



## System DFF 21

Highly elastic rail fastening for conventional rail and metro –  
the optimum single support point for slab track

# Vossloh fastening systems

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



## Conventional Rail – Safety on standard routes

Safety and comfort are decisive for rail traffic. Our tension clamps provide a stable fastening solution for types of track with a permissible axle load of up to 26 t. Components with high elasticity are able to balance the dynamic track forces out in an outstanding way.



## 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 smoothly and material-saving way: The highly elastic components of the rail fastening systems must replicate the original elasticity of the ballasted track. For system DFF 21, a highly elastic elastomer-rail pad made of *cellentic* is used in order to achieve that result. In case of single support points, the system's base plate takes over the function of concrete sleepers and their shoulders: they keep the rail in the track and transfer dynamic forces in the substructure.

### System DFF 21 – Flexible, resource-saving application in the slab track

The DFF 21 system, a single support point with screw-dowel combination for anchoring on slab tracks, is based on the approved tramway system W-Tram. Its reinforced base plate features a bigger surface for traffic load distribution: Since it withstands axle loads up to 26 t, it is suitable especially for metro and conventional rail projects. Application in covered track and switches is possible as well. Required material quantities are optimized 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 lightweight material also provides logistic advantages and an easier handling during installation.



### 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).



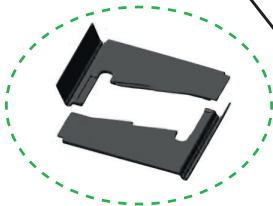
*cellentic* is an elastomer made of EPDM that ensures high stability against many types of chemical attacks. The advantage: the material provides excellent resistance to temperature, aging, and weather conditions as well as it is very stable under permanent load. *cellentic* components optimize the elasticity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

# System DFF 21

Elastic. Safe. Resilient. Flexible.

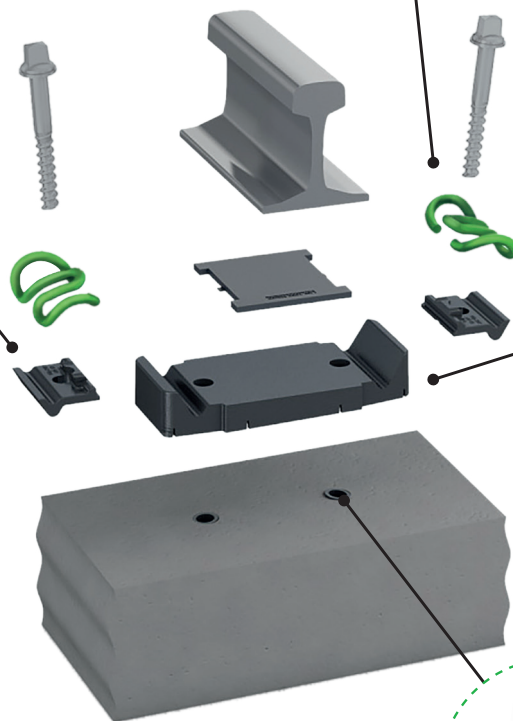
## Angled guide plates keep the rail in the track

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 adjusted 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.



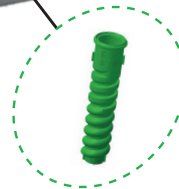
## cellentic rail pad for high elasticity

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.

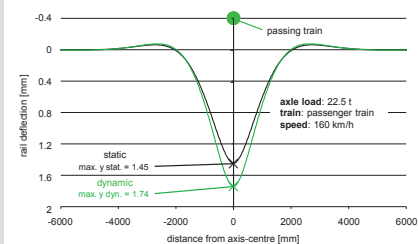
## Travel comfort through optimum rail deflection

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 DFF 21 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.

## Creep resistance and rail tilting protection

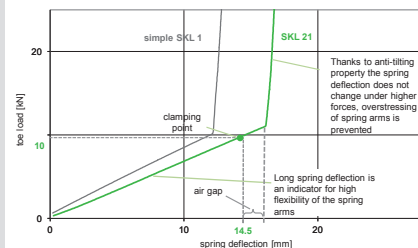
To allow optimum deflection for the rail, its fastening must respond in an elastic way. Therefore, the Skl 21 has a long spring deflection: When force is applied by a train, its spring arms remain in contact with the rail foot in each situation. For this purpose, the rail is continuously clamped in a 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.

Zimmermann computation



Simplified demonstration: one axle of a two axle bogie

Load-deflection-curve



Rail fastening system DFF 21 with tension clamp Skl 21		
Typical field of application	Conventional Rail / Urban transport / Transit; single support points on slab track	
Axle load	≤ 26 t	
Speed	≤ 250 km/h	
Curve radius	≥ 150 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	≥ 7 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.