass, [mm]	The weight od the carcass, [kg/m^2]	The thickness of the carcass, [mm]	The weight od the carcass, [kg/m^2]	
2	400	2,9	3,75	2,9	3,94	400 ÷ 1200
	500	3,3	4,06	3,3	4,18	
	630	3,5	4,34	3,7	4,51	
	800	3,9	4,72	3,9	4,89	
	1000	5,5	5,25	5,1	5,65	
	1250	*	*	5,5	6,22	
3	500	*	*	4,6	5,91	400 ÷ 2000
	630	4,6	5,63	5,2	6,28	
	800	5,2	6,09	5,8	6,77	
	1000	5,5	6,52	6,1	7,34	
	1250	6,1	7,09	7,9	8,48	
	1400	7,0	7,17	7,9	8,48	
	1600	*	*	8,2	8,65	
4	800	6,3	7,51	6,3	7,89	
	1000	7,1	8,12	7,1	8,38	
	1250	7,5	8,69	7,9	9,03	
	1400	7,9	9,18	8,3	9,79	
	1600	8,3	9,45	8,3	9,79	
	1800	9,5	9,56	10,7	11,31	
	2000	11,5	10,51	10,7	11,31	
5	1000	8,0	9,39	8,0	9,87	
	1250	9,0	10,15	9,0	10,48	
	1400	9,0	10,15	10,0	11,29	
	1600	9,5	10,86	10,0	11,29	
	1800	10,0	11,48	10,5	12,24	
	2000	10,5	11,81	10,5	12,24	
	2500	14,5	13,14	14,0	14,43	
	3000	*	*	14,5	15,57	
6	1400	10,9	12,19	10,9	12,57	
	1600	10,9	12,19	12,1	13,54	
	1800	11,5	13,05	12,1	13,54	
	2000	12,1	13,79	12,7	14,68	
	3000	17,5	15,78	16,9	17,30	
	3500	*	*	17,5	18,67	

The basic lengths of the belt are 100 mtr, 150 mtr and 200 mtr.

Back

Physico – mechanical parameters of covers

Class acc. to WT-36.07.ZGB	Tensile strength, [MPa] min.	Elongation at break, [%] min.	Abrasion [cm^3] max.	Hardness [°ShA] ± 5	Resistance to thermal ageing 70°C 144h, %, max.		Cover mass, 1 mm/m^2 [kg]	Application
					Δ Rr	Δ Er		
1	20	400	0,10	60	15	25	1,21	Lightly, moderately abrasive materials
A	25	450	0,12	65	20	30	1,21	
AA	18	400	0,09	60	15	25	1,21	
2	15	350	0,15	65	20	30	1,30	Lightly, moderately abrasive materials
3	10	300	0,20	65	25	35	1,35	
2*	15	350	0,10	60	20	30	1,33	Anti-adhesive cover

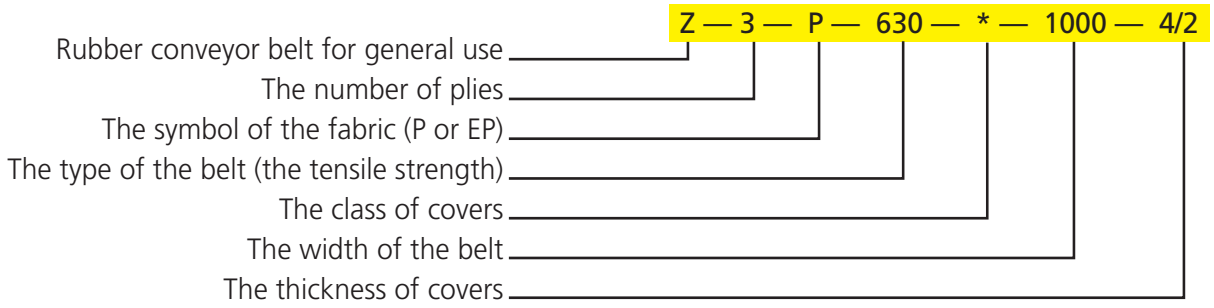
Class acc. to PN EN-ISO14890:2004	Tensile strength, [MPa] min.	Elongation at break, [%] min.	Abrasion [cm^3] max.	Hardness [°ShA] ± 5	Resistance to thermal ageing 70°C 144h, %, max.		Cover mass, 1 mm/m^2 [kg]	Application
					Δ Rr	Δ Er		
H	24	450	0,12	65	25	25	1,21	Heavily, extremely abrasive materials, shape lumps
D	18	400	0,10	60	25	25	1,21	
L	15	350	0,20	65	25	25	1,30	Lightly, moderately abrasive materials

* the version in second class can be produced also as the special version — anti–adhesive

Physico – mechanical data of belts

Standard PN EN-ISO 14890:2004	
Elongation at 10% nominal strength, max.	4,0%
Adhesion strength between plies, min.	4,5 kN/m
Adhesion strength between covers and carcass, min.	3,5 kN/m

The example of belt marking



Following the customer's wishes we can deliver the belts in different widths, class and thickness of covers and roll lengths.
Advice on cover selection can be given against full conveyor details.
For calculation of the total belt thickness it is necessary to add to the thickness of the carcass the total thickness of covers (carrying and pulley sides).
For calculation of the total belt weight on m^2 it is necessary to add to the carcass weigth the total weigth of covers.

The carcass tolerance of weights is ± 5%, of thickness is ± 5%.

The construction and requirements according to standards: DIN 22102 and PN EN-ISO 14890:2004.
The class of the electric safety according PN-EN-12882 class 1.

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EN ISO 9001
EN ISO 14001:2004

Back

Application of belts

Polyvinyl chloride conveyor belts for general use are used to transport of loose materials in lumps and pieces at ambient temperature ranging from -25 to +60°C.

Belts are most often used in:

- mineral raw materials mines,
- quarries of the coal,
- cement industry,
- paper industry,
- sugar factories,
- agriculture.

The construction of belts

The belts consist of the carcass which is based on several plies of fabric impregnated polyvinyl–chloride paste and of the ZPVC covers in standard class.

The covers of belts are highly specialised mixture of polyvinyl – chloride with easy self cleaning surface for transport of damp and gluey material like chalk or clay.

Application of special plastyficator compound allows for working in lower temperatures. This belts have heighten oil and lubricant resistance.

Series of ZPVC belts type

Number of plies	*Tensile strength, [kN/m]*	*The thickness of the carcass, [mm]*	*The weight of the carcass, [kg/m^2]*	*Belts width [mm]*
2	500	4,0	3,53	*500 ÷ 1400*
	630	4,6	4,54	
	800	5,0	5,11	
3	500	5,4	4,87	
	630	5,7	5,10	
	800	6,0	5,30	
	1000	6,9	6,81	
4	630	7,2	6,50	
	800	7,6	6,80	
	1000	8,0	7,07	
	1250	9,2	9,08	

The basic lengths of the belt are 100 mtr, 150 mtr and 200 mtr.

Following the customer's wishes we can deliver the belts in different widths, class and thickness of covers and roll lengths.
Advice on cover selection can be given against full conveyor details.
For calculation of the total belt thickness it is necessary to add to the thickness of the carcass the total thickness of covers (carrying and pulley sides).
For calculation of the total belt weight on m^2 it is necessary to add to the carcass weigth the total weigth of covers.
The carcass tolerance of weights is ± 5%, of thickness is ± 5%.

Back

Physico – mechanical parameters of covers

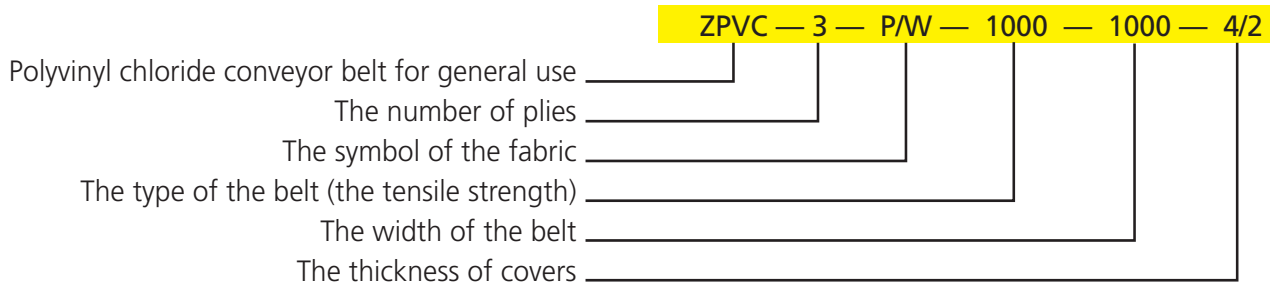
Tensile strength, [MPa] min.	Elongation at break, [%] min.	Abrasion, [cm^3] max.	Cover mass 1 mm/m^2 [kg]
15	200	0,20	1,29

Physico – mechanical data of belts

Elongation at 10% nominal strength, max.	4,0%
Adhesion strength between plies, min.	5,5 kN/m

The construction and requirements according to norms: DIN 22102, TWT-59 and PN EN-ISO 14890:2004.
The class of the electric safety PN-EN-12882 class 1, 2A, 3A.

The example of belt marking



We offer help in finding the best solutions for the system of transportation.

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EN ISO 9001
EN ISO 14001:2004

Textile–rubber flame–resistant antistatic conveyor belts

Application of belts

Transport of loose materials in lumps and pieces at ambient temperature ranging from -25 to +60°C. Transport at highly inclination, fulfil security expectations in fire hazard conditions.

Belts are most often used in:

- work on surface of coal mine,
- power – industry,
- thermal – electric power station.

The construction of belts

The belt consists of the textile – rubber carcass and rubber covers. The carcass can consist of 2 up to 6 plies made from synthetic fabrics „P" — polyamide or „EP" — polyamide–polyester, jointed by interlayer mixture. Covers and edges protect the carcass from damages, the activity of weather conditions and from the activity of chemicals. The destination and the kind of transferred material indicates the kind of cover of the belt.

The covers are made in class 2, 3 – classes of ZGB S.A. and L according to PN EN ISO 14890:2004.

Series of T belts type

Number of belts	Tensile strength, [kN/m]	on the fabric „P"		on the fabric „EP"		belts width [mm]
		The thickness of the carcass [mm]	The weight of the carcass,]kg/m^2]	The thickness of the carcass [mm]	The weight of the carcass,]kg/m^2]	
2	400	2,9	4,00	2,9	4,20	400 ÷ 1200
	500	3,3	4,31	3,3	4,44	
	630	3,5	4,59	3,7	4,77	
	800	3,9	4,97	3,9	5,15	
	1000	5,5	5,50	5,1	5,91	
	1250	*	*	5,5	6,48	
3	500	*	*	4,6	6,29	400 ÷ 2000
	630	4,6	6,00	5,2	6,66	
	800	5,2	6,46	5,8	7,15	
	1000	5,5	6,89	6,1	7,72	
	1250	6,1	7,46	7,9	8,86	
	1400	7,0	7,54	7,9	8,86	
	1600	*	*	8,2	9,03	
4	800	6,3	8,00	6,3	8,39	
	1000	7,1	8,61	7,1	8,88	
	1250	7,5	9,18	7,9	9,53	
	1400	7,9	9,67	8,3	10,29	
	1600	8,3	9,94	8,3	10,29	
	1800	9,5	10,05	10,7	11,81	
	2000	11,5	11,00	10,7	11,81	
5	1000	8,0	10,00	8,0	10,49	
	1250	9,0	10,76	9,0	11,10	
	1400	9,0	10,76	10,0	11,91	
	1600	9,5	11,47	10,0	11,91	
	1800	10,0	12,09	10,5	12,86	
	2000	10,5	12,42	10,5	12,86	
	2500	14,5	13,75	14,0	15,05	
	3000	*	*	14,5	16,19	
6	1400	10,9	12,92	10,9	13,33	
	1600	10,9	12,92	12,1	14,30	
	1800	11,5	13,78	12,1	14,30	
	2000	12,1	14,52	12,7	15,44	
	3000	17,5	16,51	16,9	18,06	
	3500	*	*	17,5	19,43	

The standard belt lengths are 100 m, 150 m, 200 m. Maximum electric surface resitance is max. 3x10^8 Ω.

Back

Following the customer's wishes we can deliver the belts in different widths, class and thickness of covers and roll lengths.
Advice on cover selection can be given against full conveyor details.
For calculation of the total belt thickness it is necessary to add to the thickness of the carcass the total thickness of covers (carrying and pulley sides).
For calculation of the total belt weight on m^2 it is necessary to add to the carcass weigth the total weigth of covers.

The carcass tolerance of weights is ± 5%, of thickness is ± 5%.

Physico – mechanical parameters of covers

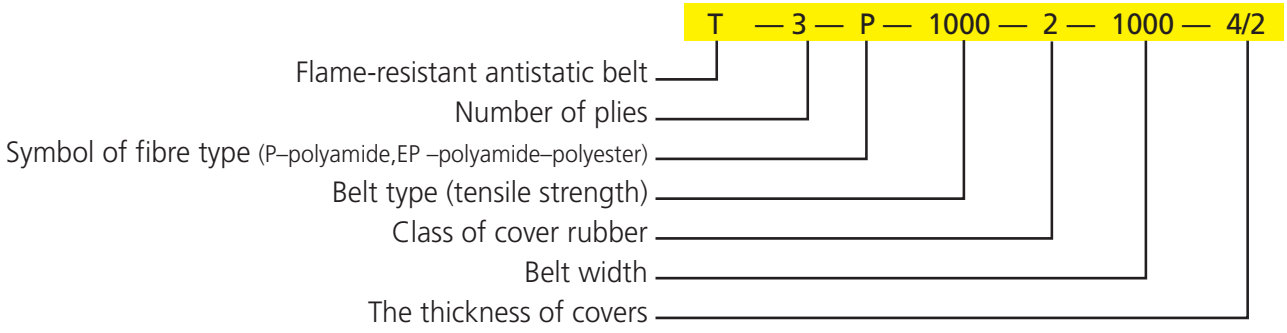
Class acc. to PN EN-ISO 14890:2004	Class acc. to WT-36.02 ZGB	Tensile strength, [MPa] min.	Elongation at break, [%] min.	Abrasion [cm^3] max.	Hardness [°ShA] ± 5	Cover mass 1 mm/m^2 [kg]	Application
L	–	15	350	0,20	70	1,45	Lightly, moderately abrasive materials
–	3	10	300	0,20	70	1,45	
–	2	15	350	0,13	60	1,32	Heavily, extremely abrasive materials, shape lumps

Physico – mechanical data of belts

Standard PN EN-ISO 14890:2004	
Elongation at 10% nominal strength, max.	4,0%
Adhesion strength between plies, min.	4,5 kN/m
Adhesion strength between covers and carcass, min.	3,5 kN/m

The construction and requirements according to norm PN EN-ISO 14890:2004.
Flame resistance according to DIN 22103.
The class of the electric safety PN-EN-12882 class 2A.

The example of belt marking



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EN ISO 9001
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Back

Application of belts

Transport of loose materials in lumps and pieces at ambient temperature ranging from -25 to +60°C.

Belts fulfil all security norms of flame resistance and electrostatic in fire hazard conditions of underground mines.

The construction of belts

The belt consists of carcass made of several plies and of fire resistant rubber covers. The rubber covers thanks to a large content of caoutchoucs possess enlarged coefficient of friction, efficiently at large inclinations and at the elevated moisture.

Recommended for high tonnage and at large inclinations of conveyors.

On the special order in the case of extreme inclinations, the large moisture exists the possibility to produce the GT belts with the developed super covers – „KARO".

