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The following chapters also apply:

	General:	A 1
	Lubrication and Lubricants:	A 4
	Inspection and Maintenance Intervals:	A 5

OVERHEAD CABLES

- General notes

Since the overhead cable is located above the haul rope, an improper condition of the overhead cable (such as fracture, excessive sag, etc.) can have serious consequences for the proper functioning of the ropeway and thus pose a hazard to passengers and other people in the area of the ropeway.

1. Instructions for safe use

**IMPORTANT:**

Any work may only be performed by suitably **trained and instructed personnel** using suitable tools. In case of doubt contact the manufacturer.

In areas with danger of falls all persons must be **secured against falling!**

Prior to commencing any work on overhead cables, the ropeway must be shut down and secured against incidental restart.

On the line: by pulling a break fork,

In the station: by actuating a safety switch or the pull cord.

**IMPORTANT:**

The safety regulations must be observed!

2. Ropes and cables

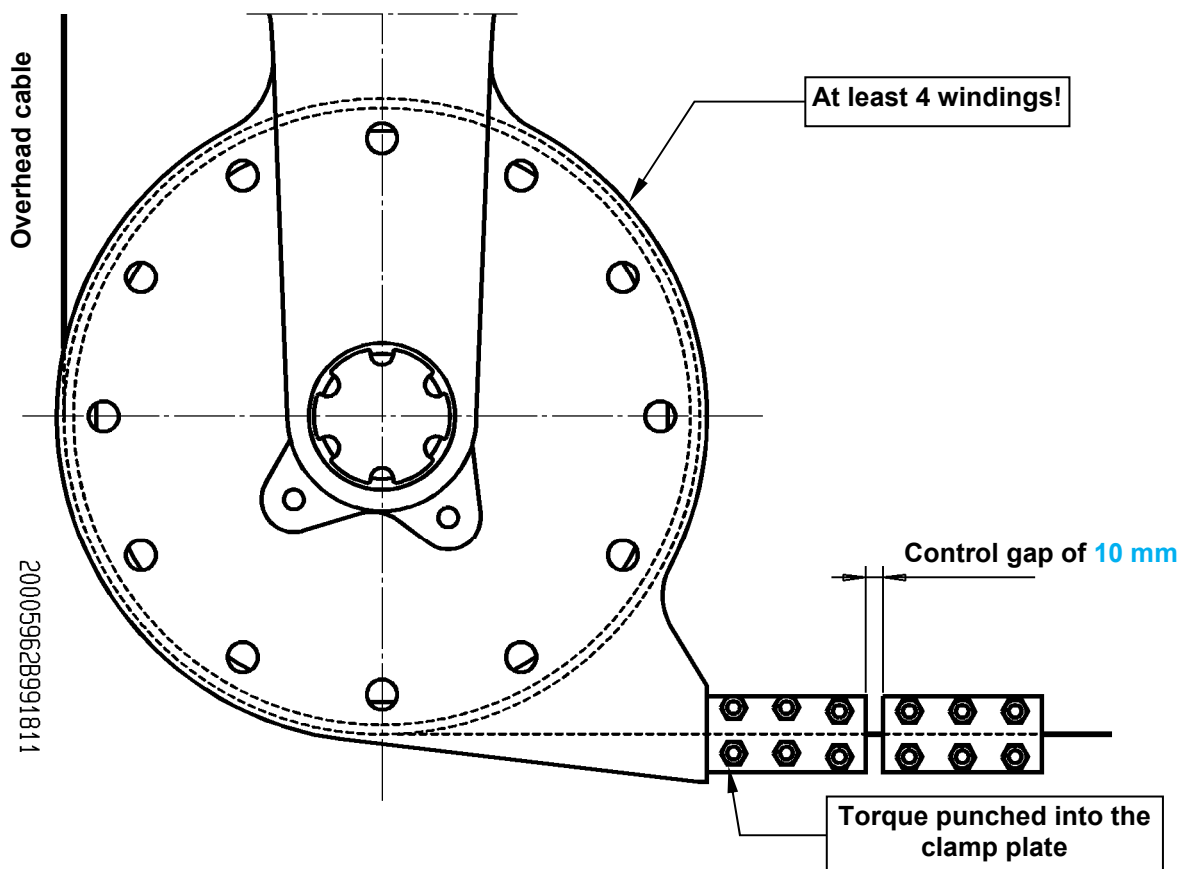
The overhead cable consists of a carrying rope (dia. 16mm) and two signal carrying cables (dia. 22mm and 11mm). The overhead cable is fastened to the carrying rope by means of a special wrapping wire.

The overhead control cable replaces the need for trenching works on the line.

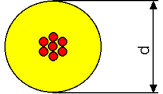
3. Overhead cable mounting

3.1 End fixtures station

The end of the rope is wound at least four times around the drum and fixed with a clamp plate to absorb the residual tension force. A safety clamp plate is positioned behind said clamp plate. A control gap between the clamp plates serves to detect any slipping of the rope through the first clamp plate.



