ArcelorMittal ROPES

ENGINEERING EXCELLENCE

Ropeway Ropes

Technical Information

ArcelorMittal

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Our commitment

ArcelorMittal Bourg-en-Bresse controls all the essential parameters for the correct production of special high performance ropes used in the aerial transport of people and materials: suitable specific equipment, an approved production process, a systematic check on raw material, an inspection system and traceability at each stage of production, trained and experienced specialists.

ArcelorMittal Bourg-en-Bresse runs an internal DNV-Certified Quality Assurance System complying with the requirements of ISO 9001.

As a result of its continuous improvement process, the plant is also certified OHSAS 18001 for safety management.

Furthermore, all of our products are CE marked.

International specifications *

EUROPE	UE 2016-424 EN 12385-8 EN 12385-9 EN 12927
SWITZERLAND	Ordonnances Fédérales
ITALY	DM 1175 - DD 144 EN 12385-8 EN 12385-9
SPAIN	B.O.E 293 EN 12385-8 EN 12385-9
AUSTRIA	DSB 80 – Örnorm 9500
GERMANY	BO-Seil und BO-Schlepp
USA	ANSI B77 1
CANADA	CAN/CSA Z98-01
CHINA	GB 12352-2018 GB 8918-2018
SOUTH KOREA	D 101 75 678

(*) Our products are manufactured to European standard by default. We can adapt our products to any worldwide specifications. Please contact us for further details.

