

## Category 1 Standard

# 1-164

# Conductor Rail – Dimensions and Tolerances



**Please read the Written Notices  
attached to this standard**

**Issue:** A2

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**MAYOR OF LONDON**



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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.

2.4 This standard replaces 1-164 A1.

## 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 3.5 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 3.6 describes quality values which in practice may be exceeded.

### 3.2 Completed works

3.2.1 Work shall be completed to the tolerances defined in clause 3.5 for the highest Class (as defined in Section 6) appropriate to the nature and scope of the work.

3.2.2 In the event that the work is not completed as planned and does not comply with the completed works tolerances, the work shall be compared to the maintenance values indicated in clause 3.6 to establish whether any intervention is required before start of traffic.

3.2.3 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.

### 3.3 Maintenance intervention

#### 3.3.1 Quality thresholds

For each track parameter and for each track category (as defined in LU Category 1 Standard 1-158) the tables define three values representing progressive thresholds of deteriorating track quality, namely:

- a) the Safety Standard;

- b) the Maintenance Limit;
- c) the Maintenance Target.

Figure 1 shows the application of these thresholds to the maintenance process.

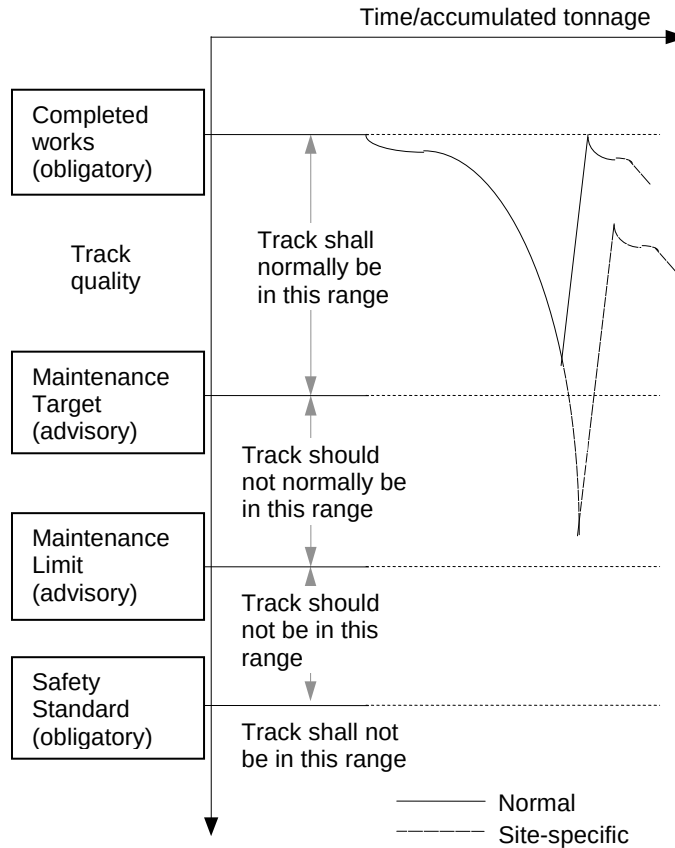


Figure 1 – Application of quality thresholds to the maintenance process

3.3.2 This standard mainly defines the limits of degradation and minimum action for individual types of fault and it is important to recognise that where different faults exist together their combined effect may create a greater risk demanding a more onerous response. Guidance on the recognition of and response to combined faults which increase safety risk shall be provided for all staff responsible for undertaking track safety inspections or scoping and prioritising the response to reported track faults.

### 3.3.3 Safety Standard (SS)

3.3.3.1 It is an obligatory requirement to maintain the conductor rail system in a condition which ensures (as a minimum) that the Safety Standards are not breached. Preventative maintenance should be targeted at the achievement of the Maintenance Target values wherever possible.