Series of GT belts type

Number of plies	*Tensile strength, [kN/m]*	*on the fabric „P"*		*on the fabric „EP"*		*belt widths [mm]*
		The thickness of the carcass [mm]	*The weight of the carcass, [kg/m²]*	*The thickness of the carcass [mm]*	*The weight of the carcass, [kg/m²]*	
2	800	5,1	6,66	4,7	6,31	*500 ÷ 2000*
	1000	6,7	7,31	5,9	7,07	
3	800	6,4	8,15	7,0	8,89	
	1000	6,7	8,58	7,3	9,46	
	1250	7,9	10,00	9,1	10,60	
	1400	8,8	10,08	9,1	10,60	
4	1000	7,9	9,74	7,9	10,04	
	1250	8,3	10,31	8,7	10,69	
	1400	8,7	10,80	9,1	11,45	
	1600	9,9	12,20	9,1	11,45	
	1800	11,1	12,31	11,5	12,97	
	2000	13,1	13,49	11,5	12,97	
5	1600	9,5	11,47	10,0	11,91	
	1800	10,0	12,09	10,5	12,86	
	2000	11,5	13,84	10,5	12,86	
	2500	15,5	15,46	14,0	15,05	

The standard belt lengths are 100 m, 150 m, 200 m. Maximum electric surface resitance is max $3x10^8$ Ω.

Following the customer's wishes we can deliver the belts in different widths, class and thickness of covers and roll lengths.
Advice on cover selection can be given against full conveyor details.
For calculation of the total belt thickness it is necessary to add to the thickness of the carcass the total thickness of covers (carrying and pulley sides).
For calculation of the total belt weight on m^2 it is necessary to add to the carcass weigth the total weigth of covers.

The carcass tolerance of weights is ± 5%, of thickness is ± 5%.

Back

Physico – mechanical parameters of covers

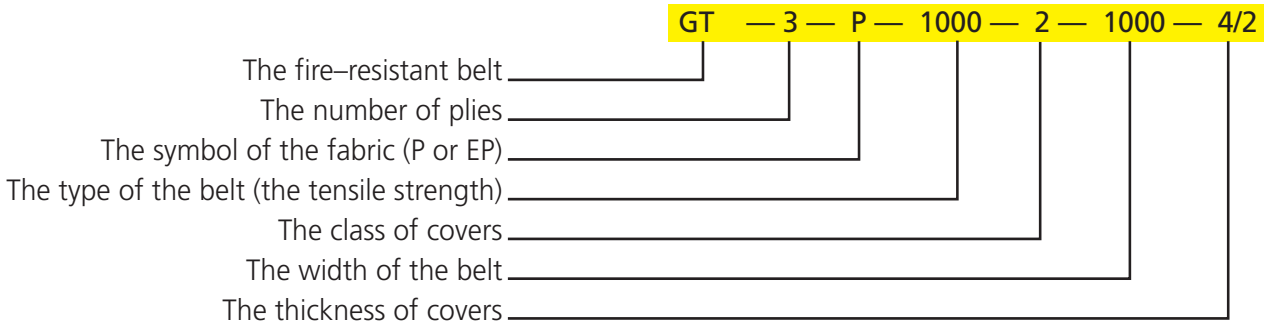
Class acc. to PN EN-ISO 14890:2004	Class acc. to WT-36.08 ZGB	Tensile strength [MPa] min.	Elongation at break, [%] min.	Abrasion [cm³] max.	Hardness [°ShA] ± 5	Cover mass 1 mm/m² [kg]
L	2	15	350	0,20	65	1,43

Physico – mechanical data of belts

Standard PN EN-ISO 14890:2004	
Elongation at 10% nominal strength, max.	4,0%
Adhesion strength between plies, min.	4,5 kN/m
Adhesion strength between covers and carcass, min.	3,5 kN/m

The construction and requirements according to norms: WT-66, PN EN-ISO 14890:2004.
Fire-resistance according to PN-93/C-05013 and DIN 22109.
The class of the electric and fire safety PN-EN-12882 class – 4A, 4B, 5A, 5B.

The example of belt marking



We keep in touch with the customer thorough checking the working belts; we collect crucial information and our customer's opinions.

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TÜV CERT TÜV NORD EN ISO 9001 EN ISO 14001:2004

Application of belts

The transportation of bulk materials, in lumps or pieces in the ambient temperature from –25°C to +60°C.
Belts can be used in underground ores mines of non–ferrous metals and mineral raw materials and non-flammable minerals.

The construction of belts

The construction of the belts consists of the carcass of several plies (fabrics) and fire–resistance rubber covers.
The rubber covers thanks of the large content of caoutchoucs possess enlarged coefficient of friction, efficiently at large inclinations and at the elevated moisture.

Recommended for high tonnage and at large inclinations of conveyors.

Series of GPM belts type

Number of plies	Tensile strength, [kN/m]	The thickness of the carcass [mm]	The weight of the carcass, [kg/m^2]	The width of belts [mm]
2	1000	6,7	7,31	500 ÷ 2000
3	1000	6,7	8,58	
	1250	7,9	10,00	
	1400	8,8	10,08	
4	1250	8,3	10,31	
	1400	8,7	10,80	
	1600	9,9	12,20	
	1800	11,1	12,31	
	2000	13,1	13,49	
5	1600	9,5	11,47	
	1800	10,0	12,09	
	2000	11,5	13,84	

The standard belt lengths are 50 m, 100 m, 150 m, 200 m. Maximum electric surface resitance is $3x10^8$ Ω.

Following the customer's wishes we can deliver the belts in different widths, class and thickness of covers and roll lengths.
Advice on cover selection can be given against full conveyor details.
For calculation of the total belt thickness it is necessary to add to the thickness of the carcass the total thickness of covers (carrying and pulley sides).
For calculation of the total belt weight on m2 it is necessary to add to the carcass weigth the total weigth of covers.

The carcass tolerance of weights is ± 5%, of thickness is ± 5%.

Back

Physico – mechanical parameters of covers

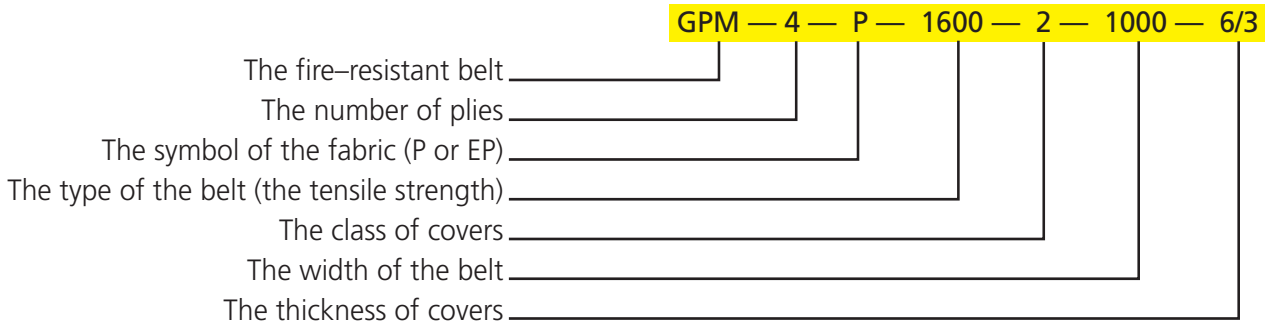
class acc. PN EN-ISO 14890:2004	class acc. WT-36.02.ZGB	Tensile strength, [MPa] min.	Elongation at break, [%] min.	Abrasion [cm³] max.	Hardness [°ShA] ± 5	Cover mass, 1 mm/m² [kg]
L	2	15	350	0,20	70	1,45

Physico – mechanical data of belts

Standard PN EN-ISO 14890:2004	
Elongation at 10% nominal strength, max.	4,0%
Adhesion strength between plies, min.	4,5 kN/m
Adhesion strength between covers and carcass, min.	3,5 kN/m

The construction and requirements according to norms: WT-66 and PN EN-ISO 14890:2004
fire-resistance according to PN-93/C-05019, EN-20340.
The class of the electric and fire safety PN-EN-12882 class 2B, 3A, 3B.

The example of belt marking



ZGB S.A. is the company that guarantees supreme quality.

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TÜV CERT TÜV NORD EN ISO 9001 EN ISO 14001:2004

Application of belts

The transportation of bulk materials, in lumps or pieces in the ambient temperature from 5°C to +60°C.

Belts fulfil all security norms of flame resistance and electrostatical in fire hazard conditions of underground mines.

The construction of belts

The construction of the belt consists of the carcass (one – monoply) or several plies impregnated by paste of the polyvinyl chloride and fire–resistant rubber covers.

• **PWG multi–plies** are cheaper alternative of rubber fire–resistant belts. Rubber covers thanks to the large content of caoutchoucs possess enlarged coefficient of friction, efficiently at large inclinations and at the elevated moisture.

• **PWG 1–ply** of the type solid–woven, recommended to work at small diameters of drums.

Advantages:
- the high impact resistance, flexibility for troughing,
- the resistance for longitudinal cracks,
- reduced belt elongation.

Recommended for high tonnage and at large inclinations of conveyors.

Series of belts PWG belts type

Number of plies	*Tensile strength, [kN/m]*	*The thickness of the carcass, [mm]*	*The weight of the carcass, [kg/m^2]*
1	1000	8,0	9,74
	1250	11,0	11,50
	1400	11,5	11,40
	1600	12,0	12,40
	1800	12,0	13,60
	2000	14,0	14,77
3	1000	7,0	8,84
	1250	8,2	8,98

The standard belt lengths are 100 m, 150 m, 200 m. Electric surface resistively is max $3x10^8$ Ω.

Following the customer's wishes we can deliver the belts in different widths, class and thickness of covers and roll lengths.
Advice on cover selection can be given against full conveyor details.
For calculation of the total belt thickness it is necessary to add to the thickness of the carcass the total thickness of covers (carrying and pulley sides).
For calculation of the total belt weight on m^2 it is necessary to add to the carcass weigth the total weigth of covers.
The carcass tolerance of weights is ± 5%, of thickness is ± 5%.

Physico – mechanical parameters of covers

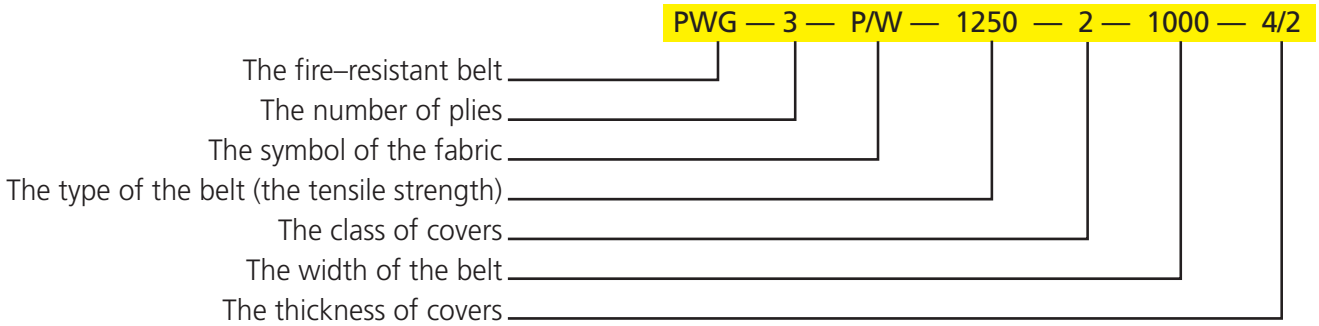
Class acc. to PN EN-ISO 14890:2004	*Class acc. to WT-36.08.ZGB*	*Tensile strength, [MPa] min.*	*Elongation at break, [%] min.*	*Abrasion [cm³] max.*	*Hardness [°ShA] ± 5*	*Cover mass 1 mm/m² [kg]*
L	2	15	350	0,20	65	1,43

Physico – mechanical data of belts

Standard PN EN-ISO 14890:2004	
Elongation at 10% nominal strength, max.	4,0%
Adhesion strength between plies, min.	4,5 kN/m
Adhesion strength between covers and carcass, min.	3,5 kN/m

The construction and requirements according to norms: WT-66, PN EN-ISO 14890:2004.
Fire-resistance according to PN-93/C-05013, DIN 22109.
The class of the electric and fire safety PN-EN-12882 class 4A, 4B, 5A, 5B, 5C.

The example of belt marking



Our advantage is 60 years' experience in every industry sector.

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EN ISO 9001
EN ISO 14001:2004

Textile–rubber polyvinyl chloride fire–resistant antistatic conveyor belts

Application of belts

The transportation of bulk materials, in lumps or pieces in the ambient temperature from –25°C to +60°C. Belts can be used in underground ores mines of non–ferrous metals and non-flammable materials.

The construction of belts

The construction of the belt consists of the carcass made of one impregnated ply covered with the polyvinyl chloride and rubber covers.

• PWG 1–ply of the type **solid–woven**, recommended to the work at small diameters of drums.

Advantages:
• the high impact resistance, flexibility for troughing,
• the resistance for longitudinal cracks,
• reduced belt elongation.

Recommended for high tonnage and at large inclinations of conveyors.

Series of PWG–PM belts type

Number of plies	*Tensile strength, [kN/m]*	*The thickness of the carcass, [mm]*	*The weight of the carcass, [kg/m^2]*
1	1000	8,0	9,74
	1250	11,0	11,5
	1400	11,5	11,4
	1600	12,0	12,4
	1800	13,0	13,6
	2000	14,0	14,77

The standard belt lengths are 100 m, 150 m, 200 m. Maximum electric surface resitance is max $3x10^8$ Ω.

Following the customer's wishes we can deliver the belts in different widths, class and thickness of covers and roll lengths.
Advice on cover selection can be given against full conveyor details.
For calculation of the total belt thickness it is necessary to add to the thickness of the carcass the total thickness of covers (carrying and pulley sides).
For calculation of the total belt weight on m^2 it is necessary to add to the carcass weigth the total weigth of covers.

The carcass tolerance of weights is ± 5%, of thickness is ± 5%.

Back

Physico – mechanical parameters of covers

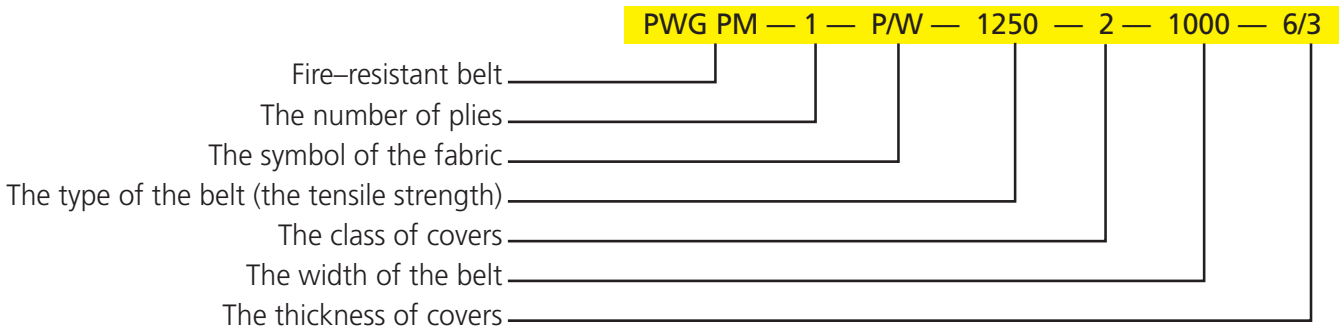
Class acc. to PN EN-ISO 14890:2004	*Class acc. to WT.36.08 ZGB*	*Tensile strength, [MPa] min.*	*Elongation at break, [%] min.*	*Abrasion [cm³] max.*	*Hardness [°ShA] ± 5*	*Cover mass 1 mm/m² [kg]*
L	2	15	350	0,20	65	1,43

Physico – mechanical data of belts

Standard PN EN-ISO 14890:2004	
Elongation at 10% nominal strength, max.	4,0%
Adhesion strength between covers and carcass, min.	3,5 kN/m

The construction and requirements according to norms: WT-66, PN EN-ISO 14890:2004 .
fire-resistance according to PN-93/C-05019, EN-20340.
The class of the electric and fire safety PN-EN-12882 class 2B, 3A, 3B.

The example of belt marking



We use most recent proffesional computer programs for selection of belts for every conveyor.

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EN ISO 9001
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Application of belts

The transportation of bulk materials, in lumps or pieces in the ambient temperature from 0°C to +60°C.

Belts fulfill all security norms of flame resistance and electrostatical in fire hazard conditions of underground mines.

