vossloh
North America

System DFF 21

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

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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 tonnes (29 tons). The highly elastic components additionally ensure a comfortable journey.

Urban Transport – Always smooth with stop and go

Frequent braking and starting on 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 nuisance – at axle loads of up to 18 tonnes (20 tons) for Metro / 13 tonnes (15 tons) for 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 take over 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 plates take over the function of concrete ties 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 tonnes (29 tons), 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 light-weight material also provides logistic advantages and an easier handling during installation.

cellentic

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. Components made of *cellentic* 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 *regulate the gauge.*

Adjustable height

Using height adjustment plates, the *height of the system can be regulated within 20 mm (0.8 in).* 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 particular *cellentic* material ensures the compensation of vertical forces and with this, *stable rail deflection;* it also damps vibrations and *minimizes the structure-borne noise.*

Securely clamped with screw-dowel combinations

Easy handling for installation and rail maintenance

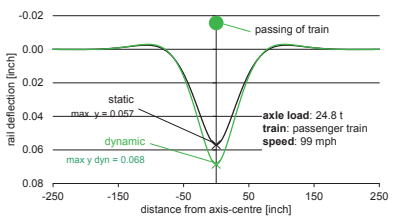
- Flexibly applicable as single support point: no special shoulders (e.g. for concrete ties) required.
- Installation is possible both with top-down and with bottom-up method.
- For welding of the rail, no fastening elements have to be removed from the support point.
- All components can be replaced.

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: high travel comfort, high safety through smooth running, as well as long lifetime of track components and vehicles.

Zimmermann computation

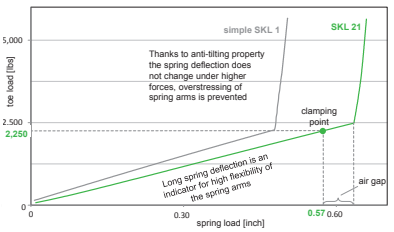


Simplified demonstration: one axle of a two axle bogie

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 (0.57 in) and a toe load of approx. 10 kN (2.25 kip). 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 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 tonnes (29 tons)	
Speed	≤ 250 km/h (155 mph)	
Curve radius	≥ 150 m (500 ft or 12°)	
Height adjustment	+ 20 mm (0.8 in)	
Gauge adjustment	± 10 mm (0.4 in)	
Vertical fatigue strength of Skl 21	2.5 mm (0.10 in)	
Static stiffness of *cellentic* rail pad	≥ 30 kN/mm (170 kip/in)	EN 13146-9:2011
Relation of dyn./stat. stiffness of *cellentic* rail pad	1.1	EN 13146-9:2011
Toe-load of Skl 21 (nominal)	10 kN (2.25 kip)	EN 13146-7: 2012
Electrical resistance	≥ 10 kΩ	EN 13146-5: 2003
Rail creep resistance	≥ 7 kN (1.57 kip)	EN 13146-1: 2012
System approval/homologation		EN 13481-5: 2012

Remark

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System DFF 30 HH

Elastic rail fastening for heavy haul – the optimum single support point for rail vehicles with extreme axle loads

