

Category 1 Standard

S1164 Conductor Rail – Dimensions and Tolerances

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1 Purpose

- 1.1 This standard defines the dimensions and tolerances for the conductor rail system, and the actions to be taken if these are not achieved, in respect of:
- a) completed works;
 - b) maintenance intervention.

2 Scope

- 2.1 This standard applies to all track including, plain line and junctionwork in open, sub-surface and tube sections and in depots.
- 2.2 This standard applies to all approved conductor rail types and configurations and to their associated components.
- 2.3 Where it is mandatory that any of the supporting information in Section 5 of this standard is to be applied, the appropriate requirement is set in Section 3.

3 Requirements

3.1 General

- 3.1.1 Where information from this standard is to be used as part of a tender or contract documentation for vehicle design it shall be made clear that:
- a) clause 3.3 describes quality values for completed work only; in practice the actual quality of the conductor rail system will deteriorate over time with the passage of traffic;
 - b) clause 3.4 describes quality values which in practice may be exceeded.

3.2 Evidence of compliance

Compliance with the requirements of this standard shall be demonstrated by the organisation responsible for the work. Additionally, compliance may be audited as part of the track surveillance regime.

3.3 Completed works: requirements and tolerances

- 3.3.1 Work shall be completed to the tolerances defined in this section 3.3 for the highest Class (as defined in Section 6) appropriate to the nature and scope of the work.
- 3.3.2 In the event that the work does not comply with the completed works tolerances, the work shall be compared to the maintenance values indicated in section 3.4 to establish whether any intervention is required before start of traffic.
- 3.3.3 Particular attention shall be given to the interface between new (or newly maintained) conductor rail and existing conductor rail. Any sudden change in the alignment or level of the conductor rail shall be avoided.

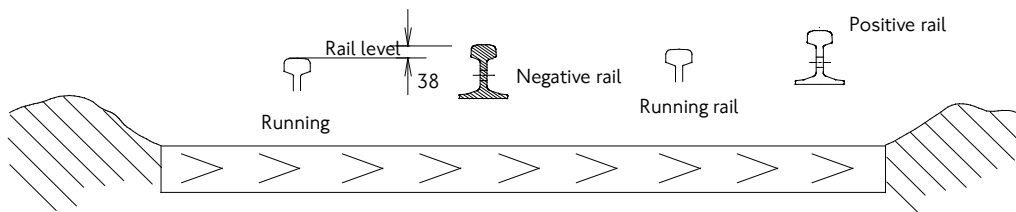
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Note: Dimensions are in millimetres unless otherwise stated.

1 Conductor rail - vertical position

	Tolerance			
	Work class		Running lines	Depots & sidings
1.1 Negative conductor rail Maximum deviation of the top of the negative conductor rail from its NOMINAL position 38mm above running rails, at support position Note: not applicable at ramps.	Class I		- 3 + 3	- 3 + 3
	Class II	♣	- 5 + 10	- 5 + 10
	Class III		- 8 + 20	- 8 + 20
	Class IV		- 8 + 20	- 8 + 20
	♣ Class I tolerances shall apply when new conductor rail is installed.			
Maximum height of the top of the negative conductor rail above the running rails Note: not applicable at ramps.	Class I		+ 35 + 41	+ 35 + 41
	Class II	♣	+ 33 + 48	+ 33 + 48
	Class III		+ 30 + 58	+ 30 + 58
	Class IV		+ 30 + 58	+ 30 + 58
	♣ Class I tolerances shall apply when new conductor rail is installed.			

