COMPANY MAIN TOPIC [PRODUCT]

TENSIONING DEVICE
FOR CONTACT LINES OF LIGHT RAIL SYSTEMS

English

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TENSIONING DEVICE FOR CONTACT LINES OF LIGHT RAIL SYSTEMS

The newly developed TracFeed® NSV tensioning device from Rail Power Systems is primarily intended for use with overhead contact lines and single tramway-type equipment. It is designed to accommodate tensile forces of up to 12 kN. Since it can be completely integrated into the poles, it is an innovative and appealing alternative to established, conventional solutions. The integrated tensioning device has now been in use since 2013, after a succesful test phase and the granting of the patent.

Introduction

Rail Power Systems has developed several innovations in response to the desire of municipal planners for contact lines that are less conspicuous in the overall cityscape. With the TracFeed® NSV Integrated Tensioning Device for tramway equipment (Figure 1), the company has taken an important step in this direction. The design goal was the development of a maintenance-free mechanical tensioning device with tensile forces up to 12 kN that can be fully integrated into a steel mast. Despite its compact design it also features an integrated blocking device. Additional variants can be derived from the assembly depending on the needs of the market.

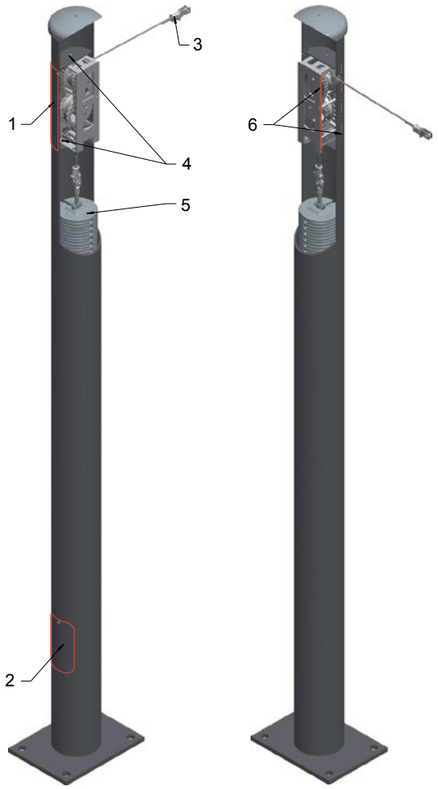


Figure 1:
TracFeed® NSV Integrated Tensioning Device for contact or messenger wire, upper tubular pole doors at approimately 6 m above top of rail.

1 Upper inspection door
2 Lower inspection door
3 Connection to overhead contact line
4 Fixing screws
5 Weight set
6 Front edge (supporting edge)

DESIGN

This new tensioning device performs the same function as conventional models, with a simple and proven functional principle. More specifically, it acts as a tensioning contact, with tensioning wires, utilising weights with a constant tensile force while compensating for temperature-dependent changes in length. However, it takes up far less space than conventional wheel-tensioning devices, with a diameter of up to 560 mm. This is not a simple issue when it comes to steel tubular masts, which only have inner diameters of approximately 300 to 350 mm at a height of 6 m above the top of the rail. Flexible 50 mm² stranded steel conductors as used by Germany Railway are applied, which require a drum diameter of at least 160 mm for winding. Due to this technical limitation, the initial approach involved made use of a planetary gear. However, since only small quantities are expected to be produced, the associated costs were considered too high. Therefore, a more affordable solution was chosen.

Unlike conventional tensioning devices, the two drums with different diameters of 160 and 210 mm have a transmission ratio of 1 : 1.3 only and are not supported on the same shaft (Figure 2). The torque transmission in between the two cable drums is carried out by a chain gear with 26 : 11 teeth as a second transmission stage (Figure 3). This transmission ratio is 1 : 2.4 and thus a total force transmission ratio of 3.1 is achieved. The largest components are the two toothed locking wheels on the weight drum for the blocking device, which have an outer diameter of only 266 mm (Figure 4).

The technical data for the tensioning device is summarised in Table 1. The overall layout of the tensioning device is shown in Figure 3. In order to keep the weight to a minimum and to avoid corrosion problems, the housing and frame are made of aluminium alloys. The tensioning wire drums are made of cast aluminum (Figure 4).

EN 50119 [1] requires that bearings have anti-corrosion protection and that attached weights are kept away from publicly accessible areas. The slide bearings are made from a special, self-lubricating solid plastic and are thus maintenance-free. Since the weights move inside a hollow body and are only accessible to authorised persons, they do not require any additional protective covering.

The tensioning device has a dampened locking device which serves as a blocking device (Figure 5). They are blocks of wound stainless steel wire with a damping capacity adapted to the dynamic load arising in the event of a wire break. In the process, the frame in the housing relieved on one side tips over a pivot point and the locking device locks the drum that carries the weights, whereby damage to the contact line will be prevented.