Technical Information

ArcelorMittal ROPES
ENGINEERING EXCELLENCE

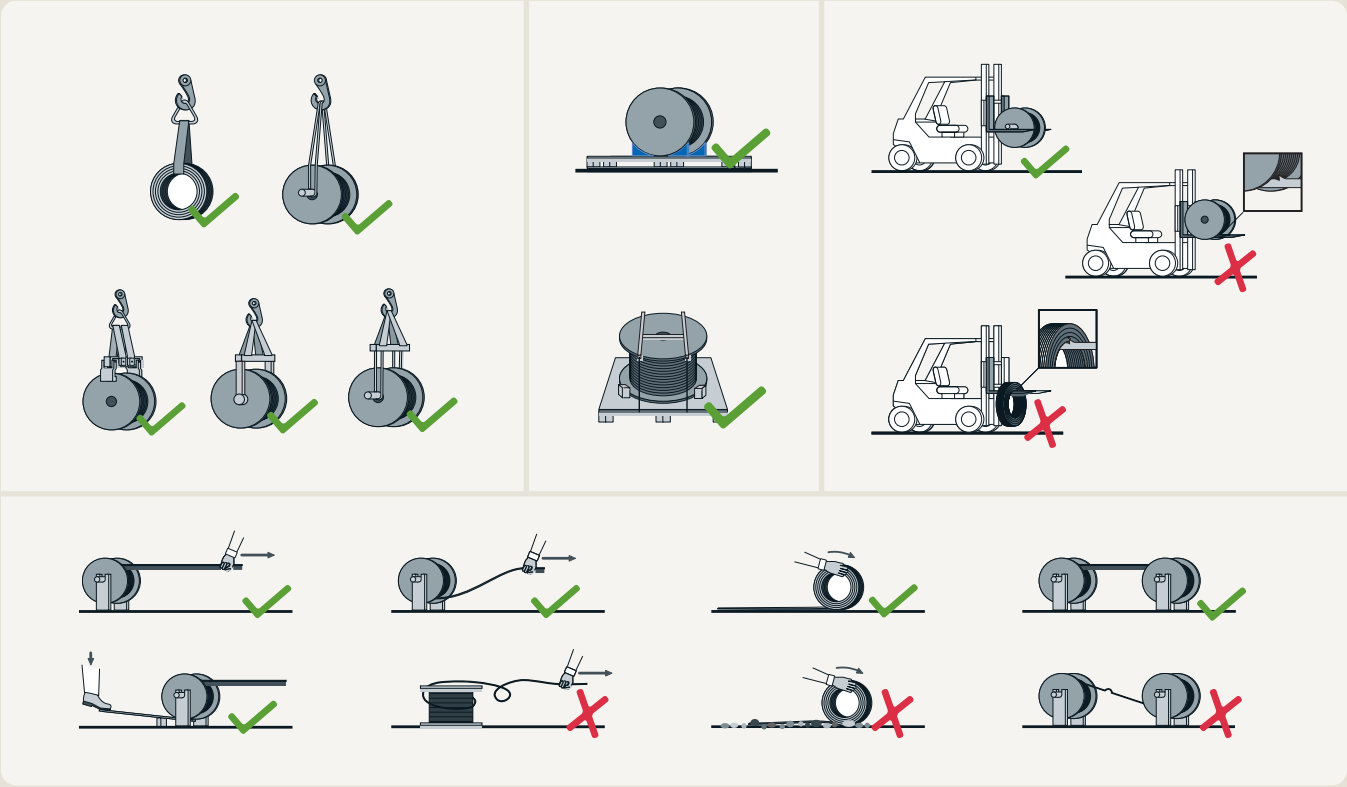
Recommandations

Storage and maintenance

The rope must be adequately maintained and regularly lubricated, as often as it is necessary, but at least when the rope works in extreme conditions and before/after prolonged inactivity. The lubricant must be compatible with the original grease. Before re-lubrication, the wire rope must be dry and cleaned by scraping or using a cryogenic spray. Cleaning by cloth, high pressure cleaner or solvents is forbidden.

When stored, the rope should be kept in a dry and ventilated environment with no direct contact with the floor and an air flow under the reel. Visual inspection is necessary before the use of a stored wire rope. In case of doubt of the quality of the wire rope, we can help you to find and make additional inspection analysis.

EWRIS handling recommendations



At all times, contact of the rope with any metallic pieces should be avoided to prevent early damage.

EWRIS
European Federation of Steel Wire Rope Industries

ArcelorMittal ROPES
ENGINEERING EXCELLENCE

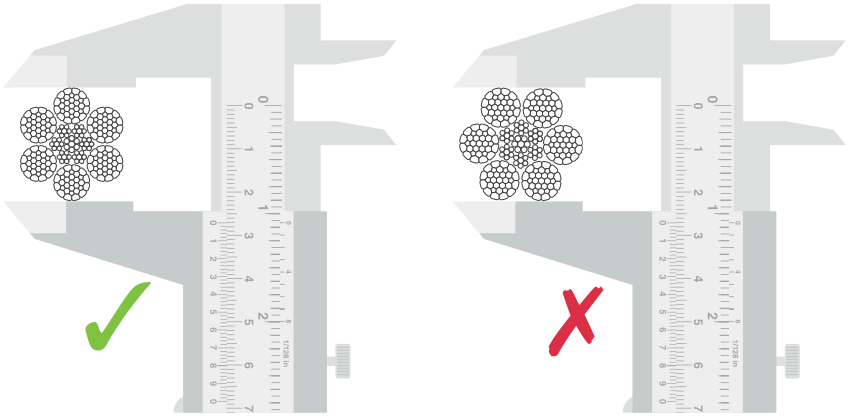
Technical Information

Dimensional control

Diameter (NF EN 12385-1)

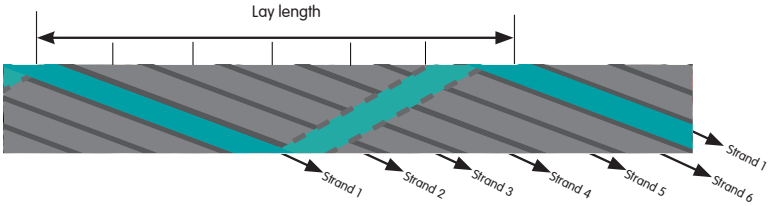
The diameter must be measured with an appropriate measuring instrument covering at least 2 strands.