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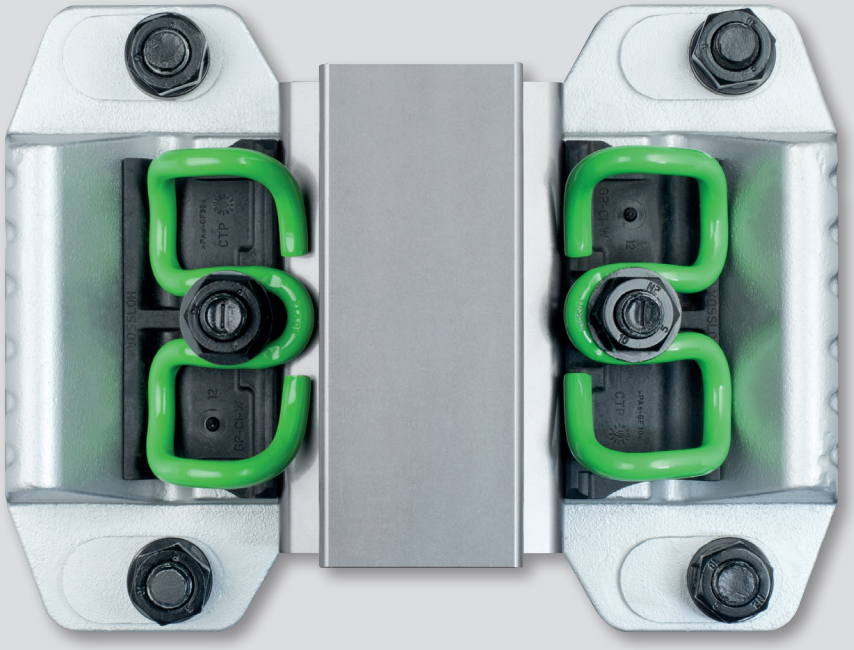


System DFF 30 HH

Elastic rail fastening for heavy haul – the optimum single support point for rail vehicles with extreme axle loads

Vossloh Fastening Systems

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

Heavy Haul – Heavy loads are led safely

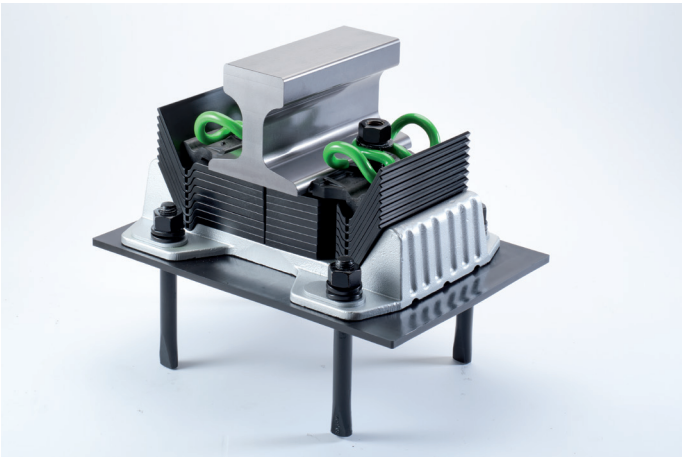
Axle loads of more than 26 tonnes (29 tons) mean extreme loads for the track. Resistant fastening systems provide for safe and durable connections and simultaneously allow fast and easy maintenance.

DFF 30 HH – designed for extreme axle loads of crane railways

In container ports, the stress of the railway infrastructure is extremely high - due to the enormous loads of the container cranes and extreme weather conditions. Especially for the requirements of heavy container crane systems in port terminals – with their high axle and lateral loads, as well as their extreme acceleration and brake forces – Vossloh has developed the DFF 30 HH system, a single support point solution for slab tracks based on the approved systems DFF 300 and W 30 HH. The extreme loads are led via the shoulder of the used cast-iron baseplate and the angled guide plates made of glass-fibre reinforced polyamide. The rail pad made of thermoplastic polyurethane not only damps the loads but also ensures the durability required for extreme loads and ambient conditions.

The DFF 30 HH system offers a height adjustment of up to 80 mm (3.2 in) and a gauge adjustment by 40 mm (1.6 in) per support point, without disassembly of the whole system. This is especially important to be able to respond on sagging of the ground – a problem typical for crane tracks, caused by the different ground textures in the port area and the extreme loads of the heavy cranes. All steel parts are protected from corrosion, so that they can also be used under extreme weather conditions including aggressive saline maritime air.

The DFF 30 HH system is already being used in two Australian projects – Port of Brisbane as well as Port Botany in Sydney.



System DFF 30 HH

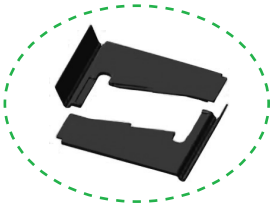
Elastic. Safe. Resilient. Flexible.