3.2 Permissible ice cover

Rope / cable	Permissible ice cylinder diameter	
16 mm spiral rope	30 mm	

These values correspond to the values indicated in the safety and utilization plan for telephone and switch lines.

3.3 Control measure



IMPORTANT:

If the ice cover exceeds the maximum permissible thickness indicated above, the icing must be removed immediately or the ropeway must be shut down. Excessive icing may endanger the passengers or lead to damage of ropeway components (stuck carriers, rope fracture).

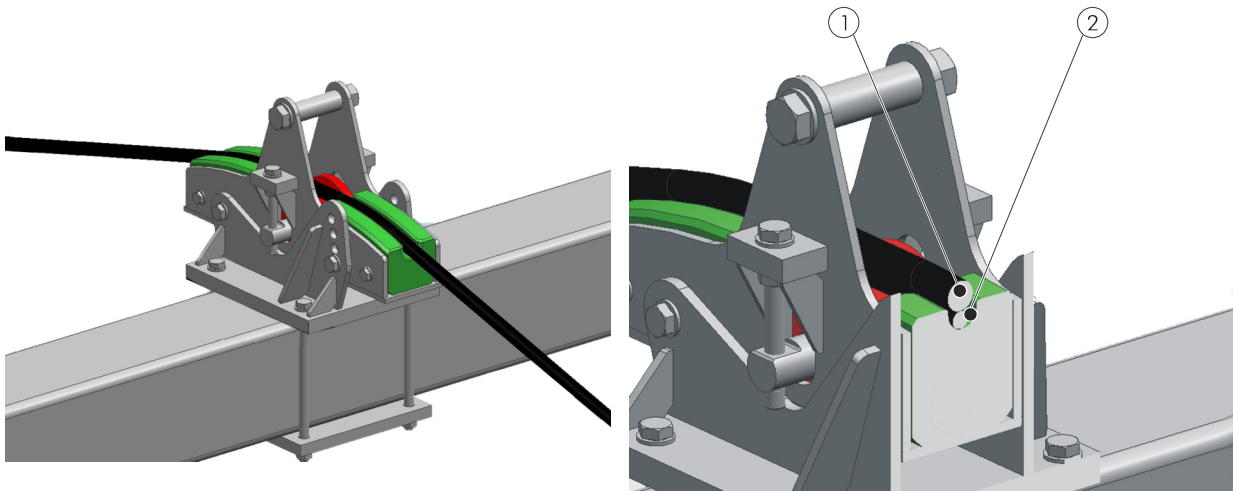
3.4 Cable support on the line



- The overhead cable is supported on the line by means of plastic sliding shoes each mounted on the rope lifting frames of the towers. In order to ease assembly, tensioning and releasing, assembly rollers are used in the middle of the overhead cable support bracket.
- The signal cable of the overhead cable is not separated from the carrying rope in the area of the sliding shoe.

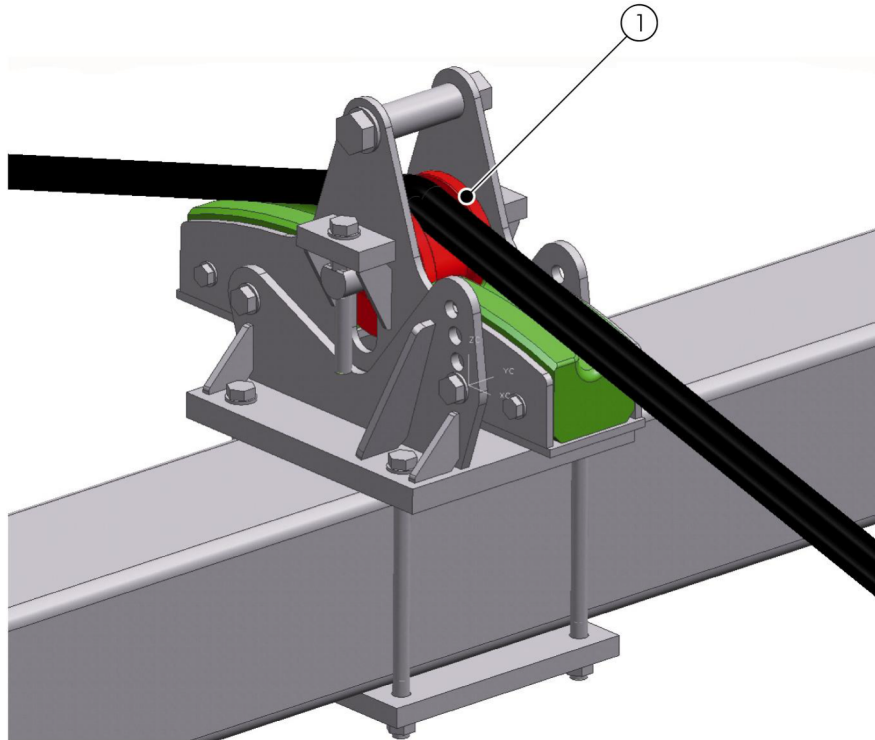


IMPORTANT:
The carrying rope **must** rest on the shoe!