The construction of belts

The construction of the belt consists of the carcass (one – monoply) or several plies impregnated by paste of the polyvinyl chloride and from the PVC covers in **„standard"** class, made for conveyors for normal installation or **„lux"** for main installation at ± 12 degrees of angles of depression.

• **PVC multiplies** are a cheaper alternative of rubber fire–resistant belts. An additional advantage is the ability of the easy cleaning, what acts it especially useful to the transportation of the coal and wet, sticky materials. The „lux" version of belts has special thick PVC covers.

• **PVC 1–ply** of the type **solid–woven**, recommended to the work at small diameters of drums, heavy impact hazards.

Series of PVC belts type

Number of plies	*Tensile strength, [kN/m]*	*The thickness of the carcass, [mm]*	*The weight of the carcass, [kg/m²]*	*Belts width [mm]*
1	630	7,0	8,42	*800 ÷ 1400*
	800	7,5	8,42	
	1000	8,0	9,74	
	1250	11,0	11,50	
	1400	11,5	11,40	
	1600	12,0	12,40	
2	630	4,8	5,89	
	800	5,5	5,99	
	1000	5,8	6,65	
3	800	7,0	8,84	
	1000	7,0	8,84	
	1250	8,2	8,98	
4	1250	9,6	11,78	
	1400	10,5	10,53	
	1600	11,0	11,97	

The basic lengths of the belt are 100 mtr, 150 mtr and 200 mtr. Maximum electric surface resitance is max $3x10^8$ Ω.

Following the customer's wishes we can deliver the belts in different widths, class and thickness of covers and roll lengths.
Advice on cover selection can be given against full conveyor details.
For calculation of the total belt thickness it is necessary to add to the thickness of the carcass the total thickness of covers (carrying and pulley sides).
For calculation of the total belt weight on m^2 it is necessary to add to the carcass weigth the total weigth of covers.
The carcass tolerance of weights is ± 5%, of thickness is ± 5%.

Back

Weight of covers

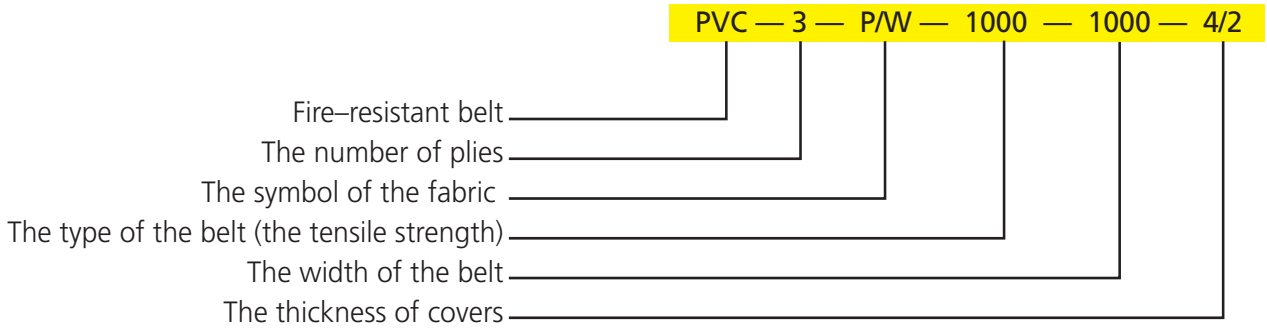
Class	*Cover weight 1 mm/m^2 , [kg]*
standard /2,3+2/	1,32
Lux (thickness)	1,30

Physico – mechanical data of belts

Standard PN EN-ISO 14890:2004	
Elongation at 10% nominal strength, max.	4,0%
Adhesion strength between covers and carcass, min.	5,5 kN/m

The construction and requirements according to norms: WT-66, PN EN-ISO 14890:2004.
Fire–resistance according to PN-93/C-05013 and DIN 22109.
The class of the electric and fire safety PN-EN-12882 class 4A, 4B, 5A, 5B, 5C.

The example of belt marking



We are one of the few international producers that possesses all production technologies of the rubber–textile belts.

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Application of belts

The transport of bulk materials, in lumps or pieces in the ambient temperature from +5°C to +60°C
Belts fulfill all security norms of flame resistance and electrostatical in fire hazard conditions of underground mines.

The construction of belts

The construction of the belt consists of the one ply carcass (monoply) impregnated by paste of the polyvinyl chloride and from the fire-resistant covers:

- racing - plastified PVC
- carrying - rubber

This is the newest belt construction in the world.

- GPVC monoply belts are recommended for conveyors with small diameters of drums.

Advantages of carcass:

- High cohesion and bending resistance
- Longitudal breakes resistance
- High density of weave of poliester fabric (E) in longitudal direction gives minimal elongation of the belt and poliamid fabric (P) in transverse direction, what ensures elasticity and good laying of the belts on drums

Advantages of covers construction:

- Equipping the belt with rubber carrying cover ensures very good friction factor, moreover the racing cover from plastified PVC ensures very good drum skid.

Combining these two different technologies provides non-failure conveyor operation.

Series of GPVC belts type

No. of plies	*Tensile strength, [kN/m]*	*The thickness of the carcass [mm]*	*The weight of the carcass, [kg/m^2]*	*Belt widths [mm]*
1	800	6,0	8,42	*800 ÷ 1200*
	1000	8,0	9,74	
	1250	11,0	11,50	
	1400	11,5	11,40	

Basic lenghts of the belt are 100 m, 150 m i 200 m. Maximum electric surface resitance is 3x10^8 Ω.

Following the customer's wishes we can deliver the belts in differnet thickness of covers.
The thickness of covers is matched acording to usage conditions.
For calculation of the total belt thickness on m^2 it is necessary to add to the carcass thickness the total thickness of covers.
For calculation of the total belt weight on m^2 it is necessary to add to the carcass weight the total weight of covers.

The carcass tolerance of weights is ± 5%
The carcass tolerance of thickness is ± 5%.

Back

Physico-mechanical parameters of fire-resistant GPVC type belts covers

carrying cover						
class acc. to PN EN-ISO 14890:2004	class acc. to TW-36.08 ZGB	Tensile strength, [MPa] min.	Elongation at break, [%] min.	Adhesion [cm^3] max.	Hardness [°ShA] ± 5	Cover mass 1 mm/m^2 [kg]
L	2	15	350	0,20	65	1,43

racing cover	
Class	Cover mass 1 mm/m^2 [kg]
standard	1,32
Lux	1,30

Physico-mechanical parameters of belts

Standard PN EN-ISO 14890:2004	
Elongation at 10% of nominal stress, max.	4,0%
Adhesion strength between covers and carcass, min.	3,5 kN/m

The constuction and requirements according to norms: WT-66, PN EN-ISO 14890:2004.
Flame resistance according to PN-93/C-05013 and DIN 22109.
The class of electric and fire safety PN-EN-12882 class 4A, 4B, 5A, 5B, 5C.

The example of belt marking

GPVC — 1 — P/W — 1000 — 2 — 1000 — 4/2

- GPVC — Fire-resistant rubber belt
- 1 — Numbers od plies
- P/W — Poliamid viscose fabric symbol
- 1000 — Type of belts (nominal strenght)
- 2 — Class of cover rubber acc. to table
- 1000 — Belt width
- 4/2 — Thickness of covers

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EN ISO 9001
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Textile–rubber conveyor belts for heightened temperatures

Application of belts

Textile–rubber conveyor belts are used to the transportation of bulk materials, in lumps or pieces in the heightened temperature. Belts can be used practical at the transportation of materials in the temperature range to 250°C. They can be used to the transportation of ash, the cement – clinker, coke, the calcareous stone, and everywhere where we convey the material with temperature over 60°C.

The construction of belt

The belt is made of the textile–rubber carcass, covers and of the rubber edge protecting the carcass of the belt. The construction of belt is the same as usual belts, the difference is in the use of special kinds of the rubber with enlarged resistance on temperature.
Type of the belt we divide in four basic temperature ranges in which they will work:
• TW–120°C • TU–150°C • TT–180°C • TS–250°C.

Belts TW can simultaneously serve to the transportation materials with oils and greasing substances.

Series of TW belts type 120°C

Number of plies	*Tensile strength, [kN/m]*	*on the fabric „P"*		*on the fabric „EP"*		*Belts width [mm]*
		The thickness of the carcass [mm]	*The weight of the carcass, [kg/m²]*	*The thickness of the carcass [mm]*	*The weight of the carcass, [kg/m²]*	
2	400	2,9	3,75	2,9	3,94	*400 ÷ 1200*
	500	3,3	4,06	3,3	4,18	
	630	3,5	4,34	3,7	4,51	
	800	3,9	4,72	3,9	4,89	
	1000	5,5	5,25	5,1	5,65	
	1250	*	*	5,5	6,22	
3	500	*	*	4,6	5,91	*400 ÷ 2000*
	630	4,6	5,63	5,2	6,28	
	800	5,2	6,09	5,8	6,77	
	1000	5,5	6,52	6,1	7,34	
	1250	6,1	7,09	7,9	8,48	
	1400	7,0	7,17	7,9	8,48	
	1600	*	*	8,2	8,65	
4	800	6,3	7,51	6,3	7,89	
	1000	7,1	8,12	7,1	8,38	
	1250	7,5	8,69	7,9	9,03	
	1400	7,9	9,18	8,3	9,79	
	1600	8,3	9,45	8,3	9,79	
	1800	9,5	9,56	10,7	11,31	
	2000	11,5	10,51	10,7	11,31	
5	1000	8,0	9,39	8,0	9,87	
	1250	9,0	10,15	9,0	10,48	
	1400	9,0	10,15	10,0	11,29	
	1600	9,5	10,86	10,0	11,29	
	1800	10,0	11,48	10,5	12,24	
	2000	10,5	11,81	10,5	12,24	
	2500	14,5	13,14	14,0	14,43	
	3000	*	*	14,5	15,57	
6	1400	10,9	12,19	10,9	12,57	
	1600	10,9	12,19	12,1	13,54	
	1800	11,5	13,05	12,1	13,54	
	2000	12,1	13,79	12,7	14,68	
	3000	17,5	15,78	16,9	17,30	
	3500	*	*	17,5	18,67	

The basic lengths of the belt are 100 mtr, 150 mtr and 200 mtr.

Back

Series of belts TU belts type 150°C

on the fabric EP				
Number of plies	*Tensile strength, [kN/m]*	*The thickness of the carcass, [mm]*	*The weight of the carcass, [kg/m²]*	*Belts width [mm]*
2	400	2,9	3,94	*400 ÷ 1200*
	500	3,3	4,18	
	630	3,7	4,51	
	800	3,9	4,89	
	1000	5,1	5,65	
	1250	5,5	6,22	
3	500	4,6	5,91	*400 ÷ 2000*
	630	5,2	6,28	
	800	5,8	6,77	
	1000	6,1	7,34	
	1250	7,9	8,48	
	1400	7,9	8,48	
	1600	8,2	8,65	
4	800	6,3	7,89	
	1000	7,1	8,38	
	1250	7,9	9,03	
	1400	8,3	9,79	
	1600	8,3	9,79	
	1800	10,7	11,31	
	2000	10,7	11,31	
5	1000	8,0	9,87	
	1250	9,0	10,48	
	1400	10,0	11,29	
	1600	10,0	11,29	
	1800	10,5	12,24	
	2000	10,5	12,24	
	2500	14,0	14,43	
	3000	14,5	15,57	
6	1400	10,9	12,57	
	1600	12,1	13,54	
	1800	12,1	13,54	
	2000	12,7	14,68	
	3000	16,9	17,3	
	3500	17,5	18,67	

The basic lengths of the belts are 100 mtr, 150 mtr and 200 mtr.

Following the customer's wishes we can deliver the belts in different widths, class and thickness of covers and roll lengths.
Advice on cover selection can be given against full conveyor details.
For calculation of the total belt thickness it is necessary to add to the thickness of the carcass the total thickness of covers (carrying and pulley sides).
For calculation of the total belt weight on m^2 it is necessary to add to the carcass weigth the total weigth of covers.

The carcass tolerance of weights is ± 5%, of thickness is ± 5%.

Series of belts TT belts type 180°C and TS belts type 250°C

on the fabric EP				
Number of plies	Tensile strength, [kN/m]	The thickness of the carcass, [mm]	The weight of the carcas, [kg/m^2]	Belt width [mm]
2	400	2,9	4,80	400 ÷ 1200
	500	3,3	5,04	
	630	3,7	5,37	
	800	3,9	5,75	
	1000	5,1	6,51	
	1250	5,5	7,08	
3	500	4,6	7,20	400 ÷ 2000
	630	5,2	7,57	
	800	5,8	8,06	
	1000	6,1	8,63	
	1250	7,9	9,77	
	1400	7,9	9,77	
	1600	8,2	9,94	
4	800	6,3	8,60	
	1000	7,1	9,09	
	1250	7,9	9,74	
	1400	8,3	10,50	
	1600	8,3	10,50	
	1800	10,7	12,02	
	2000	10,7	12,02	
5	1000	8,0	9,50	
	1250	9,0	10,11	
	1400	10,0	10,92	
	1600	10,0	10,92	
	1800	10,5	11,87	
	2000	10,5	11,87	
	2500	14,0	14,06	
	3000	14,5	15,20	
6	1400	10,9	12,13	
	1600	12,1	13,10	
	1800	12,1	13,10	
	2000	12,7	14,24	
	3000	16,9	16,86	
	3500	17,5	18,23	

The basic lengths of the belts are 100 mtr, 150 mtr and 200 mtr.

Following the customer's wishes we can deliver the belts in different widths, class and thickness of covers and roll lengths.
Advice on cover selection can be given against full conveyor details.
For calculation of the total belt thickness it is necessary to add to the thickness of the carcass the total thickness of covers (carrying and pulley sides).
For calculation of the total belt weight on m^2 it is necessary to add to the carcass weigth the total weigth of covers.

The carcass tolerance of weights is ± 5%, of thickness is ± 5%.

Back

Textile–rubber conveyor belts for heightened temperatures

Physico – mechanical parameters of covers

Type of belt	Material temperature, max.	Inside belt temperature, max.	Tensile strength, [MPa] min.	Elongation at break, [%] min.	Abrasion [cm^3] max.	Hardness [°ShA] ± 5	Resistance to thermal ageing, * 144h , %, max.		Cover mass 1 mm/m^2 [kg]
							Δ Rr	Δ Er	
TW	120°C	90°C	15	350	0,15	65	50	70	1,16
TU	150°C	120°C	10	300	0,20	70	50	70	1,17
TT	180°C	150°C	10	300	0,20	70	50	70	1,17
TS	250°C	150°C	10	300	0,20	65	50	70	1,23

* examination temperature according to thermal load of cover:

TW – 120°C
TU – 150°C
TT – 175°C
TS – 220°C

Physico – mechanical data of belts

Standard PN EN-ISO 14890:2004	
Elongation at 10% nominal strength, max.	4%
Adhesion strength between plies, min.	4,0 kN/m
Adhesion strength between covers and carcass, min.	3,5 kN/m

The construction and requirements according to norms: WT-62, PN EN-ISO 14890:2004

The example of belt marking

T* — 3 — P — 630 — 1000 — 4/2

- T* — Temperature resistance symbol (*W, U, T, S)
- 3 — The number of plies
- P — The symbol of the fabric (P or EP)
- 630 — The type of the belt (the tensile strength)
- 1000 — The width of the belt
- 4/2 — The thickness of covers

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EN ISO 9001
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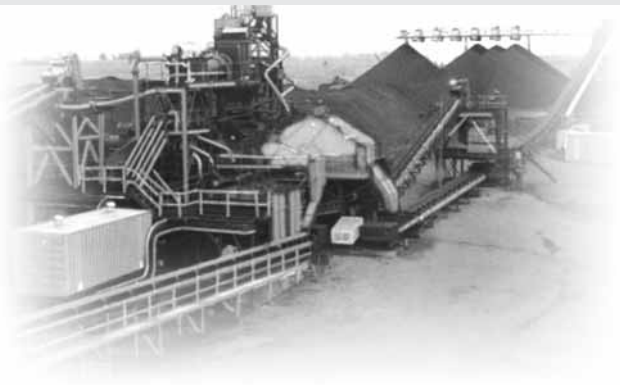
Back

Textile–rubber oil–resistant conveyor belts

Application of belts

Textile–rubber oil–resistant conveyor belts are used to the transportation of bulk materials, in lumps or pieces in the ambient temperature from 0°C to +60°C, conditioned of extorting the resistance of covers of belts on the activity of oleiferous matters.



