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# GN

**GK/GN0657**

**Guidance on Lineside Signal and Indicator Product Design and  
Assessment Requirements**

**Issue One: December 2014  
Rail Industry Guidance Note for GK/RT0057**



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# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## Issue record

| Issue | Date          | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| One   | December 2014 | Original document.<br><br>This guidance note is the result of an analysis of the lineside signalling system interfaces with authorised users. The design specification and performance assessment guidance given in this guidance note is consistent with the development of products that are capable of being readable, which is a pre-requisite of implementing a control command and signalling (CCS) trackside sub-system that supports readability compatibility. |

## Superseded documents

The following Railway Industry Guidance Note is superseded, either in whole or in part as indicated:

| Superseded documents                                                                 | Sections superseded                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Date when sections are superseded |
|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| GK/GN0645 issue three Guidance on Lineside Signals, Indicators and Layout of Signals | 2.1.3; 2.2.1.1; 2.2.1.4a; 2.2.1.4b; 2.2.1.4c; 2.2.1.5a; 2.2.1.5b; 2.2.1.6; 2.2.1.8a; 2.2.1.8b; 2.2.1.8c; 2.2.4.1; 2.2.4.4; 2.2.4.5; 2.2.4.7; 2.2.5.2; 2.2.5.3; 2.2.5.5; 2.2.5.6; 2.2.5.8a; 2.2.5.8b; 2.2.6.1; 2.2.6.3; 2.2.6.4; 2.2.6.5; 2.2.6.6; 2.2.6.8; 2.2.6.9; 2.2.7.2; 2.2.7.3; 2.2.7.5; 2.2.8.3; 2.2.8.5; 2.3.1.2a; 2.3.1.2ab; 2.3.1.2b; 2.3.2.2; 2.3.2.3; 2.3.2.4; 2.3.2.6; 2.3.3.2; 2.3.3.3; 2.4.1.2; 2.4.1.5a; 2.4.1.5b; 2.4.2.2; 2.4.2.4a; 2.4.2.4b; 2.4.2.5a; 2.4.2.5b; 2.4.3.2; 2.4.3.4a; 2.4.3.4b; 2.4.4.2; 2.4.4.3a; 2.4.4.3b; 2.4.4.4; 2.4.5.2; 2.4.5.3; 2.4.5.4; 2.4.6.5; 2.4.6.7; 2.4.6.8; 2.4.7.3; 2.4.7.5; 2.4.7.6; 2.4.8.2; 2.4.8.3a; 2.4.8.3b; 2.5.1.3; 2.5.1.4; 2.5.1.5; 2.5.2.2; 2.5.2.3; 2.5.3.2; 2.5.3.3; A1.1; A2.1; B1.1a; B1.2ab; B1.4; C1.1a; C1.1b; C1.1c; C1.3 | 07 March 2015                     |

GK/GN0645 issue three Guidance on Lineside Signals, Indicators and Layout of Signals, ceases to be in force and is withdrawn as of 07 March 2015.

## Supply

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# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## Contents

| Section            | Description                                                          | Page      |
|--------------------|----------------------------------------------------------------------|-----------|
| <b>Part 1</b>      | <b>Introduction</b>                                                  | <b>5</b>  |
| G 1.1              | Purpose of this document                                             | 5         |
| G 1.2              | Scope of this document: technical compatibility                      | 5         |
| G 1.3              | Applicable Standards                                                 | 5         |
| G 1.4              | The structure of this document                                       | 6         |
| G 1.5              | Copyright                                                            | 6         |
| G 1.6              | Approval and authorisation of this document                          | 6         |
| <b>Part 2</b>      | <b>Rationale for Lineside Signalling Product Design Requirements</b> | <b>7</b>  |
| G 2.1              | Colour light signal heads                                            | 7         |
| G 2.2              | Position light signals                                               | 12        |
| G 2.3              | Banner repeater indicators                                           | 16        |
| G 2.4              | Semaphore signals                                                    | 21        |
| G 2.5              | Lineside sign signals                                                | 28        |
| G 2.6              | Junction indicators                                                  | 34        |
| G 2.7              | Alphanumeric indicators and preliminary junction indicators          | 38        |
| G 2.8              | Coloured light signalling indicators                                 | 45        |
| G 2.9              | Loading / unloading indicators                                       | 49        |
| <b>Part 3</b>      | <b>Rationale and Guidance for Light Parameters</b>                   | <b>53</b> |
| G 3.1              | Light colours                                                        | 53        |
| G 3.2              | Light properties                                                     | 56        |
| <b>Part 4</b>      | <b>Rationale for Product Performance Assessment Requirements</b>     | <b>57</b> |
| G 4.1              | Phantom display performance                                          | 57        |
| G 4.2              | Readability performance assessment                                   | 57        |
|                    | Readability performance a                                            | 58        |
| G 4.3              | ssessment: pass / fail criteria                                      | 58        |
| <b>Part 5</b>      | <b>Application of this Document</b>                                  | <b>59</b> |
| G 5.1              | Scope                                                                | 59        |
| G 5.2              | Exclusions from Scope                                                | 59        |
| G 5.3              | General compliance date                                              | 59        |
| G 5.4              | Exceptions to general compliance date                                | 59        |
| G 5.5              | Health and safety responsibilities                                   | 60        |
| <b>Appendices</b>  |                                                                      |           |
| Appendix A         | Factors that Influence Readability Compatibility                     | 61        |
| Appendix B         | Hardware Design Parameters                                           | 65        |
| Appendix C         | Display Design Parameters                                            | 70        |
| Appendix D         | Signal Structures                                                    | 77        |
| Appendix E         | Guidance on Readability Performance Specification                    | 78        |
| Appendix F         | Guidance on Product Performance Evaluation Requirements              | 86        |
| <b>Definitions</b> |                                                                      | <b>91</b> |
| <b>References</b>  |                                                                      | <b>94</b> |
| <b>Tables</b>      |                                                                      |           |
| <b>Table 1</b>     | Colour light signal displays                                         | 7         |
| <b>Table 2</b>     | Colour light signal hardware parameters                              | 9         |
| <b>Table 3</b>     | Colour light signal display parameters                               | 11        |
| <b>Table 4</b>     | Position light signal displays                                       | 12        |

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

|                    |                                                                           |    |
|--------------------|---------------------------------------------------------------------------|----|
| <b>Table 5</b>     | Position light signal hardware parameters                                 | 13 |
| <b>Table 6</b>     | Position light signal display parameters                                  | 16 |
| <b>Table 7</b>     | Banner repeater indicator displays                                        | 16 |
| <b>Table 8</b>     | Banner repeater indicator hardware parameters                             | 18 |
| <b>Table 9</b>     | Banner repeater indicator display parameters                              | 20 |
| <b>Table 10</b>    | Semaphore signal displays                                                 | 22 |
| <b>Table 11</b>    | Semaphore signal hardware parameters                                      | 26 |
| <b>Table 12</b>    | Semaphore signal display parameters                                       | 28 |
| <b>Table 13</b>    | Lineside sign signal displays                                             | 29 |
| <b>Table 14</b>    | Lineside sign signal hardware parameters                                  | 33 |
| <b>Table 15</b>    | Lineside sign signal display parameters                                   | 33 |
| <b>Table 16</b>    | Junction indications                                                      | 34 |
| <b>Table 17</b>    | Junction indicator hardware parameters                                    | 36 |
| <b>Table 18</b>    | Junction indication parameters                                            | 38 |
| <b>Table 19</b>    | Alphanumeric indications                                                  | 39 |
| <b>Table 20</b>    | Preliminary junction indications                                          | 40 |
| <b>Table 21</b>    | Indicator hardware parameters                                             | 41 |
| <b>Table 22</b>    | Alphanumeric and preliminary junction indication parameters               | 44 |
| <b>Table 23</b>    | Coloured light signalling indications                                     | 45 |
| <b>Table 24</b>    | Coloured light indicator hardware parameters                              | 47 |
| <b>Table 25</b>    | Coloured light signalling indicator display parameters                    | 48 |
| <b>Table 26</b>    | Loading / unloading indications                                           | 49 |
| <b>Table 27</b>    | Loading / unloading indicator hardware parameters                         | 51 |
| <b>Table 28</b>    | Loading / unloading indicator display parameters                          | 52 |
| <b>Table 29</b>    | Signalling light colour specifications                                    | 54 |
| <b>Table G A.1</b> | Hardware design parameters and product capability                         | 62 |
| <b>Table G A.2</b> | Display design parameters and product capability                          | 63 |
| <b>Table G A.3</b> | Human factors associated with readability                                 | 64 |
| <b>Table G E.1</b> | Example reading distances                                                 | 78 |
| <b>Table G E.2</b> | Readability performance categories                                        | 79 |
| <b>Table G F.1</b> | Example light source: phantom ratio values for a colour light signal head | 87 |

