



System W-Tram

Highly elastic rail fastening for tram –
the optimum single support point for slab track

Vossloh fastening systems

Based on our experience we are setting standards of the future.



Urban Transport – Always smooth with stop and go

Frequent starting and stoppings at many stops within the shortest time characterize urban transport. In this case, highly elastic components provide for comfortable travelling at high operating safety and reduced noise – at axle loads of up to 18 t (Metro) / 13 t (Tram).

Direct fastening on slab track

Slab track systems must meet special requirements to deflect forces generated by a rolling train into the ground in a smooth and resource-saving way, as the highly elastic components of the rail fastening systems must take over the original elasticity of the ballasted track. For system W-Tram, a highly elastic elastomer-rail pad made of *cellentic* is used in order to achieve this result. In case of single support points, the system's base plates take over the function of concrete sleepers and their shoulders: they keep the rail in the track and transfer dynamic forces in the substructure.

System W-Tram – Flexible, resource-saving application in the slab track

The W-Tram system has been developed on the basis of the approved W-systems for concrete sleepers as ballast free variant for urban transport and especially for tram projects – as single support point with screw-dowel-combination for anchoring on slab tracks. Required material quantities are reduced due to the geometry of the plastic base plate: The high portion of long-lasting plastics ensures corrosion protection and electrical insulation. Compared to steel this light-weight material also provides logistic advantages and an easier handling during installation.

In more than 40 years, the W-Tram system has proven to be successful on rail systems of a length of approx. 600 km all over the world: Among others, trams in Algeria, Austria, Belgium, China, Czech Republic, Germany, Great Britain, Italy, the Netherlands, Romania, Spain, Sweden, Switzerland, Tunisia, Turkey and the UAE are travelling on W-Tram fastening systems.



Vossloh protect:

The new coating for tension clamps, sleeper screws and T-head bolts (incl. nuts and washers) – for a consistent and high coating quality.

Advantages

- Conventional barrier protection **plus** cathodic corrosion protection, preventing the base material from corroding in the event of damages, e.g. caused by flying ballast.
- Withstands extreme conditions such as high temperature fluctuations, high humidity and industrial climate (acid rains).



cellentic is an elastomer made of EPDM that ensures high stability against many types of chemical attacks. The advantage: the material provides excellent resistance to temperature, aging, and weather conditions as well as it is very stable under permanent load. *cellentic* components optimize the elasticity for a reduction of vibrations and the protection of track.

System W-Tram

Elastic. Safe. Resilient. Flexible.

Application in covered track possible

Caps for Skl, angled guide plates and screw, as well as *chamber filling elements*, fastened to the web of rail, allow the use of the system with *grooved rails in the covered track*.

Angled guide plates keep the rail in the track

The angled guide plates lead the forces introduced into the rail by train in the base plate first and then into the concrete. In this way, the screw-dowel-combinations are not loaded by shearing and bending forces. The design additionally supports the *tilting protection*. Different widths can *adjust the gauge*.

Adjustable height

Using height adjustment plates, the *height of the system can be regulated within 20 mm*. With the optimized height adjustment plates *NG* the *cellentic* rail pad rests completely on the bearing face.

The W-shape of the Skl 21 provides safety

For meeting the required *rail creep resistance* two highly elastic, independently acting spring arms steadily hold the rail down; the middle bend acts as an additional *tilting protection*. With its high fatigue strength, it resists the dynamic vertical movements that are caused when the vehicle rolls over the rail. The system is *maintenance-free*: Due to the permanently acting tension, Skl and screw cannot loosen, the middle bend prevents the spring arms from plastic deformation.

cellentic rail pad for high elasticity

The elasticity of the *cellentic* pad compensates the impacts of the vertical forces and with this, *stable rail deflection*; it also damps vibrations and *minimizes the structure-borne noise*.

Securely clamped with the screw-dowel combination NG

The high-quality dowels made of hightech material are extremely strong and efficient: Lateral forces are reduced, this leads to *a decrease in the load on the slab track*.