The construction of belt

The construction of the oil–resistance belts are the same as belts for general use, the difference is in the use of special kinds of the interply and cover rubber with enlarged resistance on oil–resistant matters.

Series of O belts type

Number of plies	Tensile strength, [kN/m]	on the fabric „P"		on the fabric „EP"		belts width [mm]
		The thickness of the carcass [mm]	The weight of the carcass, [kg/m^2]	The thickness of the carcass [mm]	The weight of the carcass, [kg/m^2]	
2	400	2,9	3,75	2,9	3,94	400 ÷ 1200
	500	3,3	4,06	3,3	4,18	
	630	3,5	4,34	3,7	4,51	
	800	3,9	4,72	3,9	4,89	
	1000	5,5	5,25	5,1	5,65	
	1250	*	*	5,5	6,22	
3	500	*	*	4,6	5,91	400 ÷ 2000
	630	4,6	5,63	5,2	6,28	
	800	5,2	6,09	5,8	6,77	
	1000	5,5	6,52	6,1	7,34	
	1250	6,1	7,09	7,9	8,48	
	1400	7,0	7,17	7,9	8,48	
	1600	*	*	8,2	8,65	
4	800	6,3	7,51	6,3	7,89	
	1000	7,1	8,12	7,1	8,38	
	1250	7,5	8,69	7,9	9,03	
	1400	7,9	9,18	8,3	9,79	
	1600	8,3	9,45	8,3	9,79	
	1800	9,5	9,56	10,7	11,31	
	2000	11,5	10,51	10,7	11,31	
5	1000	8,0	9,39	8,0	9,87	
	1250	9,0	10,15	9,0	10,48	
	1400	9,0	10,15	10,0	11,29	
	1600	9,5	10,86	10,0	11,29	
	1800	10,0	11,48	10,5	12,24	
	2000	10,5	11,81	10,5	12,24	
	2500	14,5	13,14	14,0	14,43	
	3000	*	*	14,5	15,57	
6	1400	10,9	12,19	10,9	12,57	
	1600	10,9	12,19	12,1	13,54	
	1800	11,5	13,05	12,1	13,54	
	2000	12,1	13,79	12,7	14,68	
	3000	17,5	15,78	16,9	17,30	
	3500	*	*	17,5	18,67	

The basic lengths of the belts are 100 mtr, 150 mtr and 200 mtr.

Back

Physico – mechanical parameters of covers

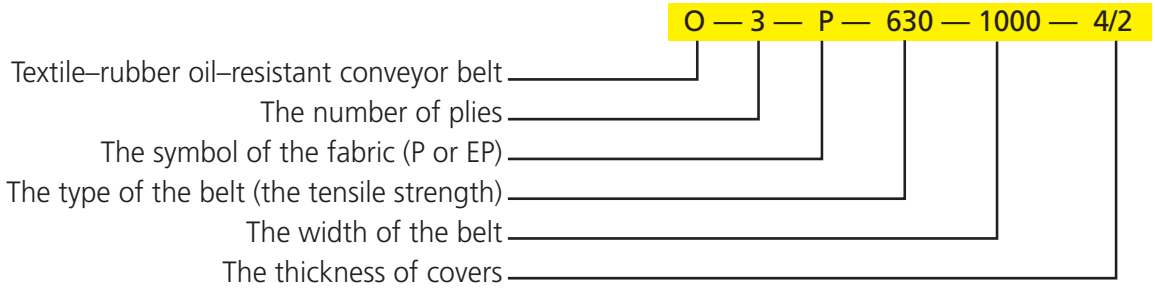
Class acc. to PN EN-ISO 14890:2004	Class acc. to WT 36.05 ZGB	Tensile strength, [MPa], min.	Elongation at break, [%], min.	Abrasion [cm^3] max.	Hardness [°ShA] ± 5	Cover mass 1 mm/m^2 [kg]	Oil resistance (standard oil No. 3) max., [%]
L	2	15	350	0,20	65	1,24	10

Physico – mechanical data of belts

Standard PN EN-ISO 14890:2004	
Elongation at 10% nominal strength, max.	4,0%
Adhesion strength between plies, min.	4,5 kN/m
Adhesion strength between covers and carcass, min.	3,5 kN/m

The construction and requirements according to standards: WT-62, DIN 22102 i PN EN-ISO 14890:2004.

The example of belt marking



Following the customer's wishes we can deliver the belts in different widths, class and thickness of covers and roll lengths.
Advice on cover selection can be given against full conveyor details.
For calculation of the total belt thickness it is necessary to add to the thickness of the carcass the total thickness of covers (carrying and pulley sides).
For calculation of the total belt weight on m^2 it is necessary to add to the carcass weigth the total weigth of covers.

The carcass tolerance of weights is ± 5%, of thickness is ± 5%.

Highly qualified specialists are at our customer's disposal.

Assortment

ZGB S.A. delivers rubber plates with properties, thickness and dimensions that were agreed with customer.
The assortment includes the following kinds:

- fire – resistance,
- flame – resistance,
- for general use,
- heightened abrasion resistance,
- acids– and base–, oil–resistance,
- heightened temperatures resistance.

Fire – resistance plates made of the **ONB** mixture, are made for:
- the facing of drums and rollers
- of antyelectrostatical facings (chambers of explosives) at skew resistance less or equal $0,5 \times 10^4\ \Omega$.

Fire resistant compound ONB obtained safety mark B.

Series of vulcanised rubber plates

Kind	*Weight 1 mm/m² [kg]*	*Tensile strength, [MPa] min.*	*Elongation at break, [%] min.*	*Abrasion [cm³]*	*Hardness [°ShA]*
for general use	1,11 to 1,40	from 10 to 25	300-450	0,09 to 0,20	60-75
fire–resistant	1,42	from 10 to 20	300-450	0,10 to 0,20	65-75
flame–resistant	1,29 to 1,45	15	350	0,18 to 0,20	65-70
oil–resistant	1,24	10	300	0,20	65-70

Basic dimensions

width, max.	1400 mm
length, max.	100 m
thickness, max.	30 mm

We will consider all our customer's inquiries concerning other kind, construction and properties of plates.

ZGB S.A. can give technical advises and offer a service. The customers inquiries are treated by us individually.

Back

Application

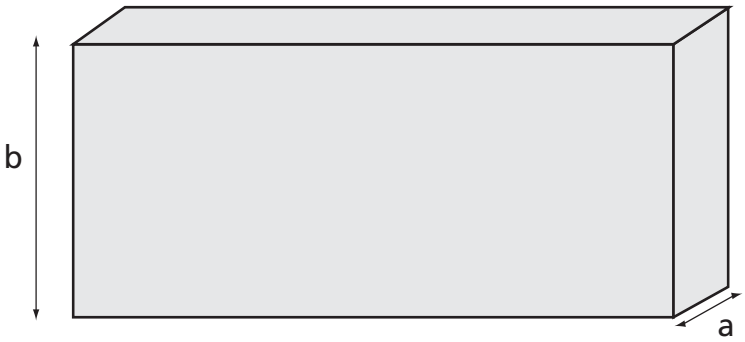
The scraper is an indispensable element of the equipment of every conveyor.
Nothing destroys the belt as much as its non–proper selection.
The first ones at the selection of scrapers are physico–mechanical parameters. The rubber used in the production of scrapers should be the less abrasion resistant rubber. It means, less abrasion resistant than the cover of belt it works on. Working scraper has to abrade itself and at the same time it cleans the cover. The wrong selection of scraper damages the cover without abrasion process.

Well-chosen scrapers guarantee longer use of belt.

Scrapers produced by ZGB S.A can be divided in:

- fire–resistance (working with belts GT, PVC, PWG, GPM, PWG-PM),
- flame–resistance (working with belts T),
- usual (working with belts Z, ZPVC, oil– and temperatures–resistant belts).

Construction



a - thickness
b - height

Series of rubber scrapers

Kind	*mono–ply*	
	thickness [mm]	*weight [kg/m²]*
general use	20	27,6
	25	34,5
	30	41,4
flame–resistant	20	26,6
	25	33,2
	30	40,0
fire–resistant	20	25,6
	25	32,0
	30	38,4

Basic heights: 200, 250, 300, 400 mm.

Physico – mechanical parameters

No.	Application / type	Base rubber	Hardness [°ShA] ±5	Tensile strenght, min., [MPa]	Elongation at break, [%] min.	Abrasion, [cm³] max.	Vulcanization time	
							temp. [°C]	[min.]
1	general use	SBR	70	10	300	0,20	150	5-10
2	general use	SBR, NR	65	15	350	0,15	150	5-10
3	general use	NR, BR	60	20	400	0,10	150	5-10
4	general use	NR, BR	60	18	400	0,09	150	5-10
5	general use	NR, BR	65	25	450	0,12	150	5-10
6	general use	SBR, NR	80	10	200	–	150	4
7	general use	SBR	50	5	100	–	150	3
8	general use	SBR	60	5	100	–	150	3
9	general use	SBR	70	5	100	–	150	3
10	general use	SBR	80	5	100	–	150	3
11	general use	SBR, NR	70	20	300	0,15	160	5
12	fire resistant	SBR, NR	70	15	350	0,20	150	5
13	fire resistant	SBR	70	10	300	0,20	150	5
14	flame resistant	SBR	70	15	350	0,20	150	5
15	flame resistant	BR, CR	70	20	400	0,15	150	5-10
16	flame resistant	BR, CR	65	15	350	0,20	150	5-10
17	flame resistant	SBR, NR, BR	65	15	350	0,20	150	5-10
18	flame resistant	CR, BR	70	10	300	0,35	150	4
19	flame resistant	CR, BR	45	10	500	–	150	4
20	tyre tread	CR	75	12	350	0,28	150	4
21	insulating cable reparation	NR	60	5	250	–	150	4
22	conducting	SBR, NR	60	12	350	0,16	150	5
23	oil resistant	NBR	70	10	150	0,20	150	4
24	oil resistant	NBR	50	5	300	–	150	5
25	oil resistant	NBR	85	12	150	0,20	150	4
26	heat resistant 120°C	SBR, NBR	65	15	350	0,15	150	5
27	heat resistant 180°C	EPDM, SBR	70	10	300	0,20	170	0,5
28	heat resistant 250°C	EPDM, SBR	70	10	300	0,20	170	1,13
29	shock absorpting	CR	60	14	375	–	150	4
30	shock absorpting	NR	50	18	400	–	150	3
31	shock absorpting	NR	55	16	450	–	150	5
32	tyre tread	BR, NR	55 +/-3	15	400	0,10	150	10
33	tyre tread	NR, BR, SBR	55 +/-3	15	400	0,12	150	5-10
34	tyre tread	NR, BR, SBR	65 +/-2	18	420	0,085	150	>9
35	tyre tread	SBR, BR	65-72	15	350	0,15	150	6
36	tyre tread	BR, NR, SBR	55 +/-2	15	350	0,12	150	6
37	tyre tread	SBR	63 +/-3	12	450	0,14	130	17-22
38	tyre sides	NR, BR, SBR	50	10	500	0,10	130	23
39	tyre tread	NR, BR	65 +/-1	21	500	0,09	150	5,5-7
40	general use speed	NR, BR, SBR	60	10	300	0,20	150	>3
41	seals	SBR, NR	59 +/-1	8	400	–	180	TS2-1 T90-3,3
42	form articles	SBR, NR	45-50	6	300	–	150	4
43	hard	EPDM, SBR	85	10	150	–	150	6
44	general use	SBR, NR	50	4	–	–	150	>4

ZGB S.A. manufacture rubber compounds which can be used for many different purposes.
We can prepare a rubber compound for special customer's requirements.

Application

We offer rubber cements to connec, repair and regenerate in hot vulcanisation method for all kinds of belts produced by ZGB S.A..

We produce cements according to internal standard: ZN-98/03.

Rubber cements are offered in hermetic galvanized containers being returnable packings.

Physical and mechanical properties

Kind of cement	*Destination*	*Joints strength, at least*	
		Adhesion, after 24 h [kN/m]	*Tear, after 24 h [MPa]*
BKS	Belt connection Z, TW, O, TU	4,5	1,5
BTKU	Belt connection T	5,5	2,0
TFC	Belt connection fire-resistant GT, GPM	9,0	2,2
O/TFTT	Belt connection resistant for heightened temperatures TT, TS	4,0	1,8

Material for connection in hot vulcanising method

Type of belt	*Kind of cement*	*Kind of tie compound*	*Kind of cover compound*
Z	BKS	FS	OSB, OSC, WB, WA, X
TAs	BTKU	FN	ONC,TB
GTAs	TFC	FC	OCB
GPM	TFC	FPM	TB
PWG	–	PI	OPB
PWG PM	–	PI	OPB
PVC	–	PI	DZ
ZPVC	–	PAF	DAF
O	BKS	FS	OTW + OSB 1:1
TW	BKS	FS	OTW + OSB 1:1
TU	BKS	FS	OTT
TT	O/TFTT	FTT	OTT
TS	O/TFTT	FTT	OTS
GPVC	–	PI	OPB + DZ

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EN ISO 9001
EN ISO 14001:2004

Application

The foil, symbol F–G are used to seal:

- ventilation shields
- excavation
- gunis

and all kinds of bulkheads in the underground excavations with fire hazard of class a; b; c.

Thickness of the foil: 0,5 to 1,5 mm with dimensional tolerance ± 0,2 mm.
Max. width 1800 mm.

Physico–mechanical parameters of the foil

Tensile strength	in longitudinal direction, min.	10 MPa
	in transverse direction, min.	5 MPa
Relative elongation at break	in longitudinal direction, min.	80%
	in transverse direction, min.	100%
Fire–resistance	length of non–glow part	>75mm
	average burning time, 6 samples	< 3,0 s.
	average glow time, 6 samples	< 10,0 s.
	average burning time, 1 sample	< 10,0 s.
	average glow time, 1 sample	< 30,0 s.
	repeated appearance of flame	none
Surface–resistance	resistance	$<1x10^9$ Ω

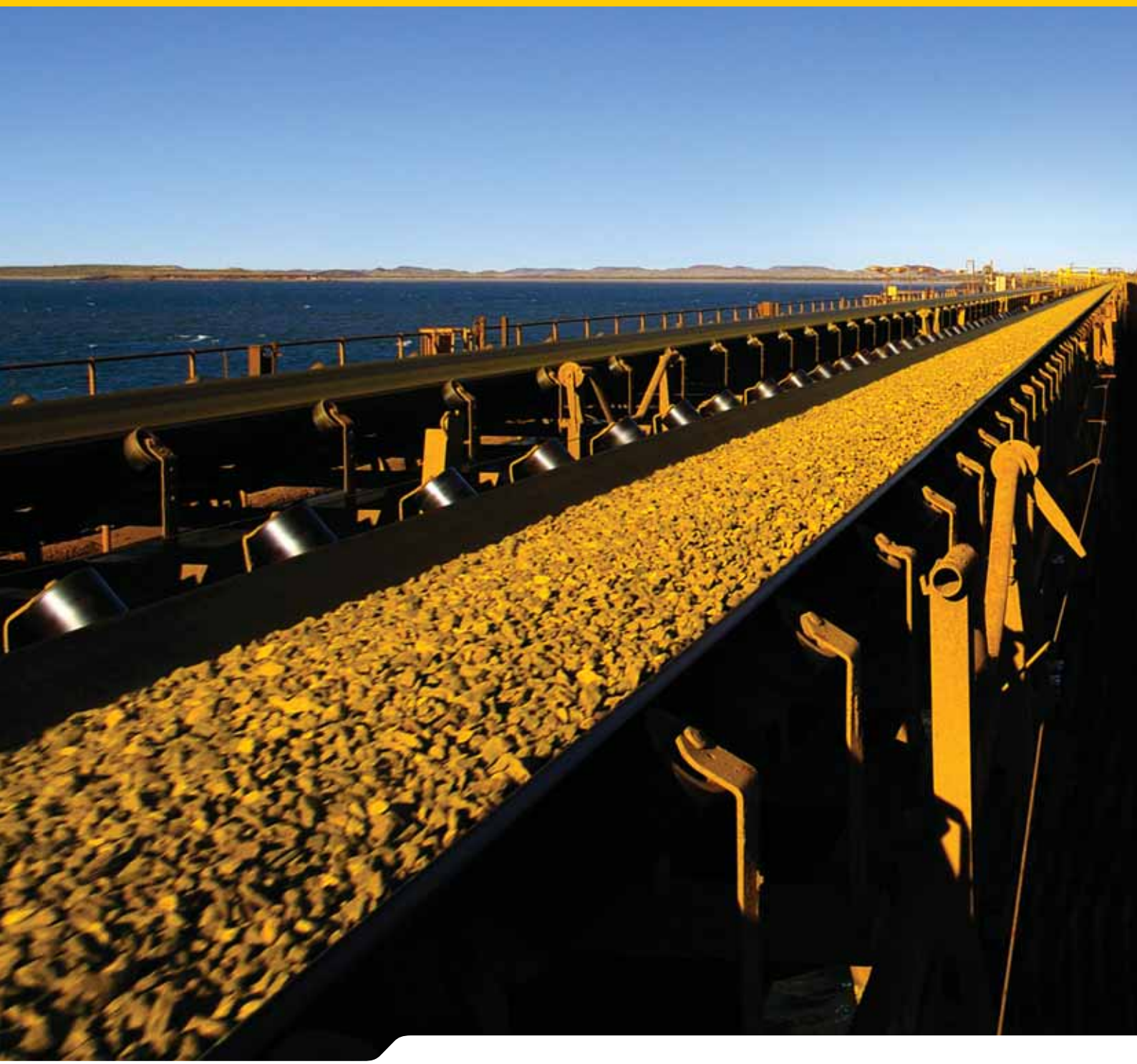
Construction requirements of the foil according to Polish standards PN-81/C-89034, fire–resistance according to BN-78/C-6301-07 standard.
Electrical resistance according to Polish standard PN-92/E-05203.
Manufacturing according to internal standard WT-52.
Foil obtained safety mark B.