|                     |                                                                                             |    |
|---------------------|---------------------------------------------------------------------------------------------|----|
| <b>Figures</b>      |                                                                                             |    |
| <b>Figure 1</b>     | Colour light signal head: display element spacing                                           | 11 |
| <b>Figure 2</b>     | Banner repeater indicator parameters                                                        | 19 |
| <b>Figure 3</b>     | Upper quadrant stop arm                                                                     | 22 |
| <b>Figure 4</b>     | Upper quadrant distant arm                                                                  | 23 |
| <b>Figure 5</b>     | Upper quadrant subsidiary arm                                                               | 23 |
| <b>Figure 6</b>     | Upper quadrant disc                                                                         | 24 |
| <b>Figure 7</b>     | Stop board dimensions                                                                       | 30 |
| <b>Figure 8</b>     | Fixed distant board dimensions                                                              | 31 |
| <b>Figure 9</b>     | Retro-reflective buffer beam dimensions                                                     | 31 |
| <b>Figure G B.1</b> | Example colour light signal head / backboard shapes                                         | 65 |
| <b>Figure G B.2</b> | Example position light signal housing shapes                                                | 66 |
| <b>Figure G B.3</b> | Position light junction indicator using five separate light sources to generate a white bar | 67 |
| <b>Figure G B.4</b> | Junction indicator using a bar of light                                                     | 67 |
| <b>Figure G B.5</b> | Example coloured light indicator housing shapes                                             | 68 |
| <b>Figure G C.1</b> | Typical arrangement of light sources making up a bar of light                               | 74 |

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

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## Part 1 Introduction

### G 1.1 Purpose of this document

- G 1.1.1 This document gives guidance on interpreting the requirements of Railway Group Standard GK/RT0057 issue one 'Lineside Signalling Product Design and Assessment Requirements'. It does not constitute a recommended method of meeting any set of mandatory requirements.
- G 1.1.2 Part 2 provides the rationale for the lineside signalling product hardware and display requirements set out in GK/RT0057 Part 2. Appendices A to E provide further guidance relevant to the specification of lineside signalling products.
- G 1.1.3 Part 3 provides the rationale and guidance relevant to the signal light colour specification requirements set out in GK/RT0057 Part 3.
- G 1.1.4 Part 4 provides the rationale relevant to the product performance assessment requirements set out in GK/RT0057 Part 4. Appendix F provides further guidance relevant to product readability performance assessment.

### G 1.2 Scope of this document: technical compatibility

- G 1.2.1 Three areas of technical compatibility are relevant to lineside signalling systems:
- a) Readability.
  - b) Interpretability.
  - c) Driveability.
- G 1.2.2 This document provides rationale and guidance relevant to readability. Further guidance about the relationship between readability, interpretability and driveability is given in GE/GN8602 (when published).
- G 1.2.3 Further guidance on readability is given in Appendix A.

### G 1.3 Applicable Standards

- G A.1.2 The eventual aim is to publish all of the technical compatibility requirements relevant to lineside signalling systems in the following Railway Group Standards:
- a) GK/RT0057 setting out the requirements relevant to product readability performance.
  - b) GE/RT8101 setting out the requirements relevant to lineside signalling system readability in the operational context.
  - c) GK/RT0058 setting out the requirements for signal aspects and indications to be interpretable (appearance and meaning).
  - d) GK/RT0070 setting out the requirements for signalling layouts to be driveable.
  - e) GE/RT8102 setting out the requirements for lineside signalling system driveability assessment in the operational context, which is part of the route compatibility assessment before a new or modified lineside signalling system is taken into use.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

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G A.1.3 In addition to compliance with Railway Group Standards, product design specifications should take account of relevant:

- a) Rail Industry Standards (RISs).
- b) Rail Industry Guidance Notes, including:
  - i) GK/GN0657.
  - ii) GK/GN0658.
  - iii) GE/GN8601.
- c) Standards contained within the safety management system operated by the infrastructure manager, including:
  - i) Lineside signalling product specifications.
  - ii) Asset management standards relevant to lineside signalling systems.
- d) Relevant international standards, European standards and British standards, including those referenced in this document.

## G 1.4 The structure of this document

G 1.4.1 All requirements from Railway Group Standard GK/RT0057 are reproduced with a grey background in this document.

G 1.4.2 Guidance is provided as a series of sequentially numbered clauses prefixed 'G' immediately below the greyed text to which it relates.

G 1.4.3 Specific responsibilities and compliance requirements are laid down in the Railway Group Standard itself.

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## G 1.6 Approval and authorisation of this document

G 1.6.1 The content of this document was approved by Control Command and Signalling (CCS) Standards Committee on 16 October 2014.

G 1.6.2 This document was authorised by RSSB on 24 October 2014.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## Part 2 Rationale for Lineside Signalling Product Design Requirements

### G 2.1 Colour light signal heads

#### G 2.1.1 Display appearance

##### Extract from GK/RT0057

##### Section 2.1.1 Display appearance

2.1.1.1 Each colour light signal head display shall have the appearance of an arrangement of either one or two coloured lights, as shown in Table 1.

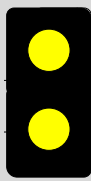
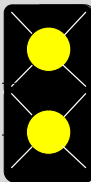
| Display type           | Description                                             | Example                                                                               |
|------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------|
| Red                    | One red display element                                 |    |
| Single yellow          | One yellow display element                              |   |
| Double yellow          | Two vertically aligned yellow display elements          |  |
| Flashing single yellow | One flashing yellow display element                     |  |
| Flashing double yellow | Two vertically aligned flashing yellow display elements |  |
| Green                  | One green display element                               |  |

**Table 1** Colour light signal displays

G 2.1.1.1 Rationale: The appearance of colour light signal aspects is used to codify movement authority information. A different aspect appearance would not be understood by authorised users and could imply a different meaning.

G 2.1.1.2 The display examples shown in GK/RT0057 Table 1 are for illustrative purposes only and do not imply a particular technology or the number or arrangements of display elements and light sources within the signal head. This detail should form part of the product design specification.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## G 2.1.2 Hardware and display parameters

### Extract from GK/RT0057

#### Section 2.1.2 Hardware and display parameters

2.1.2.1 Colour light signal heads shall:

- a) Comply with the hardware parameters set out in Table 2.

And

- b) Be capable of generating signal displays that meet the parameters set out in Table 3.

G 2.1.2.1 Rationale: These parameters result in a display appearance that should be readable.

## G 2.1.3 Hardware size

### Extract from GK/RT0057

#### Table 2 Colour light signal hardware parameters

| Design parameter |                     | Value       |
|------------------|---------------------|-------------|
| Hardware size    | Signal head housing | Unspecified |
|                  | Backboard           |             |

G 2.1.3.1 Rationale: It is not appropriate to specify a hardware size parameter because it would need to take account of all potential performance requirements and applications.