3.3.3.2 The tables in clause 3.6 specify the minimum action that shall be taken when the measurement of a conductor rail parameter, component or state of adjustment gives a reading which is at the Safety Standard, or beyond the Safety Standard as a result of a component failure.

3.3.3.3 Where two or more conductor rail geometry parameters at one location give readings that are at or beyond the mid-point between the values defined for the safety standard and the maintenance limit, the location is to be treated as one where the safety standard



has been infringed. The minimum action to be taken shall be the most demanding of the obligatory actions associated with the parameters concerned.

**Note:** Two or more conductor rail geometry parameters giving readings close to the safety standard at one location may together present more of a safety risk than a single parameter giving a reading at or beyond the safety standard.

### 3.3.4 Maintenance Limit (ML) and Maintenance Target (MT)

3.3.4.1 The MT and ML thresholds shown in clause 3.6 are advisory: any alternative values shall reflect an appropriate and sustainable asset maintenance regime which provides an efficient and optimum-cost infrastructure.

3.3.4.2 Where measurement of a conductor rail parameter gives a reading worse than the ML, corrective maintenance shall be considered within the terms of this standard.

3.3.4.3 The MT should be achieved or bettered in all locations where normal conditions apply.

**Note:** In the case of parameters which are recorded statistically over sections of the conductor rail the MT value should normally be achieved or bettered on not less than 90% of the length of the conductor rail.

The 10% margin of tolerance for MT allows for locations untypical of the conductor rail as a whole, where characteristics impose particularly complex maintenance requirements, for example in junctionwork, or where conductor rail components are scheduled for renewal.

## 3.4 Evidence of compliance

3.4.1 Compliance with the requirements of this standard shall be demonstrated to LU by each party contracted to LU. Additionally LU may audit compliance as part of its surveillance regime.



### 3.5 Completed work tolerances

#### Completed work tolerances applicable to all conductor rail systems

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#### Completed work tolerances applicable to composite conductor rail only

|                                                    |    |
|----------------------------------------------------|----|
| Composite conductor rail support insulator spacing | 18 |
|----------------------------------------------------|----|