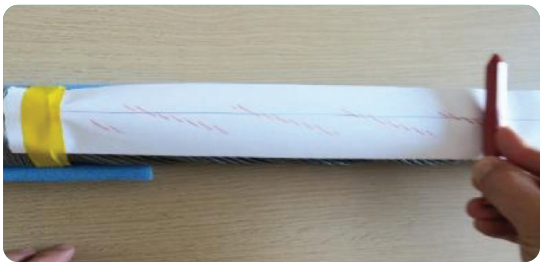
Measurements must be made at two positions spaced at least one metre apart and for each position, 2 measurements must be taken at right angles.



Lay Length

On ropes dedicated to people transportation, lay length is a very important parameter.
Lay length is the distance measured parallel to the centre line of a wire rope in which a strand makes one complete spiral or turn around the rope. If the lay length is not well defined or modified during the installation phase or during utilisation, the rope can generate some vibrations on the pillar or others elements of the structure.





Checking the lay length is a quite complicated operation. We recommend the following process :

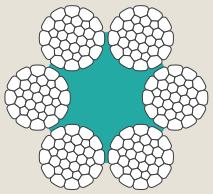
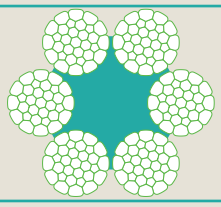
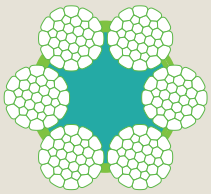
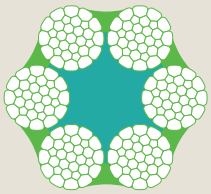
1. Stick a paper strip on the rope. The paper strip should be pulled tight.
2. Draw a thin straight line on it using a corner piece. This line will represent the rope axis.
3. Using a chalk stick, identify the track of the rope.
4. Remove the paper strip from the rope.
5. Make the measurement directly on the paper strip.

Remark: the paper strip can be stored for further investigations.

The lay length should ideally be measured on 5 lay lengths minimum.

Technical Information

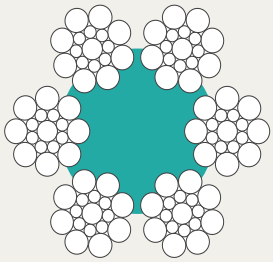
Lubrication for hauling ropes

Type of Lubrication	Lubrication Method		% mass	Note	Illustration
Dry	Closing	No grease slight oil only	0.0	For stainless wire ropes and specific demands (oil is applied to avoid trouble in the die during assembly)	
	Stranding				
A-1	Closing	No grease, oil only	0.5	For ropeway ropes, mining ropes on Koepe sheave and plastified wire ropes	
	Stranding	Lubrication + tight wipe			
A-3	Closing	Lubrication + wipe	1.5 - 1.75	Hoisting applications	
	Stranding	Lubrication + wipe			
A-4	Closing	Lubrication + wipe	2.0 - 2.5	Not available direct from the mill. (Can be performed by our distributors on specific demand)	
	Stranding	Lubrication + wipe			

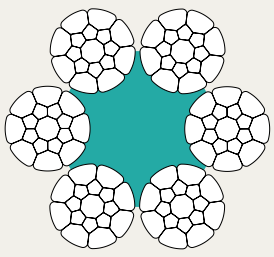
Please note that the lubricant must be compatible with the rubber used on the pulleys

Compaction

Thanks to the rope compaction, the metallic section is increased, which leads to a higher breaking load than a non compacted wire rope of the same diameter. The outside strand area is also increased and smoother, which decreases the contact pressure between the rope and the drum/sheaves, and thus increases the fatigue properties.