## G 2.1.4 Hardware colour

### Extract from GK/RT0057

#### Table 2 Colour light signal hardware parameters

| Design parameter |                         | Value                             |
|------------------|-------------------------|-----------------------------------|
| Hardware colour  | Forward facing surfaces | BS 4800-2011 shade 00-E-53: Black |
|                  | All other surfaces      | Silver or grey                    |

G 2.1.4.1 Rationale: A black signal head housing and signal backboard:

- a) Provides a strong colour contrast ratio for colour light signal displays.

And

- b) Means that colour light signal displays have a similar appearance irrespective of whether they are displayed in a dark or an illuminated environment.

G 2.1.4.2 Rationale: The different colour of front facing and other surfaces helps authorised users to distinguish between the front of a signal that should be displaying a signal display and the rear of other signals and indicators that should be ignored.

G 2.1.4.3 Rationale: The black front facing surface helps authorised users to detect and identify lineside signals and indicators.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## G 2.1.5 Hardware shape

### Extract from GK/RT0057

**Table 2 Colour light signal hardware parameters**

| Design parameter                            | Value       |
|---------------------------------------------|-------------|
| Hardware shape (signal head with backboard) | Unspecified |

- G 2.1.5.1 Rationale: It is not appropriate to specify a hardware shape parameter because the overall shape of a colour light signal is also affected by the type of signal structure and any other hardware that is fitted to the signal (for example, route indicator assemblies).

## G 2.1.6 Hardware surface gloss

### Extract from GK/RT0057

**Table 2 Colour light signal hardware parameters**

| Design parameter       | Value       |
|------------------------|-------------|
| Hardware surface gloss | Unspecified |

**Table 2** Colour light signal hardware parameters

- G 2.1.6.1 Rationale: A low surface gloss value enhances the display contrast ratio and reduces the likelihood of misreading that would arise from a more reflective surface. Colour light signal heads should not generate or reflect visible light that could impair readability of the colour light signal display.

## G 2.1.7 Display element luminous intensity, size and contrast

### Extract from GK/RT0057

**Table 3 Colour light signal display parameters**

| Design parameter                   | Value                                                                                                 |
|------------------------------------|-------------------------------------------------------------------------------------------------------|
| Display element luminous intensity | Unspecified:<br>Simultaneously lit display elements of the same colour shall have a similar intensity |
| Display element size               | Unspecified:<br>All display elements shall be the same radius (-5%, +10%)                             |
| Display element contrast           | Unspecified                                                                                           |

- G 2.1.7.1 Rationale: It is not appropriate to specify display element luminous intensity, size and contrast parameters because they would need to take account of all potential performance requirements and applications.
- G 2.1.7.2 Rationale: The similar intensity and size of simultaneously illuminated display elements helps authorised users to recognise that the lights are part of the same colour light signal display.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## G 2.1.8 Display element colour

### Extract from GK/RT0057

**Table 3 Colour light signal display parameters**

| Design parameter                       |                             | Value               |
|----------------------------------------|-----------------------------|---------------------|
| Display element colour<br>(See Part 3) | Red display                 | Signal red light    |
|                                        | Yellow displays (all types) | Signal yellow light |
|                                        | Green display               | Signal green light  |

G 2.1.8.1 Rationale: Colour is one of the methods used to convey the information displayed by each colour light signal aspect.

## G 2.1.9 Display element shape

### Extract from GK/RT0057

**Table 3 Colour light signal display parameters**

| Design parameter      | Value                               |
|-----------------------|-------------------------------------|
| Display element shape | Circular disc appearance from >20 m |

G 2.1.9.1 Rationale: A consistent filled circular shape helps authorised users to detect and identify colour light signal aspects from a long distance in the operational context. At a closer distance, authorised users should find it much easier to detect colour light signal aspects.

## G 2.1.10 Steady and flashing displays

### Extract from GK/RT0057

**Table 3 Colour light signal display parameters**

| Design parameter               | Value                                                                                                                      |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Non-flashing (steady) displays | Shall be capable of generating a lit display that has an uninterrupted appearance                                          |
| Flashing displays              | Shall be capable of generating displays that comply with the flashing aspect parameters set out in GK/RT0058 Appendix A.13 |

G 2.1.10.1 Rationale: Authorised users need to be able to observe that a colour light signal aspect is displayed and distinguish between flashing and steady signal aspects.

G 2.1.10.2 Rationale: Steady displays should not appear to be interrupted because this could mislead the authorised user, either because the display is not consistently visible or because it appears to be flashing.

G 2.1.10.3 Rationale: Colour light signal head products should be capable of generating the correct flashing display appearance when integrated within the overall CCS subsystem.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

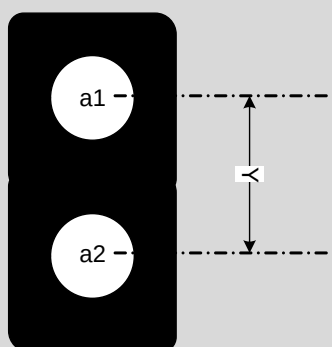
## G 2.1.11 Number, arrangement and spacing of display elements

### Extract from GK/RT0057

**Table 3 Colour light signal display parameters**

| Design parameter                                                      |                                           | Value                                                                                                                                           |
|-----------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of display elements                                            |                                           | See Table 1                                                                                                                                     |
| Arrangement of display elements                                       |                                           | See Table 1                                                                                                                                     |
| Spacing of simultaneously illuminated display elements (see Figure 1) | Vertical spacing (double yellow displays) | $Y \leq 5 r$ (miniature tunnel signals excepted)<br>$Y \leq 8.8 r$ (miniature tunnel signals only)<br>(where $r$ is the display element radius) |
|                                                                       | Horizontal spacing                        | Not applicable                                                                                                                                  |

**Table 3** Colour light signal display parameters



**Notes:**

1.  $a1$  and  $a2$  denote two simultaneously displayed, vertically aligned display elements contained within one signal head assembly
2. Dimension  $Y$  denotes the distance between vertically presented display element centres ( $a1 - a2$ )

**Figure 1** Colour light signal head: display element spacing

- G 2.1.11.1 Rationale: Double yellow displays should have a consistent appearance irrespective of any variation on display element radius.
- G 2.1.11.2 Rationale: In most circumstances, a separation of approximately  $5 r$  is sufficient to achieve the required readability performance of the double yellow display. A greater separation could result in an authorised user not associating the two display elements as part of a single display.
- G 2.1.11.3 Rationale: Miniature tunnel signals are read against a dark background and have a significantly reduced display element radius ( $r$ ). In this case, a greater display element spacing is permitted to optimise readability performance.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## G 2.2 Position light signals

### G 2.2.1 Display appearance

#### Extract from GK/RT0057

#### Section 2.2.1 Display appearance

2.2.1.1 Each position light signal display shall have the appearance of an arrangement of two coloured lights, as shown in Table 4.

| Display type     | Description                                                                | Example                                                                               |
|------------------|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| PLS red ON       | Two horizontally aligned red display elements                              |    |
| PLS yellow ON    | Two horizontally aligned yellow display elements                           |    |
| PLS steady OFF   | Two white display elements aligned in the upper quadrant position          |   |
| PLS flashing OFF | Two flashing white display elements aligned in the upper quadrant position |  |

**Table 4** Position light signal displays

G 2.2.1.1 Rationale: The appearance of position light signal aspects is used to codify movement authority information. A different appearance would not be understood by authorised users and could imply a different meaning.

G 2.2.1.2 The display examples shown in GK/RT0057 Table 4 are for illustrative purposes only and do not imply a particular technology or the number or arrangements of display elements and light sources within the position light signal. This detail should form part of the product design specification.