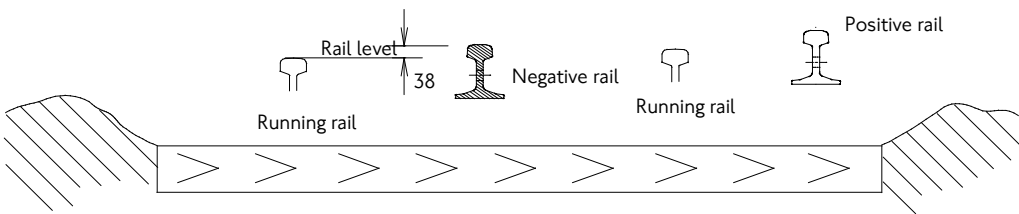


### 3.5.1 Completed work tolerances applicable to all conductor rail systems

**Note:** Dimensions are in millimetres unless otherwise stated.

#### 1 Conductor rail - vertical position

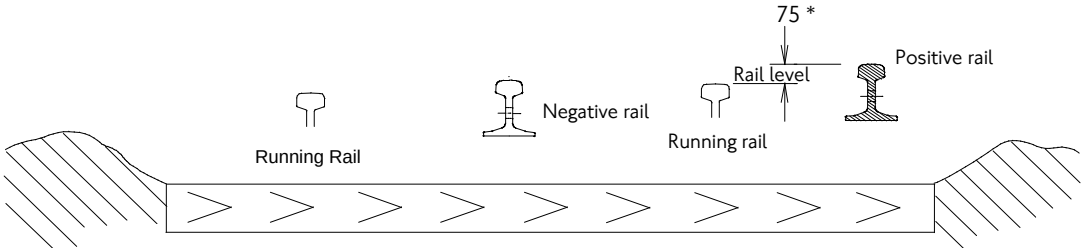
|                                                                                                                                                                           | Tolerance                                                              |               |                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|---------------|------------------|
|                                                                                                                                                                           | Work class                                                             | Running lines | Depots & sidings |
| <b>1.1 Negative conductor rail</b><br>Maximum deviation of the top of the negative conductor rail from its NOMINAL position 38mm above running rails, at support position | Class I                                                                |               | - 3 + 3          |
|                                                                                                                                                                           | Class II                                                               | ♣             | - 5 + 10         |
|                                                                                                                                                                           | Class III                                                              |               | - 8 + 20         |
|                                                                                                                                                                           | Class IV                                                               |               | - 8 + 20         |
|                                                                                                                                                                           | ♣Class I tolerances shall apply when new conductor rail is installed.  |               |                  |
| Maximum deviation of the top of the negative conductor rail above the height of the RUNNING rails                                                                         | Class I                                                                |               | + 35 + 41        |
|                                                                                                                                                                           | Class II                                                               | ♣             | + 33 + 48        |
|                                                                                                                                                                           | Class III                                                              |               | + 30 + 58        |
|                                                                                                                                                                           | Class IV                                                               |               | + 30 + 58        |
|                                                                                                                                                                           | ♣ Class I tolerances shall apply when new conductor rail is installed. |               |                  |



The diagram illustrates the vertical arrangement of conductor rails. At the base is the 'Running rail'. Above it, at a nominal distance of 38mm, is the 'Negative rail'. Further up is the 'Positive rail'. The diagram shows the rail level and the support structure. The running rail is shown as a horizontal line with a cross-section of a rail head. The negative rail is shown as a cross-section of a rail head. The positive rail is shown as a cross-section of a rail head. The diagram also shows the rail level and the support structure.



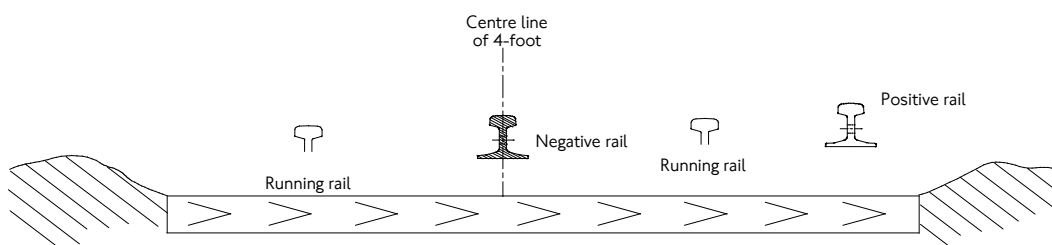
|                                                                                                                                         | Work class                                                            | Running lines | Depots & sidings |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------|------------------|
| 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. |               |                  |



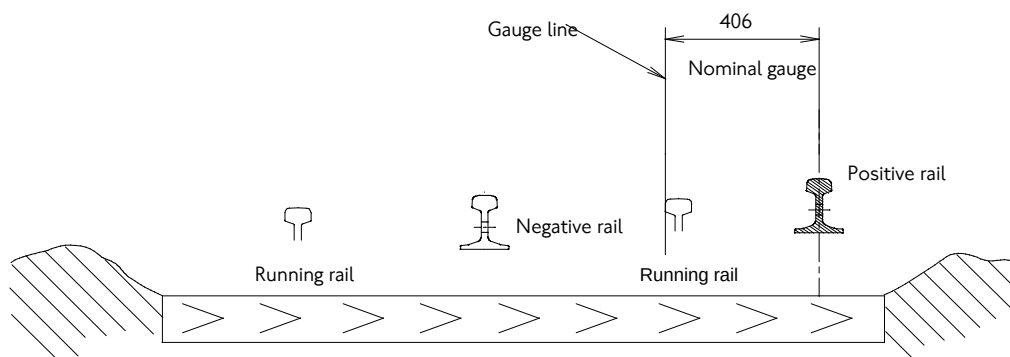
\* positive rail Central line, Liverpool Street to White City 115mm or lower subject to minimum of 75mm