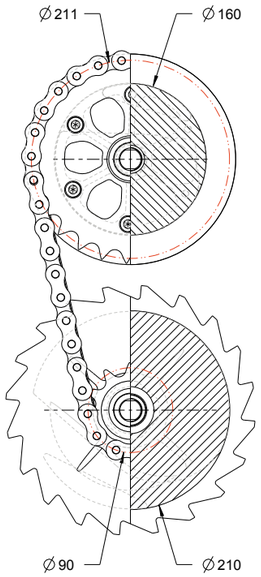


Figure 2:
Chain gear and tensioning wire drum transmissions, diameters in mm.

Figure 3:
TracFeed® NSV Integrated Tensioning Device for contact wire or supporting messenger wire: overview. The two parallel chain gears and the blocking device are shown.

INSTALLATION AND SERVICE

The steel poles have two door flaps for installation (Figure 1). With the upper door flap, which is about 6 m above top of rail, the tensioning device is pushed into the pole and mounted on a holder in the pole with four bolts. With its front edge, the housing has a form-fitting support in the pole tube, wherein the tensile force from the contact line is transferred directly to the pole and not over the bolts of the holder. After the installation of this device, the tensioning wires are guided upwards and out of the pole and downwards within the pole. The door for installation of the weights is positioned on the bottom part of the pole. In order to facilitate this process, 12.5 kg cast iron weights are used. The installation of the tensioning device can be performed on a lying pole or an already erected pole.

We recommend inspecting the devices every 24 months. In doing so, the ease of movement of the weights, their position depending on the current temperature and the cable in-takes on the drams should be inspected.

The run of the tensioning wires in the tensioning device is specified in the product documentation. Their proper winding on the drums needs to be checked during acceptance of the system. The lower tensioning wire can also be incorrectly slung around its guiding pulley (Figure 5). This can lead to malfunctions. Therefore, it is necessary to check the correct position of the wires during commissioning and to adjust them, if necessary.

TracFeed® Integrated Tensioning Device technical data		
Functional data		
Tensile force	kN	≤ 12
Temperature range	°C	–30 ... +70
Compensation length	mm	1 200
Installation data		
Width	mm	220
Depth	mm	280
Height	mm	700
Mass	kg	45
Gear		
Drum diameter	mm:mm	160 : 210
Number of teeth		26 : 11
Transmission		3.1

Figure 4:
Cast aluminium weight drum.

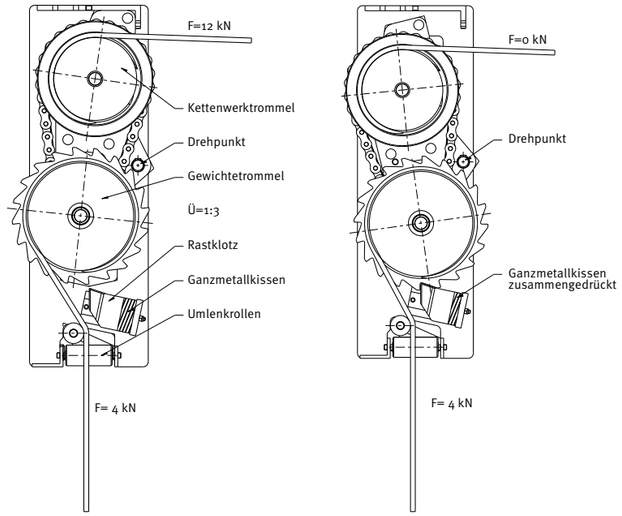


Figure 5:
Blocking device in operating position (left) and in blocked position (right).

TYPE TESTING

According to EN 50119 sections 8.5.1 and 8.5.2, a type testing is required for these devices, it consists of a static tension test, a dynamic test and an efficiency test. For this purpose, the test set was mounted on a column. The tensioning wire was guided horizontally through a protective tube and attached to a come-along via a wedge-type dead-end clamp. The come along was then connected to tension the measuring unit. A weight set was suspended from the vertical tensioning wire (Figures 6 and 7).

First the function of movement in normal mode was tested. Then 1.33 times the nominal tensile force was generated in accordance with the standard using additional weights and a cable break was repeatedly simulated by cutting through the horizontal tensioning wire with pneumatic shears between the protective tube and the come along. The reliable operation of the blocking device was verified in the process.

The regular 405 kg weights were attached to generated 4.0 kN. The actual tensile force generated on the fixed anchoring was measured at 12.0 kN. The resulting efficiency was calculated as:

12.0 kN / 3.10 · 4.0 kN = 0.97

This value corresponds to the efficiency of conventional tensioning devices. The device passed the tests without failing and without lasting deformations.

The German translation is published in eb – Elektrische Bahnen 110 (2012), Iss. 8-9, pp. 484–487.

References

[1] EN 50119:2010-05: Railway applications – Fixed Installations – Electric traction overhead contact lines.