Marking of the foil

F-G - 0,5 - 1200

Mining foil
Thickness, mm
Width, mm

Back



Belts exploitation guide

CONTENTS

Conveyor belt is a kind of device that is used in transporting both minerals and other materials of specified characteristics and sizes.
The selection of a right belt complying with requirements of a given transport task decides upon the efficiency and cost of the transport.

The objective of this Handbook is to provide easy instructions to belt selection and utilisation.
In case of non–typical conveyors, with a characteristics of extremely high output, length and drive power an additional dynamic calculation may be necessary, based on methods given in literature.

Scheme diagram of a belt conveyor is as follows:

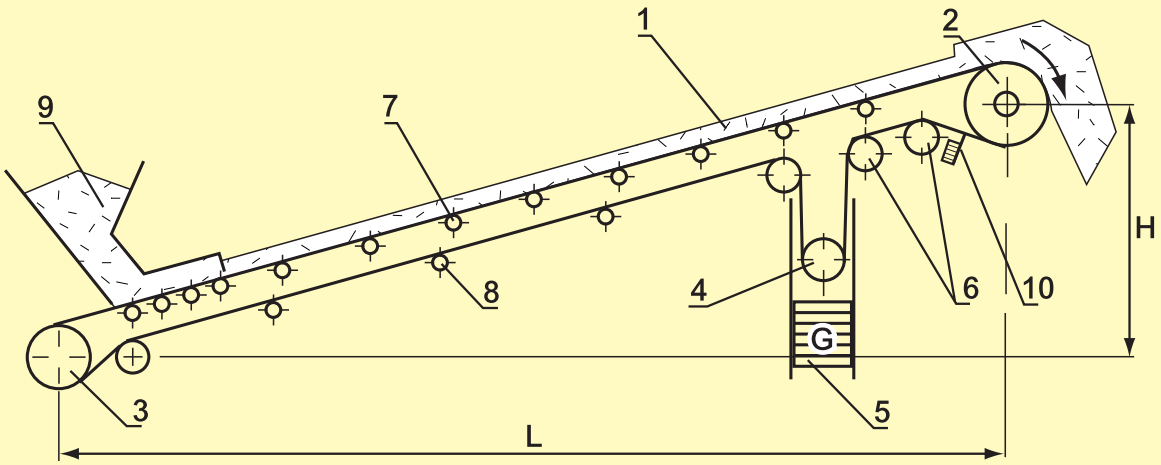


fig. 1. Scheme diagram of a belt conveyor.
1 — belt; 2 — driving (chute) drum; 3 — reversing drum; 4 — stretcher; 5 — stretcher weight; 6 — deflecting drums; 7 — carrying runner; 8 — bottom runner; 9 — hopper; 10 — scraper; L — conveyor length; H — handled material lift height

I. SELECTING THE BELTS

The belt is selected on the basis of its tensile strength determined for every type and of the maximum useful stress occurring in the conveyor operated at steady motion under its rated load.

On customers demand we select by the use of computer the conveyor belt to the given conveyor. We use the computer programme „QNK –PRO".

Base of all calculations are technical parameters of conveyor, calculated according to „Conveyor Belt Questionary".

The selection of the belt will be simplified by using the calculation algorithm (see Fig. 2) showing the sequence of operations in determining individual parameters of conveyor belt for the given transport task.

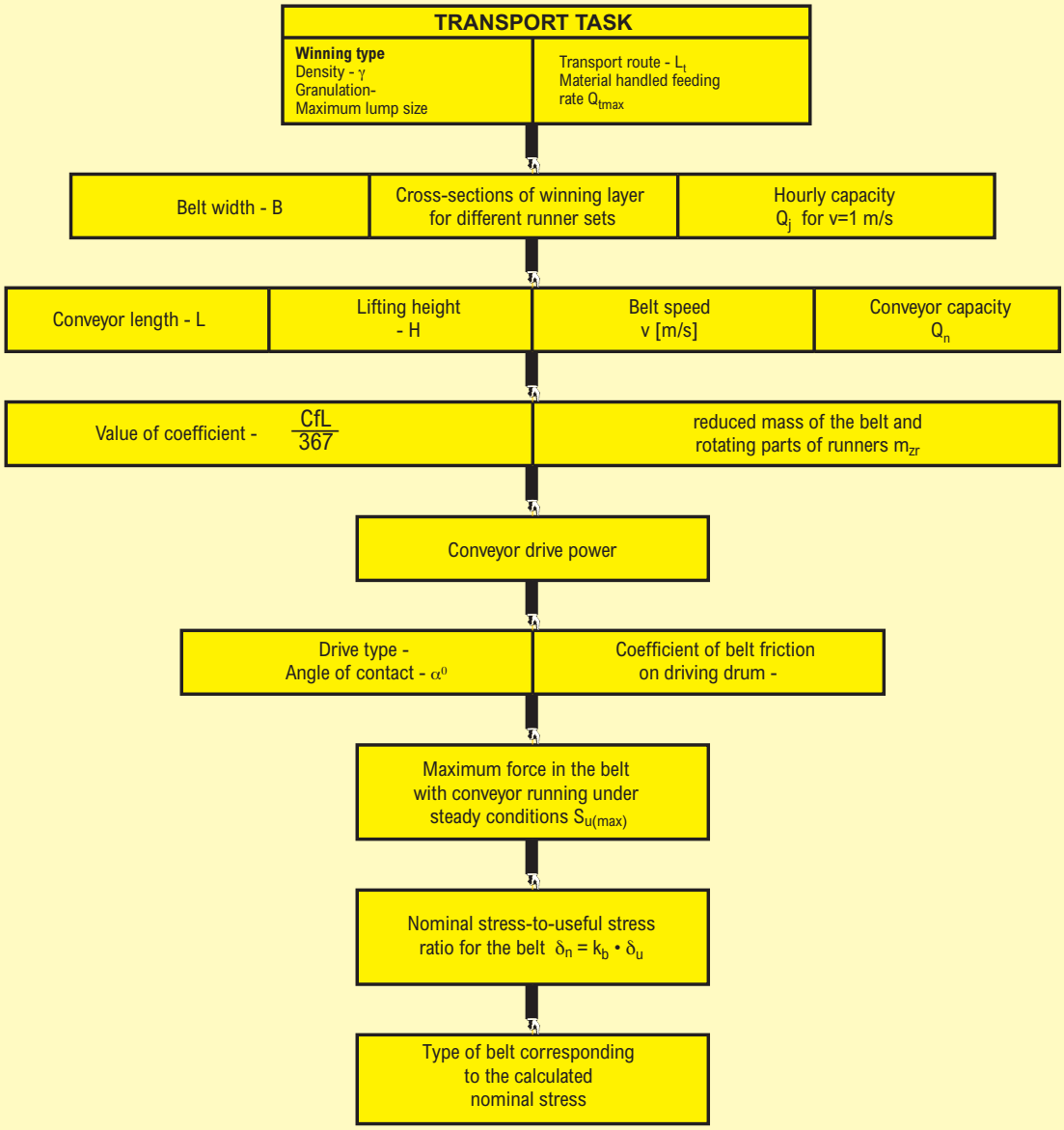


Fig. 2. Algorithm of belt selection

I. Conveyor specifications

a. belt width [mm] .....

b. belt speed [m/s] .....

c. conveyor capacity [t/h] .....

d. conveyor length [m] .....

e. angle of depression [°] ..... or lift height [m] .....

f. rated tension [%] .....

g. take–up data length .....

h. conveyor profile

☐ horizontal flight distance (one section)

☐ vertical flight distance (few sections); length of sections .....

i. working conditions of conveyor

☐ good ☐ average ☐ poor

II. Loading

a. material conveyed .....

b. max. lump size [cm] .....

III. Drive data

a. Drive location

☐ on head of conveyor ☐ on tail of conveyor

b. No. of motors per drive .....

c. power of single motor [kW] .....

d. degree of wrap [°] .....

e. drive pulley surface:

☐ not lagging ☐ lagging

f. type of drive, start–up device

☐ single–drive ☐ tandem–drive

☐ direct start–up

☐ fluid coupling

☐ thyristor start–up device

☐ frequency controller

IV. Idlers

V. Other information:

a. conveyor description [name or number] .....

.....

b. conveyor location .....

c. drive pulleys diameter .....

Idlers specifications	Carrying side	Return side
- distance between frames [mm]		
- length of middle idler [mm]		
- troughing angle		
- idlers surface [mm]		
- idlers diameter [mm]		

d. tail pulleys diameter .....

e. additional information that should be considered when developing a belt for your system: .....

.....

.....

.....

- name .....
- position .....
- company name .....

.....

- phone number ..... fax number .....

....

date signature

Please fill in as many fields as possible.

Provided information only for ZGB S.A.

Please forward this completed questionary to

- post address: ZGB S.A., 41-902 Bytom, Poland, PO BOX 101
- fax number: +48 32 397 61 84
- e-mail: zgb@zgb.pl

For transport the following datas have to be specified:
- kind of material handled
- density
- granulation (lump size)
- admissible angle of belt elevation
- conveyance route length
- material lift based on difference between material feeding, levels
- maximum instantaneous material feeding rate

3. Conveyor rated capacity

The basic characteristic of conveyor deciding upon its other parameters is its rated capacity Q_n, which has to satisfy the following condition::

$$Q_n \geqslant Q_{(t)max} \qquad (1)$$

$Q_{(t)max}$ – instantaneous rate of material feeding onto conveyor.
The value of rated capacity Q_n is usually calculated from the formula:

$$Q_n = 3600 \cdot k_k \cdot F_n \cdot v \ [m^3/h] \qquad (2)$$

wherein:
k_k — correction factor depending on belt inclination (table 11)
F_n — nominal cross–sectional areas of the layer of material handled [m^2] depending upon the width of the belt and set of supporting runners (fig. 3)
v — belt speed [m/s]

Table 1.
Correction factor k_k for inclined conveyors

Angle of depression deg.	Correction factor k_k
0-4	1
5	0,99
6	0,98
7	0,98
8	0,97
9	0,96
10	0,95
11	0,94
12	0,93
13	0,93
14	0,92
15	0,91
16	0,90
17	0,88
18	0,85
19	0,83
20	0,81

To facilitate calculations formula (2) is simplified to the equation:

$$Q_n = k_k \cdot Q_j \cdot v \ [m^3/h] \qquad (3)$$

wherein:
Q_j — unitary capacity with belt speed v= 1 [m/s], depending upon the belt width and type of runners set (Table 2).

Table 2. Theoretical unitary capacity Q_j w [m³/h] with a horizontal belt speed v= 1 m/s for different set of runners

Belt width [mm]	Type of manner set							
	Single runner	two runners		three runners				
		angle						
		15°	20°	20°	25°	30°	35°	40°
500	38	72	80	75	80	87	91	95
650	69	129	143	135	144	156	164	172
800	108			211	227	247	258	269
1000	173			340	365	398	415	434
1200	255			498	537	585	610	638
1400	351			688	738	808	840	878
1600	465			908	976	1070	1110	1160
1800	592			1160	1245	1360	1415	1475
2000	735			1445	1545	1690	1760	1835

NOTE: In the case of conveyors to be operated with PVC belts it is recommended to use belt channelling which do not exceed 25°.

In cases where capacity Q_n is to be expressed in kilograms [kg/h] or tons per hour [t/h] advantage should be taken of Table 3, where the densities of materials handled are given.
The capacity is then determined by the following formula:

(3a) $$Q_n = \frac{k_k \cdot O_j \cdot \gamma \cdot v}{1000} \quad [t/h]$$

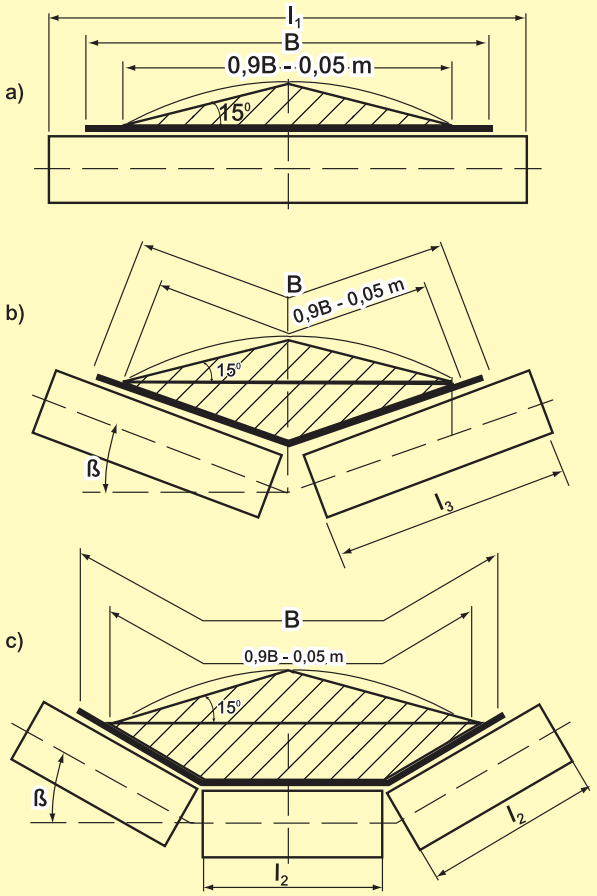


Fig. 3. Cross–sectional areas of winning bulk for:
a — one runner; b — two–runner set; c — three–runner set