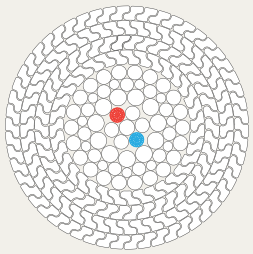
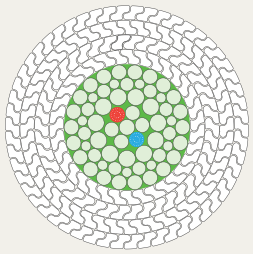
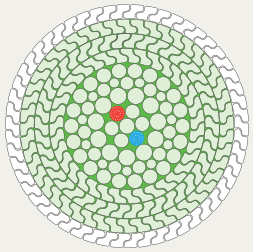
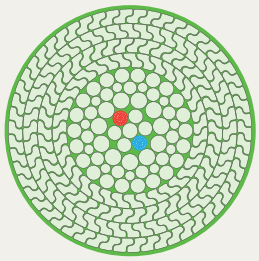
Round Wire Rope



Compacted Rope

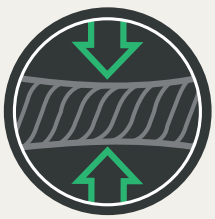
Technical Information

Lubrication for Full Locked Coil ropes

Type of Lubrication	Lubrication Method		% mass	Note	Illustration
Dry	Core	No grease Slight oil	0%	Stainless wire ropes and specific demends	
	Z Layer				
	Outer Shape				
A-1	Core	+	0.30%	Specific demands for indoor applications	
	Z Layer	-			
	Outer Shape	-			
A-2	Core	+	1%	Ropeway ropes	
	Z Layer	+			
	Outer Shape	-			
A-3	Core	+	1.15%	Ropeway ropes in aggressive environments	
	Z Layer	+			
	Outer Shape	+			

Crush resistance

Crushing is the effect of external pressure on a rope which damages the rope by distorting the cross-sectional shape of the rope, its strands, core or all three. Crush resistant ropes withstand or resist external forces.



Groove characteristics for sheaves, saddle and grooved drums

Grooves in sheaves and drums should be circular and smooth.

Sheaves

To ensure good support, the rope must contact the groove for approx 130-140° of arc, which leads to the following recommendation for the groove diameter:

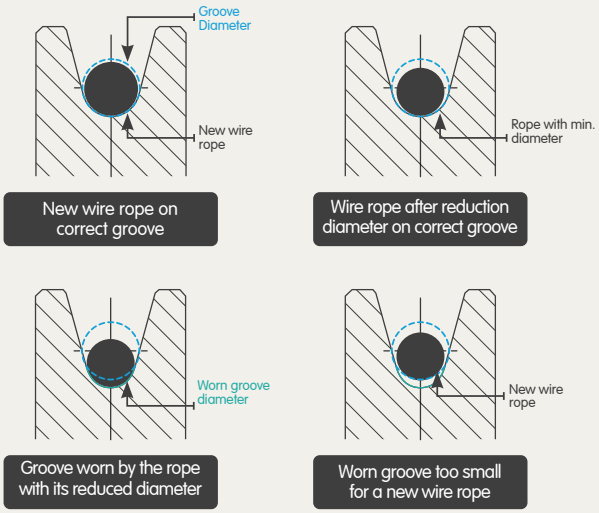
$$1.05d < d_g < 1.1d$$

$$Optimal\ value = 1.075$$

With:

- d = nominal rope diameter with 0/+4% tolerances;
- d_g = groove diameter.

During a wire rope's lifetime, the rope diameter will decrease. This is due first to the elongation of the rope, and then the wear on the rope wires. This diameter variation begins quickly but then slows down. The wire rope will create a new groove in the sheave which corresponds to the reduced diameter. If a new wire rope is installed in a worn sheave, without resurfacing, the new rope will wear more quickly. The lifetime can be divided by 10.