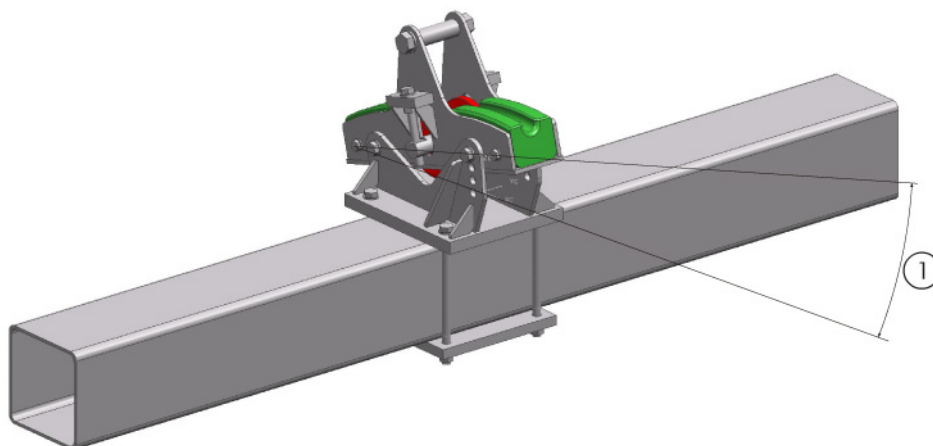
- ▷ Signal cable
- ▷ Carrying rope

- During rope pulling, tensioning and releasing, the assembly roller must be lifted up. The assembly roller may only be lifted up for such purposes; otherwise it must remain in the lower position.



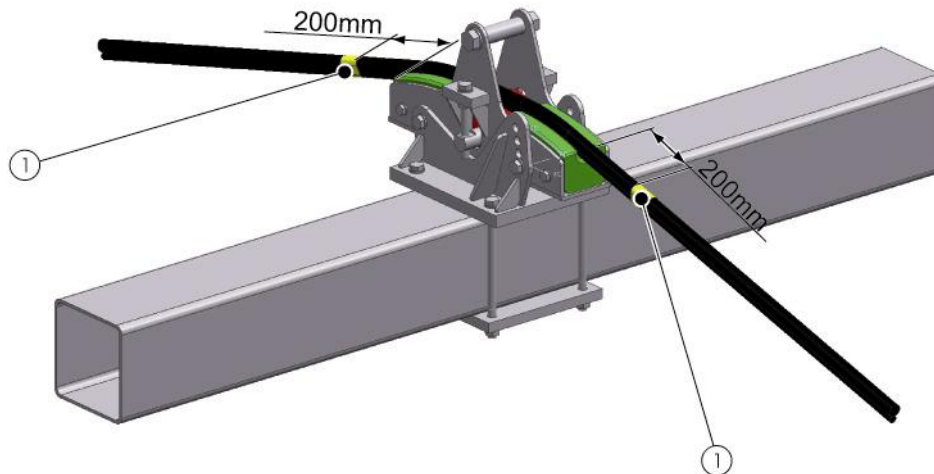
▷ Assembly roller 'up position'

- The sliding shoes must be set to the correct angle.



▷ Setting angle

- The overhead cable must be colour-marked 200 mm before and after the plastic sliding shoe (see sketch).



⇒ Colour marking

Set the colour marking when the cable is tensioned and all rope angles are correct. The markings serve to detect any significant movement of the overhead cable on the shoe.

The marking tape must be **replaced** once it is damaged by environmental influences or it cannot be seen clearly anymore.

4. Inspection and maintenance

→ See also the operating and maintenance manual of the overhead cable manufacturer (if available)

4.1 Maintenance intervals

The given maintenance intervals are for reference only. The results of the periodic maintenance may show that the maintenance intervals must be reduced.

4.2 Inspection and maintenance of the overhead cable

4.2.1 Every day

- During the daily test run, closely watch the overhead cable, especially if there is a risk of icing.
- The test run may only be carried out by suitably trained personnel who can judge the condition of the sags and any possible icing.
- If any ice is found on the overhead cable,
 - remove ice covers with a thickness of 10 mm or higher, or
 - check if the tangential angles or the sags on the indicated towers lie within the permissible range.
→ see 4.4 'Angle measurement'
- If the colour markings are no longer located before and after the sliding shoe, the overhead cable must be brought back into its normal position.
 - Move the assembly rollers into their upper position and displace the overhead cable until both colour markings are back in their normal position.
 - Finally, measure the angles and put the results down in writing.
→ see 4.4 'Angle measurement'
In case of any deviation between the actual and the reference values, re-establish the reference values by tensioning or releasing the cable.
→ see 0 'Tensioning / releasing the overhead cable'
- Visually check the overhead cable along its entire length for any damage (wires sticking out, damage to the sheath).

