Ingenieurbüro Bahlke (IBB)

Büro für Oberleitung, Haltestellenausrüstung und Bahnstrom im Nahverkehr
Sachkundige Person nach §5 Abs. 2 BOStrab im Rahmen der Prüfung, Begutachtung und Abnahme von Fahrstromanlagen
Mess- und Prüflabor von Materialien für die Schienenisolierung

C E R T I F I C A T E / T E S T R E P O R T

File No.:	IBB 506_P01
Customer:	edilon)(sedra GmbH Schoßbergstraße 19 65201 Wiesbaden Germany
Order:	E-mail from 29/09/2023
Task:	Testing a test specimen constructed of a support system of RAILONE and an insulation system of edilon)(sedra calculation of track-to-earth resistivity or the conductance per length relating the regulations below
Measuring Location:	RAILONE GmbH, track sleeper production in Coswig, Germany
Measurement date:	26/10/2023 and 27/10/2023
Measuring Procedure:	Determination of the resistance track to earth by way of the direct current-voltage method
Regulations:	BOStrab, EN 50122-2: 2022 and EN 62631-3-1: 2016
Enclosures:	Document number: N135416-0B Cross-section edilon)(sedra insulation system 07/11/2023

Requirements for the rail bedding

According to BOStrab Section 3(1) No. 4, installations for DC traction systems for which power is transmitted via the running rails must be constructed in such a way that adverse effects of stray currents are only slight. For this reason, EN 50122-2 requires the running rails to be insulated electrically from earth. Thus, the conductance per length between track and earth must be so low that stray currents leaking per length from the running rails will not exceed 2.5 mA/m per track. In DC powered light rail and tram systems, where rails are laid in a closed formation, experience has shown an average shift in rail potential of ≤ 1 V towards positive, resulting in a maximum permissible conductance per length of G'_{RE} = 2.5 S/km per track. This value corresponds to a track-to-earth resistivity of 0.4 Ω km.

In order to avoid inadmissible stray current influences on metal installations buried in the ground, a track-to-earth resistivity of 100 Ω km is aimed for projects in Israel.

Aim of RAILONE and edilon)(sedra

In order to take these high requirements into account, RAILONE and edilon)(sedra decided to develop a concept together.
These components were installed into a test specimen, which was subject of the measurements.

Description of the insulation system and their components:
The “Editack Spray” system was first applied on the 53R1 rail.
After sandblasting to the Sa2 level, a layer of “Editack Spray” with a thickness of at least 1mm was applied on the rail. Only the upper tread remained free.
Then, the Sedrapur HD chamber filling elements from the „SDS“ product family with a densitity of more than 1100 kg/dm³ were applied into the rail chambers by gluing. A special 1K polyurethane adhesive was used for this. This adhesive can also seal any remaining gaps between the chamber filling elements.
The insulation is completed by insulated sleeper pads and intermediate rail foot layer as well as the isolated fixing points, which were additionally protected with bituminous heaps.
Insulated in this way, the rails were installed at the sleepers and integrated into the concrete body.
For more details, see the attached cross-section of the insulation system, drawn 07.11.2023.

Test result

The company edilon)(sedra, Wiesbaden, commissioned us to determine the electrical resistance between the track and the metal trough of the test specimen shown in the enclosed document number N135416-0B. The measurements were carried out at RAILONE GmbH's Coswig track sleeper production in Germany.

As shown in document no. N135416-0B and the cross-section edilon)(sedra insulation system 07/11/2023, the rails were mounted on a concrete slab with electrical insulation. Both grooved rails were coated with an insulating Editack spray before installation. It is worth mentioning that both rails have a welded joint in the centre, which were also coated with Editack Spray. Chamber filling elements were then installed, and the grooved rails were concreted in. Finally, the joints on both sides of the rails were sealed with a silane terminated polymer e)(s STP 25 as joint filler.

Fig. 1 – test specimen under test

The metrological tests were carried out in accordance with EN 50122-2, Annex D.
The electrical resistance between the rail and the metal trough of the concrete block was measured.

The applied test voltages were ±10 V DC, ±100 V DC, ±300 V DC and ±500 V DC.

First, the electrical resistance was measured in a dry state. In the evening, the test specimen was soaked with tap water, see Fig. 2, and measured again the next morning. It was found that there was still water in some areas on the joint sealant, see Fig. 3. After wiping off the water with a cloth, the electrical resistance was measured a third time.