## 2 Conductor rail – lateral position

|                                                                                                                                                 | Tolerance                                                                                                |               |                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------|------------------|
|                                                                                                                                                 | Work class                                                                                               | Running lines | Depots & sidings |
| <b>2.1 Negative conductor rail</b><br>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.<br>♦ ± 7mm at insulators |               |                  |



|                                                                                                                                                                  |                                                                                                                                                                                                                                  |      |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|
| <b>2.2 Positive conductor rail</b><br>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.<br>♦ ± 12mm on Central line, Liverpool Street to White City<br>♥ ± 10mm on Central line, Liverpool Street to White City<br>♠ ± 7mm at insulators |      |      |



**3 Conductor rail - joints**

|                                                                                                                                                                                                                                                                                                                                    | Tolerance                                                                               |               |                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|---------------|------------------|
|                                                                                                                                                                                                                                                                                                                                    | Work class                                                                              | Running lines | Depots & sidings |
| <b>3.1 Conductor rail - vertical profile - joints</b><br>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.<br><br><b>Note:</b> Positive value denotes hump at joint and negative value denotes dip at joint. | All joints except welded                                                                |               |                  |
|                                                                                                                                                                                                                                                                                                                                    | Class I Straightness                                                                    | - 1 + 1       | - 1 + 1          |
|                                                                                                                                                                                                                                                                                                                                    | Class I Step                                                                            | 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 Straightness                                                                    | ± 1           | ± 1              |
|                                                                                                                                                                                                                                                                                                                                    | Class I Step                                                                            | 0             | 0                |
|                                                                                                                                                                                                                                                                                                                                    | Class II Straightness                                                                   | ± 1           | ± 1              |
|                                                                                                                                                                                                                                                                                                                                    | Class II Step                                                                           | 0             | 0                |
|                                                                                                                                                                                                                                                                                                                                    | Class III Straightness                                                                  | ± 1           | ± 1              |
|                                                                                                                                                                                                                                                                                                                                    | Class III Step                                                                          | 0             | 0                |
|                                                                                                                                                                                                                                                                                                                                    | Class IV Straightness                                                                   | ± 1           | ± 1              |
|                                                                                                                                                                                                                                                                                                                                    | Class IV Step                                                                           | 0             | 0                |
| <b>3.2 Conductor rail - lateral alignment - joints</b><br>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.                  |               |                  |
| <b>3.3 Conductor rail - individual joint assembly</b><br>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 |
| <b>4.1 Conductor rail bonds</b><br>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     |
| <b>4.2 Conductor rail insulators</b><br>Insulators cracked, broken, secured by less than 4 screws or with defective packings.<br><br>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:<br>Open Sub-surface 3160mm (composite 4300mm);<br>Tube running tunnels 3120mm (composite 4300mm);<br>Tube station pit pedestals 2745mm;<br>Tube siding pit pedestals 3050mm |               |                  |

