INTERNATIONAL CONVEYORS LIMITED

World's Second Largest PVC Conveyor Belt Company

Mineplast

Belts that Trough

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INTRODUCTION

With more than three decades of experience in research and development and manufacture and marketing of conveyor belting for underground mining operations, ICL today has emerged a global leader in Conveyor Belting Products and Services. The company has to its credit an unbroken track record of innovation and product design and application engineering. In addition to our consistent effort to achieve the highest standards of technical excellence, we are also guided by core human values. At ICL, our uncompromising commitment to customer service and human safety remain sacrosanct. It is the combination of these factors that have made ICL a global leader.

The keystone of modern mining operations is the robustness of the company's material handling systems. Considering the tough conditions under which conveyors operate, it is of prime importance to choose the right belt, one that has the tenacity to resist impact, ripping, abrasion, bacteria, acid and water and to have a by and large trouble-free working life.

With our stringent quality check mechanisms and one of most superior conveyor belting facilities worldwide, ICL's Mineplast is a Competent, Dependable and Safe conveyor belt for profitable mining operations. ICL enjoys a dominant market share in the markets that it operates in.

The Company that leads PVC Conveyor Belting Globally in underground mine and surface applications.

CONTENTS

1 THE ADVANTAGES OF MINEPLAST

ICL cares for human life and that is why our high-performance belts are a result of integrated in-house development - from yarn preparation, fabric weaving, and compound mixing to belt finishing. The high standards of quality control at every stage conform to the highest global standards of safety and performance. Each belt is meticulously tested for physical, fire retardant and anti static properties.

Mineplast offers a superior Carcass that completely prevents of any ingress of moisture and a perfectly finished Solid Woven Conveyor Belting. The advantages of Mineplast Solid Woven conveyor belting are:

- No possibility of ply separation, due to the fact that it is a solid woven belt
- Elimination of any chance of delamination, due to the fact that Covers form an integral part of the finished belt
- Adherence to the most stringent safety parameters in the world for fire resistant and anti-static properties
- Easier toughing and tracking, made possible due to the greater flexibility exhibited by solid woven construction
- Higher resistance to impact, edge wear and longitudinal tear due to the solid woven construction
- Excellent capacity for retention of mechanical fasteners
- Resistance to attacks from water, oil, bacteria, acid and chemicals
- Capacity to withstand high dynamic and static properties for both vulcanized (splicing) and mechanical joints

2 BELT CONSTRUCTION

Carcass

The carcass of the belt is an important factor as it provides the necessary tensile strength of the belt and is so designed to carry the required load as well as to ensure flexibility for proper troughing on the conveyor system.

Various synthetic and natural fibers are used for the construction of the carcass in order to meet the requirements for load support, troughing flexibility, resistance to impact, and elongation of the belt.

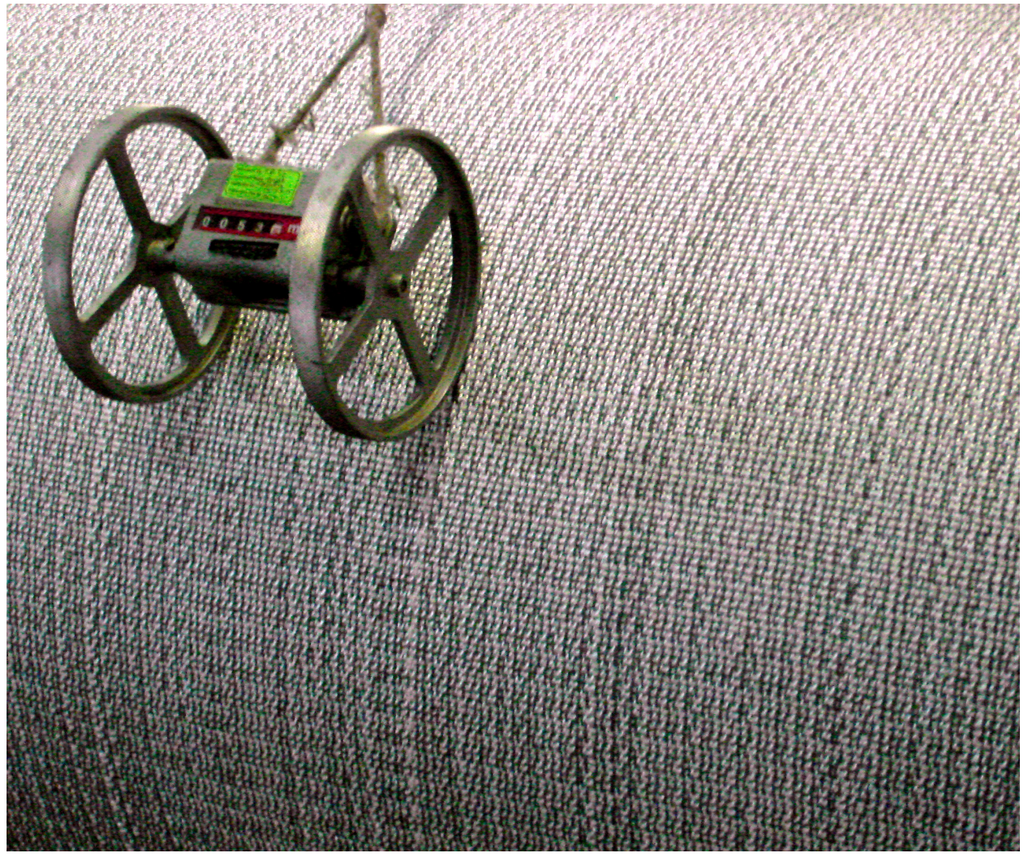
The woven carcass is fully impregnated with PVC compound for making a finished carcass that is resistant to attack from chemicals, bacteria, moisture and oils.