Easy handling for installation and rail maintenance

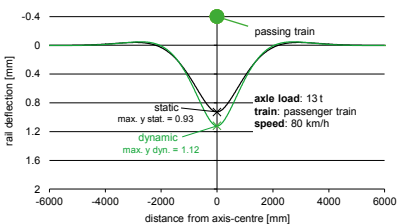
- Flexibly applicable as single support point: no special shoulders (e.g. for concrete sleepers) required.
- Installation is possible both with bottom up (by bottom casting of base plate) and top-down method.
- For welding of the rail, no fastening elements have to be removed from the support point.
- All components can be replaced.

Safety. Comfort. Track protection.

Travel comfort through optimum rail deflection

The railway track must be elastic to compensate forces caused by running trains. Because ballast is not used for slab tracks, the highly elastic *cellentic*-components of the rail fastening system are designed to undertake this job. The W-Tram system with *cellentic* rail pad allows rail deflection and can optimally distribute occurring vertical forces. The result: Protection of track. Its elasticity is adapted to the traffic load to achieve optimum rail deflection: load distribution is at the maximum without overloading the rail. Furthermore, the *cellentic* component damps the vibrations caused by the unevenness of track and wheels; structure-borne track vibration is minimized. The result: travel comfort, safety through smooth running, as well as increased lifetime of track components and vehicles.

Zimmermann computation

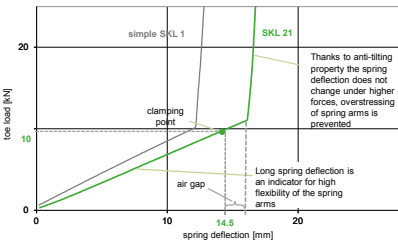


Simplified demonstration: one axle of a two axle bogie

Creep resistance and rail tilting protection

To allow optimum deflection for the rail, its fastening must respond in an elastic way. Therefore, the Skl 21 has a long spring deflection: When force is applied by a train, its spring arms remain in contact with the rail foot in each situation. For this purpose, the rail is continuously clamped in a force-fitted way by the two spring arms with a spring deflection of approx. 14.5 mm and a toe load of approx. 10 kN. With this, also a high creep resistance is achieved: When the trains accelerate/decelerate, the rails remain in position; dangerous fracture gaps due to broken rails are avoided. Simultaneously, a small gap between the middle bend and the rail foot of the rail has exactly the play required for operation. If the rail tilts excessively, e.g. in narrow curves, high forces are applied to the tension clamp. The Skl 21 is able to resist them: Rail movements are limited by the middle bend after the gap has been overcome, and the spring arms are not overstretched.

Load-deflection-curve



| Rail fastening system W-Tram with tension clamp Skl 21 | | |
|---|--|------------------|
| Typical field of application | Urban transport/Transit; single support points on slab track | |
| Axle load | ≤ 13 t | |
| Speed | ≤ 100 km/h | |
| Curve radius | ≥ 40 m | |
| Height adjustment | + 20 mm | |
| Gauge adjustment | ± 10 mm | |
| Vertical fatigue strength of Skl 21 | 2.5 mm | |
| Static stiffness of <i>cellentic</i> rail pad | ≥ 30 kN/mm | EN 13146-9: 2011 |
| Relation of dyn./stat. stiffness of <i>cellentic</i> rail pad | 1.1 | EN 13146-9: 2011 |
| Toe-load of Skl 21 (nominal) | 10 kN | EN 13146-7: 2012 |
| Electrical resistance | ≥ 10 kΩ | EN 13146-5: 2003 |
| Rail creep resistance | ≥ 9 kN | EN 13146-1: 2012 |
| Corrosion protection category (Skl,Ss) | C5-L (1440 h stainless) | ISO 12944 |
| System approval/homologation | | EN 13481-5: 2012 |

Remark

Contents, figures and technical data in this brochure display the performance of the fastening system, however, they always depend on external conditions. Please contact us to enable us to develop a solution for you that will be customized to your requirements. The information presented corresponds to the technical state at the time of printing; in the meantime, continuous research and development programmes at Vossloh could have caused adaptations of the product.



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