**5 Conductor rail ramps - position**

|                                                                                                                                                                                                                                                                                                                                                        | Tolerance<br>Work class                                                                                                                        | Running lines, depots and sidings |         |     |           |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------|-----|-----------|-----|
|                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                | 65 kg/m                           | 75 kg/m |     | Composite |     |
|                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                | HS, LS                            | HS      | LS  | HS        | LS  |
| <b>5.1 Vertical position – negative rail</b><br><br>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.<br><br>Design positions:<br>65 kg/m: HS -33mm, LS -35mm, both taken as -34mm for this table<br>75 kg/m: HS -45mm, LS -40mm<br>Composite: HS -55mm, LS -50mm | Class I max                                                                                                                                    | -29                               | -40     | -35 | -50       | -45 |
|                                                                                                                                                                                                                                                                                                                                                        | Class I min                                                                                                                                    | -39                               | -50     | -45 | -60       | -55 |
|                                                                                                                                                                                                                                                                                                                                                        | Class II max ①                                                                                                                                 | -24                               | -35     | -30 | -45       | -40 |
|                                                                                                                                                                                                                                                                                                                                                        | Class II min ①                                                                                                                                 | -44                               | -55     | -50 | -65       | -60 |
|                                                                                                                                                                                                                                                                                                                                                        | Class III max                                                                                                                                  | -14                               | -25     | -20 | -35       | -30 |
|                                                                                                                                                                                                                                                                                                                                                        | Class III min                                                                                                                                  | -49                               | -60     | -55 | -70       | -65 |
|                                                                                                                                                                                                                                                                                                                                                        | Class IV max                                                                                                                                   | -14                               | -25     | -20 | -35       | -30 |
|                                                                                                                                                                                                                                                                                                                                                        | Class IV min                                                                                                                                   | -49                               | -60     | -55 | -70       | -65 |
|                                                                                                                                                                                                                                                                                                                                                        | HS = high speed, LS = low speed<br>① Class I tolerances shall apply when a new ramp is fitted or where maintenance adjustment has taken place. |                                   |         |     |           |     |

|                                                                                                                                                                                                                                                                                                                                                   | Work class                                                                                                                                     | Running lines, depots and sidings |         |     |           |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------|-----|-----------|-----|
|                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                | 65 kg/m                           | 75 kg/m |     | Composite |     |
|                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                | HS, LS                            | HS      | LS  | HS        | LS  |
| <b>5.2 Vertical position – positive rail</b><br><br>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.<br><br>Design positions:<br>65 kg/m: HS +4mm, LS +2mm, both taken as +3mm for this table<br>75 kg/m: HS -8mm, LS -3mm<br>Composite: HS -18mm, LS -13mm | Class I max                                                                                                                                    | +8                                | -3      | +2  | -13       | -8  |
|                                                                                                                                                                                                                                                                                                                                                   | Class I min                                                                                                                                    | -2                                | -13     | -8  | -23       | -18 |
|                                                                                                                                                                                                                                                                                                                                                   | Class II max ①                                                                                                                                 | +13                               | +2      | +7  | -8        | -3  |
|                                                                                                                                                                                                                                                                                                                                                   | Class II min ①                                                                                                                                 | -7                                | -18     | -13 | -28       | -23 |
|                                                                                                                                                                                                                                                                                                                                                   | Class III max                                                                                                                                  | +23                               | +12     | +17 | +2        | +7  |
|                                                                                                                                                                                                                                                                                                                                                   | Class III min                                                                                                                                  | -12                               | -23     | -18 | -33       | -28 |
|                                                                                                                                                                                                                                                                                                                                                   | Class IV max                                                                                                                                   | +23                               | +12     | +17 | +2        | +7  |
|                                                                                                                                                                                                                                                                                                                                                   | Class IV min                                                                                                                                   | -12                               | -23     | -18 | -33       | -28 |
|                                                                                                                                                                                                                                                                                                                                                   | HS = high speed, LS = low speed<br>① Class I tolerances shall apply when a new ramp is fitted or where maintenance adjustment has taken place. |                                   |         |     |           |     |

|                                                                                                                                                     | Work class                                                                                                 | Running lines | Depots & sidings |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|---------------|------------------|
| <b>5.3 Longitudinal position</b><br><br>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 |
| <b>6.1 Conductor rail ramp support</b><br>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.

|                                                                                                                      |           |   |   |
|----------------------------------------------------------------------------------------------------------------------|-----------|---|---|
| <b>6.2 Steel shims</b><br>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 |

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

|                                                                                                                                                  |           |   |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---|
| <b>6.4 Insulator support pads</b><br>The maximum number of 12.5mm rubber 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 |

|                                                                                                                                                                       |           |              |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|--------------|
| <b>6.5 Conductor rail safety blocks</b><br>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 required (maximum distance between blocks, 400m)