Cover

The belt cover ensures the following parameters:

- Protects the reinforced carcass to achieve enhanced belt usage life
- Safeguards from oils, chemicals, water and other hazardous materials
- Improves resistance to abrasion
- Improves coefficient of friction, while in use.

Mineplast offers various formulations of covers to match specific applications.



Other Application

Mineplast PVC Conveyor Belting can be custom built for use in special surface application like Bucket elevators and Grain handling and Miscellaneous Material handling applications.

3 RANGE OF PRODUCTS

Mineplast Fire Resistant

Mineplast Fire Resistant belting has a proven track record of superior service in coal mining and other similar applications where the high, continuous output depends largely on the performance and reliability of the belt. Mineplast Fire Resistant, designed primarily for use in underground and other potentially hazardous situations, meets and in many cases, exceeds the fire-resistance and anti-static requirements of all worldwide safety standards, through its PVC compounds, customizable cover thickness and its solid woven carcass, making the belt ideal for conveying coal, potash, phosphate, fertilizer, clay, gypsum and salt. It is also suited for use in the timber industry.

4 PRODUCT TESTING

A key function of the ICL Research & Development wing is the continual testing of Mineplast products to ensure that the highest standards are met in Conveyor belting, especially belting that is for use in underground applications. Our in-house dynamic testing processes ensure that every belt exceeds its promise of performance and life.

Mineplast is ISO 9001:2008 certified, which means that one of our ongoing aims is to focus on the continual improvement of systems and conformity to customer and statutory and regulatory requirements. As a result of this focus, the company's Research and Development wing at Aurangabad, India, is continuously involved in the ugradation of the technology of the product. The Research & Development wing oversees not just process development, but it also tests all raw materials that go into the making of our world-class belting that meets the specifications of customers.

One of the foremost functions of the Research & Development wing is the testing of the product in accordance to its standards and also in accordance to customer specifications, facets that are most stringently adhered to. Our in-house testing facilities have state-of-the-art equipment to conduct all testing, including safety tests that are crucial for belts for use in underground mining applications.

Mineplast – Research & Development – Centre Of Technology Upgradation

Safety Testing

Fire resistance specifications vary from country to country. However, Mineplast belts can be formulated to meet any fire performance specifications in the world. In terms of Fire Safety, our stringent tests ensure that belts should never be the cause of a fire, that belts should be difficult to ignite, and if ignited by an external fire source, belts should not propagate the fire.

For this, the belts are put through tests like Drum Friction Test, Laboratory Flame Test, Gallery Fire Test and Electrical Resistance Test, which eliminate the fire hazards.

1. Drum Friction Test

In Conveyor applications, there is a danger of the belt stalling while the drums keep rotating. In order to ensure that the temperature levels do not exceed the set standards, the belt is mounted on drums to test the temperature, flame or glow for a specific time period, or till the belt breaks, during which time and all parameters are noted.