**IMPORTANT:**

The ropeway may only be operated if the tangential angles and sags lie within the permissible range and the overhead cable is not damaged.

- Check the overhead cable for proper position (guided parallel) in the rope spans and re-establish it if need be.
- Observe the overhead cable for vibrations and oscillations and contact the manufacturer if any such movements are detected.

4.2.2 Check every month and after extraordinary occurrences (storm, thick ice cover, etc.)

- Visually check the colour markings on the towers.
 - If the colour markings are no longer located before and after the sliding shoe, the overhead cable must be brought back into its normal position.
 - Move the assembly rollers into their upper position and displace the overhead cable until both colour markings are back in their normal position.
 - Finally, measure the angles and put the results down in writing.
→ see 4.4 'Angle measurement'
 - In case of any deviation between the actual and the reference values, re-establish the reference values by tensioning or releasing the cable.
→ see 0 'Tensioning / releasing the overhead cable'

4.2.3 Check every six months and after extraordinary occurrences (storm, thick ice cover, etc.)

- Visually check the overhead cables for wire breakage, signs of abrasion, wires sticking out of the cable, pressure marks, corrosion, damage to the sheath and fastening of the signal cable, etc.
Furthermore, special attention shall be paid to the clamping points, return and deflection units, end fixtures and their components.
- Check the rope tension.
→ see 4.3 'Checking the rope tension'
- Check the support areas (plastic shoes) of the overhead cable on the towers for wear (score marks, indentations, etc.) and replace the shoes if need be.

**IMPORTANT:**

The cable must NOT contact any metallic parts (bolts, supports, etc.). Therefore, the plastic shoes must be replaced well in time!

- If any damage to the cable is detected during the six-monthly inspection, contact the manufacturer or a competent authority.
- Each inspection must be documented in writing.
- Check the support brackets on the towers and the end fixtures for cracks, rust, deformation, proper position, etc.
- Angle measurement
→ See 4.4 'Angle measurement'
- Check and record monitored gap
→ See "8Record data sheet for control gap".

4.3 Checking the rope tension

In order to ensure sufficient clearance to the adjacent components (e.g. haul rope, carriers, etc.) and to the terrain, the rope tension determined in the overhead cable calculation must be maintained. Correct rope tension will ensure that the sags and their corresponding tangential angles remain within the correct range.

Measure the angles to check the rope tension and correct sag.
→ see 0 'Table of Records of Angle Measurement'

In case of a deviation from the reference value re-establish the correct value by tensioning or releasing
→ see 0, Tensioning / releasing the overhead cable

4.4 Angle measurement

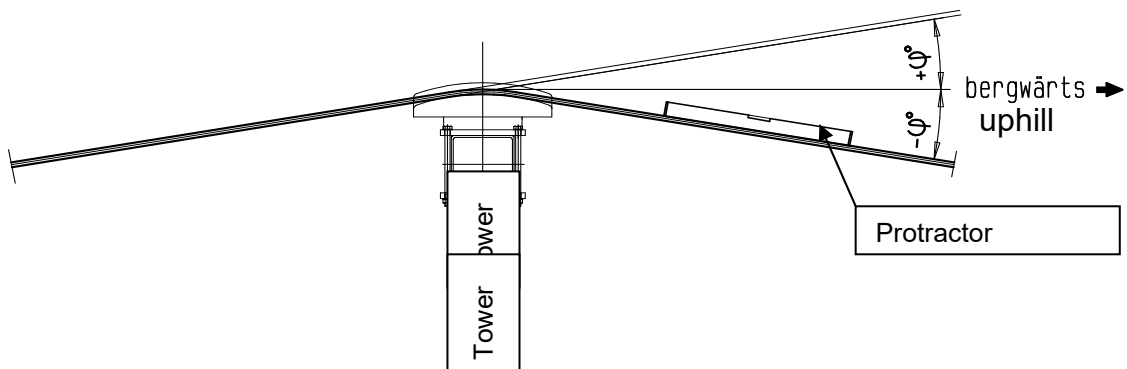
- Perform the measurement only in suitable weather conditions (without ice, with no wind, etc.) as ice cover or wind will distort the results.
- Use an electronic gradient indicator for measurement.
- Compare the measuring results with the reference values and document them -
→ see 0 'Table of Records of Angle Measurement'
- If the measured angles exceed the limit values indicated, tension or release the cable to establish the correct values.
- Following tensioning resp. releasing, check the position of the colour markings. If the distance is less or more than 200 mm, install new colour markings.

**IMPORTANT:**

Following extraordinary weather conditions such as storms or extreme icing the rope angles must be checked.