Table 3. Characteristic of material handled

Kind of material	Bulk density γ [kg/m^3]	Permissible elev. angle of rubber belt δ		Edge sharpness	Abrasiveness
		rad	*deg.*		
Aluminium	900	0,26	15	slight	average
Barite	2900	0,35	20	slight	low
Basalt	1600-1800	0,35	20	average	average
Bauxite	1300-2200	0,35	20	average	average
Cement	900-1000	0,31	18	slight	average
Portland cement	1100-1300	0,38	22	slight	average
Dolomite	1500-2700	0,35	20	average	average
Phosphorate rock	1500-2700	0,36	20	slight	high
Crushed gypsum	1300-1500	0,35	20	average	average
Dry clay	1200-1600	0,73	25	slight	low
Wet clay	1400-1800	0,31	18	slight	low
Granite	1500-1800	0,35	20	average	average
Clinker	1300-1500	0,31	18	slight	high
Coke	400-600	0,35	20	slight	high
Quartzite	1600-1800	0,35	20	considerable	average
Crushed shale	1200-1500	0,31	18	average	low
Strippings	1500-1700	0,31	18	slight	low
Bounders	1500-2000	0,24	14	slight	low
Dry sand	1400-1600	0,26	15	slight	average
Wet sand	1700-2100	0,35	20	slight	low
Sandstone	1500-2200	0,35	20	average	high
Piryte	1500-2200	0,35	20	average	high
Dry ash	500-650	0,26	16	slight	average
Wet ash	750-900	0,30	17	slight	low
Porphyre	1600-1800	0,35	20	average	average
Zinc ore	3300-4300	0,31	18	average	average
Lead ore	6400-7600	0,31	18	average	average
Copper ore	4200-4700	0,31	18	average	average
Magnesium ore	2000-2300	0,31	18	average	average
Rough crushed iron ore	2000-3000	0,31	18	average	average
Fine crushed iron ore	2400-3500	0,38	22	average	average
Sulphur	800-1400	0,35	20	slight	average
Rock salt	700-1200	0,35	20	slight	average
Potassium salt	1100-1600	0,28	17	slight	average
Soft limestone	1200-1400	0,35	20	slight	average
Hard lignite	1600-1800	0,35	20	average	average
Dry lignite	450-650	0,28	17	slight	low
Wet lignite	700-900	0,32	19	slight	low
Briquetted lignite	700-800	0,25	15	slight	low
Rough hard coal	760-1200	0,35	20	average	average
Hard coal (cobble, nut)	750-900	0,31	18	slight	average
Small coal	800-900	0,38	22	slight	low
Slag	1300-1400	0,31	18	average	high
Blast furnace slag	1500-2000	0,38	22	slight	high
Dry gravel	1700-1800	0,35	20	considerable	average
Wet gravel	1800-2000	0,26	15	considerable	average

In calculating the capacity Qn [m^3/h] for a given transport the belt width, runner–set type, belt side channelling angle and speed should be specified. The speed of the belt should be compared with Table 5 wherein the permissible speeds are given depending upon the type and granulation of material handled.

Table 4. Maximum permissible lump size [mm]

Belt width [mm]	Percentage of lumps in material handled		
	10%	50%	100%
500	160	110	90
650	220	150	120
800	300	200	160
1000	400	270	220
1200	500	340	270
1400	550	400	320
1600	600	450	370
1800	650	500	400
2000	700	550	430

Table 5. Maximum and recommended belt speed depending upon physical–and–mechanical characteristics of material handled [mm]

Material handled	Max. speed [m/s]	Recommended speed [m/s] for belts having a width [mm]							
		500	650	800	1000	1200	1400	1600	1800
Graded material with grain size up to 25 mm	5,0	2,5	3,0	3,5	4,5	5,0	5,0	5,0	5,0
Graded material with lumps with a size not exceeding 10% of belt width	4,5	2,5	3,0	3,5	4,0	4,5	4,5	4,5	4,5
Material with lumps with a size equal to the half of permissible value (T. 14)									
— *abrasive*	3,5	2,0	2,5	3,0	3,25	3,5	3,5	3,5	3,5
— *non abrasive*	4,0	2,25	2,75	3,25	3,5	4,0	4,0	4,0	4,0
Material with lumps with the maximum size (Tab. 14)									
— *oval lumps*	3,25	2,0	2,5	2,75	3,0	3,25	3,25	3,25	3,25
— *abrasive lumps with blunt edges*	3,0	2,0	2,5	2,75	2,75	3,0	3,0	3,0	3,0
— *abrasive lumps with sharp edges*	2,75	1,5	2,25	2,25	2,25	2,75	2,75	2,75	2,75
Material to be prevented from breaking up:									
— *hard coal*	2,0	1,25	1,5	1,5	1,75	2,0	2,0	2,0	2,0
— *lignite*	1,5	1,25	1,25	1,25	1,5	1,5	1,5	1,5	1,5
Dust–producing material:									
— *high density particles*	1,5	—	—	—	—	—	—	—	—
— *lightweight dry particles*	1,5	—	—	—	—	—	—	—	—

The length of conveyor L depends primarily on the distance between the points where the material handled is fed and received, i.e. on the conveyance route length. The length of conveyance route L_t can be expressed as a multiplication of the conveyor length.

$$L_t = k \cdot L \quad \text{at} \quad k \geqslant 1 \qquad (4)$$

In cases where the conveyance length is expressed as a multiplication of the length of conveyor, i.e. k > 1, the whole length should be divided so as to obtain a flight of conveyors of one and the same type with their parameters approximating the optimum in terms of costs and efficient performance. One should be very cautions in implementing the equipment to be operated with extreme parameters since the belt should be overloaded whereby its life will be considerably reduced.

Table 6. Technical data of typical conveyors produced in Poland

Belt conveyor type	Belt speed [m/s]	Belt width [mm]	Belt capacity in function of speed [t/h]	Drive power [kW]	Maximum horizontal length of conveyor with the max. capacity and power of the conveyor [m]	Permissible angle of conveyor inclination
PTG 800/1x30	1,5 1,8	800	394	1x32	410	-14° ÷ +16°
PTG 800/1x50	1,5 1,8 2,4		394 473 631	1x55	680 540 410	
PTG 1000/1x50		1000	636 763 1017 1230	1x55	450 360 270	
MIFAMA 800/1x55	1,5 ,8 ,4 2,9	800	394 473 631 62	1x55	680 540 410 20	
MIFAMA 800/1x75				1x75	940 750 570 450	
MIFAMA 1000/1x55		1000	636 763 1017 1230	1x55	450 360 270 210	
MIFAMA 1000/1x75				1x75	630 500 380 300	
MIFAMA 1000/2x55				2x55	890 710 540 430	
MIFAMA 1000/2x75				2x75	1380 990 750 600	
MIFAMA 1000/4x55				4x55	1450 1160 1000 860	
MIFAMA 1000/4x75				4x75	1520 1300 1220 1110	
MIFAMA 1000/1x90				1x90	760 600 460 360	
MIFAMA 1000/2x90				2x90	1650 1180 900 720	
MIFAMA 1000/4x90				4x90	1830 1560 1460 330	
MIFAMA 1200/2x55	2,3 2,9	1200	1435 1810	2x55	450 350	
MIFAMA 1200/2x75				2x75	570 430	
MIFAMA 1200/4x55				4x55	810 620	
MIFAMA 1200/4x75				4x75	1050 850	
MIFAMA 1200/1x90				1x90	410 310	
MIFAMA 1200/2x90				2x90	685 520	
MIFAMA 1200/4x90				4x90	1140 970	
Gwarek 1000	2,0 2,5 3,15 3,86	1000	650 810 1020 250	4x132	1030	-14° ÷ +16°
Gwarek 1200	2,0 2,5 2	1200	950 1190 1500 1860	4x250	1350	
Gwarek 1200MW	2,0 2,5 15 4,0	1200	950 1190 1500 1900	5x250	1840	
Gwarek 1400	2,0 ,5 3,9	1400	1100 1400 2240 2730	4x250	930	

5. Drive power

The power of the drive is dictated by the speed of the belts and its resistance to motion, the latter being composed of the resistance of material handled in the feeding area, friction resistance and material lifting resistance. With the known value of power necessary to counteract the belt resistance to motion one can calculate the maximum resultant force and the stress in the belt which should be compared with the rated strength of the belt to verify the right selection of the latter.
In the case of conveyors listed in Table 6, the type of belt for the maximum power is given in that Table as well. If the conveyor power is less than the rated values (e.g. due to lower length or capacity) it is necessary to calculate the maximum stress in the belt with the conveyor running under steady conditions and the values as obtained will decide upon the selection of the belt type. In the case of non typical conveyors advantage should be taken of the algorithm shown in Fig. 2, i.e. one should calculate the power necessary to transport the winning from formula (5) below (according to DIN – 22101),

$$P = \frac{CfL}{367} \cdot (3{,}6 \cdot m_{zr} \cdot v + Q_n) \pm \frac{Q_n \cdot H}{367} \quad [kW] \tag{5}$$

The above formula is valid for conveyor angle of depression $\delta \leqslant 15^0$, L > 50 m, the symbols (+) and (–) being used in the case of declivity and decline, respectively. In order to determine the drive motor power P_s consideration should be given to mechanical losses in the drive system whereby formula (5) will be expressed as follows:

$$P_s = \frac{1}{\eta} \left[\frac{CfL}{367} \cdot (3{,}6 \cdot m_{zr} \cdot v + Q_n) \pm \frac{Q_n \cdot H}{367} \right] [kW] \tag{6}$$

wherein:

η - drive efficiency assumed within the range of (0,85 - 0,92)
Q_n - capacity [t/h]
H - material lifting height [m]
C - concentrated resistance factor
f - coefficient of friction in runner bearings (taken as 0,025 for rolling bearings, acc. to Table 7)
m_{zr} - reduced mass referred to 1 [m] of the route length resulting from the belt and rotating parts of carrying and bottom runners
v - speed [m/s]

$$m_{zr} = 2m_t + m_g + m_d \tag{7}$$

wherein:

m_t - weight of 1 meter of belt according to catalogue cards of conveyor belts
m_g ,m_d - weight of idlers set

Table 7. Coefficient of friction f

Route system of conveyor	Working conditions of conveyor	Coefficient of friction f					
		Belt speed v[m/s]					
		1	2	3	4	5	6
Incline, decline, horizontal, min. decline conveyors	Advantageous route system, min. motion resistance, conveying material with low internal friction	0,0135	0,0140	0,0150	0,0160	0,0170	0,0190
	Standard conveyors used in typical working conditions	0,0160	0,0165	0,0170	0,0180	0,0200	0,0220
	Disadvantegous route system, material with high internal friction, positive temperatures	0,025 ÷ 0,027					
	Conveyors in underground mines with high intensity of exploitation	0,025 ÷ 0,028					
	Conveyors in underground mines with low intensity of exploitation	0,028 ÷ 0,031					
	Standard working conditions, but very low ambient temperature	do 0,035					
Conveyor heavily declining	Standard route system, conveying material with typical internal friction (low or medium)	0,012 ÷ 0,016					

Table 8. Appropriate weights m_g, m_d [kg], with runner sets being spaced 1 [m] one from another

Belt width	Runner set	Runner diameter				
		63	89	108	133	159
400	one runner	2,7	3,7			
	two runners	3,5	5,5			
	three runners	4,2	7,2			
500	one runner		3,2	5,3	8,6	
	two runners		4,0	6,7	11,5	
	three runners		4,6	8,1	13,3	
650	one runner	4,0	6,7	10,1		
	two runners	4,8	8,2	12,8		
	three runners	5,5	9,6	14,8		
800	one runner	4,8	8,0	12,0	15,3	
	two runners	5,7	9,7	14,7	17,9	
	three runners	6,5	11,3	16,8	19,7	
1000	one runner	4,8	9,4	13,1	18,8	
	two runners		11,3	16,0	22,3	
	three runners		13,0	18,3	25,0	
1200	one runner			16,7	23,3	30,2
	two runners			19,5	26,9	35,7
	three runners			21,6	30,1	39,8
1400	one runner				26,2	33,4
	two runners				31,0	38,2
	three runners				34,6	44,3
1600	one runner				27,8	37,4
	two runners				34,5	43,2
	three runners				39,8	47,7

The values of $\frac{CfL}{367}$ coefficient are given in table 9. Where the drive system is to incorporate several motors their total power rating shall not be less than Ps. An excess power rating from 5 to 10% is usually added. For conveyors driven from the power network where considerable voltage drops occur a lugher value of excess power should be considerable in selecting the power rating of the motors.

Table 9. Value of $\frac{CfL}{367}$ coefficient

L in [m]		3	4	5	6	8	10	12,5
C		9	7,6	6,6	5,9	5,1	4,5	4
$\frac{CfL}{367}$ for f=	0,016	0,0012	0,0013	0,0014	0,0015	0,0018	0,0020	0,0022
	0,018	0,0013	0,0015	0,0016	0,0017	0,0020	0,0022	0,0024
	0,020	0,0015	0,0016	0,0018	0,0019	0,0022	0,0024	0,0027
	0,022	0,0016	0,0018	0,0020	0,0021	0,0024	0,0027	0,0030
	0,025	0,0018	0,0021	0,0022	0,0024	0,0028	0,0031	0,0034
	0,030	0,0020	0,0025	0,0027	0,0029	0,0033	0,0037	0,0043
L w [m]		16	20	25	32	40	50	63
C		3,6	3,2	2,9	2,6	2,4	2,2	2,0
$\frac{CfL}{367}$ for f=	0,016	0,0025	0,0028	0,0032	0,0036	0,0042	0,0048	0,0055
	0,018	0,0028	0,0031	0,0035	0,0047	0,0047	0,0054	0,0062
	0,020	0,0031	0,0035	0,0040	0,0045	0,0052	0,0060	0,0069
	0,022	0,0035	0,0038	0,0043	0,0050	0,0057	0,0066	0,0076
	0,025	0,0039	0,0043	0,0049	0,0057	0,0065	0,0075	0,0086
	0,030	0,0047	0,0052	0,0059	0,0068	0,0078	0,0090	0,0103
L w [m]		80	100	150	200	300	400	500
C		1,92	1,78	1,58	1,45	1,31	1,25	1,20
$\frac{CfL}{367}$ for f=	0,016	0,0067	0,0078	0,0103	0,0126	0,0171	0,0218	0,0262
	0,018	0,0075	0,0087	0,0116	0,0142	0,0193	0,0245	0,0294
	0,020	0,0084	0,0097	0,0129	0,0158	0,02140	0,0272	0,0327
	0,022	0,0092	0,0107	0,0142	0,0174	,0235	0,0300	0,0360
	0,025	0,0104	0,0121	0,0161	0,0198	0,0368	0,0341	0,0409
	0,030	0,0125	0,0146	0,0194	0,0238	0,0321	0,0409	0,0490
L w [m]		600	700	800	900	1000	2000	2500
C		1,17	1,14	1,12	1,10	1,09	1,06	1,05
$\frac{CfL}{367}$ for f=	0,016	0,0306	0,0348	0,0391	0,0432	0,0475	0,0693	0,0916
	0,018	0,0344	0,0391	0,0439	0,0486	0,0535	0,0780	0,1030
	0,020	0,0383	0,0435	0,0488	0,0540	0,0594	0,0866	0,1144
	0,022	0,0421	0,0478	0,0537	0,0593	0,0653	0,0953	0,1258
	0,025	0,0478	0,0544	0,0610	0,0674	0,0743	0,1083	0,1431
	0,030	0,0574	0,0652	0,0732	0,0809	0,0891	0,1300	0,1717

The circumferential force F_u is transferred from the driving drum onto the belt to friction. The following relationship occurs:

$$\frac{S_1}{S_2} \leqslant e^{\mu\alpha} \tag{8}$$

wherein:
μ — friction coefficient ; α — contact angle acc. to Fig. 4 in radius
S_1 — force in the belt running onto the driving belt [N]
S_2 — force in the belt running off the driving belt [N]

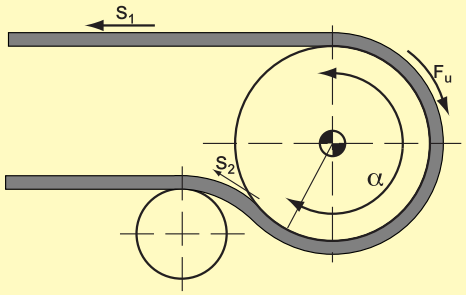


Fig. 4. Force pattern in the belt within the driving drum zone

By summing up the forces on the belt within the driving drum zone the value of circumferential force is obtained:

$$F_u - S_2 \tag{9}$$

The circumferential force F_u results from the driving moment necessary to overcome the belt resistance to motion. Thus, the circumferential force F_u can be calculated from the formula:

$$F_u = \frac{102 \cdot P}{v} \cdot g \quad [N] \tag{10}$$

wherein:
g — acceleration of gravity equal to 9,81 [m/s²]

Following the relationship (5), (8) i (9) it can be taken that:

$$S_1 = F_u \cdot \left(1 + \frac{1}{e^{\mu\alpha} - 1} \right) = \frac{102 \cdot P \cdot g}{v} \cdot \left(1 + \frac{1}{e^{\mu\alpha} - 1} \right) \quad [N]$$

$$S_2 = F_u \cdot \frac{1}{e^{\mu\alpha} - 1} = \frac{102 \cdot P \cdot g}{v} \cdot \frac{1}{e^{\mu\alpha} - 1} \quad [N] \tag{11}$$

The value of coefficient $\left(1+\frac{1}{e^{\mu\alpha}-1}\right)$ depending upon the coefficient of friction μ and contact angle α is given in table 10.