2. Laboratory Flame Test

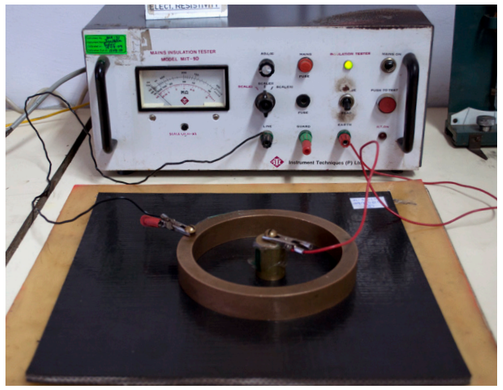
To assess a belt's 'self-extinguishing' capability, the Bunsen burner flame test is carried out. The test ensures that the belt is self-extinguishing as per standards. The times for glow to self-extinguishing, with and without covers, are noted before desptach.

3. Fire Propagation Test

The test is carried out to ensure that belts do not propagate and spread to other areas from a larger ignition. The assessment of fire propagation is carried out by using the gallery test method, where a conveyor belt sample is placed in a specified cabinet on a trestle that has specific dimensions. The sample length of belt is ignited by a set of gas burners using propane gas for a minimum of 50 minutes, and at the same time, air is continuously drawn at a specific velocity through the cabinet. After removing the source of the flame, the un-burnt portion of the belt is measured and compared with set country-specific standards.

4. Electrical Resistance Test

This test is carried out to ensure that no static electricity is generated on rotating Conveyors. The PVC Compounds are formulated in a manner that ensures the belt's resistance to generation of static electricity. The measurement of electrical resistance is determined by placing electrodes on the surface of the belt and then passing an electric current of specified voltage. The acceptance of maximum conductivity of electrical resistance is 3 x 108 ohms - a universally accepted standard.



Physical and Mechanical Quality Testing

Mineplast Conveyor belting is manufactured to Quality Management System compliant with ISO 9001:2008 and is tested to comply with standards for the following parameters:

- Physical measurements of the belt
- Tensile strengths in warp and weft direction
- Elongation at break
- Elongation at reference load (i.e. 10% of belt tensile)
- Tear Strength
- Cover adhesion
- Flexural rigidity – troughability
- Safety tests (Flame, Drum Friction and Electrical Resistance)
- Abrasion resistance

Dynamic Rig Testing

This test ensures that belts perform in accordance with customers' requirements. It also tests the belt's ability to be joined, either by the use of mechanical fasteners or vulcanized splices. A test piece is mounted on a prototype conveyor and is tensioned to the requirement. The test piece is allowed to move continuously to ensure the performance of the belt to the extent of 1, 00,000 cycles to arrive at the following parameters of field simulation:

- Joint life evaluation
- Evaluation of belt troughing
- Testing of belt to customer requirements.
- Product development.
- Field application testing

5 TECHNICAL INFORMATION

Belt Nomenclature

Belts can be manufactured to various tensile strengths. Different markets may specify or enquire in different terms, for example, they may quantify either in lbs/in or in kN/m. The table below gives the tensile strength of our range of belts in lbs/in and kN/m.

The belt designation has been expressed in lbs/in with the corresponding values in kN/m provided. The typical values of warp and weft tensile strength are given in the table based on a 1mm PVC cover thickness.

Belt Thickness

The textile content of Solid Woven Mineplast belting, as compared to ply belting is high and the properties exhibited by the bulk carcass are far better. Thus, a thinner cover can be chosen than one that would be normally associated with a ply belt, largely due to Mineplast's enhanced carcass density, which provides the load-bearing support.

Belt Weight

A lower belt weight in solid woven belting, as compared to a ply belt, may be advantageous for a long conveyor as it saves on power consumption, a factor that customers may take into consideration.

Drum Diameters

Recommended minimum drum diameters are provided for general applications. However, if conveyor details like angle of wrap, belt speed, tension and method of jointing are furnished, it is possible to suggest smaller drum diameters.

Factor of Safety

The operating factor of safety is 10:1 with a superior quality joint whether vulcanized or mechanical

Belt Stretch

Mineplast Solid Woven belting is manufactured with a unique design and in such a manner that the elongation in service is kept to a minimum.