The W-shape of the Skl 30 provides safety

For meeting the required *creep resistance* two highly elastic, independently acting spring arms steadily hold the rail down; the middle bend is used 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. Due to the permanently acting tension, Skl and screw cannot loosen and therefore, they are *maintenance-free.*

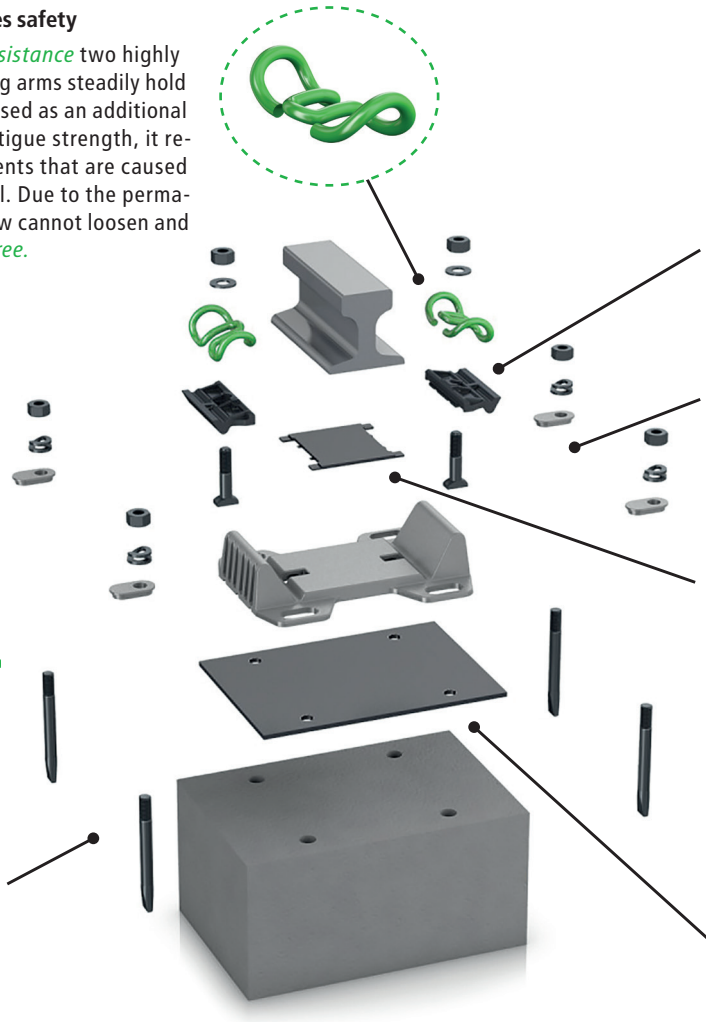
Adjustable height

Using height adjustment plates, the *height of the system can be regulated within 80 mm (3.2 in)*. With the optimized height adjustment plates *NG* the rail pad rests completely on the bearing face.



Safely tied

By means of T-headed bolts, the Skl tension clamps are safely mounted to the baseplate. The baseplate itself is fixed in the concrete track with anchor bolts.



Angled guide plates keep the rail in the track

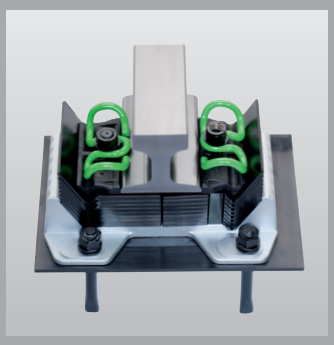
The angled guide plates lead the forces introduced into the rail by train in the baseplate made of cast iron. In this way, the T-headed bolts are not loaded by shearing and bending forces. The design of the angled guide plates additionally supports the *tilting protection*. Different widths can *regulate the gauge.*

The gauge can be adjusted using *adjusting plates.*

Optimum distribution of extreme lateral loads

Due to its adapted shoulder of the cast-iron base plate, extreme *lateral loads can be deflected*. The rail pad made of thermoplastic polyurethane *not only damps the loads* but also ensures the required *durability*. Furthermore, it *electrically insulates* the baseplate from the rail.