Table 10. Values of coefficient

Drum shell	Friction coefficient μ	Single drum drive				Double drum drive			
		Angle of contant α^0							
		180°	190°	200°	210°	360°	380°	400°	420°
Plain steel shell wet and fouled									
	0,10	3,7	3,55	3,41	3,28	2,13	2,06	1,99	1,90
Rubberized grooved shell, wet and fouled	0,25	1,83	1,77	1,77	1,67	1,26	1,24	1,21	1,19
	0,30	1,64	1,64	1,59	1,50	1,18	1,16	1,14	1,13
Plain and dry shell with rubberized grooved lining or wet drum with ceramic lining									
	0,35	1,50	1,46	1,42	1,38	1,13	1,11	1,10	1,08
Drum with grooved ceramic lining in wet condition	0,35	1,50	1,46	1,42	1,38	1,13	1,11	1,10	1,08
	0,40	1,40	1,36	1,33	1,30	1,09	1,08	1,07	1,06
Dry rubber drum with ceramic lining	0,40	1,40	1,36	1,33	1,30	1,09	1,08	1,07	1,06
	0,45	1,32	1,29	1,24	1,21	1,06	1,05	1,04	1,03

In the case of rubber belts values of coefficient μ are generally adopted as equal to 0,25 for plain and dry steel drums and 0,35 for drums with rubber lining. For belts the values of coefficient μ should be reduced by 20%.

7. Selection of belt type

The maximum force $S_{u\,max}$ [N, kN] occurring during the steady motion of the conveyor running under maximum load (as calculated from formula 11) produces the stress:

$$\delta_u = \frac{S_{umax}}{B} \quad [N/mm],\ [kN/m] \tag{12}$$

wherein: B — belt width [mm, m]

In the case of fabric core belts, the safety factor k_b calculated as the ratio of nominal stress δ_n (nominal strength) to the useful stress δ_u, is ranging from 9 to 12 depending upon the service conditions, type of belt and belt interconnecting methods. On the basic of higher to gained service experience the average value of coefficient k_b can be taken as 10.

Thus the relationship will occur:

$$\delta_n \geqslant \frac{k_b \cdot S_{umax}}{B} \tag{13}$$

or

$$\frac{\delta_n}{\delta_u} = k_b \geqslant 10 \tag{14}$$

The belt type as selected shall satisfy the condition resulting from relationship (13) or (14).

II. CONDITIONS OF BELT FUNCTIONING IN THE CONVEYOR

1. Selection of conveyor drums

The diameters of the drums supporting the running belt have a considerable effect on the life of both the belt and its joints. An additional strain resulting from the belt being bent on the drum is added to the longitudinal strain due to the useful stress and produces a considerable increase of stress in the belt. Furthermore the value of the strain varies thorough the thickness of the belt whereby tangential stresses occur between the plies and eventually result in the separation of plies and general destruction of the belt.

Table 11. Recommended minimal diameter of drum, in mm

Belt type / number of plies	For multiplies textile–rubber belts		For textile mono–ply belts	
	driving	returnable and stretching	driving	returnable and stretching
400/2	250	200	–	–
630/1	–	–	400	315
630/2	250	200	–	–
630/3	400	315	–	–
630/4	630	500	–	–
800/1	–	–	400	315
800/2	500	400	–	–
800/3	500	400	–	–
800/4	630	500	–	–
1000/2	500	400	–	–
1000/3	630	500	–	–
1000/1	–	–	630	500
1000/4	800	630	–	–
1000/5	1000	800	–	–
1250/3	630	500	–	–
1250/4	800	630	–	–
1250/1	–	–	800	630
1250/5	1000	800	–	–
1400/4	1000	800	–	–
1400/1	–	–	800	630
1600/4	1000	800	–	–
1600/5	1250	1000	–	–
2000/4	1250	1000	–	–
2000/5	1250	1000	–	–
2000/6	1400	1250	–	–
2500/5	1250	1000	–	–
2500/6	1400	1250	–	–
3000/6	1400	1250	–	–
3150/6	1400	1250	–	–

2. Stretching the belts

The circumferential force will be transferred onto belt due to friction forces provided that the necessary pulling force is maintained in the lower belt during all phases of conveyor motion. The force is produced by different tensioning gears which another objective is to take up an increase in the length of the belt resulting from its elastic and permanent strain. The length of tensioning drum stroke depends upon the length of conveyor, moduls of elasticity of the belt and its initial tension. In designing the conveyors with the belts having the core with unvowen cloth plies an estimated lengths of stretching drum stroke depend upon the length of conveyor L and are as follows:

conveyors up to	30 m in length	—	0,02 L
	300 m in length	—	(0,015÷0,02) L
	1500 m in length	—	(0,005÷0,01) L
	3000 m in length	—	0,005 L

3. Guiding the belt

An incorrect running of the belt along the conveyor route is caused by:
— horizontal curvatures of the route
— misalignment of interconnected belt sections
— wrong settings of separate runner sets
— defective connection between the sections of the belt
— asymmetric feeding of material onto the belt.

To eliminate excessive lateral displacements of the belt the runner sets are applied wherein the side runners are positional askew as shown in Fig. 5. The setting angle is $2 \div 3^0$. The spacing between the guiding runners is taken as 10÷20 m. The similar method may also be applied in guiding the lower belt (the runner shall be set in such a manner that the transverse component of the vector of runner rotational speed is directed opposite to the direction of belt deviations from the route).

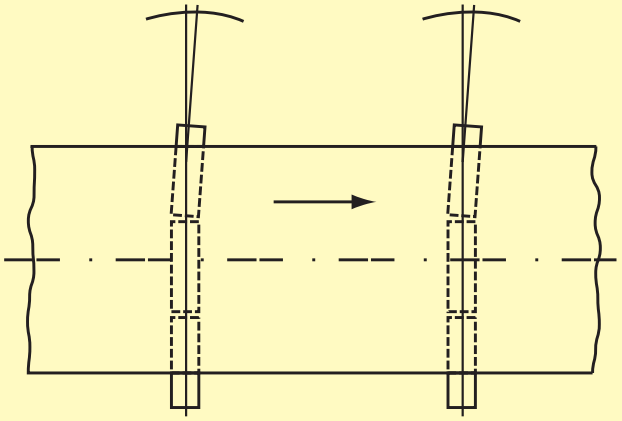


Fig. 5. Setting of belt guidance runners

4. Spacing between runner sets

Spacing between runner sets depends upon the load to which the runners are subjected, taking in consideration their life and inadmissible deformations in the channel profile of the belt. The spacing is determined so as to ensure that the sag of the belt between the runner sets is equal to 1÷1,5% of their spacing. The distance „a" satisfying the above condition is calculated from the formula:

$$a = \frac{(0{,}01 \div 0{,}015) \cdot 8 \cdot S_n}{(m_T + m_n) \cdot g} \quad [m] \qquad (15)$$

wherein:

S_n — force in the belt occurring at the place of the route under consideration [N]
m_T — belt weight [kg/m]
m_n — material handled weight [kg/m]
g — acceleration of gravity – 9,81 [m/s^2]

According to formula (15) the spacing between the runner sets for the upper belt branch may vary with the place of their installation. The closer the driving drum the greater may be the spacing following the criterion of the permissible belt sag.

5. Cleaning the belts

The remainders of material handled has to be removed from the belt, particularly in cases where the material can stick to the belt surface.
It is also important to prevent the remainder of material from penetrating between the drum and belt which could result in belt damage or an excessive wear of drum shell and belts covers. For this purpose the scrapers or special cleaning equipment are provided. In the case of conveyors for special purposes e.g. those operating in boiler coaling system the material handled has to be directed to the bunkers situated in different places under the conveyor, which requires the application of special staggered scrapers.
The problem of belt cleaning and removal of material remainders is of great importance in the case of high capacity conveyors operated in strip mines, especially at ambient temperatures below 0°C, when the remainders of material handled stick to the frozen drums. It is generally adopted that the different types of scrapers have to be provided with rubber lining which is relatively flexible, resistant to abrasion and does not injure the joints between the belts. Scraper lining shall not be made of the pieces of belt.

In our catalogue cards you can find the technical information about rubber scrapers produced by us and how to select them with the used conveyor belts. It is necessary in the case of the cleaning of the belts produced by ZGB S.A. by using futher cleaning systems to agree in the range of their building.

III. TRANSPORT AND STORAGE OF BELTS

Belts are delivered in coils protected against unwinding. Packing, marking, transport and storage of the belts shall comply with the requirements of standards specified on the belt production program. In the case of prolonged storage the belts shall be rewound every three months.
PVC belts transported at temperature below 0°C shall be handled with care and must not be cast down from the trucks, otherwise they can crack.

Prior to unwinding the belts have to be brought to a temperature of at least +5°C and kept at that temperature for at least 24 hours.

These belts shall be protected against sun rays, by covering the windows with orange or red curtains. Blue curtains must not be used.

$$L = \frac{\Pi}{4S}(D^2 - d^2) \quad [m] \tag{16}$$

$$D = \sqrt{\frac{4LS}{\Pi} + d^2} \tag{17}$$

wherein: S — the thickness of belt;
L — the length of belt
d — core diameter
D — external diameter of belt roll

IV. METHODS OF SPLICING

The belts can be joined using several methods depending upon the grade, carcass construction and type (strength). Cementing should preferably be used, since such joints do not interrupt the continuity of belt structure which is advantageous for the combined work of belt, runners and drums. Furthermore, cemented joints made strictly to the proper technologies exhibit a long service life.

1. Types of splices

- cold cemented (stepped)
- vulcanization (stepped, finger)

Finger joints are used in the mono–ply belts (PVC, PWG, PWG PM, GPVC).

Stepped joints are used in all types of multi–ply belts.

1.1. Finger joints

To make the finger joints by vulcanization it is necessary to remove the covers from the belt in the joining place and mould exact after template of prepared belt ends. To make the joints it is necessary to use the producers materials in accordance with catalogue card ***Materials for joining.***

To reinforce the cross finger joints it is necessary to cover on both sides with breaker fabric, which will provide transverse strength of joint.

Table 12. The dimensions of each element of finger joint

Nominal belt strength [kN/m]	Dimension of fingers		Length of removal of covers	
	the width b [mm]	the length l_p [mm]	p_1 [mm]	p_2 [mm]
315; 400	30	350	370	450
500; 600; 800	40	700	730	830
1000; 1250	60	1200	1250	1370
1600	70	1600	1660	1800
2000	70	2000	2070	2230

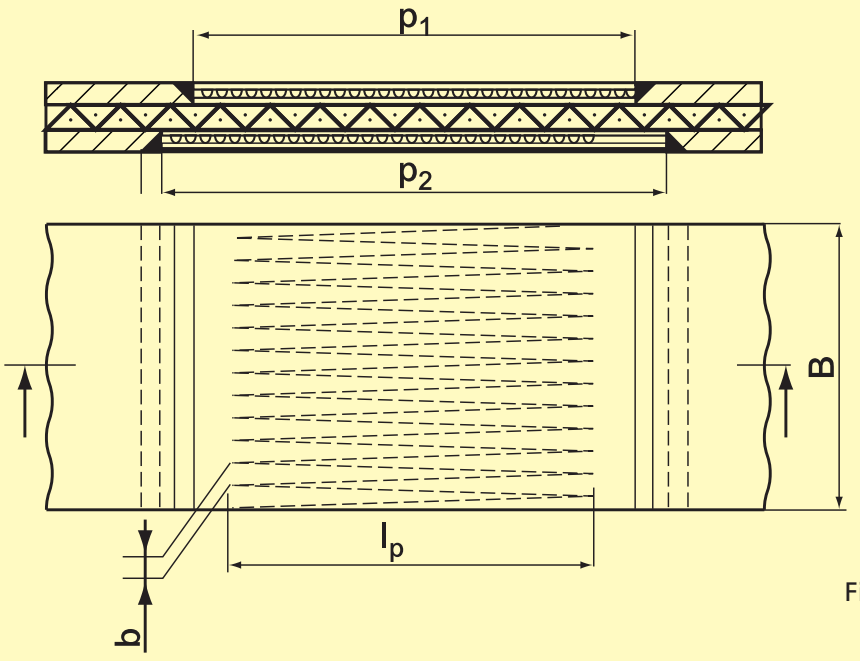


Fig. 6 Finger joints

Stepped joints for multiply belts are made with the method of „hot" and „cold".

Hot vulcanization (vulcanized joints on rubber belts) is made by bonding the prepared belt surface by rubber compounds and rubber cement, by putting together elements to be jointed and vulcanizing them on presses providing the specified temperature and time.

Cold cementing is made by coating the prepared surface with self–vulcanized cement, filling up the slots which close the joint, putting together, pressing down, stabilizing the jointed elements.