2 per conductor rail length ≤ 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 1-162

**7 Conductor rail anchors**

|                                                       | Tolerance  |               |                  |
|-------------------------------------------------------|------------|---------------|------------------|
|                                                       | Work class | Running lines | Depots & sidings |
| Maximum number of rail anchors incorrectly tensioned. | Class I    | None allowed  | None allowed     |
|                                                       | Class II   | None allowed  | None allowed     |
|                                                       | Class III  | None allowed  | None allowed     |
|                                                       | Class IV   | None allowed  | None allowed     |

| Number of anchors required                                                                                                                                                                              |                        |                                 |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------|----------------|
| Length of conductor rail                                                                                                                                                                                | Steel rail             |                                 | Composite rail |
|                                                                                                                                                                                                         | In direction of travel | Opposite to direction of travel |                |
| Up to 55m                                                                                                                                                                                               | 1                      | 1                               | 1              |
| 55m to 150m                                                                                                                                                                                             | 2                      | 1                               | 2              |
| Over 150m                                                                                                                                                                                               | 3                      | 1                               | 3              |
| In the case of composite rail, one Brecknell Willis anchor comprises four pairs of anchor blocks, the pairs being clamped to the rail and in contact with opposing sides of two consecutive insulators. |                        |                                 |                |

**8 Conductor rail wear**

|                                          | Rail section                                                                                                                                                                                                                                                                                                                                                                            |       | Depth    | Tolerance                |              |        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------|--------------------------|--------------|--------|
|                                          | kg/m                                                                                                                                                                                                                                                                                                                                                                                    | lb/yd | new rail | Work class               | R lines      | depots |
| Maximum allowable wear of conductor rail | 75                                                                                                                                                                                                                                                                                                                                                                                      | 150   | 138      | Class I                  | None allowed |        |
|                                          | 75                                                                                                                                                                                                                                                                                                                                                                                      | 150   | 138      | Class II, III & IV ♣ ♠   | 24           | 24     |
|                                          | 65                                                                                                                                                                                                                                                                                                                                                                                      | 130   | 102      | Class I                  | None allowed |        |
|                                          | 65                                                                                                                                                                                                                                                                                                                                                                                      | 130   | 102      | Class II, III & IV ♣ ♠   | 24           | 24     |
|                                          | 52                                                                                                                                                                                                                                                                                                                                                                                      | 106   | 117      | Class I                  | None allowed |        |
|                                          | 52                                                                                                                                                                                                                                                                                                                                                                                      | 106   | 117      | Class II, III & IV ♣ ♠   | 22           | 22     |
|                                          | 42                                                                                                                                                                                                                                                                                                                                                                                      | 85    | 87       | Class I                  | None allowed |        |
|                                          | 42                                                                                                                                                                                                                                                                                                                                                                                      | 85    | 87       | Class II, III & IV ♣ ♠   | 22           | 22     |
|                                          | 26                                                                                                                                                                                                                                                                                                                                                                                      | 53    | 102      | Class I                  | None allowed |        |
|                                          | 26                                                                                                                                                                                                                                                                                                                                                                                      | 53    | 102      | Class II, III & IV ♣ ♦ ♠ | 16 (9)       | 16 (9) |
|                                          | Composite Conductor rail                                                                                                                                                                                                                                                                                                                                                                |       | 105      | Class I                  | None allowed |        |
|                                          |                                                                                                                                                                                                                                                                                                                                                                                         |       | 105      | Class II, III & IV ♥ ♠   | 3            | 3      |
|                                          | ♣ Wear is measured with reference to the depth of new rail shown above.<br>♦ Angle iron section. Where copper bar is not present, wear reduced to 9mm.<br>♥ Composite conductor rail. Wear is measured with reference to the 5mm thick steel cap and is by ultrasonic measurement or by the built-in stepped wear indicators.<br>♠ Class I tolerances apply when new rail is installed. |       |          |                          |              |        |