### G 2.2.2 Hardware and display parameters

#### Extract from GK/RT0057

#### Section 2.2.2 Hardware and display parameters

2.2.2.1 Position light signals shall:

- Comply with the hardware parameters set out in Table 5.

And

- Be capable of generating signal displays that meet the parameters set out in Table 6.

G 2.2.2.1 Rationale: These parameters result in a display appearance that should be readable.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## G 2.2.3 Hardware size

### Extract from GK/RT0057

**Table 5 Position light signal hardware parameters**

| Design parameter | Value       |
|------------------|-------------|
| Hardware size    | Unspecified |

- G 2.2.3.1 Rationale: It is not appropriate to specify a hardware size parameter because it would need to take account of all potential performance requirements and applications.

## G 2.2.4 Hardware colour

### Extract from GK/RT0057

**Table 5 Position light signal hardware parameters**

| Design parameter | Value                             |
|------------------|-----------------------------------|
| Hardware colour  | Forward facing surfaces           |
|                  | BS 4800-2011 shade 00-E-53: Black |
|                  | All other surfaces                |
|                  | Silver or grey                    |

- G 2.2.4.1 Rationale: A black signal background:

- a) Provides a strong colour contrast ratio for position light signal displays.

And

- b) Means that position light signal displays have a similar appearance irrespective of whether they are displayed in a dark or an illuminated environment.

- G 2.2.4.2 Rationale: The different colour of front facing and other surfaces helps authorised users to distinguish between the front of a signal that should be displaying a signal aspect and the rear of other signals and indicators that should be ignored.

## G 2.2.5 Hardware shape

### Extract from GK/RT0057

**Table 5 Position light signal hardware parameters**

| Design parameter | Value       |
|------------------|-------------|
| Hardware shape   | Unspecified |

- G 2.2.5.1 Rationale: It is not appropriate to specify a hardware shape parameter because the overall shape of a position light signal is also affected by the type of signal structure and any other hardware that is fitted to the signal (for example, route indicator assemblies).

## G 2.2.6 Hardware surface gloss

### Extract from GK/RT0057

**Table 5 Position light signal hardware parameters**

| Design parameter       | Value       |
|------------------------|-------------|
| Hardware surface gloss | Unspecified |

**Table 5** Position light signal hardware parameters

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

- G 2.2.6.1 Rationale: A low surface gloss value enhances the display contrast ratio and reduces the likelihood of misreading that would arise from a more reflective surface. Position light signals should not generate or reflect visible light that could impair readability of the position light signal display.

## G 2.2.7 Display element luminous intensity, size and contrast

### Extract from GK/RT0057

Table 6 Position light signal display parameters

| Design parameter                   | Value                                                                                                 |
|------------------------------------|-------------------------------------------------------------------------------------------------------|
| Display element luminous intensity | Unspecified:<br>Simultaneously lit display elements of the same colour shall have a similar intensity |
| Display element size               | Unspecified:<br>Both display elements shall be the same radius                                        |
| Display element contrast           | Unspecified                                                                                           |

- G 2.2.7.1 Rationale: It is not appropriate to specify display element luminous intensity, size and contrast parameters because they would need to take account of all potential performance requirements and applications.
- G 2.2.7.2 Rationale: The similar intensity and size of simultaneously illuminated display elements helps authorised users to recognise that the lights are part of the same position light signal display.

## G 2.2.8 Display element colour

### Extract from GK/RT0057

Table 6 Position light signal display parameters

| Design parameter                       | Value                                        |
|----------------------------------------|----------------------------------------------|
| Display element colour<br>(See Part 3) | PLS red ON display<br>Signal red light       |
|                                        | PLS yellow ON display<br>Signal yellow light |
|                                        | PLS OFF displays<br>Signal white light       |

- G 2.2.8.1 Rationale: Colour is one of the methods used to convey the meaning of each position light signal aspect.

## G 2.2.9 Display element shape

### Extract from GK/RT0057

Table 6 Position light signal display parameters

| Design parameter      | Value                               |
|-----------------------|-------------------------------------|
| Display element shape | Circular disc appearance from >10 m |

- G 2.2.9.1 Rationale: A consistent circular shape helps authorised users to detect and identify position light signal aspects from a long distance in the operational context.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## G 2.2.10 Steady and flashing displays

### Extract from GK/RT0057

**Table 6 Position light signal display parameters**

| Design parameter  | Value                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------------|
| Steady displays   | Shall be capable of generating a lit display that has an uninterrupted appearance                                         |
| Flashing displays | Shall be capable of generating displays that comply with the flashing aspect parameters set out in GK/RT0058 Appendix A.5 |

- G 2.2.10.1 Rationale: Authorised users need to be able to observe that a position light signal aspect is displayed and distinguish between flashing and steady signal aspects.
- G 2.2.10.2 Rationale: Steady displays should not appear to be interrupted because this could mislead the authorised user, either because the display is not consistently visible or because it appears to be flashing.
- G 2.2.10.3 Rationale: Position light signal products should be capable of generating the correct flashing display appearance when integrated within the overall CCS subsystem.

## G 2.2.11 Number and arrangement of display elements

### Extract from GK/RT0057

**Table 6 Position light signal display parameters**

| Design parameter                |                  | Value                                                 |
|---------------------------------|------------------|-------------------------------------------------------|
| Number of display elements      |                  | Two                                                   |
| Arrangement of display elements | PLS ON displays  | Horizontally aligned                                  |
|                                 | PLS OFF displays | Aligned 45° above horizontal in a clockwise direction |

- G 2.2.11.1 Rationale: The number, colour and arrangement of lights helps authorised users to:
- Detect and identify position light signals at locations where the signalling layout includes other types of signal and indicator.
- And
- Differentiate between stop and proceed displays.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## G 2.2.12 Spacing of display elements

### Extract from GK/RT0057

**Table 6 Position light signal display parameters**

| Design parameter                                       | Value                                      |
|--------------------------------------------------------|--------------------------------------------|
| Spacing of simultaneously illuminated display elements | 5 x r (where r is the light source radius) |

**Table 6** Position light signal display parameters

- G 2.2.12.1 Rationale: The display element spacing is specified so that all position light signal displays have a consistent appearance, irrespective of any variation in display element size.

## G 2.3 Banner repeater indicators

### G 2.3.1 Display appearance

### Extract from GK/RT0057

#### Section 2.3.1 Display appearance

- 2.3.1.1 Each banner repeater display shall have the appearance of a black bar displayed against a circular illuminated area, as shown in Table 7.

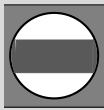
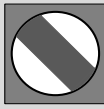
| Display type     | Description                                                                                       | Example                                                                               |
|------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Banner ON        | A black band, horizontally aligned, displayed against a lit white background                      |  |
| White banner OFF | A black band, aligned in the upper quadrant position and displayed against a lit white background |  |
| Green banner OFF | A black band, aligned in the upper quadrant position and displayed against a lit green background |  |

**Table 7** Banner repeater indicator displays

- G 2.3.1.1 Rationale: The distinctive appearance is intended to help drivers distinguish banner repeater indicator indications from other types of signalling system display.
- G 2.3.1.2 The display examples shown in GK/RT0057 Table 7 are for illustrative purposes only and do not imply a particular technology or the number or arrangements of light sources within the indicator. This detail should form part of the product design specification.

### G 2.3.2 Hardware and display parameters

### Extract from GK/RT0057

#### Section 2.3.2 Hardware and display parameters

- 2.3.2.1 Banner repeater indicator heads shall:

- Comply with the hardware appearance parameters set out in Table 8.

And

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

- b) Be capable of generating displays that meet the display appearance parameters set out in Table 9 and Figure 2.

G 2.3.2.1 Rationale: These parameters result in a display appearance that should be readable.