Grooved drums

The groove diameter d_g and the pitch diameter p must comply with the following criteria:

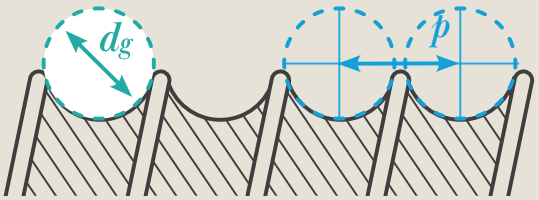
$$d_g = 1.0173d$$

$$1.035d_g < p < 1.09d_g$$

$$Optimal\ value = 1.06$$

With:

- d = rope diameter under tension of 5%MBL
- d_g = groove diameter
- p = pitch between 2 grooves



Test resources

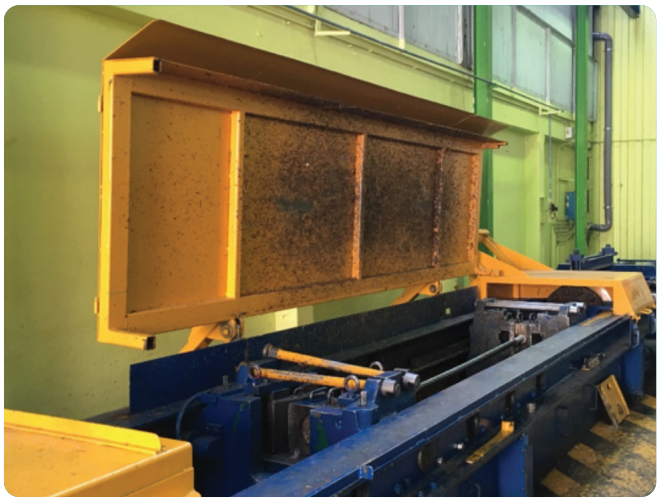
Wire

Prior to the manufacture of our ropes, a sample is taken from each wire spool and tested according to the international standards:

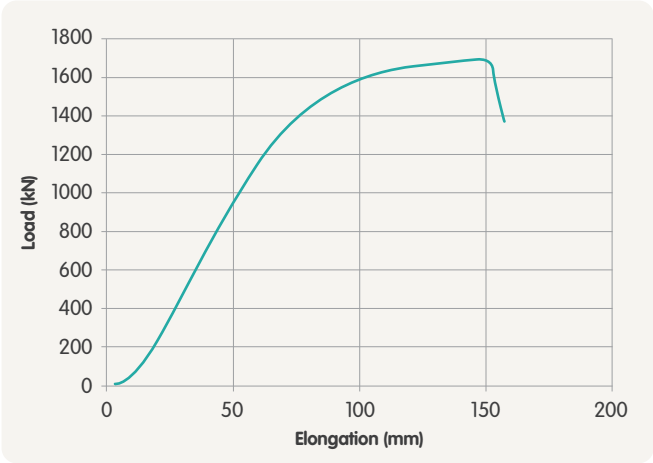
- Tensile test
- Torsion test
- Bending test

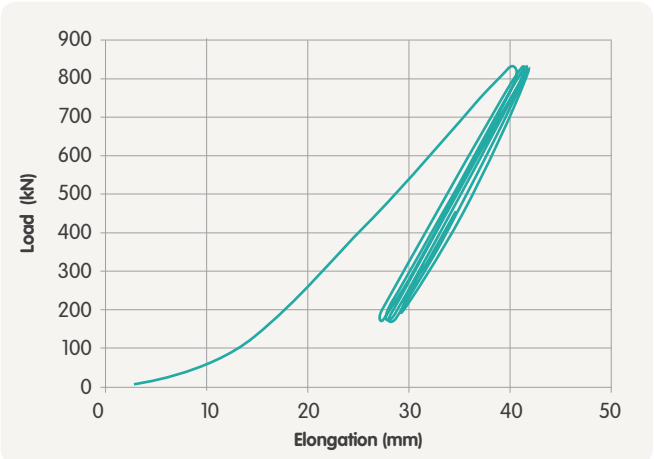
Wire rope

For each manufactured wire rope, the breaking load is checked with a test. During this test, the stress/strain curve is recorded and a modulus measurement can be made on request.