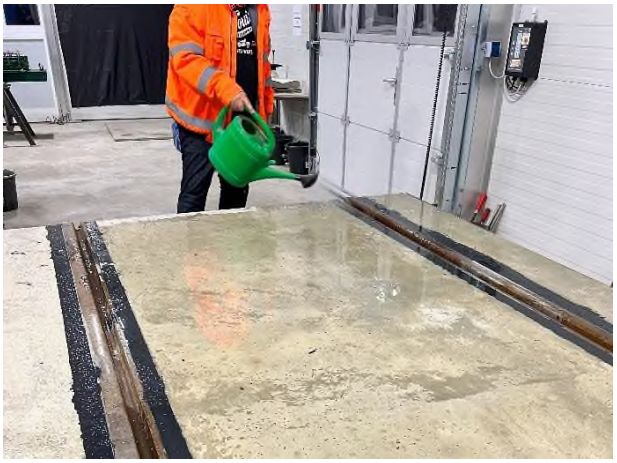

Fig. 2 - Watering the superstructure and track.

Fig. 3 - Residual water on the joint sealant

From the measured values and the length of the embedded rail, the track-to-earth resistivity and the conductance per length of a track was calculated. The results of these tests are summarised in Table 1. In addition to the minimum (min), average (avg) and maximum (max) values, the standard deviation (std.dev.) is also given in this table.

Test condition	**track-to-earth resistivity ρ_{RE} [Ω km]**				**conductange per length track/earth G'_{RE} [S/ km]**			
	min	**avg**	**max**	**std.dev.**	**min**	**avg**	**max**	**std.dev.**
Initial test	1.17 E+03	**1.13 E+04**	3.50 E+04	1.23 E+04	2.86 E-05	3.02 E-04	8.57 E-04	2.93 E-04
Influence of rain	7.78 E+00	**1.19 E+01**	1.43 E+01	1.87 E+00	6.98 E-02	8.67 E-02	1.29 E-01	1.71 E-02
After wiping off the the residual water on on the joint sealant	2.80 E+02	**2.50 E+03**	6.46 E+03	2.15 E+03	1.55 E-04	9.40 E-04	3.57 E-03	1.04 E-03

Table 1 – Track-to-earth resistivity and conductance per length of the test specimen

In the dry state, the mean track-to-earth resistivity of the tested specimen is 11300 Ω km per track. The mean conductance per length is 0.3 mS/km per track. After watering and air drying overnight, the resistivity decreases on average to 11.9 Ω km per track and the conductance per length was measured at 86.7 mS/km per track. After the sealant was wiped dry, the average resistivity increased to 2500 Ω km per track and the average conductance per length was recorded at 0.94 mS/km per track.

The track-to-earth resistivity is in the dry state significantly higher than 100 Ω km per track. This also applies after soaking and wiping up the residual water on the sealant. Under all test conditions, the conductance per length is significantly smaller than the value of 2.5 S/km per track required in EN 50122-2.

It should be noted that lower track-to-earth resistivities are to be expected in the long term as a result of normal pollution. The electrical insulation of the components connected to the track, e.g. track junction boxes, also has a significant influence on the track-to-earth resistance. In addition, the quality of workmanship on the construction site and the mechanical and chemical long-term resistance of the insulating material have an influence on the resistivity.

Schaafheim, 21/11/2023

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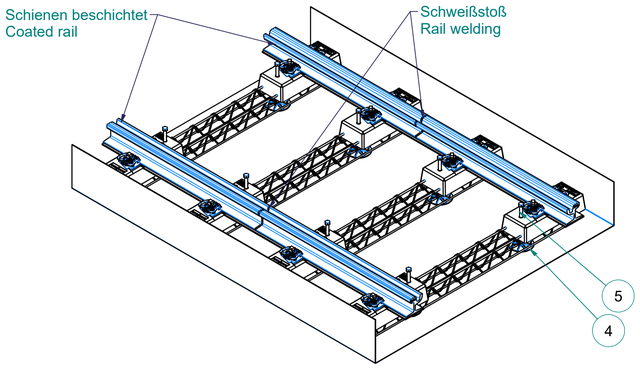
Gutachter
für
Elektrotechnische Anlagen
Planprüfung, Abnahmeprüfung
Nr.: 22/20/2220
anerkannt durch das
Eisenbahn-Bundesamt