## G 2.3.3 Hardware size

### Extract from GK/RT0057

Table 8 Banner repeater indicator hardware parameters

| Design parameter | Value       |
|------------------|-------------|
| Hardware size    | Unspecified |

G 2.3.3.1 Rationale: It is not appropriate to specify a hardware size parameter because it would need to take account of all potential performance requirements and applications.

## G 2.3.4 Hardware colour

### Extract from GK/RT0057

Table 8 Banner repeater indicator hardware parameters

| Design parameter |                                                       | Value                             |
|------------------|-------------------------------------------------------|-----------------------------------|
| Hardware colour  | Banner repeater head housing: forward facing surfaces | BS 4800-2011 shade 00-E-53: Black |
|                  | Banner repeater head housing: all other surfaces      | Silver or grey                    |
|                  | Banner arm                                            | BS 4800-2011 shade 00-E-53: Black |

G 2.3.4.1 Rationale: A black banner arm provides a strong colour contrast against the illuminated background.

G 2.3.4.2 Rationale: A black surround:

- a) Provides a strong colour contrast ratio for banner repeater indicator displays.

And

- b) Means that banner repeater indicator displays have a similar appearance, irrespective of whether they are displayed in a dark or an illuminated environment.

G 2.3.4.3 Rationale: The different colour of front facing and other surfaces helps authorised users to distinguish between the front of a banner repeater indicator that should be displaying an indication and the rear of other signals and indicators that should be ignored.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## G 2.3.5 Hardware shape

### Extract from GK/RT0057

**Table 8 Banner repeater indicator hardware parameters**

| Design parameter |                              |                        | Value                                              |
|------------------|------------------------------|------------------------|----------------------------------------------------|
| Hardware shape   | Banner repeater head housing |                        | Rectangular or circular when viewed from the front |
|                  | Display area                 | Banner arm             | Rectangular                                        |
|                  |                              | Illuminated background | Circular                                           |

G 2.3.5.1 Rationale: A rectangular or circular banner signal housing shape helps authorised users to identify single and splitting banner repeater indicators when they are viewed against a background of other visible objects.

G 2.3.5.2 Rationale: The circular display area containing a centrally pivoted banner arm results in a display that mimics a semaphore signal arm contrasted against an illuminated background.

## G 2.3.6 Hardware surface gloss

### Extract from GK/RT0057

**Table 8 Banner repeater indicator hardware parameters**

| Design parameter                 | Value       |
|----------------------------------|-------------|
| Hardware surface gloss (housing) | Unspecified |

**Table 8** Banner repeater indicator hardware parameters

G 2.3.6.1 Rationale: A low surface gloss value enhances the display contrast ratio and reduces the likelihood of misreading that would arise from a more reflective surface finish. Banner repeater indicator hardware should not generate or reflect visible light that could impair readability of the banner repeater indicator display.

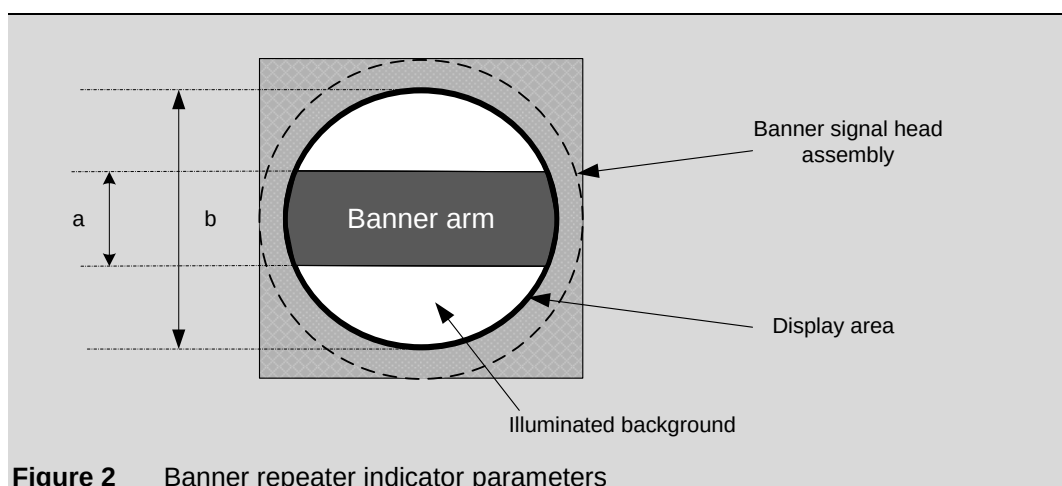
## G 2.3.7 Display element luminous intensity, size and contrast

### Extract from GK/RT0057

**Table 9 Banner repeater indicator display parameters**

| Design parameter                   |                        | Value                                                                                    |
|------------------------------------|------------------------|------------------------------------------------------------------------------------------|
| Display element luminous intensity | Illuminated background | Unspecified:<br>Both halves of the illuminated background shall have a similar intensity |
| Display element size               | Banner arm             | $a = 0.4b$ (+/-10%)                                                                      |
|                                    | Illuminated background | $b =$ Unspecified                                                                        |
| Display element contrast           |                        | Unspecified                                                                              |

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements



G 2.3.7.1 Rationale: It is not appropriate to specify display element luminous intensity, overall size and contrast parameters because they would need to take account of all potential performance requirements and applications.

G 2.3.7.2 Rationale: The consistent level of intensity throughout the display supports the appearance and readability of banner signal displays.

G 2.3.7.3 Rationale: The proportional relationship between the size of the banner arm (dimension a) and the size of the illuminated background (dimension b):

a) Helps authorised users to detect the position of the banner arm.

And

b) Means that banner signal displays have a consistent appearance, irrespective of the overall size of the hardware.

## G 2.3.8 Display element colour

### Extract from GK/RT0057

**Table 9 Banner repeater indicator display parameters**

| Design parameter                       |                  | Value                 |
|----------------------------------------|------------------|-----------------------|
| Display element colour<br>(See Part 3) | Green background | Signal green light #1 |
|                                        | White background | Signal white light    |

#1 Three-state banner repeater indicators only

G 2.3.8.1 Rationale: The colour of the illuminated background is one of the methods used to convey the meaning of each banner repeater indicator indication.

## G 2.3.9 Display element shape

### Extract from GK/RT0057

**Table 9 Banner repeater indicator display parameters**

| Design parameter      |                        | Value                                |
|-----------------------|------------------------|--------------------------------------|
| Display element shape | Illuminated background | Bi-furcated circular disc appearance |
|                       | Banner arm             | Rectangular appearance               |

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

- G 2.3.9.1 Rationale: A consistent circular background appearance helps authorised users to detect and identify banner repeater indicator indications from a long distance in the operational context. At a closer distance, authorised users should find it much easier to detect banner repeater indicator indications.

## G 2.3.10 Steady and flashing displays

### Extract from GK/RT0057

**Table 9 Banner repeater indicator display parameters**

| Design parameter               | Value                                                                                                           |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Non-flashing (steady) displays | The banner repeater indicator shall be capable of generating a lit display that has an uninterrupted appearance |
| Flashing displays              | Banner repeater indications shall not appear to flash                                                           |

- G 2.3.10.1 Rationale: Steady displays should not appear to be interrupted because this could mislead the authorised user, either because the display is not consistently visible or because it appears to be flashing.
- G 2.3.10.2 Rationale: There is no requirement in GK/RT0058 for a banner repeater to display a flashing indication.