Intermediate plate



Easy handling for installation, rail maintenance and replacement

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

Safety. Comfort. Track protection.

Creep resistance and rail tilting protection

To allow optimum deflection for the rail, fastening must response in an elastic way. Therefore, the Skl 30 has a long spring deflection: When forces are 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 mm (0.55 in) and a toe load of approx. 12.5 kN (2.8 kip). With this, a high creep resistance is also achieved: When the trains accelerate / decelerate, the rails remain in position, dangerous open 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 that is required for operation. If the rail tilts excessively, e.g. in narrow curves, high forces are applied to the tension clamp. The Skl 30 is able to resist them: Rail movements are compensated by the middle bend after the air gap has been overcome, and the spring arms are not overstretched.

Load-deflection-curve

Rail fastening system DFF 30 HH with tension clamp Skl 30		
Typical field of application	Heavy haul / Crane trains; slab track	
Axle load	≤ 72 tonnes (79 tons)	
Speed	≤ 80 km/h (50 mph)	
Curve radius	≥ 300 m (1,000 ft or 6°)	
Height adjustment	+ 80 mm (3.2 in)	
Gauge adjustment	– 10 / + 70 mm (– 0.4 in / + 2.8 in)	
Vertical fatigue strength of Skl 30	2.2 mm (0.09 in)	
Static stiffness of rail pad	≥ 400 kN/mm (2,300 kip/in)	EN 13146-9:2011
Toe load of Skl 30 (nominal)	12.5 kN (2.8 kip)	EN 13146-7: 2012
Electrical resistance	≥ 5 kΩ	EN 13146-5: 2003
Rail creep resistance	≥ 9 kN (2 kip)	EN 13146-1: 2012
System audit / homologation		EN 13481-5: 2012

Remark

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System DFF 300 UTS

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

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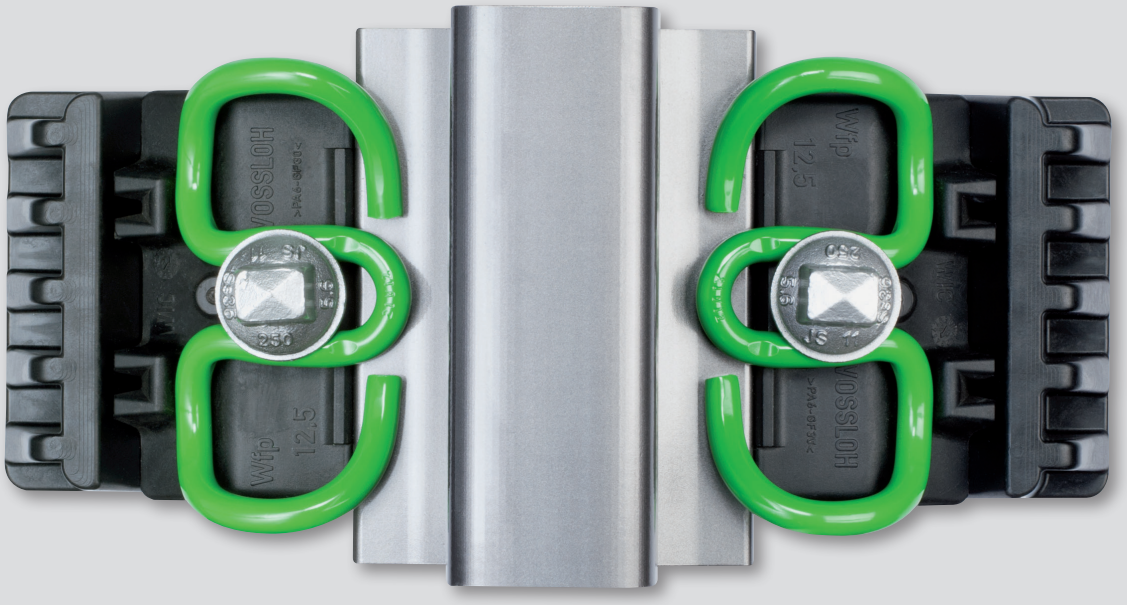


System DFF 300 UTS

Highly elastic rail fastening for metro –
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 braking and starting on 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 nuisance – at axle loads of up to 18 tonnes (20 tons) for Metro/ 13 tonnes (15 tons) for 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 material-saving way: The highly elastic components of the rail fastening systems must take over the original elasticity of the ballasted track.