Table of Records of Angle Measurement

Name of installation	Guthries	
Order no.	2020-15	
Type of installation	2-CLF	
Signal cable data	ID no.	16.0SR119-003
	Cable type	1x19 G1960 dia. 16mm
	Min. breaking strength [kN]	281 kN



Project [-No]: 2-CLF Guthries [2020-15]

Assembly table - Rope forces

T [°C]	-20	-10	0	10	20	30	
RP	T1 [kN] T2 [kN]	T1 [kN] T2 [kN]	T1 [kN] T2 [kN]	T1 [kN] T2 [kN]	T1 [kN] T2 [kN]	T1 [kN] T2 [kN]	
BEB	0.0 28.8	0.0 26.9	0.0 25.0	0.0 23.2	0.0 21.5	0.0 19.8	
1	28.9 28.9	26.9 26.9	25.0 25.0	23.2 23.2	21.5 21.5	19.9 19.9	
2	29.4 29.4	27.5 27.5	25.6 25.6	23.8 23.8	22.0 22.0	20.4 20.4	
3	29.8 29.8	27.9 27.9	26.0 26.0	24.2 24.2	22.4 22.4	20.8 20.8	
4	30.3 30.3	28.3 28.3	26.4 26.4	24.6 24.6	22.9 22.9	21.2 21.2	
5	30.5 30.5	28.6 28.6	26.7 26.7	24.9 24.9	23.1 23.1	21.5 21.5	
6	31.0 31.0	29.1 29.1	27.2 27.2	25.3 25.3	23.6 23.6	22.0 22.0	
7	31.4 31.4	29.5 29.5	27.6 27.6	25.8 25.8	24.0 24.0	22.4 22.4	
TEB	31.4 0.0	29.4 0.0	27.5 0.0	25.7 0.0	24.0 0.0	22.4 0.0	

Assembly table track rope - Rope forces

T [°C]	-20	-10	0	10	20	30	
RP	T1 [kN] T2 [kN]	T1 [kN] T2 [kN]	T1 [kN] T2 [kN]	T1 [kN] T2 [kN]	T1 [kN] T2 [kN]	T1 [kN] T2 [kN]	
BEB	0.0 28.1	0.0 26.1	0.0 24.0	0.0 22.0	0.0 20.1	0.0 18.3	
1	28.2 28.2	26.1 26.1	24.0 24.0	22.1 22.1	20.1 20.1	18.3 18.3	
2	28.5 28.5	26.5 26.5	24.4 24.4	22.4 22.4	20.5 20.5	18.7 18.7	
3	28.8 28.8	26.7 26.7	24.7 24.7	22.7 22.7	20.8 20.8	18.9 18.9	
4	29.1 29.1	27.0 27.0	25.0 25.0	23.0 23.0	21.1 21.1	19.2 19.2	
5	29.3 29.3	27.2 27.2	25.2 25.2	23.2 23.2	21.2 21.2	19.4 19.4	
6	29.6 29.6	27.5 27.5	25.5 25.5	23.5 23.5	21.6 21.6	19.7 19.7	
7	29.9 29.9	27.8 27.8	25.8 25.8	23.8 23.8	21.8 21.8	20.0 20.0	
TEB	29.9 0.0	27.8 0.0	25.7 0.0	23.7 0.0	21.8 0.0	20.0 0.0	

Uphill rope angles for assembly

Project [-No]: **2-CLF Guthries [2020-15]**

Assembly table - Rope angles

T [°C]	-20	-10	0	10	20	30
RP	φ_2 [°]	φ_2 [°]	φ_2 [°]	φ_2 [°]	φ_2 [°]	φ_2 [°]
BEB	11.3	11.3	11.3	11.3	11.3	11.2
1	14.3	14.2	14.0	13.9	13.7	13.5
2	14.3	14.2	14.1	14.0	13.9	13.8
3	12.1	12.0	11.8	11.7	11.5	11.3
4	7.4	7.3	7.2	7.0	6.9	6.7
5	19.0	18.9	18.8	18.7	18.6	18.5
6	15.3	15.2	15.1	15.0	14.9	14.8
7	-4.3	-4.3	-4.3	-4.4	-4.4	-4.4