## G 2.3.11 Number and arrangement of display elements

### Extract from GK/RT0057

**Table 9 Banner repeater indicator display parameters**

| Design parameter                |                        |             | Value                                                                                                   |
|---------------------------------|------------------------|-------------|---------------------------------------------------------------------------------------------------------|
| Number of display elements      |                        |             | See Table 7                                                                                             |
| Arrangement of display elements | Angle of banner arm    | ON display  | Horizontal                                                                                              |
|                                 |                        | OFF display | Turned in a clockwise direction about the centre point of the illuminated background at an angle of 45° |
|                                 | Position of banner arm |             | Centrally positioned against illuminated background                                                     |

**Table 9** Banner repeater indicator display parameters

- G 2.3.11.1 Rationale: The consistent appearance of banner repeater indicator displays helps authorised users to detect the position of the banner arm and, therefore, which display is being presented.
- G 2.3.11.2 Rationale: The central position of the banner arm relative to the illuminated background means that the proportions of the illuminated area either side of the banner arm appear as equal sized segments. This helps to make the position of the banner arm visible.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

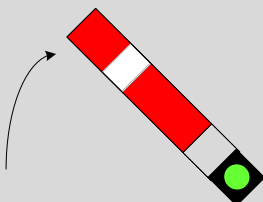
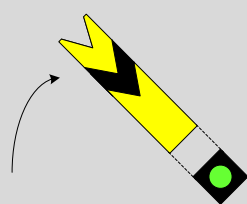
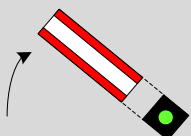
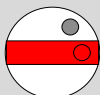
## G 2.4 Semaphore signals

### G 2.4.1 Display appearance

#### Extract from GK/RT0057

#### Section 2.4.1 Display appearance

2.4.1.1 Each semaphore signal display shall have the appearance of the relevant coloured signal arm / disc and a coloured semaphore signal light, as shown in Table 10.

| Display type       | Description                                                                                   | Example                                                                                                            |
|--------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Stop arm ON        | Stop arm horizontal and one red lit display element                                           |                                 |
| Stop arm OFF       | Stop arm in upper quadrant or lower quadrant position and one green lit display element       | <br>(upper quadrant is shown)  |
| Distant arm ON     | Distant arm horizontal and one yellow lit display element                                     |                               |
| Distant arm OFF    | Distant arm in upper quadrant or lower quadrant position and one green lit display element    | <br>(upper quadrant is shown) |
| Subsidiary arm ON  | Subsidiary arm horizontal and one red lit display element                                     |                               |
| Subsidiary arm OFF | Subsidiary arm in upper quadrant or lower quadrant position and one green lit display element | <br>(upper quadrant is shown) |
| Shunting disc ON   | Disc horizontal and one red lit display element                                               |                               |

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

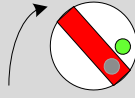
| Display type      | Description                                                                         | Example                                                                                                          |
|-------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Shunting disc OFF | Disc in upper quadrant or lower quadrant position and one green lit display element | <br>(upper quadrant is shown) |

**Table 10** Semaphore signal displays

G 2.4.1.1 Rationale: The appearance of semaphore signal arms and semaphore signal lights is used to codify the movement authority information conveyed by the signalling system. A different display appearance would not be understood by authorised users and could imply a different meaning.

G 2.4.1.2 The display examples shown in GK/RT0057 Table 10 are for illustrative purposes only and do not imply a particular design or a requirement for upper quadrant signals. This detail should form part of the product design specification.

## G 2.4.2 Hardware and display parameters

### Extract from GK/RT0057

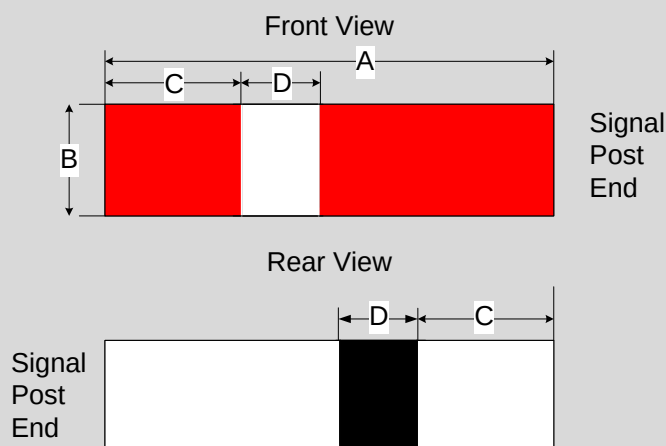
#### Section 2.4.2 Hardware and display parameters

2.4.2.1 Semaphore signal arms and signal lights shall:

- Comply with the hardware appearance parameters set out in Table 11 and Figures 3 to 6.

And

- Be capable of generating displays that meet the display appearance parameters set out in Table 12.



| Parameter | Dimension        |                    |
|-----------|------------------|--------------------|
|           | Main stop arm    | Miniature stop arm |
| A         | 1060 mm (+/- 5%) | 533 mm (+/- 5%)    |
| B         | 260 mm (+/- 5%)  | 159 mm (+/- 5%)    |
| C         | 318 mm (+/- 5%)  | 152 mm (+/- 5%)    |
| D         | 178 mm (+/- 5%)  | 115 mm (+/- 5%)    |

