edilon)(sedra ERS Embedded Rail System
(ERS-LR) Rail Fastening System for tram, LRT and metro
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Trams, LRT and metro systems have traditionally operated – since the beginning of the 20th century – extensively on ballastless tracks, and not only on ballasted systems. More demanding requirements – arising for example from high-speed trains, greater axle loads, increasing train frequencies, and enhanced environmental consciousness – have given rise to the need for further ballastless development.

The edilon)(sedra ERS Embedded Rail System has been developed as the logical response to this challenge: as a high-performance and maintenance-free rail fastening system with especially elastic characteristics.

The ERS rail fastening system is characterized by continuous support of the rails, as well as by the elimination of any and all forms of small hardware components and gauge tie bars. This also means avoidance of the support-point frequencies of traditional, discrete rail fastening systems – and it enables transfer of live traffic loads more uniformly and with reduced load peaks into the supporting track substructure.

The main product of the ERS rail fastening system results from enclosing and bonding the rails with the 2 component edilon)(sedra Corkelast® embedding compound in a concrete or steel channel. This unique, long-life material ensures that the rails have homogeneous support throughout, with specifically determined elasticity, in accordance with specified conditions. edilon)(sedra Corkelast® is a polymer embedding compound with hardness and quantities of filling material (e.g. cork) that depend on the product type. edilon)(sedra Resilient ERS Strip controls the rail deflection for ERS rail fastening systems, under the prevailing loads. Such strip mats are available with various thickness and hardness characteristics, according to requirements for system stiffness. The filling material used here primarily serves to reduce the use of embedding compound. Empty tubes employed for the same purpose can also be used to enclose cables for signals and other functions.
The ERS rail fastening system was developed in the early 1970s, in collaboration with Netherlands Railways (NS). ERS has been used since 1982 throughout Europe and the rest of the world for applications for tram networks, commuter trains, and underground railway systems. The fields of application for ERS rail fastening systems in the light-rail (LR) version today primarily include urban environments sensitive to airborne and structure-borne noise, as well as urban areas heavily burdened by motor-vehicle and bus traffic. The ERS-LR versions are designed for axle loads between 8 and 13 metric tonnes (i.e. for trams) and for underground railways and commuter trains with axle loads up to a maximum of 16 tonnes and top speeds of 80 to 100 km/h.
The special flexibility of the ERS rail fastening system is evident in all feasible types of track covering materials – as well as in a great variety of application environments: e.g., grass tracks, bridges, tunnels, etc. The ERS of course enables implementation with all track gauges and all types of track geometry, and all railway signalling systems can be effectively integrated.
CIVIL STRUCTURES
Accessibility for rescue and service vehicles
Low weight
Reduction of track structural height
Reduction of structure-borne noise
Reduction of secondary airborne noise

TRAIN STATIONS AND STOPPING POINTS
Appealing design of the track
Simple cleaning of the track surface
Accessibility for rescue and service vehicles
Mass-spring system

WORKSHOPS AND DEPOTS
Washing and painting lines
Chemical resistance to acidic and alkaline substances
Flat and stable surfaces
High quality joint sealing

SPECIAL DESIGNS / ACCESSORY SYSTEMS
Tracks with 3 and more rails
Drainage boxes and channels
Signal boxes
Signalling loops
Turnout heating units

RAIL EXPANSION JOINTS
Vignole, grooved rail, and special rail profiles
Accessible to buses and lorries
Reduction of structure- and airborne noise
Reduction in wear
Reduced and simple maintenance

In combination with the ERS rail fastening system, edilon)sedra also offer standardized ballastless track, level-crossing and bridge systems. For more information, please visit www.edilonsedra.com.
ERS system design

The flexible application possibilities of the rail fastening systems for edilon|sedra ERS Embedded Rail System result from decades of development work and experience gained from employment of the systems.

The ERS rail fastening systems have been reorganized in application groups (see table at the right). These groups serve as starting point for customer and project-specific implementation models, as well as for application in ballastless tracks, level-crossing and bridge systems. These groups accordingly define the basic geometric conditions for channels made of concrete or steel.

In addition, the ERS stiffness categories provide orientation for rail deflection under the assumption of various load models.

It is possible in individual projects to modify the static and dynamic support stiffness, as well as sound-attenuation level in order to comply with technical requirements for airborne and noise.

Each ERS system design undergoes extensive internal and external system testing (e.g. according to EN 13481-5 and EN 13146) as well as official approval tests. State-of-the-art computer supported test equipment enables simulation of all conditions acting on the rail fastening system. For example, performance between -20 and +50°C can be verified in our own climate-controlled testing chambers.