Dimension of belt joints by „stepped" method

$$L_p = n \cdot l_{st} + 1_A \qquad (18)$$

wherein:

n — number of steps (N= z–1)

l_A — length of bevel, in mm;

l_{st}— length of step, in mm;

Z — number of plies

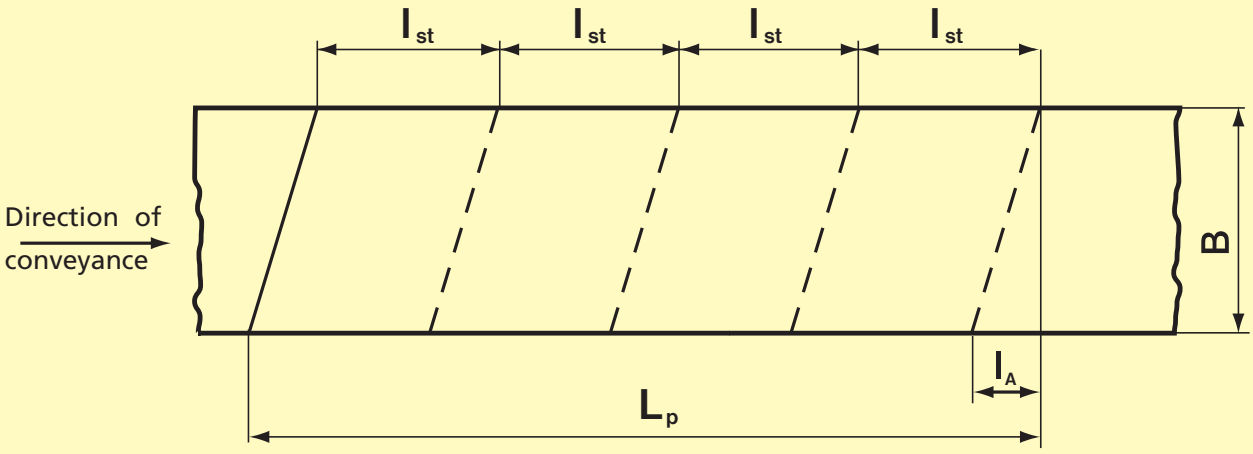


Fig. 7. Joint of multi–ply belt

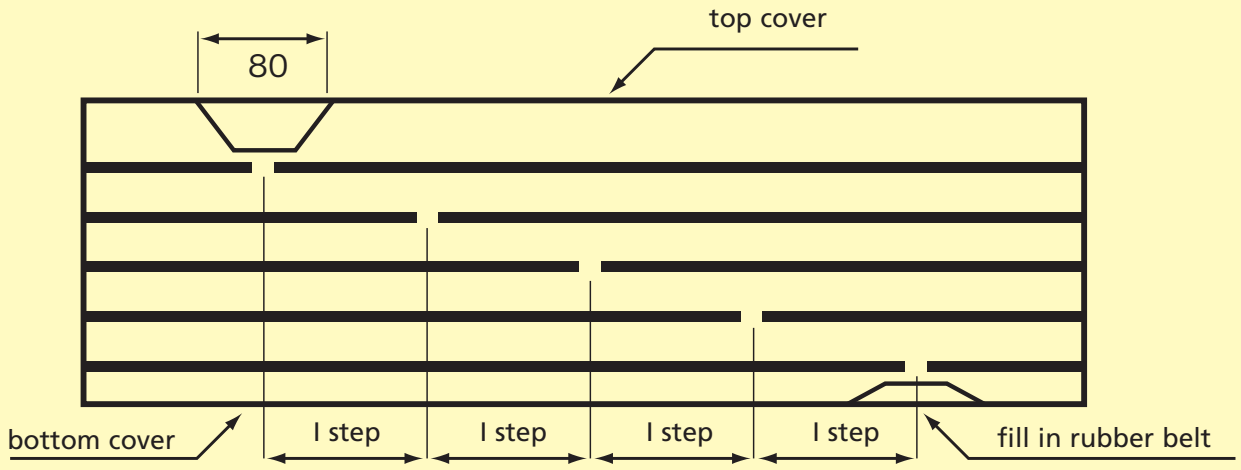


Fig. 8. Four–step hot vulcanized joint

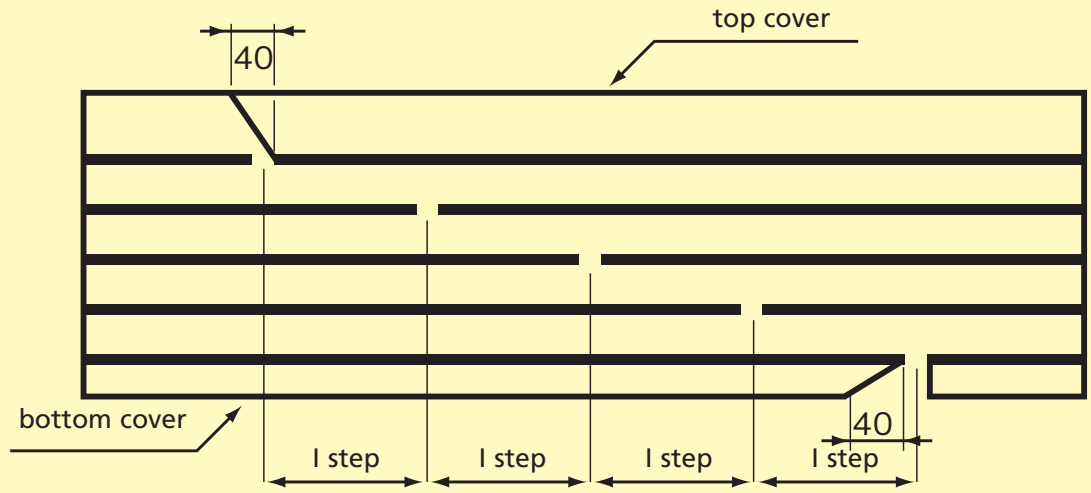


Fig. 9. Four–step cold vulcanized joint

Table 13. Length of step l_{st} in mm

Strength of ply [kN/m]	Length of step l_{st} [mm]
from 150	150
from 160 to 250	250
from 315 to 400	350
from 500 to 630	400

The length of bevel l_A should be 0,3B or 0,4B (B – belt width in mm).

The thickness of joint should be equal to the thickness of jointed belts or smaller at most 1 mm.

The width of joint should be equal to the width of jointed belts or smaller at most 5 mm.

In case of any need of advice or more specific question please contact our export department or technology department.

1. Sources of defects

Defects likely occur during the operating of conveyors are given in Table 14. Each defect is designated with a capital letter. Possible sources of defects according to the list of defects given on following pages are designated with a digit corresponding to that given in said list (after register from 58÷60 pages).

Table 14. Causes and rectification of defects

Defect		Defect source (following the probability of occurence)					
A	Belt deviates on one side at a determined point of route	5	4	1	2	3	44
B	One and the same section of the belt deviates on one side along the whole route	6	7	—	—	—	—
C	Belt deviates aside along a considerable section of conveyor or along the whole conveyor	39	8	5	1	2	3
D	Belt deviates from the terminal drum	39	10	1	—	—	—
E	Belt deviates from the front drum	33	10	1	3	—	—
F	Belt slip	34	33	31	10	4	—
G	Belt slip at start up	34	31	33	—	—	—
H	Excessive tension in the belt	41	42	43	12	32	35
I	Grooving, scratching or tearing away of the carrying cover	13	14	15	16	—	—
J	Excessive wear (abrasion) of carrying cover	19	20	10	8	36	27
K	Fast wear of driving drums lining	4	9	10	17	11	27
L	Longitudinal scratches or cracks on running cover	4	10	9	33	—	—
M	Belt covers are hardening or cracking	23	37	—	—	—	—
N	Point or streak swelling on belt cover	21	—	—	—	—	—
O	Belt breaks at or just behind the mechanical joint – – the fasteners „comb away" from the belt	24	22	12	23	—	—
P	Ply separation in vulcanized joints	38	30	12	17	25	—
Q	Excessive wear on belt edges, cracks appear on edges	8	10	40	7	—	—
R	Transverse ruptures on belt edges	18	25	26	—	—	—
S	Short longitudinal cracks on belt core and transverse cracks	16	17	—	—	—	—
T	Belt ply separation	29	30	23	—	—	—
U	Fatigue (loosening) of belt core observed where the belt passes between the runner inclined in relation to one another	25	26	27	28	29	36
V	Blisters on the belt cover	45	21	—	—	—	—
W	Point wear of the covers of new belts (in the form of intended craters)	46	—	—	—	—	—
X	Point wear of the covers of used belts (in the form of intended craters)	21	23	—	—	—	—

2. Causes of defects and its recovery

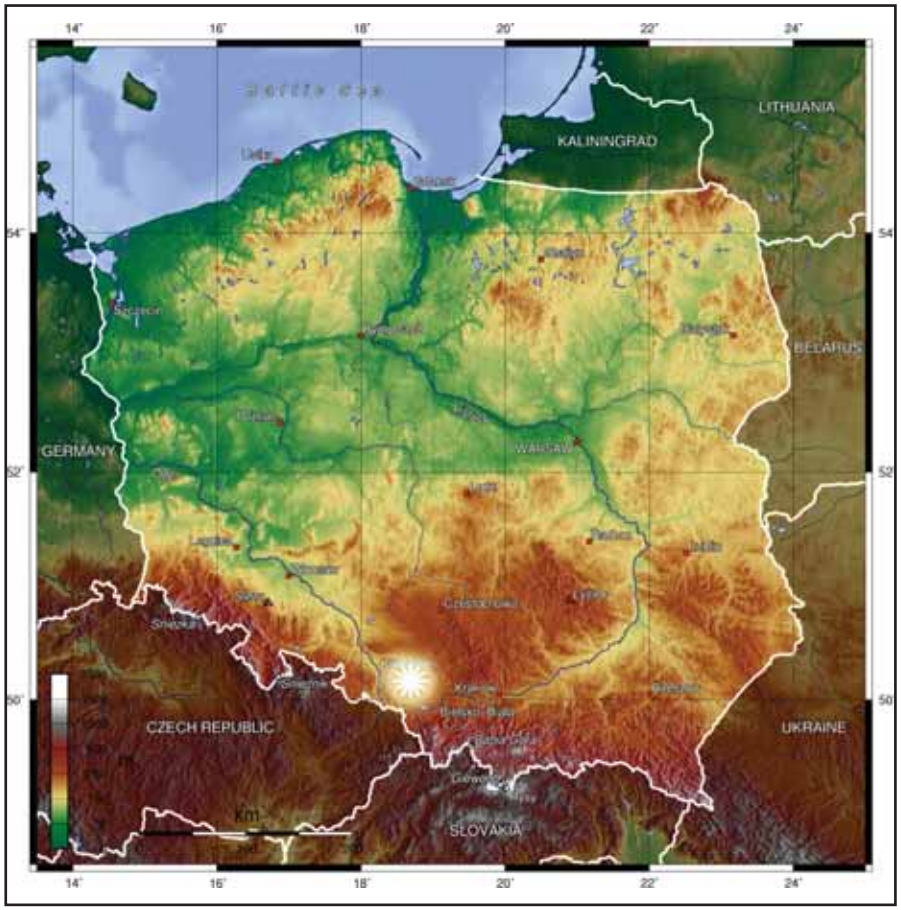
The numbers are those from Table 14.

1. **Adjustable and fixed runners are misaligned in relation to the belt centre–line:** correct the setting of adjustable runners where the belt deviates from the route.
2. **The route structure is twisted:** straighten the route where belt deviations occur.
3. **Adjustable runner stands are misaligned in relation to the centre line of the route:** adjust the setting of the stands.
4. **Belt runners get seized:** remove fouling, rectify their protective coating and lubrication.
5. **Accumulation of material handled under the runners:** remove the material, make up protective coatings install scrapers or other cleaning devices.
6. **Belt sections are joined out–of–square in relation to one another:** remove faulty joint and join correctly the belts.
7. **Sickle–profile of the belt:** this should disappear in service, in rare cases the belt has to be straightened (by making additional joints) or replaced. Check the conditions of transport and storage of belts.
8. **Non–axial feedings:** adjust the chute so as the material could be fed on the middle of the belt, unload the material following the belt movement direction with the belt running with normal speed.
9. **Material handled drops of the belt within the drive area:** increase belt tension, apply a lining on the driving drum, increase angle of contact.
10. **Spilling or accumulation of material handled:** improve feeding and transport conditions, install cleaning devices, improve protective treatment.
11. **Bolt heads protrude above the drum lining:** remove the bolts, replace the lining, apply the lining of stick–on type.
12. **Excessively high stress in the belt:** increase the belt speed with the feeding rate unchanged or reduce feeding rate with belt speed unchanged, reduce friction by better maintenance and replacement of damaged runners, reduce the tension by increasing the angle of contact or line the driving drums, reduce the initial tension of the belt to a necessary minimum.
13. **Side strips at feeding points are either improperly set or made of improper material:** adjust the strips so as to obtain the gap between the strips and the belt increasing in the direction of belt motion. The strips must be lined with special rubber rather than with old belt.

14. **An effective deflection of the belt due to the load on the hopper:** install additional cushion runners.
15. **Material handled bridging in the chute or under the chute cover:** trim the material to reduce its building up install guard rails, apply a wider chute.
16. **Material impingement on the belt:** reduce the impingement by better setting of chute, install additional cushion runners.
17. **Material gets seized between the belt and drum:** install scrapers on the lower belt ahead of terminal drum.
18. **Belt edges run onto the vertical pillar of the conveyor structure and get corrugated:** Do as recommended under numbers 1, 2, 3; install limit switches, provide a larger gap between the belt and conveyor route pillars.
19. **Bottom runners are dirty, blocked or misaligned:** remove accumulated fouling, install cleaning devices apply self–cleaning bottom runners, improve protective treatment and lubrication.
20. **Poor carrying cover:** apply a stronger one or improve the quality of rubber.
21. **Oil or grease spills:** excessive lubrication of runners, improve maintenance regime, reduce the amount of lubricant, check lubricant seals.
22. **Poor quality of fastener elements with their attachment to the belt, being too loose or too light:** apply correct fasteners and attachment method, prepare and implement joint inspection schedule.
23. **Damage of chemical or thermal nature:** apply the belt earmarked for concrete conditions.
24. **The fasteners are too long in relation to driving drum diameter:** apply shorter fasteners or a drum with larger diameter.
25. **Incorrect profiling of the section between the channelled belt and discharge drum;** the transition section is too short or the generating line of the drum is situated too low in relation to the bottom of channelled belt.
26. **Excessively high vertical curvature (lumps) of the route:** decrease the spacing between the runners and increase the radius of curvature (according to the User's Manual).
27. **An excessive forward inclination of side runners:** decrease the inclination of the runners not to exceed 1^0
28. **Excessive gap between the runners:** improve runners fixation in the sets, apply a thicker belt.
29. **Unsatisfactory rigidity of the belt:** apply a right belt.
30. **Driving drums are too small:** apply greater ones.

31. **Weights in the tensioning system are insufficient:** increase their size or pretension the belt to the calculated value.
32. **Weights in the tensioning systems are oversized:** decrease their size or reduce the pretension of the belt to the calculated value.
33. **Worn drum lining:** replace with new one.
34. **Insufficient friction contact between the belt and drums:** apply a lining on the driving drums, increase the angle of contact, install belt cleaning devices.
35. **Conveyor capacity is too low:** recalculate the tension of the belt and select a right belt.
36. **Excessive belt sag between the runners resulting in material intermixing where the belt passes over the runners:** if the belt tension is too low increase the tension, otherwise reduce the spacing between the runners.
37. **Improper storage or handling of belt:** check the corresponding recommendations in this Manual.
38. **Poor joints on the belt:** make new joints as recommended in corresponding instructions.
39. **Belt running off from the reversing drum and within the feeding area:** install adjustable setting runners on the bottom tape ahead of reversing drum.
40. **Belt rubs against its supporting structure:** apply an advance arrangement of adjustable runners on carrying (loaded) and bottom (empty) belt.
41. **Incorrect installation of the belt resulting in its excessive extension:** tension the belt to the value normally occurring at idle running and run the conveyor for a certain period of time so as the belt could take up a proper position and stabilize its length. To facilitate belt shortening during that period apply at least one mechanical joint.
42. **Incorrect setting of weight tensioning system resulting in an excessive tension of the belt:** correct the setting of the tensioning system.
43. **Incorrect setting of weight tensioning system resulting in the limited displacement of the tensioning drum and an excessive belt tension:** correct the initial setting of the tensioning system.
44. **Poor levelling of the structure:** correct its setting where disturbances occur in belt motion.
45. **Cuts or very small punctures on the carrying cover result in small material grains penetrating thereunder whereby the cove gets separated from the core of the belt:** make local repairs using vulcanization or self–hardening cement.
46. **Excessive cover thickness–to–core thickness ratio:** apply the belt with thinner cover or thicker core.

How to get to ZGB S.A.
Additional information



We try to help our customers to find the best solution, which will guarantee not only basic technical parameters, but also long and non–problematical exploitation. The sale of our conveyor belts to the end–user does not finish with the despatch of the goods.

Our staff are available for consultation on all aspects of conveyor belt selection and for trouble–shooting activities.

This after–sales service and support is considered to be of vital importance, ensuring the customer the most benefit form our products.

ZGB S.A. is famous manufacturer with over 60 years' tradition of conveyor belts production.

We keep well–founded conviction that our belts fulfil the highest requirements of global market. Today our belts are used in the whole world in such fields as energetics, metallurgy, building and chemical industry.

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location of ZGB S.A.: longitude and latitude
(GPS map reference):
Latitude: 50°19'44.62" North
Longitude: 18°55'25.18" East

EN ISO 9001
EN ISO 14001:2004

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ZGB

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CERTIFICATE

Management system as per
EN ISO 9001 : 2000

In accordance with TÜV CERT procedures, it is hereby certified that

Zakłady Gumowe Bytom SA
ul. Szyby Rycerskie
PL / 41-909 Bytom

applies a management system in line with the above standard for the following scope

Manufacture of conveyor belts and other rubber and PVC products.

Certificate Registration No. **04 100 048217**
Audit Report No. **PL 77/2007**

Valid until **2010-09-02**
Initial certification **2004**

TÜV CERT Certification Body
at TÜV NORD CERT GmbH

Katowice, 2007-06-14

This certification was conducted in accordance with the TÜV CERT auditing and certification procedures and is subject to regular surveillance audits.
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