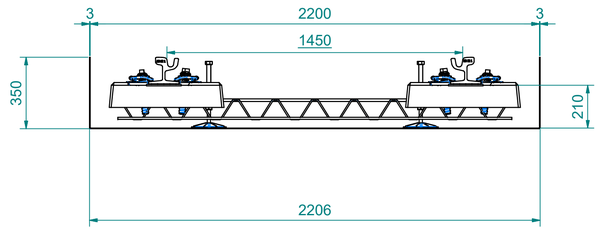
Expert for electrotechnical installations, acceptance tests and design review
No.: 22/20/2220 Approved by the German federal railway Authority (EBA)

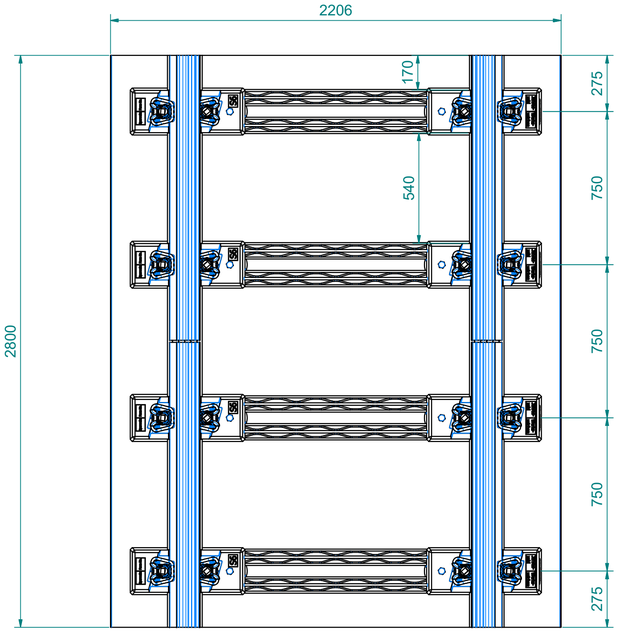
1

- Schwellen gespindelt
- Spindeled sleepers

- SfZw montiert
- Sleeper compartment liner assembled





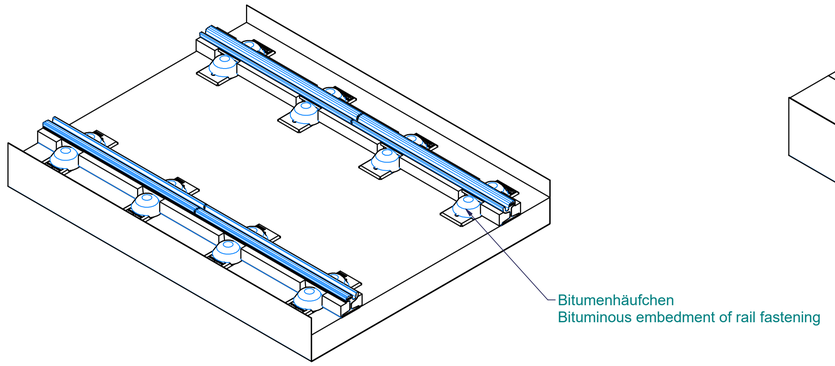


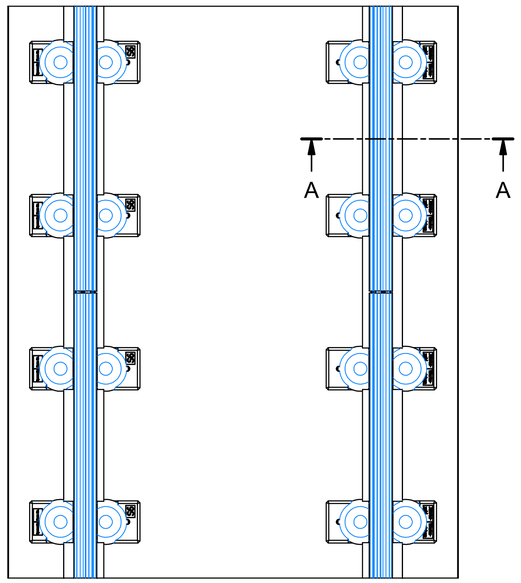
2

- Platte betoniert
- Concrete slab

- KFE montiert
- CFE assembled

- "Häufchen" auf Befestigung
- "Heap" on fastening

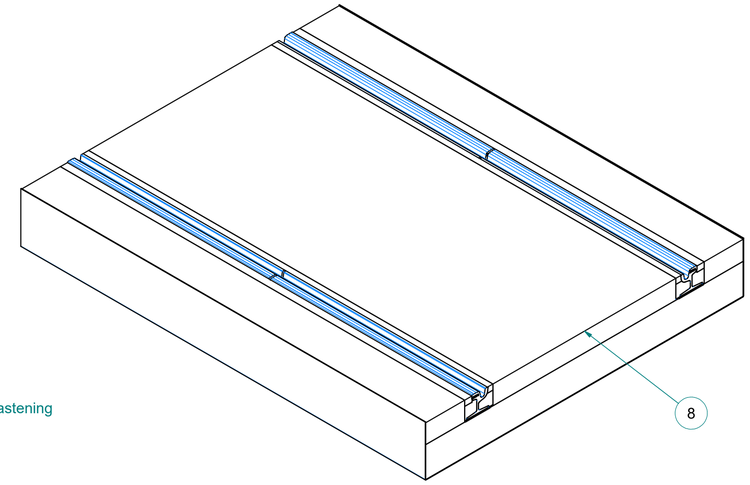


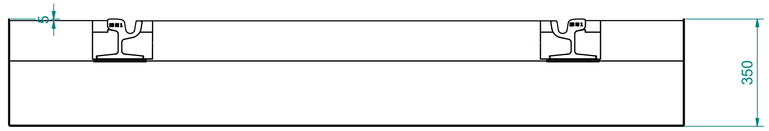


3

- Betoneindeckung
- Concrete track covering

- Fugenverguß
- Rail joint sealing material



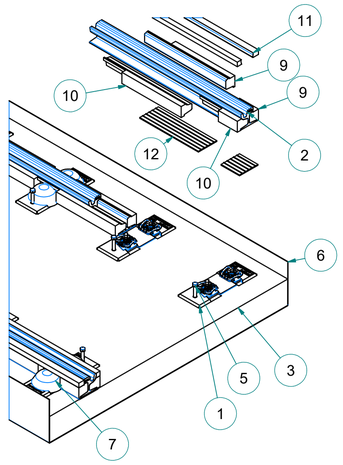


Bemerkungen:

- Schwelle N132617-0A
- Schiene beschichtet mit edilon)(sedra Editack Isolationsspray, 1mm dick
- Kammerfüllelemente (KFE) edilon)(sedra MT010207 / MT010208
- KFE an Schweißstoß anpassen

Remarks:

- Sleeper N132617-0A
- Rail, coated with edilon)(sedra Editack spray insulating layer 1mm thick
- Rail chamber filler elements (CFE) edilon)(sedra MT010207 / MT010208
- CFE`s adjusted to rail welding