<table>
<thead>
<tr>
<th>ERS-LR</th>
<th>Stiffness category</th>
<th>Typical static support stiffness (rail)</th>
<th>Max. static rail deflection (typical axle loads)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>Standard</td>
<td>60 kN/mm/m</td>
<td>&lt; 1.0 mm</td>
</tr>
<tr>
<td>MS</td>
<td>Medium</td>
<td>15 kN/mm/m</td>
<td>1.0 - 2.0 mm</td>
</tr>
<tr>
<td>LS</td>
<td>Low</td>
<td>9 kN/mm/m</td>
<td>&gt; 2.5 mm</td>
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</tbody>
</table>

ERS-LR APPLICATION GROUPS

- Group "B" - Basic
- Group "LV" - Level crossing, vignole rail
- Group "LG" - Level crossing, grooved rail

NOISE AND VIBRATIONS

- Support stiffness can be adjusted
- Rail deflection of 0.3 - 4.0 mm possible
- Reduction of structure-borne noise
- Reduction of airborne noise

The standard designs of the ERS-LR rail fastening system are based on an axle spacing of 1.8 m.
ERS rail fastening systems in Group B applications are designed for vignole rail profiles in track areas that are not used by street vehicles driving along or across the tracks.

The heads of the rails are not embedded, which allows automatic drainage as well as grinding and re-profiling with high performance grinding machines.

In cases of tight curves (less than approx. 100 m), Corkelast® is poured at the outside of the rail heads up to e.g. 35 mm below top of rail. The embedding height on the inner side is e.g. 50 mm below top of rail.
Group “LV” - Level crossing or roadway, includes vignole rails

ERS rail fastening systems in Group LV are designed for the use of vignole or special rail profiles in track areas that can also serve as level crossing or roadway for vehicles crossing the tracks, or moving along or over the tracks (e.g. for rescue and service vehicles).

Top of rail is located e.g. 5 mm above the surface of the paved track. The depth of the flange groove is e.g. 50 mm. Narrow track groove widths assure safety at level crossings and enable reduced impacts by lorries, buses and the like.

APPLICATION AREAS FOR GROUP “LV”
- Tracks flush with surroundings
- Grass tracks
- Crossings for pedestrians and vehicles
- Workshops and depots
- Civil structures

STANDARD PROFILES IN GROUP “LV”
- 41E1 / 46E1 / 49E1 / etc.

SPECIAL PROFILES IN GROUP “LV”
- SA42 / S33 / R6 / R41 / u.v.m. / etc.

For example: ERS-LR 49E1-MS
Group “LG” - Level crossing or roadway, includes grooved rails

Group LG versions of ERS rail fastening systems for grooved rails and special grooved rail profiles are designed for applications in track areas which are used by pedestrians and cyclists, or which are crossed or used by vehicles as a roadway.

Depending on the rail profile, the rail heads are approx. 5 to 6 mm above the top of the groove head or the top edge of edilon (sedra Corkelast®).

In cases of tight curves (less than approx. 100 m), a harder embedding compound can be used to limit head deflection in the upper part. Generally, no types of gauge bars are used here.

**APPLICATIONS FOR GROUP “LG”**
- Tracks flush with their surroundings
- Grass tracks

**STANDARD PROFILES GROUP “LG”**
- 60R1 / 60R2 / 59R2 / 53R1 / 51R1

**SPECIAL PROFILES GROUP “LG”**
- PR55-112 / LK1 / SEI35GPB / SEI35 / etc.
- SEI41 / Ri45 / Ph37 / Ph37a / etc.
Installation and geometric alignment of the rails take place in accordance with the two techniques described below (Top-Down and Bottom-Up). For the embedding work either project-dedicated machines pour the compound, or it is applied by manual pouring from buckets.

**TOP-DOWN**
- Suspension of the rails by their heads
- ERS portal every 3.0m
- Track positioning accuracy = ± 0.5 mm
- Precise adjustment of the rail cant

**BOTTOM-UP**
- Installation starts at bottom of channel
- Shims and wedges every 1.5 m
- Track positioning accuracy = ± 1.0 mm
- Simple handling
- Traditional mode of construction
Preventive and corrective maintenance
Exchange of rails
Disposal of materials

Preventive and corrective maintenance
For over 35 years, experience has demonstrated the advantages of ERS rail fastening systems of significantly reduced maintenance in comparison to traditional track forms. In addition, conventional maintenance work is of course also applicable to the ERS-LR systems.

Exchange of rails
The ERS rail fastening systems enable to exchange individual rails without breaking the track surface. edilon)(sedra lease special asphalt-cutting wheels and other equipment to perform this work effectively and efficiently.

Disposal of ERS rail fastening systems and packing materials
All edilon)(sedra materials are completely recyclable and are classified in accordance with the European Waste Catalogue. For more detailed information, please see the Product Information Sheets. edilon)(sedra Corkelast® is classified in hardened condition as domestic waste.

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<th>ADVANTAGES</th>
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<tbody>
<tr>
<td>Virtually no maintenance</td>
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<tr>
<td>Optimal ride comfort over decades</td>
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<tr>
<td>Reduced rail corrugation</td>
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<tr>
<td>Reduced wear on the rail head</td>
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<tr>
<th>CONVENTIONAL MAINTENANCE WORK</th>
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<tbody>
<tr>
<td>Cleaning of flangeways (e.g. crossings)</td>
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<td>Rail grinding (acoustic)</td>
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<tr>
<td>Rail re-profiling</td>
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<tr>
<td>Surface welding</td>
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