**Figure 3** Upper quadrant stop arm

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

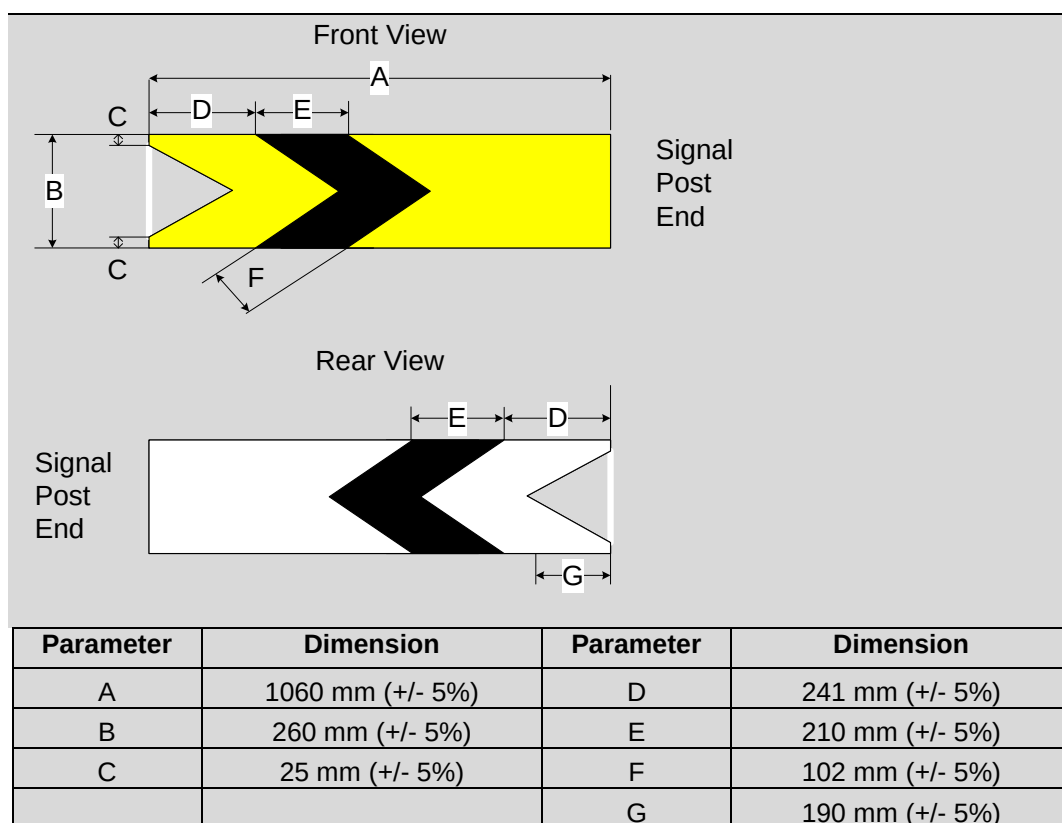


**Figure 4** Upper quadrant distant arm

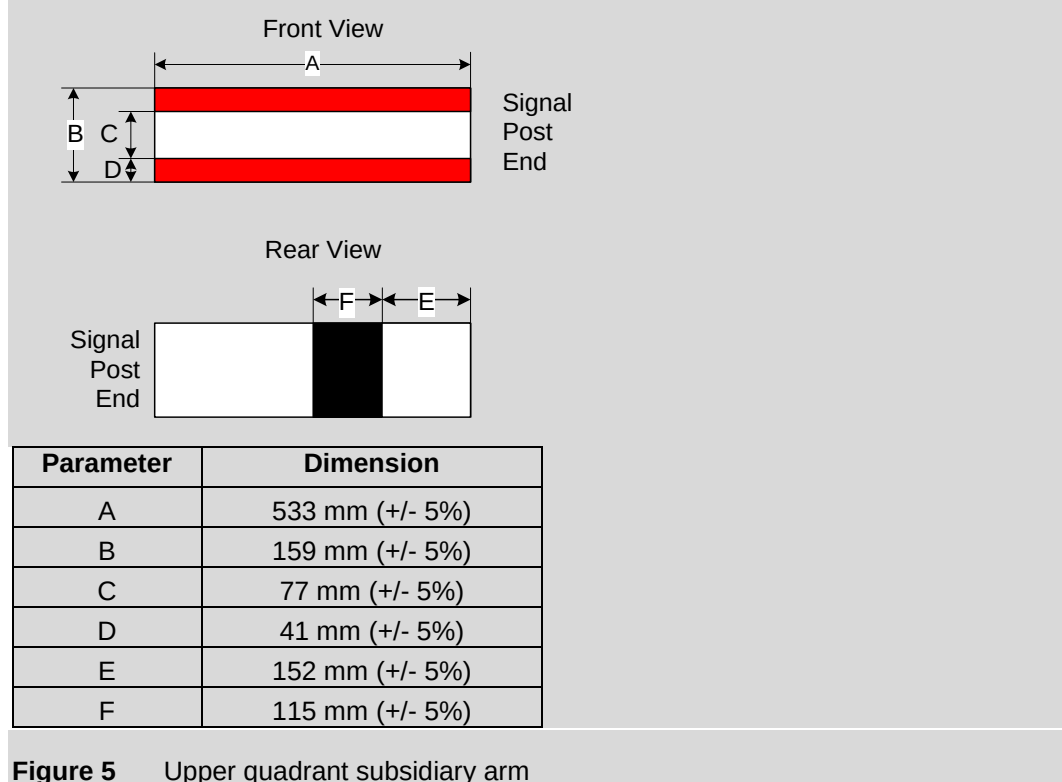


**Figure 5** Upper quadrant subsidiary arm

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

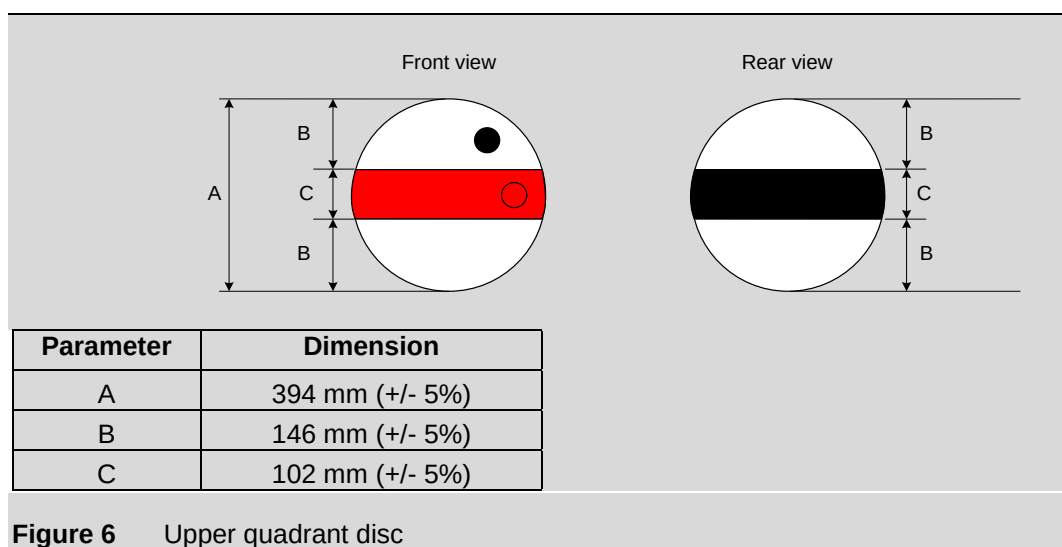


**Figure 6** Upper quadrant disc

- G 2.4.2.1 Rationale: The dimensions in Figures 3, 4, 5 and 6 are consistent with the standard mechanical signalling equipment drawings produced by British Railways.
- G 2.4.2.2 Lower quadrant signalling hardware should be manufactured using the relevant historical mechanical design drawings.
- G 2.4.3 Hardware size**

## Extract from GK/RT0057

**Table 11 Semaphore signal hardware parameters**

| Design parameter |                 |                | Value        |
|------------------|-----------------|----------------|--------------|
| Hardware size    | Stop arm        | Upper quadrant | See Figure 3 |
|                  |                 | Lower quadrant | Unspecified  |
|                  | Distant arm     | Upper quadrant | See Figure 4 |
|                  |                 | Lower quadrant | Unspecified  |
|                  | Subsidiary arm  | Upper quadrant | See Figure 5 |
|                  |                 | Lower quadrant | Unspecified  |
|                  | Disc            | Upper quadrant | See Figure 6 |
|                  |                 | Lower quadrant | Unspecified  |
|                  | Spectacle plate |                | Unspecified  |

- G 2.4.3.1 Rationale: The size of semaphore signal arms and discs helps them to be visible in daylight.
- G 2.4.3.2 Rationale: The consistent overall size of each type of signal arm and disc helps authorised users to read and interpret the information conveyed by each signal display, particularly where a signal or signal structure includes multiple signal arms of different types.
- G 2.4.3.3 Rationale: The dimensions relating to the colour pattern on each signal arm face helps authorised users to identify the applicability of signal arms within the signalling layout.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## G 2.4.4 Hardware shape

### Extract from GK/RT0057

Table 11 Semaphore signal hardware parameters

| Design parameter |                |                | Value        |
|------------------|----------------|----------------|--------------|
| Hardware shape   | Stop arm       | Upper quadrant | Rectangular  |
|                  |                | Lower quadrant |              |
|                  | Distant arm    | Upper quadrant | See Figure 4 |
|                  |                | Lower quadrant |              |
|                  | Subsidiary arm | Upper quadrant | Rectangular  |
|                  |                | Lower quadrant |              |
|                  | Disc           | Upper quadrant | Circular     |
|                  |                | Lower quadrant |              |
| Spectacle plate  |                | Unspecified    |              |

- G 2.4.4.1 Rationale: Because the visible colour of a signal arm can be adversely affected by back-lighting, the appearance of stop arms and distant arms is also differentiated by their shape. This means that each signal arm should be readable when it is observed as a silhouette.

