IfB Ulrich Bette
Institut für Beeinflussungsfragen
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CERTIFICATE / TEST REPORT

File No.:	IfB 154-15
Measuring Location:	IfB Laboratory
Task:	Testing of filling bodies for the filling of a rail chamber (solid brick and light-weight design) in respect of their suitability for reduction of strays currents caused by DC traction systems
Customer:	REGUM GmbH Heinrich-Diehl-Str. 2 D-90552 Röthenbach
Order:	of 24.10.2015
Days of Measurement:	November 10 and 12, 2015
Measuring Procedure:	Determination of the conductance per length by way of resistance tests according to the direct current-voltage method
Regulations:	BOStrab, DIN EN 50122-2 (VDE 0115-4) and DIN IEC 60093 (VDE 0303-30)

Requirements for the Rail Formation

According to Article 3(1) No. 4 of BOStrab facilities of DC traction systems with power transmission via the running rails have to be so constructed that the disadvantageous effects from stray current are minimised. Therefore, electrical insulation of the running rails against the earth is required in DIN EN 50122-2 (VDE 0115-4), i.e. it is required that the conductance per length between the running rails and the earth is so small in the positive direction as a function of the changes in rail potential that the stray current leaving the running rails relative to the length does not exceed 2.5 mA/m per track on the mean of time. As regards DC operated tramway and light rail lines in the closed formation it is assumed that the average positive change of the rail potential is usually ≤ 1 V so that a maximum permissible conductance per length of G' = 2.5 S/km results.
The above mentioned values for the stray current leaving relative to the length and the conductance per length can be kept if – besides other measures – the rail chambers are insulated electrically against the earth.

Test Result

REGUM GmbH handed over two chamber filling bodies from the current production to us and instructed us to determine their suitability for reduction of stray currents. The two filling bodies were a solid-brick filling body and a light-weight filling body, respectively, for the outer chamber of a grooved rail and were made from black PU-bound rubber granulate.

For the tests the chamber filling bodies were fitted in the outer chamber of a grooved rail behind one another. A measuring electrode (750 x 135 mm) was fitted at the outer surface of each chamber filling body and the grooved rail was used as the counter-electrode.
The tests were carried out with test voltages varied from DC -200 V to DC +200 V in steps of 50 V. The volume resistance of the chamber filling bodies was measured according to DIN IEC 60093 (VDE 0303-30) with the help of this measuring set-up. The measurements were made in the dry state and after storage in a 0.1n NaCl solution for 48 hours with subsequent air drying for two hours. The achievable conductances per length, which are listed in table 1, were calculated on the basis of the volume resistance measured and the lengths of the measuring electrodes. In the table the minimum, average and maximum values as well as the standard deviation (s) are listed.

Sample	Conductance per length G' in mS/km per track							
	Dry state				After storage in 0.1n NaCl solution			
	min	average	max	s	min	average	max	s
Solid brick	3.04	3.77	4.41	± 0.48	47.1	46.3	52.5	± 5.28
Light-weight design	1.68	2.61	3.69	± 0.65	5.92	7.93	12.2	± 2.54

Table 1 – Determined conductances per length of the chamber filling bodies

From the table it appears that the average conductance per length of the solid brick amounted to 3.77 mS/km per track in the dry state and that it was increased to 52.5 mS/km after the watering. The increase in weight after the storage in the 0.1n NaCl solution amounted to < 1%.
The light-weight filling body had better values, both in the dry state and after the watering. In the dry state the average conductance per length amounted to 2.61 mS/km per track and after the

watering it amounted to 7.93 mS/km per track. There was no increase in weight after the storage in the 0.1n NaCl solution.

If it is assumed that the average change in rail potential is ≤ 1 V and that the maximum conductance per length amounts to 52.5 mS/km, the maximum stray current is calculated to 52,5 µA/m relative to the length for the solid-brick filling body. The light-weight filling body had a maximum value of 12.2 mS/km, which means that the stray current relative to the length amounts to 12,2 µA/m. These values are much smaller than the guide value of 2.5 mA/m per track mentioned in DIN EN 50122-2. Thus, it is concluded that the tested chamber filling bodies are suited to reduce stray currents.

For the assessment of the measured values it has to be considered that the calculated stray current corresponds to the stray current escaping via the chamber filling bodies. In practice, higher stray currents relative to the length are likely as e.g. the insulation of the rail feet and tie rods as well as the drainage of the running rails influence the size of the stray current considerably.

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