Technical Specifications

The table below shows nominal figures for minimum warp & weft breaking strengths, belt thickness & weight for a selection of belt types, based on 1mm x 1mm PVC covers on either side. For every additional 1 mm PVC cover, add 1.25 kg/sq.mtr. for PVC covers.

Belt Designation	Warp Breaking Strength	Weft Breaking Strength	Cover Thickness	Belt Thickness*	Belt Weight*	Minimum recommended Drum Diameters	
lbs/in	kN/Mtr	kN/Mtr	mm	mm	kg/sq.m	high tension (mm)	low tension (mm)
2500	438	265	1.0x1.0	7.5	9.5	315	250
3500	610	265	1.0x1.0	8.0	10.5	400	315
4000	700	265	1.0x1.0	8.3	10.9	400	355
4500	788	352	1.0x1.0	8.5	11.2	500	355
5000	875	352	1.0x1.0	8.9	11.5	500	355
6000	1050	352	1.0x1.0	9.4	12.0	630	400
6500	1140	352	1.0x1.0	9.5	12.5	630	400
7000	1225	352	1.0x1.0	10.5	14.0	750	450
8000	1400	425	1.0x1.0	11.0	15.0	750	450
9000	1576	425	1.0x1.0	12.0	15.5	800	600
10000	1751	455	1.0x1.0	13.0	16.5	800	600
11000	1926	455	1.0x1.0	13.5	17.0	1000	750
12000	2100	455	1.0x1.0	14.5	18.0	1000	750
14000	2452	455	1.0x1.0	15.5	19.0	1250	800
15000	2625	455	1.0x1.0	16.5	20.0	1250	800

*Nominal values with 1+1 PVC covers

Belt Width
Customer specified belt width can be manufactured upto 1800MM (72") belt width. The preferred widths are in accordance with ISO ranges. However, non-standard belt width can also be supplied as per customer requirements.

Note: Slit edge belt with required widths are also available on request.

Roll Lengths
Generally, the standard roll length of 200 Mtrs in a single roll is manufactured. However, depending upon different strengths, the belt can be manufactured to non-standard roll length as per customer requirements. Belts can also be pre-fitted with mechanical fasteners if required by the customer. Rolls in single or double coil can also be supplied.

Usage Temperature Range
The properties of a PVC Conveyor belt undergo a change when the temperature exceeds 85 - 900 C, thereby prohibiting the use of PVC belts for transpiration of materials at the above specified temperature range. In cold weather conditions, a PVC belt is not recommended for use in a temperature range below 10 – 150 C.

Note:- The above specified temperature is the working temperature for conveying materials by PVC conveyor belting in operating sites.

6 SAFETY & QUALITY ASSURANCE

Safety Assurance
Mineplast PVC Solid Woven Conveyor Belting is manufactured under stringent quality control systems compliant with ISO 9001 : 2008 and meets all Safety Standard laid down by county specific updated specifications:

COUNTRY	APPLICABLE STANDARD
Australia	AS 4606
Canada	CSAM422
China	MT914
India	IS:3181
USA	MSHA Title Part 14 and Part 18
South Africa	SANS 971

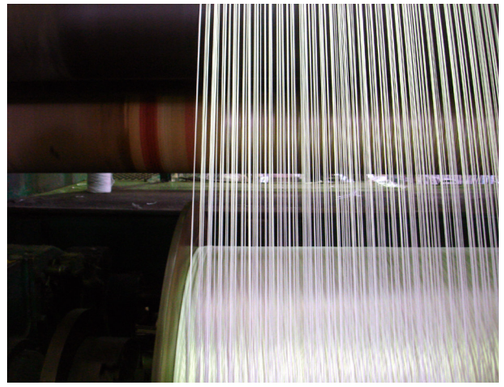
Quality Assurance
In accordance with the requirements of our major customers, the planning, design, manufacture and quality control procedures of ICL have been assessed and are approved to Specification ISO 9000:2008, the International Standard for official approval of a manufacturer's quality system. The system approved under the above standard has been accepted by the USA Mines Safety and Health Commission. A similar assessment of ICL Mineplast has been carried out by the Canadian Federal Energy Mines and Resources Department against the Canadian Standard CAN3Z299, 1-78 "Quality Assurance Programme Requirements" and by the Spanish LOM Authority.

7 JOINTING OF MINEPLAST

There are two methods of Mineplast belt jointing - By the use of mechanical fasteners and by hot vulcanized finger splicing.