For system DFF 300 UTS, a highly-elastic elastomer-intermediate plate made of *cellentic* is used in order to achieve that result. In case of single support points, the system's base plates take over the function of concrete ties and their shoulders: they keep the rail in the track and transfer dynamic forces in the substructure.

System DFF 300 UTS – Flexible resource-saving application in the slab track

With the DFF 300 UTS system, Vossloh Fastening Systems established a rail fastening system as single support point on a slab track that has been developed on the basis of the approved advantages of the rail fastening system 300 and with this, it has been adapted to the special requirements of urban transport.

Required material quantities are optimized due to the geometry of the plastic base plate.

The high portion of durable plastics ensures corrosion protection and electrical insulation. Compared to steel this light-weight material also provides logistic advantages and an easier, safer handling during installation.

cellentic

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. Components made of *cellentic* optimize the elasticity for a reduction of vibrations and the protection of track.

System DFF 300 UTS

Elastic. Safe. Resilient. Flexible.

The W-shape of the Skl 21 provides safety

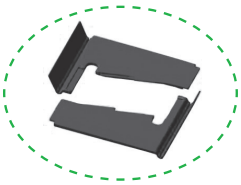
For meeting the required *rail creep resistance* two highly elastic, independently acting spring arms steadily hold the rail down; the middle bend acts as an additional *tilting protection*. With its high fatigue strength, it resists the dynamic vertical movements that are caused when the vehicle rolls 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.

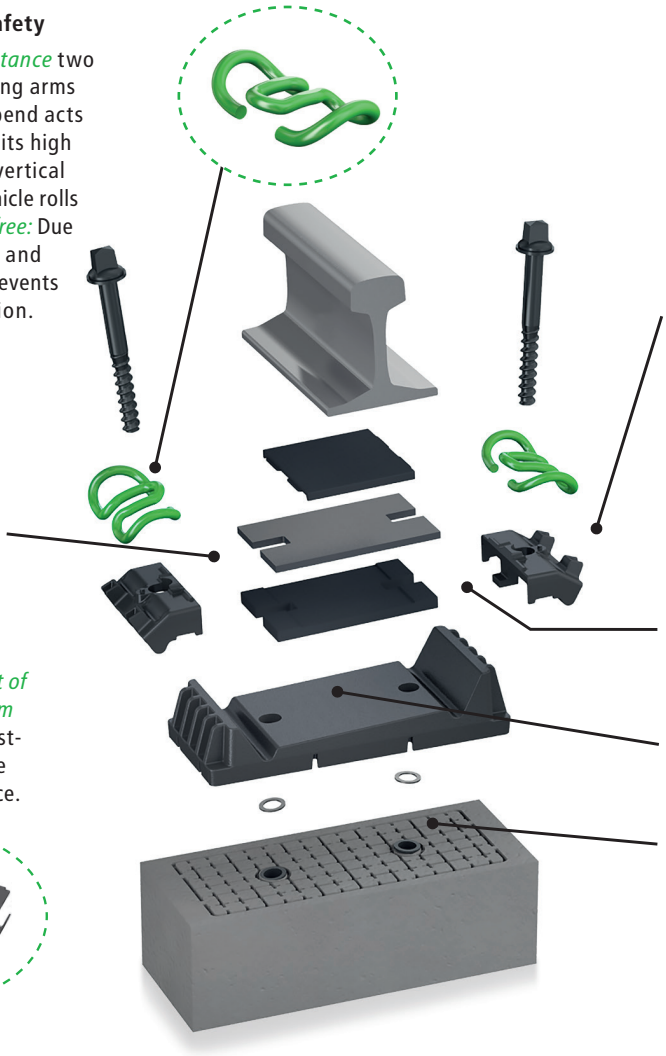
A steel plate ensures an optimum distribution of load

A steel plate provides for *load distribution* from the rail foot to the elastic intermediate plate and offers additional *tilting protection* through its large surface. A plastic rail pad insulates the rail electrically.