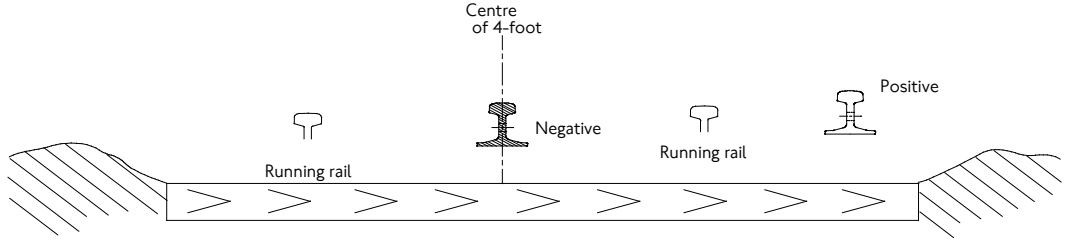




	Work class		Running lines	Depots & sidings
1.2 Positive conductor rail	All lines except Central line locations specified below			
Maximum deviation of the top of the positive conductor rail from its NOMINAL position 75mm above the running rails, at support position	Class I		- 3 + 3	- 3 + 3
	Class II	♣	- 5 + 10	- 5 + 10
	Class III		- 8 + 20	- 8 + 20
	Class IV		- 8 + 20	- 8 + 20
Note: not applicable at ramps	♣Class I tolerances shall apply when new conductor rail is installed.			
Maximum deviation of the top of the positive conductor rail from its NOMINAL position 115mm above running rails, at support position	Central line Liverpool St to White City with high conductor rail			
	Class I		- 3 + 3	- 3 + 3
	Class II	♣	- 15 + 10	- 15 + 10
	Class III		- 48 + 30	- 48 + 30
	Class IV		- 48 + 30	- 48 + 30
Note: not applicable at ramps.	♣Class I tolerances shall apply when new conductor rail is installed.			
* positive rail Central line, Liverpool Street to White City 115mm or lower subject to minimum of 75mm				

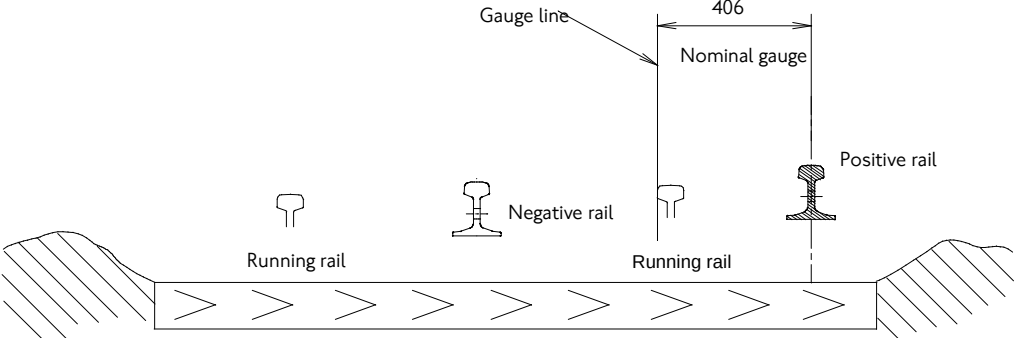
2 Conductor rail – lateral position

	Tolerance		
	Work class	Running lines	Depots & sidings
2.1 Negative conductor rail Maximum permitted deviation from lateral conductor rail gauge measured from the centre line of the track.	Class I ♦	± 10	± 10
	Class II ♣ ♦	± 15	± 15
	Class III	± 20	± 20
	Class IV	± 20	± 20
	♣ Class I tolerances shall apply when new negative conductor rail is installed. ♦ ± 7mm at insulators		



The diagram illustrates the lateral position of a negative conductor rail. It shows a cross-section of a track with a running rail on the left and a negative conductor rail in the center. A vertical dashed line indicates the 'Centre of 4-foot' track. To the right of the negative rail is a positive conductor rail, and further right is another running rail. The ground is shown with hatching on both sides of the track bed.

2.2 Positive conductor rail Maximum permitted deviation from lateral conductor rail gauge measured from the running edge of the adjacent running rail.	Class I ♠	± 10	± 10
	Class II ♣ ♥ ♠	± 15	± 15
	Class III ♦	± 20	± 20
	Class IV ♦	± 20	± 20
	♠ Class I tolerances shall apply when new positive conductor rail is installed. ♦ ± 12mm on Central line, Liverpool Street to White City ♥ ± 10mm on Central line, Liverpool Street to White City ♠ ± 7mm at insulators		



The diagram illustrates the lateral position of a positive conductor rail. It shows a cross-section of a track with a running rail on the left, followed by a negative rail, then another running rail, and finally a positive rail on the right. A vertical line labeled 'Gauge line' is positioned between the second running rail and the positive rail. The distance between the gauge line and the positive rail is labeled 'Nominal gauge' with a dimension of 406. The ground is shown with hatching on both sides of the track bed.