Hot Vulcanized Jointing
The process involves the use of conventional vulcanizing presses and various polymeric jointing materials for obtaining maximum joint efficiency. Hot finger splicing exhibits excellent joint efficiency, quite as good as the belt tensile. Hot vulcanizing finger splicing has the following attributes:

- Highest joint strength
- No possibility of tearing in the spliced area
- A smooth joint area for enhanced performance under scrapers, ploughs, deflectors and minimal impact over pulleys and idlers
- No hindrance for operation through automatic weighing devices and magnetic separators
- Minimum maintenance
- Impervious to attacks from moisture and chemicals
- Excellent resistance to abrasion
- Easy cleaning
- Minimized spillage, as the joint has no gaps



Mechanical Fasteners
The high density of a Mineplast solid woven carcass, combined with the high quality PVC impregnation in a vacuum impregnation process, delivers excellent fastener retention properties. The range of fasteners is suitable for use with Mineplast, amongst which, Mato Fasteners (range mentioned below) are widely accepted. Belt with mechanical fasteners are used in conditions where:

- Changing of belts is frequent
- Extension of belts and conveyors happens regularly
- Repair or emergency joint are required
- Cushion in take-up is limited

Mato Range of Fasteners

Type	Tensile Strength		Belt Thickness
	max N/mm	max lbs/in	mm
U35A	1050	6000	5 - 9
U35	1050	6000	7 - 11
U37A	1400	8000	8 - 12
U37	1400	8000	10 - 14
U38A	3500	20000	12 - 15
U38	3500	20000	15 - 18
U65A	1400	8000	6 - 10
U65	1400	8000	8 - 12
U67A	1600	9000	9 - 13
U67	1600	9000	12 - 16
U68A	3500	20000	12 - 15
U68	3500	20000	12 - 18
MH22A	630	3500	5 - 7
MH22B	630	3500	7 - 9
MH25A	1050	6500	5 - 7
MH25B	1050	6500	7 - 9
MH27A	1400	8000	10 - 12
MH27B	1400	8000	12 - 14
MP27	800	4500	8 - 11
MP28	800	4500	8.5 - 14.5

8 GUIDE FOR BELT SELECTION

ICL Mineplast is a premier solid-woven conveyor belt capable of delivering outstanding performance under practically all operating conditions. However, belting is the most vulnerable part of a conveyor system and unnecessary belt wear and stress caused by incorrect installation or maintenance can result in costly repairs and replacements.

The information referred here will assist engineers in making basic calculations that are necessary for determining which belt in the ICL Mineplast range is most suited to a particular application and also to give other general guidance to belt users.

ICL's Mineplast engineers can be consulted for advice on conveyor belt problems outside the scope of the User Guide.

Power Calculation

The power required at the head shaft is dependent on three major factors:

1. Power to drive the empty belt

$$\frac{Fx\ W \times 5x\ (L+D) \times 9.81}{1000}\ kW$$

2. Power to move the load horizontally

$$\frac{F \times T \times (L+D) \times 2.72}{1000}\ kW$$

3. Power to raise or lower the load

$$\frac{T \times H \times 2.72}{1000}\ kW$$

Total Power required on an inclined conveyor raising the load

$P = a + b + c$

Total Power required on an inclined conveyor lowering the load

$P = a + b - c$

Total Power required on a horizontal conveyor

$P = a + b$

In order to calculate the power requirement, the following information is necessary

- L = Length of conveyor, centres of terminal pulleys (mtrs.)
- W_h = Width of belt in mm
- S = Speed of bell in mps
- M_b = Mass of belt in kg/mr length.
- H = Vertical distance material is lifted or lowered, (mtrs,)
- T = Peak load in Tonnes /hr.
- F = Friction Factor (ref. T Table-1)
- W = Inertia Factor (ref. Table -2)
- D = Centre Length Conversion Factor (ref, Table -1)
- Angle of Wrap round driving drums.
- Type of idler, Angle of trough, Dia of idler and return rollers.
- Spacing of troughed idlers and return rollers.
- Diameter of driving drums and other drums lagged or bare.