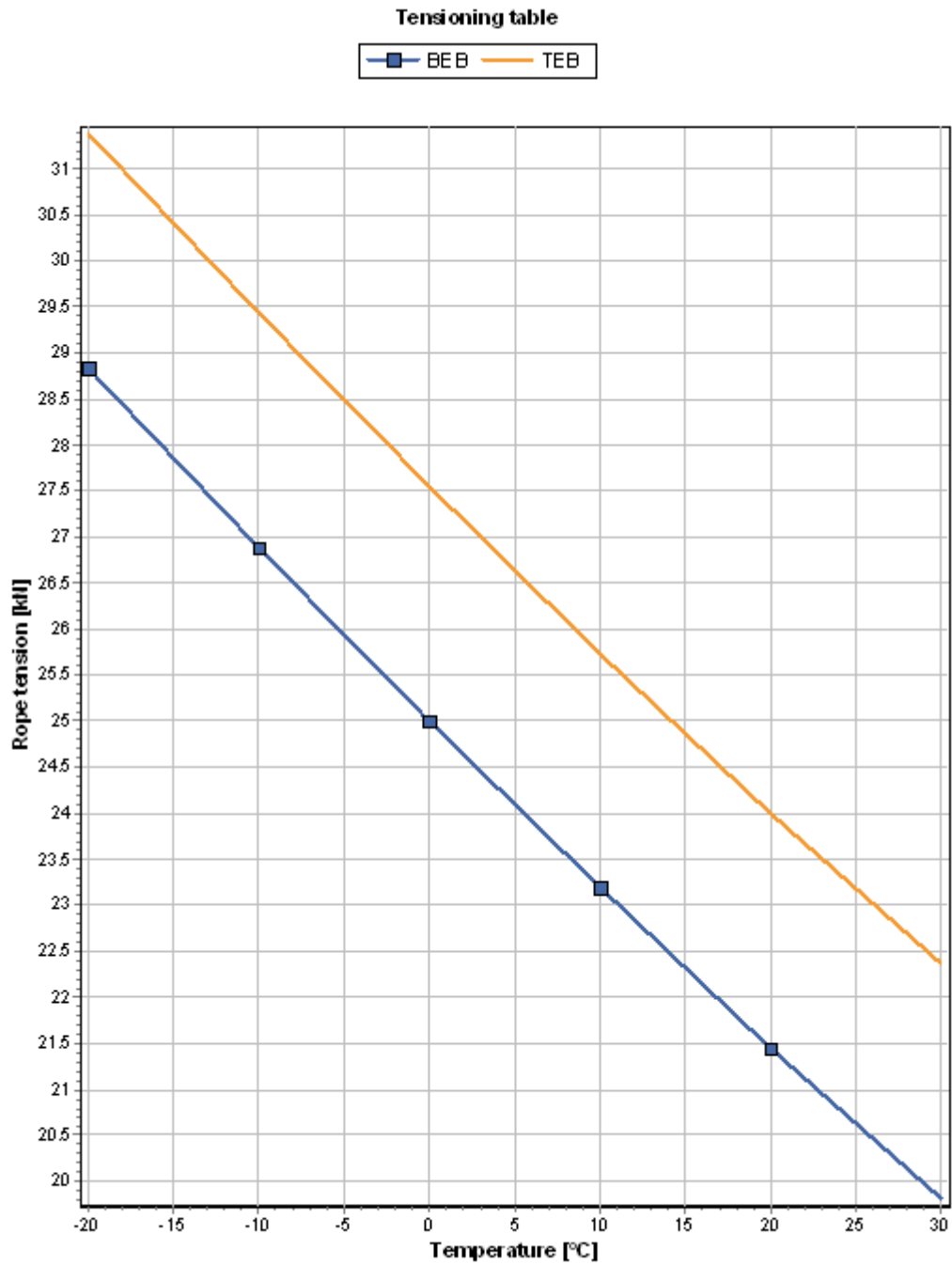
Assembly table track rope - Rope angles

T [°C]	-20	-10	0	10	20	30
RP	φ_2 [°]	φ_2 [°]	φ_2 [°]	φ_2 [°]	φ_2 [°]	φ_2 [°]
BEB	11.4	11.4	11.4	11.4	11.3	11.3
1	14.9	14.8	14.7	14.5	14.4	14.2
2	14.7	14.7	14.6	14.5	14.4	14.2
3	12.6	12.5	12.4	12.3	12.1	12.0
4	7.9	7.8	7.7	7.6	7.4	7.3
5	19.3	19.3	19.2	19.1	19.0	18.9
6	15.7	15.6	15.5	15.4	15.3	15.2
7	-4.2	-4.2	-4.2	-4.3	-4.3	-4.3