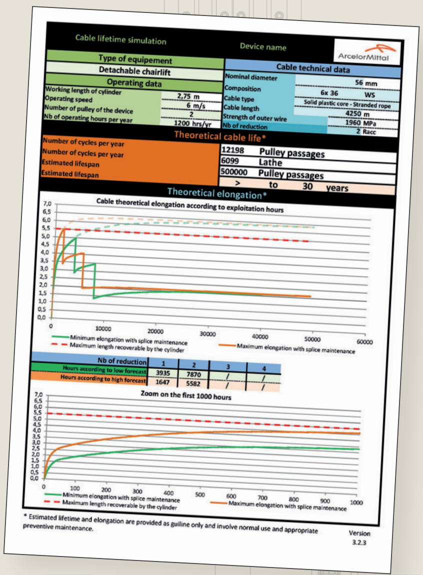


The Bourg-en-Bresse site has 3 test benches: 200 tons, 350 tons and 1500 tons.





Banc de test: Lutèce



In association with our partners, Mécamont and TEC Câbles, we have developed and invested in a 120m test bench, capable of simulating speeds of up to 20 metres per second on cables from 30-60mm in diameter. This test simulates a cable lifespan of 25 years in just 2 months.

Our whole production process is part of a continuous control system which includes breaking strength testing, radial deformation and diameter reduction measuring.

It is out of these rigorous monitoring processes that the "Lutèce Project" was born to fulfil the need to create products at the forefront of technology, able to respond to important changing market requirements.

Together, we are setting the performance benchmarks for the future.

Operational since the beginning of 2019, our latest product innovations have been tested on the Lutèce bench to ensure we are providing our customers with reliable solutions.

MECAMONT HYDRO

TEC CABLES BOURG

ArcelorMittal ROPES
ENGINEERING EXCELLENCE

Installation and maintenance

Choosing the right rope

The characteristics listed in the tables featured in this catalogue correspond to usual levels of performances. They are given for information purposes only and have no contractual value. We recommend you contact our team and check that the rope characteristics comply with regulatory and technical requirements, as these may vary according to national codes or the particular specifications of constructors.

We pay careful attention to what our clients have to say and are, as far as possible, ready to adapt our product design to fit your exact project requirements or to upgrade rope performances compared to existing products. Parameters such as breaking strength, length of lay, rope diameters adequately adjusted to attachment geometries and choice have to be assessed during a contract review and be part of written agreements related to this contract.

Rope assembly and maintenance

a) Packing and storing

The ropes are wound in the factory on metal or wooden reels designed for handling in the horizontal axis position with appropriate means.

Care should be taken:

- To avoid the inversion of the reel.
- To prevent the rope coming into contact with parts liable to damage it through shock, friction or chemical pollution corrosion risks. The rope must not come into contact with the ground.
- To prevent any risk of fire exposure (blow torch) or electric contact (no earth clamp on the rope when using a welding post).

The rope may be stored for a long period provided that its qualities and protection system are maintained.

b) Installing the rope

These operations must be carried out by experienced, competent persons who have received professional training in rope work. Safety and risk prevention will be carefully studied and integrated into the written procedure for rope installation.

Procedure must take into account the characteristics and design requirements of the lift.

It must also be approved by the manufacturer of the lift or the client who will specify the initial setting conditions in writing (e.g. rope sag).

Elementary caution should be exercised in unwinding the rope, i.e. contacts and stress liable to cause irreversible damage. The following type of means should be used: support placed on the ground, deviation sheaves (diameter must be above 25 times the dia. of the rope), devices presenting the rope extremities from rotating and untwisting during the rope installation.

c) Tensioning and positioning the rope

Particular attention should be paid to respect rope tension settings and to the position of the tension appliances which must allow them to operate according to the constructor's specifications.

d) Splices, shortening and fastening of end attachments

These are the final operations to be performed on the ropes once installed, and include; final rope length adjustments, splices, shorter wings, socketing with molten metal or resin. These operations must be carried out by specialists. Depending on national codes currently in force, approval from an official body may be required with regard to the qualifications of these specialists and the working procedures.

Requirements concerning the geometry of the splices or the selection of approved products for socketing may vary according to the national codes or the technical criteria drawn up by the manufacturers.

The customer shall take steps to find out what requirements and obligations are to be respected and bring them to the attention of the specialist in writing at the time of ordering rope fixing work.