Reference Tables

TABLE 1

FRICTION FACTOR "F" & CENTRE LENGTH CONVERSION FACTIOR "D"

Standard rotary friction rollers an normal installations	0.030	50
Good operating condition, high level of maintenance	0.025	60
Excellent low friction rollers an very good installations	0.022	65
Downhill regenerative installations	0.012	150

TABLE 2
Inertia Factor "W" (kg/m)

Belt Width mm	Idler Diameter		
	102 mm	127 mm	152/168 mm
400	25	29	37
450	28	32	41
500	29	35	44
600	34	40	50
650	35	43	53
750	40	49	59
800	43	52	62
900	47	65	77
1000	52	71	84
1050	53	74	87
1200	61	84	101
1350	67	93	111
1400		96	114
1500			122
1600			129
1800			144

TABLE 3
Belt Driving Factor "K"

Angle of Wrap Degrees	Screw		Gravity	
	Bare	Lagged	Bare	Lagged
180	2.00	1.84	1.64	1.52
200	1.87	1.72	1.54	1.44
210	1.81	1.67	1.50	1.40
220	1.76	1.60	1.46	1.37
240	1.66	1.55	1.40	1.32
250	1.63	1.50	1.37	1.30
270	1.55	1.45	1.32	1.25
300	1.46	1.37	1.26	1.20
360	1.34	1.26	1.18	1.13
420	1.25	1.19	1.13	1.09
430	1.24	1.18	1.12	1.08
450	1.22	1.16	1.11	1.07

Calculation of Belt Tension

The following steps ore to be followed for calculation of Belt Tension

$$T_e = \frac{P}{S}\ kN \qquad T_2 = (K - I)\ T_e\ kN$$

$$T_1 = T_e + T_2\ kN \qquad T_1 = \frac{K \times P}{S}\ kN$$

T_B = Effective belt tension
T_5 = Slack side belt tension
T = Tight side belt Tension
P = Total Power requirement in kW
K = Belt driving factor (ref. Table 3)
S = Belt speed in mps

Slope Tension (T2)
In case of inclined conveyor, it is important to consider the slope tension Ts due to the weight of the belt on the Incline. For practical purposes the slope tension may be calculated from:

$$T_s = \frac{Mb \times H \times 9.81}{1000}\ kN$$

where:
Mb = Belt mass in Kg/m length
H = Vertical rise or fall in metres

If the slope tension Ts is greater than T2 i.e. T1 - Te, the max, tension T1 is the sum of Te + Ts Instead of Te + T2.

9 BELT INSPECTION, PACKING & STORAGE

Pre Despatch Inspection

Before shipping, belts are 100% inspected and coiled into rolls with a maximum diameter of 2.6m (the maximum size that can be handled safely through the factory) and packaged into a container. We can supply double coils in cases where there are height constraints. At this stage, the customer's preferred mechanical fasteners can be fitted.

Storage and Handling of a New Belt

The factory packaging is designed to protect the belt rolls during normal transportation and handling.

Unloading

Conveyor belting should be handled very carefully during unloading. If it is dropped or handled roughly, the protective package could break, causing the belt to unroll in a telescoping twist. Once telescoping occurs, rerolling properly is almost impossible.

Belt Storage and Handling

- Never drop the belt roll while loading or unloading.
- Move belt by rolling (in the same direction as it was wound on the wooden core) or by hoisting with a bar through the core by means of a crane.
- Store belt in a cool and dry location.
- Keep belt packaging on belt, as protection from oils, solvents, corrosive liquids, ozone, sunlight and other weather effects.
- Store belt in an upright position, preferably on a stand with each roll supported by a bar through its core.

Belt Handling

The preferred way to move a belt is with a hoisting bar and a sling or cable. If cables are used, protect belt edges with a spreader bar or with short wooden planks. A sling should never be used around the circumference of a roll of belting. Slings are very unstable and can cause personal injury or belt damage.

Temperature

Ideally, the storage temperature should be below 25° C, though temperatures up to 40° C can be tolerated. The effects of low temperatures are not permanently detrimental, though at temperatures below 0° C, belts become stiffer and care should be taken when handling at and below this temperature. When rolls are removed from storage at low temperatures for immediate use, their temperature should be raised to approximately 20° C throughout, before they are put into service.

Packaging

Belting requiring long term storage should be bound with steel or high tenacity plastic or textile straps and protected with waterproof plastic material. Belting should be stored out of direct sunlight whenever possible. To minimise the possibility of ozone attack, belts should be stored some distance from electric generators or arc welders. Unused belts should be stored in their protective packing until ready for use.

10 CONTACTS

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