## G 2.4.5 Hardware colour

### Extract from GK/RT0057

Table 11 Semaphore signal hardware parameters

| Design parameter |                         |                 | Value                                     |
|------------------|-------------------------|-----------------|-------------------------------------------|
| Hardware colour  | Signal arm              | Red elements    | BS 4800-2011 shade 04-E-53: Poppy         |
|                  |                         | Yellow elements | BS 4800-2011 shade 08-E-51: Golden yellow |
|                  |                         | Black elements  | BS 4800-2011 shade 00-E-53: Black         |
|                  |                         | White elements  | BS 4800-2011 shade 00-E-55: White         |
|                  | Signal light housing    |                 | Black or grey                             |
|                  | Spectacle plate housing |                 | Black or grey                             |
|                  | Signal back board #1    |                 | BS 4800-2011 shade 00-E-55: White         |

#1 Where provided

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

- G 2.4.5.1 Rationale: Compliance with BS 4800:2011 red and yellow shades means that stop and distant signal arms should have a consistent colour appearance.
- G 2.4.5.2 Rationale: The colour pattern on the front face of each signal arm helps authorised users to:
- a) Differentiate between different types of signal arm.
- And
- b) Identify which line the signal arm applies to, particularly when the signal is in the ON position.
- G 2.4.5.3 Rationale: The black and white colour of the rear of semaphore signal arms helps authorised users to distinguish between the front of a semaphore signal arm and the rear of other semaphore signals that may be ignored.

## G 2.4.6 Hardware surface gloss

### Extract from GK/RT0057

**Table 11 Semaphore signal hardware parameters**

| Design parameter                                                 |                   | Value               |
|------------------------------------------------------------------|-------------------|---------------------|
| Hardware surface gloss                                           | Signal arm        | Enamelled finish #2 |
|                                                                  | Signal back board | Unspecified         |
| #2 Semaphore signal arms shall not use retro-reflective material |                   |                     |

**Table 11** Semaphore signal hardware parameters

- G 2.4.6.1 Rationale: The enamelled surface finish is based on existing practice, which is known to support sufficient readability in daylight and ease of maintenance.
- G 2.4.6.2 Rationale: Trials have shown that retro-reflective material has the potential to adversely affect the appearance of a semaphore signal arm / disc.

## G 2.4.7 Display element luminous intensity, size and contrast

### Extract from GK/RT0057

**Table 12 Semaphore signal display parameters**

| Design parameter                   |                  | Value                        |
|------------------------------------|------------------|------------------------------|
| Display element luminous intensity | Signal arm       | See 'hardware surface gloss' |
|                                    | Signal light     | Unspecified                  |
| Display element size               | Signal arm       | See 'hardware size'          |
|                                    | Signal light     | Unspecified                  |
| Display element contrast           | Signal backboard | Unspecified                  |
|                                    | Signal light     | Unspecified                  |

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

- G 2.4.7.1 Rationale: Authorised users should be able to detect, identify and distinguish semaphore signal displays against a background of other visible objects and lights in the prevailing ambient conditions.

## G 2.4.8 Display element colour

### Extract from GK/RT0057

Table 12 Semaphore signal display parameters

| Design parameter       |                            | Value                 |
|------------------------|----------------------------|-----------------------|
| Display element colour | Signal arm                 | See 'hardware colour' |
|                        | Red lit display element    | Signal red light      |
|                        | Yellow lit display element | Signal yellow light   |
|                        | Green lit display element  | Signal green light    |

- G 2.4.8.1 Rationale: The signal light colour is the method used to convey the meaning of each semaphore signal display at night.

## G 2.4.9 Display element shape

### Extract from GK/RT0057

Table 12 Semaphore signal display parameters

| Design parameter      |              | Value                    |
|-----------------------|--------------|--------------------------|
| Display element shape | Signal arm   | See 'hardware shape'     |
|                       | Signal light | Circular disc appearance |

- G 2.4.9.1 Rationale: A consistent circular appearance helps authorised users to detect and identify semaphore signal lights when they are displayed against a background of other visible light sources in the operational context.

## G 2.4.10 Non flashing / flashing displays

### Extract from GK/RT0057

Table 12 Semaphore signal display parameters

| Design parameter  | Value                                                                                                             |
|-------------------|-------------------------------------------------------------------------------------------------------------------|
| Steady displays   | The semaphore signal light unit shall be capable of generating a lit display that has an uninterrupted appearance |
| Flashing displays | Semaphore signal lit displays shall not appear to flash                                                           |

- G 2.4.10.1 Rationale: Semaphore signal lit displays should not appear to flash or flicker because this could mislead the authorised user, either because the display is not consistently visible at night or because it appears to be flashing.

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

## G 2.4.11 Number of display elements and signal arm alignment

### Extract from GK/RT0057

**Table 12 Semaphore signal display parameters**

| Design parameter           |                             | Value                                                                 |
|----------------------------|-----------------------------|-----------------------------------------------------------------------|
| Number of display elements |                             | See Table 10                                                          |
| Signal arm alignment       | ON displays                 | Horizontal (+5° /-5°)                                                 |
|                            | Upper quadrant OFF displays | Left-hand end of signal arm raised 45° (+20° /-10°) above horizontal  |
|                            | Lower quadrant OFF displays | Left-hand end of signal arm lowered 45° (+20° /-10°) below horizontal |

G 2.4.11.1 Rationale: ON and OFF displays are distinguished by the angle of the signal arm relative to horizontal.

G 2.4.11.2 Rationale: The permitted alignment angle tolerances provide for mechanical adjustment and temperature changes. A signal arm that is positioned outside of these tolerances is considered to be in the 'wrong' position and might not display the correct signal light at night.

## G 2.4.12 Spacing of display elements

### Extract from GK/RT0057

**Table 12 Semaphore signal display parameters**

| Design parameter            | Value       |
|-----------------------------|-------------|
| Spacing of display elements | Unspecified |

**Table 12** Semaphore signal display parameters

G 2.4.12.1 Further guidance about the dimensions relating to the spatial relationship between multiple semaphore signal arms is given in GE/GN8601.

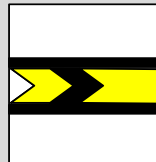
## G 2.5 Lineside sign signals

### G 2.5.1 Display appearance

### Extract from GK/RT0057

#### Section 2.5.1 Display appearance

2.5.1.1 Each lineside signal display shall display one of the reflectorized images shown in Table 13.

| Display Type        | Description                                                                                                  | Example                                                                               |
|---------------------|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Stop board          | A red spot displayed against a white background associated with the word 'Stop'                              |  |
| Fixed distant board | An image of a semaphore distant signal arm in the ON position centrally displayed against a white background |  |

# Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements

| Display Type                 | Description                                                            | Example                                                                             |
|------------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Retro-reflective buffer beam | A white horizontal stripe centrally displayed against a red background |  |

**Table 13** Lineside sign signal displays

- G 2.5.1.1 Rationale: The appearance of stop boards, fixed distant boards and retro-reflective buffer beams codifies the movement authority information conveyed by the signalling system. A different display appearance would not be understood by authorised users and could imply a different meaning.
- G 2.5.1.2 The display examples shown in GK/RT0057 Table 13 are for illustrative purposes only and do not imply a particular design. This detail should form part of the product design specification. For example, the design of the retro-reflective buffer beam should be compatible with the buffer stop equipment.
- G 2.5.1.3 Rationale: The word 'Stop' enhances the appearance of stop boards and makes them easier to identify.

## G 2.5.2 Hardware and display parameters

### Extract from GK/RT0057

#### Section 2.5.2 Hardware and display parameters

2.5.2.1 Stop boards, fixed distant boards and retro-reflective buffer beams shall:

- Comply with the hardware appearance parameters set out in Table 14 and Figures 7 to 9.

And

- Be capable of generating displays that meet the display appearance parameters set out in Table 15.

- G 2.5.2.1 Rationale: These parameters result in a display appearance that should be readable.

## G 2.5.3 Hardware size

### Extract from GK/RT0057

**Table 14** Lineside sign signal hardware parameters

| Design parameter |                              | Value        |
|------------------|------------------------------|--------------|
| Hardware size    | Stop board                   | See Figure 7 |
|                  | Distant board                | See Figure 8 |
|                  | Retro-reflective buffer beam | See Figure 9 |