**3 Conductor rail - joints**

	Tolerance		
	Work class	Running lines	Depots & sidings
3.1a Conductor rail - vertical profile - joints Maximum permitted error in straightness of vertical profile of the joint using a 1-metre straightedge and measuring the gap between the rail head and the straightedge. Note: Positive value denotes hump at joint and negative value denotes dip at joint.	All joints except welded		
	Class I	- 1 + 1	- 1 + 1
	Class II	♣ ± 2	± 3
	Class III	± 3	± 5
	Class IV	± 3	± 5
	♣ Class I tolerances shall apply when joining new conductor rail to new conductor rail.		
	Welded joints		
	Class I	± 1	± 1
	Class II	± 1	± 1
	Class III	± 1	± 1
	Class IV	± 1	± 1
3.1b Conductor rail – vertical profile – steps at joints Maximum permitted vertical step in direction of travel		Steel	Composite
	All work Classes	Plated joints 1 up, 1 down	Plated joints 0 up, 1 down
		Welded joints 0 up, 0 down	Welded joints N/A
3.2 Conductor rail - lateral alignment - joints Maximum permitted error in straightness of alignment of joint using a 1-metre straightedge with allowance for curvature of the track.	Class I	± 1	± 1
	Class II	♣ ± 2	± 2
	Class III	± 4	± 5
	Class IV	± 4	± 5
	♣ Class I tolerances shall apply when new conductor rail is installed.		
3.3 Conductor rail - individual joint assembly Defective or incomplete assemblies.	Class I	None allowed	None allowed
	Class II	None allowed	None allowed
	Class III	None allowed	None allowed
	Class IV	None allowed	None allowed

**4 Conductor rail – electrical continuity**

	Tolerance		
	Work class	Running lines	Depots & sidings
4.1 Conductor rail bonds Number of conductor rail bonds missing defective or loose.	Class I	None allowed	None allowed
	Class II	None allowed	None allowed
	Class III	None allowed	None allowed
	Class IV	None allowed	None allowed
4.2 Conductor rail insulators Insulators cracked, broken, secured by less than 4 screws or with defective packings. Maximum number allowed per 100 track metres, provided that no two adjacent insulators are in such a condition.	Class I	None allowed	None allowed
	Class II	None allowed	None allowed
	Class III	2	3
	Class IV	2	3
	Maximum insulator spacings shall be as shown in S1162:		

**5 Conductor rail ramps - position**

	Work class	Tolerance						(1)	
		Running lines, depots and sidings							
		65 kg/m		75 kg/m		Compo-site			USD BH
		HS, LS	Bull-nose	HS	LS	HS	LS		
5.1 Vertical position – negative rail Maximum range of position of the top surface of lower end of the conductor rail ramp relative to the top surface of the running rails. Design positions: 65kg/m HS: -33mm 65kg/m LS: -35mm (both taken as -34mm for this table) 65kg/m Bullnose: -54mm 75kg/m HS: -45mm 75kg/m LS: -40mm Composite HS: -55mm Composite LS: -50mm Upside-down bullhead: -27mm	Class I max	-29	-49	-40	-35	-50	-45	-24	
	Class I min	-39	-59	-50	-45	-60	-55	-30	
	Class II max ①	-24	-44	-35	-30	-45	-40	-17	
	Class II min ①	-44	-64	-55	-50	-65	-60	-32	
	Class III max	-14	-34	-25	-20	-35	-30	-7	
	Class III min	-49	-69	-60	-55	-70	-65	-35	
	Class IV max	-14	-34	-25	-20	-35	-30	-7	
	Class IV min	-49	-69	-60	-55	-70	-65	-35	
HS = high speed, LS = low speed ① Class I tolerances shall apply when a new ramp is fitted or where maintenance adjustment has taken place. (1) Upside-down bullhead permitted in depots and sidings only. Tolerance ranges are limited to those for conductor rail.									