Pos.	Anz.	Bauteil-Nr.	Rev	Bezeichnung 2	Description 2	Werkstoff
12	10	N135491	A	Schwellenfach-Zw SF 150mm	Sleeper space intermediate layer rail foot 150mm	XPE
11	2			Kunststoff - Fugenverguss	Plastic rail joint sealing	Silan therm. polymers
10	10	MT010208		Kammerfüllelement e)(s SDS 53R1 (i), geklebt	Chamber filling element e)(s SDS 53R1 (i), glued	recycled rubber
9	10	MT010207		Kammerfüllelement e)(s SDS 53R1 (a), geklebt	Chamber filling element e)(s SDS 53R1 (a), glued	recycled rubber
8	1			Betoneindeckung	Upper concrete layer	Concrete
7	16			Häufchen - DD	Heap - DD	Bitumen
6	1			Schalungsblech U-Form	Sheet metal U-shape	Steel
5	8	N007994	F	Justierschraube M20	Adjusting screw M20	Steel
4	8	N134783	A	Kunststoffaufstandsplatte für M20	Plastic support plate for M20	PA 6 GF30
3	1		A	Beton	Concrete	Concrete
2	4			Rillenschiene 53 Ri1	Grooved rail 53 Ri1 incl. Editac Spray	Steel/coating
1	4	N132617	A	TB/ZB-1450 NV-1 Ri53N	TB/ZB-1450 NV-1 Ri53N	

(Verwendung) | (Zul. Abw.) | (Maßstab) | (Gewicht) 5954,37 kg

Feste Fahrbahn - Bauart RHEDA CITY
Ballastless track - system RHEDA CITY

Testmuster - Ableitbelag
test specimen Conductance G' (EN 50122-2)