Installation Record

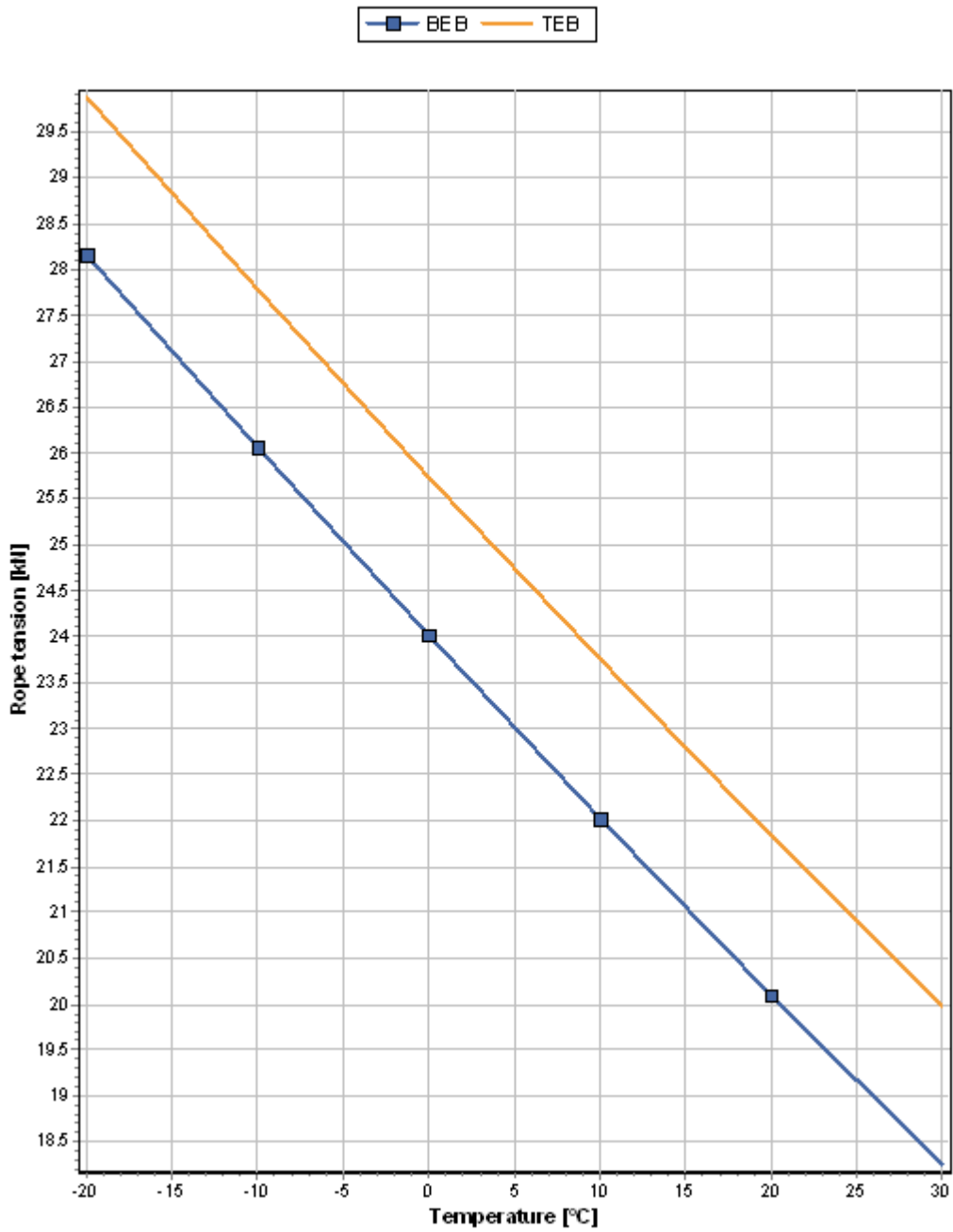
Tower no.	Temperature	Uphill angle	Date / Signature

Tensioning tables at calm (no wind, no icing or snow) with control cables



Tensioning tables at calm (no wind, no icing or snow) rope only

Tensioning table Track rope

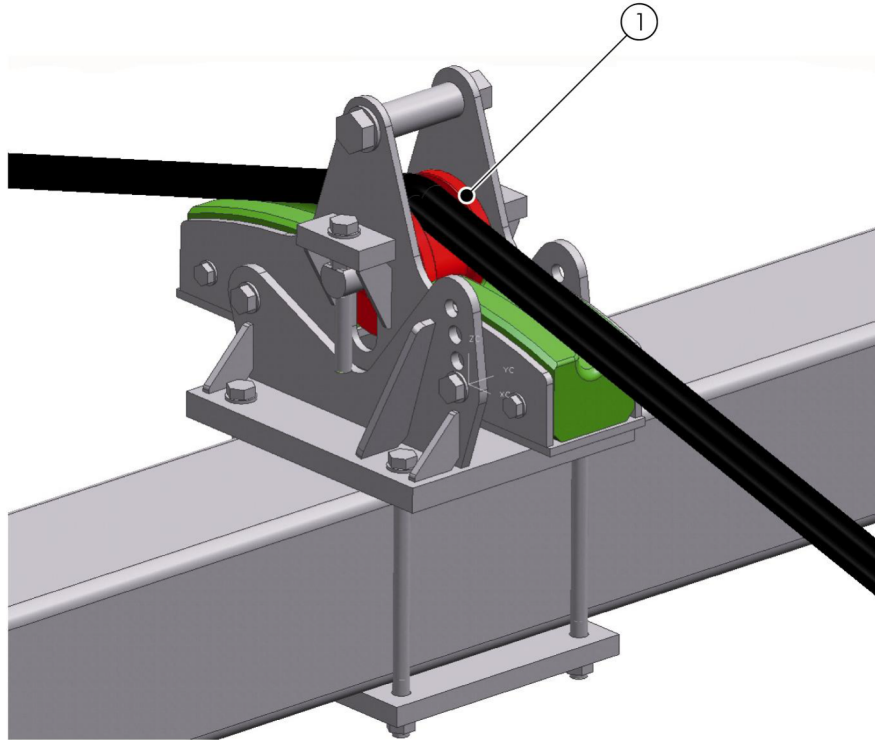


5. Tensioning / releasing the overhead cable

- Prior to and following overhead cable tensioning or releasing, the cable and its end fixtures must be checked visually.
→ see 4.2.3 'Check every six months and after extraordinary occurrences (storm, thick ice cover, etc.)'
- After the cable has been released or tensioned, check the tangential angles or sags in the corresponding spans and record the results.
- Any work on the rope must be supervised by the operations manager and documented in writing.
- Special care shall be taken not to damage the electrical cables and connections. The connections must be free of strains.
- Tensioning/releasing shall only be performed under proper weather conditions (without ice cover, with no wind, etc.)