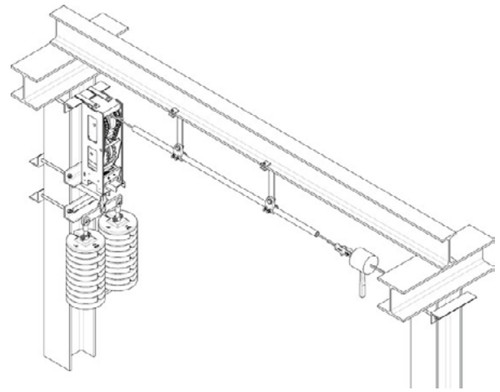
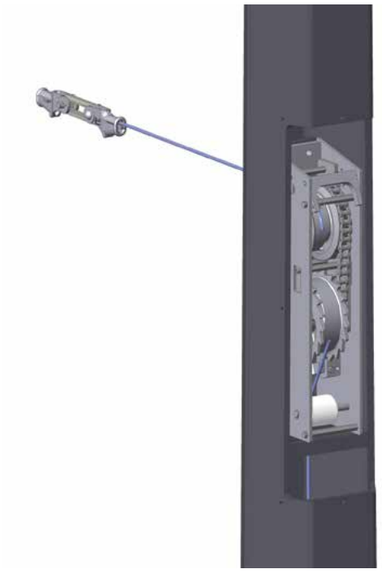


Figure 6:
Test setup, tensioning wire guided in a protective tube, come along for load application to the right, tensile force measuring device (concealed) next to it.

Figure 7: Test setup.

Installation examples in different types of poles

Round Pole



6-Edged Pole

H-Beam Pole (example for 2 sets installed in parallel)

Customer: VAG Nuremberg

The crossing of Pirckheimerstraße and Maxfeldstraße in Nuremberg (Germany) features integrated tensioning devices installed by Rail Power Systems. The picture on the right shows the new pole containing the integrated tensioning device. As it cannot be seen from the outside, it contributes to a more harmonious visual impression of urban catenary systems. As shown in the upper-left picture, it is possible to see through opening for the contact wire which leads to the tensioning device. The lower-left picture shows the access hatch to the pole for installation and inspection of the weight set. The installation of the tensioning device itself is performed via a similar opening at the respective height on the pole.

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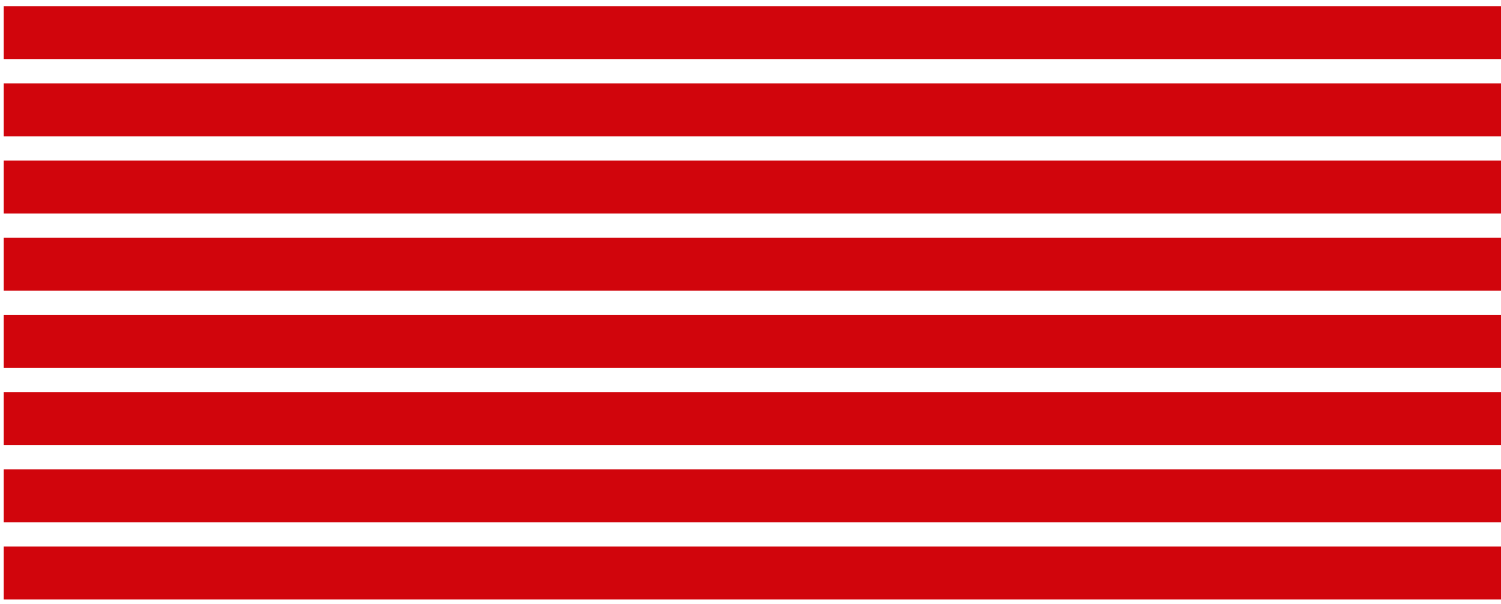

The specifications set out in this document apply to popular applications. They do not represent performance limits. This means that divergent specifications may be attained in specific applications. The contractually agreed specifications alone shall apply. We reserve the right to effect technical modifications. TracFeed® is a registered trademark of Rail Power Systems GmbH.

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