	Work class	Running lines, depots and sidings						(1)
		65 kg/m		75 kg/m		Compo-site		USD BH
		HS, LS	Bull-nose	HS	LS	HS	LS	
5.2.1 Vertical position – positive rail Maximum range of position of the top surface of lower end of the conductor rail ramp relative to the top surface of the running rails. Design positions: 65kg/m HS: +4mm 65kg/m LS: +2mm (both taken as +3mm for this table) 65kg/m Bullnose: -17mm 75kg/m HS: -8mm 75kg/m LS: -3mm Composite HS: -18mm Composite LS: -13mm Upside-down bullhead: +10mm	Class I max	+8	-12	-3	+2	-13	-8	+13
	Class I min	-2	-22	-13	-8	-23	-18	+7
	Class II max ①	+13	-7	+2	+7	-8	-3	+20
	Class II min ①	-7	-27	-18	-13	-28	-23	+5
	Class III max	+23	+3	+12	+17	+2	+7	+30
	Class III min	-12	-32	-23	-18	-33	-28	+2
	Class IV max	+23	+3	+12	+17	+2	+7	+30
	Class IV min	-12	-32	-23	-18	-33	-28	+2
HS = high speed, LS = low speed ① Class I tolerances shall apply when a new ramp is fitted or where maintenance adjustment has taken place. (1) Upside-down bullhead permitted in depots and sidings only. Tolerance ranges are limited to those for conductor rail.								



	Work class	Running lines and sidings
5.2.2 Vertical position – positive rail: special ramp for elevated conductor rail on Central line between Liverpool Street and White City (drawing T050508) Maximum range of position of the top surface of the lower end of the ramp relative to the top surface of the running rails. Design position is +38mm.	Class I max	+43
	Class I min	+33
	Class II max ①	+48
	Class II min ①	+28
	Class III max	+50
	Class III min	+23
	Class IV max	+50
	Class IV min	+23
① Class I tolerances shall apply when a new ramp is fitted or where maintenance adjustment has taken place. Note: the tolerances for a low ramp position do not apply unless there is adequate electrical clearance (insulated if necessary).		

	Work class	Running lines	Depots & sidings
5.3 Longitudinal position Max deviation of the position of the conductor rail ramp end in plain line relative to the design position.	Class I	± 20	± 20
	Class II ♣	±100	±100
	Class III	± 100	± 100
	Class IV	±100	±100
	♣ Class I tolerances shall apply when a new ramp is fitted or where maintenance adjustment has taken place.		

**6 Conductor rail support**

	Tolerance		
	Work class	Running lines	Depots & sidings
6.1 Conductor rail and ramp support (see S1162 for insulator spacing and Note below regarding ramps) No. of missing insulators supporting a conductor rail ramp	Class I	None allowed	None allowed
	Class II	None allowed	None allowed
	Class III	None allowed	None allowed
	Class IV	None allowed	None allowed

Note: Ramps for steel conductor rail shall where practicable be supported by one insulator towards each end. Where this cannot be achieved there shall be one insulator, positioned such that any damage to the collector shoe is minimised in the event that the ramp-rail joint breaks. Ramps for composite conductor rail are intended to be supported by a single insulator, which should be positioned towards the ramp tip.

6.2 Steel shims Maximum permitted number of 3mm steel packing pieces between insulator and conductor rail.	Class I	1	1
	Class II	1	1
	Class III	1	1
	Class IV	1	1

6.3 Nylon shims Maximum permitted number of 3mm nylon packing pieces between insulator and conductor rail.	Class I	1	1
	Class II	♣	3
	Class III	3	3
	Class IV	3	3
	♣Class I tolerances shall apply where new conductor rail is installed.		

6.4 Insulator support pads The maximum number of 12.5mm insulator pads per insulator is two. This number shall not be exceeded.	Class I		2	2
	Class II		2	2
	Class III		2	2
	Class IV		2	2

6.5 Conductor rail safety blocks Conductor rail support - safety blocks missing, defective or inadequately secured relative to the minimum number required.	Class I	None allowed	None allowed
	Class II	None allowed	None allowed
	Class III	None allowed	None allowed
	Class IV	None allowed	None allowed

Minimum number of blocks to be provided, where required by S1162 (maximum distance between blocks, 400m)

2 per conductor rail length $\leq$ 400m

3 per conductor rail length $>$ 400m

1 per negative conductor rail in splayless layouts

Note: Of these, one shall be located at each end of the conductor rail, on the first available sleeper from the junction with the ramp, but avoiding the ramp. For provision of safety blocks in short lengths of conductor rail, see S1162.