Technical Information

At the written request of the customer, ArcelorMittal will send a team:

- Either responsible for all the assembly work.
- Or only the wire rope work: splice, shortening, socketing. In this case, the company in charge of the rope installation work must carry out the supervision and take full responsibility of the following operations.

Prior to splicing:

- The adjustment of the appliance tensioning device according to the cableway manufacturer's or operator's requirements.
- The tensioning of the rope using the appropriate pulling devices (clamps jaws and winches) in compliance with safety and risk prevention procedures.
- The positioning of the two rope ends in the working area for splicing in accordance with cableway manufacturer's or operation's requirements to help the splicing specialist.
- The mobilisation of the necessary number of operators to help the splicing specialist.

After the splice has been made:

- The traceability form should be drawn up, mentioning the positioning of its tensioning carriage device: a) After the splice has been made and before rope operation. b) After 100 hours of rope running in.
- The positioning of the tensioning carriage on the guide should be indelibly marked. a) After the splice has been made and before rope operation. b) After 100 hours of rope running in.

The specialist in charge of the wire rope works (splice, shortening, socketing) will draw up a work report, mentioning the dimensions measured and compliance with contractual requirements.

Surveillance, inspection of ropes

The requirements regarding rope surveillance and discard criteria are detailed in the corresponding national and international standards and recommendations. However, we recommend that the frequency of rope inspection should constantly be adapted to real life working and environment conditions.

Cable maintenance

Lubricants

The products incorporated in the ropes when manufacturing are selected by the rope maker in compliance with operating requirements and the applicable standards to be specified in the order.

Not using adequate products could dangerously modify the friction ratio of the rope on the sheaves or damage the liners.

In any circumstances, the ropeway manufacturer's recommendations should always be followed when applying maintenance and cleaning products. You are advised not to use chemical solvents or products liable to cause corrosion on the cable itself or on the organs coming into contact with it.

We recommend consulting the ropeway manufacturer before using any rope maintenance lubricants, solvents, or any other chemical products. These should not be applied on the rope surface as they will wash the rope internal lubrication out. This might also, sooner or later, initiate some corrosion process.

Technical Information

Means of preventing localised damage

The cables are submitted to particular stress in such zones as:

- For carrying-hauling ropes: rope sections previously positioned inside fix grips (e.g. attachments for fixed seats).
- For track ropes: deviations on pylon shoes and tension devices, sockets.

By displacing the attachments on the ropes or the ropes on the ropeway, the risk of stress concentration on such areas can be significantly decreased. It is therefore essential to follow the manufacturer's ropeway recommendations and to respect the instructions given by applicable national regulations and standards, especially concerning the amplitude and frequency of such planned displacements.

Rope repairs

When the prescriptive criteria are reached, repair work can most of the time be carried out in order to be able to safely continue to operate once the rope is repaired. It is essential that these operations are carried out by skilled and trained specialists. Depending on national codes, approval from an official body may be required with their regard to the qualification of specialists and working procedures.

Repairing Lock Coil carrying ropes

The possibility of rupture of the external wires on this kind of rope must be carefully monitored. This should be accompanied by a more thorough inspection in the case it occurs on a particular zone such as deviation or an anchoring.

- 1 wire broken: check that the distance between the two extremities is not more than 25mm and that the two wire extremities are not raised out of their place as they have a tendency to do. Apply a sealing joint in the gap.
- 2 wires broken in the same rope lay length: repair is necessary. In case of such a repair, it is mandatory to observe the various corresponding requirements stated in applicable national regulations and applicable standards, in order to make sure that the results of the planned repair will totally comply with them.

Repairing stranded

In the case of localised or accidental damage, and provided that the prescriptive requirements are respected, a rope may be repaired by substituting one or two strands, adopting the same requirements and process as that used for making a splice. A standard rope can generally be repaired, taking into account the requirements stated in applicable national regulations and applicable standards by locally changing one or two strands, rising a process divided from one used for complete splices.