	Datum	Name
Bearb.	01.08.2023	SAECKLER
Gepr. Technik		
Gepr. Vertrieb		

Zust.	Änderungen	Datum	Name
B	Deutsch-Englisch	07.11.23	SAE
A	Neuanlage	01.08.23	SAE

RAILONE

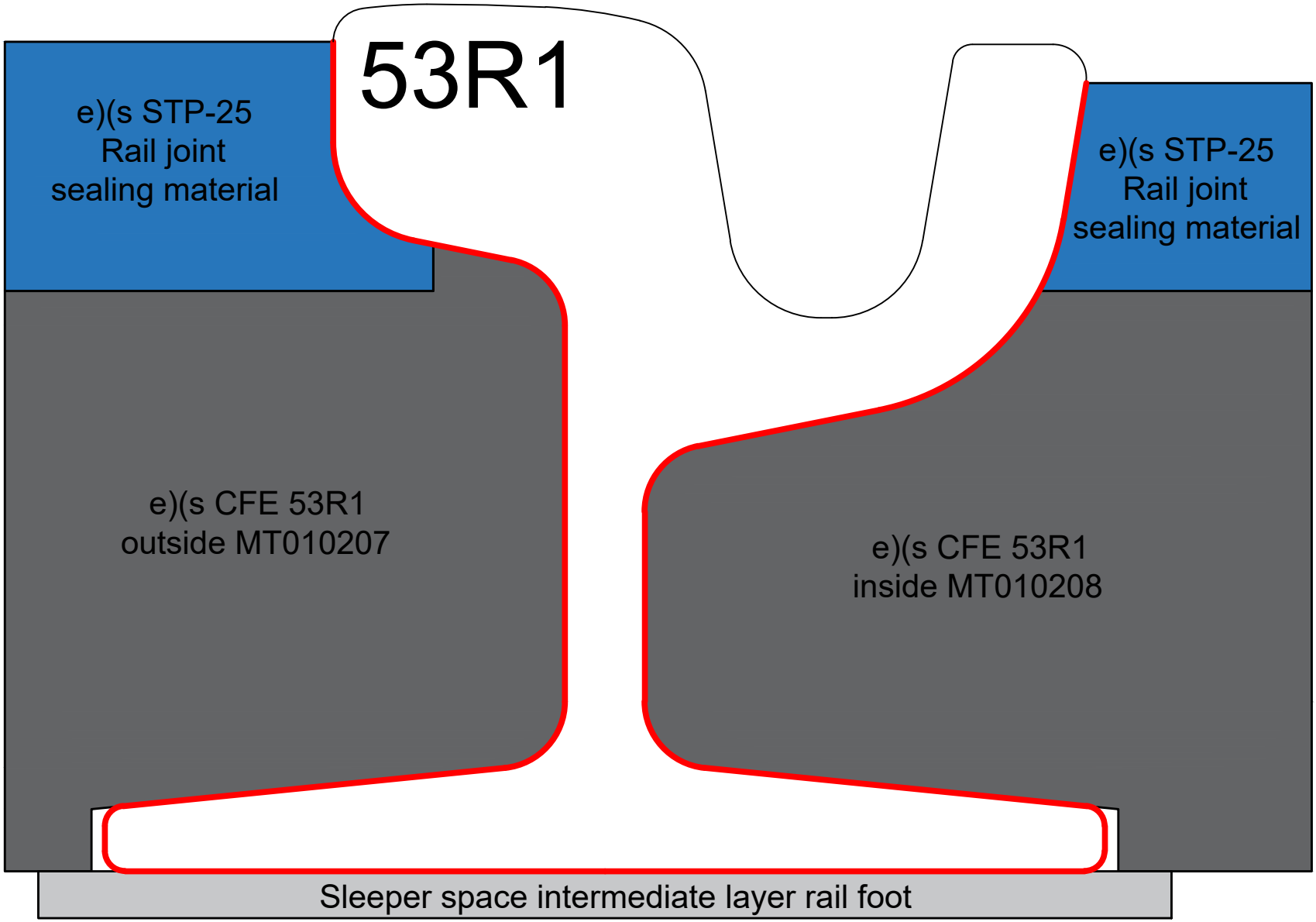
Dokumentnummer *N135416-0B* | Blatt 1 | A1

(Ers. f.:) | (Ers. d.:)

841 x 594 mm

edilon)(sedra

e)(s Editack Spray at least
1 mm layer on sandblasted rail



Wiesbaden, am 07.11.2023
Gez. L. Jalal