6. Tensioning / releasing / relocation procedure

- Put the assembly rollers into the upper position and secure them with counter nuts against unintended slide down caused by vibrations or similar.



⇒ Assembly roller 'up position'

- Tension the overhead cable before the uphill end fixture using suitable tools.
- The max. pull forces occurring during the tensioning/releasing must not exceed the temperature-dependent tensioning value by more than 10%.
- → see 'Tensioning tables' on page 18
The tools used must correspond to the maximum rope tension forces that may occur.
- Tension or release the overhead cable at the end fixture on the downhill or uphill side.
- Reassemble the end fixtures.
- Release the tensioning tools.
- Check the rope tension using the gradient indicator.
- Remove the tensioning tools.
- Check the end fixtures again after one or two days (for control dimensions, spaces, torque, etc.)
- Document the measured values and the works carried out.
- Once the overhead cable has reached its nominal position again, re-attach the colour markings. → see 'Colour marking' on page 9

7. Relocation of the overhead cable

Every 4 years:

- Prior to relocation, check the overhead cable and its end fixtures visually.
→ see 4.2.3 'Check every six months and after extraordinary occurrences (storm, thick ice cover, etc.)'
- Relocate the overhead cable always in the same direction.
- Relocate the overhead cable at the support points (shoes, rollers, clamps) by the length that corresponds to the (longest) support area at these support points, but not less than 0.5 m.
- Upon relocation, visually check the relocated cable section (previously in the support area) for damage (wire breakage, pressure marks, signs of abrasion, etc.).
- After the cable has been relocated, check the tangential angles or sags in the corresponding spans and record the results.
- All works on the rope must be supervised by the operations manager and documented in writing.
- During relocation, care shall be taken not to damage the electric cables and connections. The connections must be free of strains.
- Perform the relocation only in proper weather conditions (without ice cover, with no wind, etc.).

Note:

- **Relocation is not necessary or a different relocation interval is permissible provided that the manufacturer of the overhead cable or a competent authority has confirmed it due to the cable's design and has provided information on further inspection and maintenance intervals.**

8. Record data sheet for control gap


Date of inspection	Control gap (10 mm) correct		Name	Signature
	Bottom station	Top station		
Sample	✓	✓		

9. Inspection by authorized person

Every 6 years:

- After 6 years in use, the overhead cable must be inspected for the first time by a rope specialist of the rope manufacturer. Special attention shall be paid to the tower supports and end fixtures. The results must include information if and how the rope can be further used, indicate any special conditions (e.g. repair measures, relocation, etc.) if required, and the time of the next inspection.

10. Strainer Wire Certificate

FATZER AG • Hofstrasse 44 • 8590 Romanshorn / Schweiz 
Tel. +41 71 466 81 11 • www.fatzer.com • info@fatzer.com



Rope data sheet

Rope designation	Guy rope, 16.0 1x19J-. 1960 B(Zn/Al) Z	FA21-103145
Conformity	Regulation (EU) 2016/424	
Applied standards	EN 12385-10 FATZER works standard	
Client		
Order number		
Operating Party		
Identification of Installation		
Type of Installation		
Order lengths	1 x 2030 m	
Produced lengths	1 x 2030 m	
Rope diameter, nominal / design	16.0 mm 16.28 mm	
Mass per unit length	1.28 kg/m	
Calculated breaking load	305 kN	
Minimum breaking load (MBL)	281 kN	
Construction	1x19 spiral	
Number of strands	Outer 1	
Number of wires	1 6 12	
Nominal wire diameter mm	3.40 3.22 3.22	
Metall. cross-section mm ²	9.08 8.14 8.14	
Tensile grade N/mm ²	1960 1960 1960	
Number of wires		
Nominal wire diameter mm		
Metall. cross-section mm ²		
Tensile grade N/mm ²		
Number of wires		
Nominal wire diameter mm		
Metall. cross-section mm ²		
Tensile grade N/mm ²		
Metallic cross section of rope	156 mm ²	
Total number of wires	19	
Wire material	EN 10264-3	
Wire finish	Zn95Al5, Cl. B	
Core material		
Basic lubricant of rope		
Type of lay and lay direction	Outer layer right	
Lay length	163 mm	
Remarks		

Romanshorn, 27.04.2022