Adjustable height

Using height adjustment plates, the *height of the system can be regulated within 30 mm (1.2 in).* With the optimized height adjustment plates *NG* the *cellentic* intermediate plate rests completely on the bearing face.





Angled guide plates keep the rail in the track

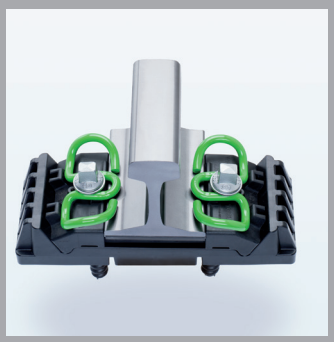
The angled guide plates lead the forces introduced into the rail by train in the base plate first and then into the concrete. In this way, the screw-dowel combinations are not loaded by shearing and bending forces. The design of the angled guide plates additionally supports the *tilting protection.*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

Highly-elastic intermediate plate for low vibration

The elasticity of the special *cellentic* material ensures stable rail deflection; *Vibrations and structure-borne noise are minimised*. Their reinforced edge area also contributes to the *tilting protection.*

Base plate

Securely clamped with screw-dowel combinations



Easy handling for installation, rail maintenance and replacement

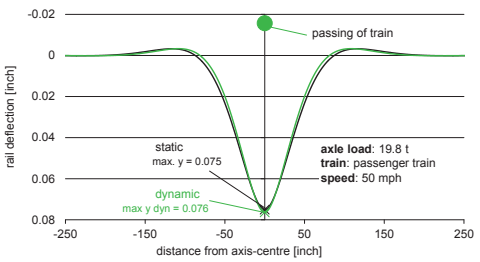
- Flexibly applicable as single support point: no special shoulders (e.g. for concrete ties) required.
- Installation is possible both with top-down and with bottom-up method.
- For welding of the rail, no fastening elements have to be removed from the support point.
- All components can be replaced.

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 300 UTS system with *cellentic* intermediate plate 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 the track and wheels; structure-borne track vibration is minimized. The result: high travel comfort, high safety through smooth running, as well as long lifetime of track components and vehicles.

Zimmermann computation

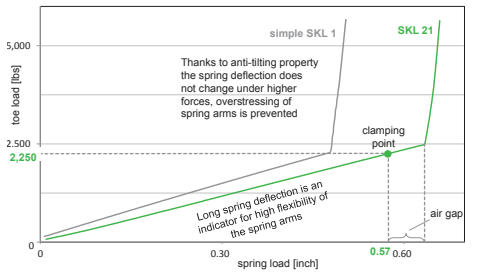


Simplified demonstration: one axle of a two axle bogie

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 (0.57 in) and a toe load of approx. 10 kN (2.25 kip). 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 DFF 300 UTS with tension clamp Skl 21		
Typical field of application	Urban transport / Transit; single support point on slab track	
Axle load	≤ 18 tonnes (20 tons)	
Speed	≤ 140 km/h (90 mph)	
Curve radius	≥ 80 m (265 ft or 20°)	
Height adjustment	+ 30 mm (1.2 in)	
Gauge adjustment	± 10 mm (0.4 in)	
Vertical fatigue strength of Skl 21	2.5 mm (0.10 in)	
Static stiffness of *cellentic* intermediate plate	≥ 16 kN/mm (90 kip/in)	EN 13146-9:2011
Relation of dyn. / stat. stiffness of *cellentic* intermediate plate	1.1	EN 13146-9:2011
Toe load of Skl 21 (nominal)	10 kN (2.25 kip)	EN 13146-7: 2012
Electrical resistance	≥ 5 kΩ	EN 13146-5: 2003
Rail creep resistance	≥ 9 kN (2 kip)	EN 13146-1: 2012
System audit / homologation		EN 13481-5: 2012

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