

BRITISH RAILWAYS BOARD

SPECIFICATION No. BR 1651 PART 5

FIBRE OPTIC TRAIN OPERATED POINTS INDICATOR

PRELIMINARY

The information contained in this document is confidential and must not be used other than for the purposes for which this specification was released.

BR1651P5

- 1 -

March 1991



Documents

Document Sharing Hub

INDEX FOR BR 1651 PART 5

FIBRE OPTIC TRAIN OPERATED POINTS INDICATOR

FOREWORD

REFERENCES

1. SCOPE
2. DEFINITIONS
3. GENERAL CONSTRUCTION
 - 3.1 Case Unit
 - 3.2 Access
 - 3.3 Fixing
 - 3.4 Environmental Conditions
 - 3.5 Ventilation
 - 3.6 Cable Entry
 - 3.7 Hoods
 - 3.8 Finish
4. ELECTRICS
 - 4.1 Lamps
 - 4.2 Lamp Lighting Transformers
 - 4.3 Internal Wiring
 - 4.4 Terminal Blocks
5. INDICATIONS
6. MATRIX
7. FRONT SCREEN
8. OPTICS
9. RANGE
10. MAINTAINABILITY
11. TYPE APPROVAL
12. QUALITY ASSURANCE

APPENDICES

- A. COORDINATES & LAYOUTS FOR INDICATIONS (8 Sheets)
- B. INDICATOR
- C. TERMINAL BLOCK
- D. TRANSFORMER

BRITISH RAILWAYS BOARD

SPECIFICATION No. BR 1651 PART 5

FIBRE OPTIC TRAIN OPERATED POINTS INDICATOR

FOREWORD

This specification is issued by:-

British Railways Board,
Director of S & T. Engineering Department,
Materials Management Group,
Room 514, Rail House,
Gresty Road,
CREWE CW2 6EA.

from whom copies may be obtained.

Technical queries shall be referred to:-

British Railways Board,
Director of S & T. Engineering Department,
Mechanical Equipment Group,
Macmillan House,
Paddington Station,
LONDON W2 1FT.

Telephone:- BT (STD) 071-922-6597
BR (ETD) 00-26597

REFERENCES

Reference in this specification is made to:-

British Railways Specifications

BR 10 Painting Schedule for Signal Department Equipment
BR 820 Colours of light signals, colour filters and lenses
BR 872 Flame retardant compound insulated cables for Railway Signalling
BR 924 Air cooled power transformers for Railway Signalling
BR 967 Railway Signalling Apparatus Environmental Conditions
Leaflet BRB Supplier Quality Assurance Requirements

British Standards

BS 57 B.A. Screws, Nuts & Bolts
BS 1706 Electroplated coatings of Zinc
BS 3410 Metal washers for General Engineering purposes
BS 4579 Part 1 Compression joints in copper conductors
BS 5750 Quality Systems

Where this specification requires reference to BR Specifications or British Standards, the latest issue shall apply unless specially stated.

1. SCOPE

- 1.1 This specification covers the requirements for Train Operated Points Indicator using Fibre Optic light guides.
- 1.2 The Indicator Unit is required to display either a red rectangular indication or a yellow circular indication.
- 1.3 Each indication to be illuminated from its own designated lamp unit and individual transformer.

2. DEFINITIONS

- | | |
|---------------------------|--|
| 2.1 Optical Fibre | - An optically transparent fibre consisting of a central core surrounded by a cladding of lower refractive index and used to transmit light by means of multiple internal reflections. |
| 2.2 Fibre Optic Arm | - A collection of optical fibres fastened together to form a cable within a single sleeve. One end of each arm is terminated either as a plain polished surface or as a coned/lens system. The other end is connected to a collet which is shared with other fibre optic arms. |
| 2.3 Fibre Optic Harness | - A collection of fibre optic arms all terminating in a single collet. |
| 2.4 Light Point | - The optical output from the end of a single fibre optic arm. |
| 2.5 Tungsten Halogen Lamp | - A lamp in which the tungsten filament is enclosed in a gas filled quartz bulb containing a quantity of halogen. |
| 2.6 Red Indication | - The colour of the light emitted by the signal and defined as Red to Class RC1 in BR 820. |
| 2.7 Yellow Indication | - The colour of the light emitted by the signal and defined as Yellow to Class B in BR 820. |
| 2.8 Matrix | - A screen or plate into which fibre optic arms are plugged to form an indication. |
| 2.9 Engineer | - The Director of S&T Engineering. |

3. GENERAL CONSTRUCTION

3.1 Case Unit

- 3.1.1 The case unit to be of robust construction, weather-proof and corrosion resistant to last 25 years in a railway environment.
- 3.1.2 The case to be constructed from light alloy or other approved non-ferrous material with similar strength/weight/rigidity ratio.
- 3.1.3 The unit shall conform to the dimensions shown in Appendix 'B'.

3.2 Access

- 3.2.1 The case shall have a rear access door or lift-off backplate.
- 3.2.2 The door or backplate shall be sealed with a closed-cell expanded neoprene gasket and capable of being locked closed with a 38 mm BR standard padlock having a 6 mm diameter shackle and 20 mm shackle clearance.
- 3.2.3 The door shall be supplied hinged on the left hand side when viewed from the rear and provided with a chain restraint to 100° opening.
- 3.2.4 Lift-off backplates shall be positively located to ensure correct alignment and provided with a safety chain which is long enough for the backplate to hang clear of the case opening.
- 3.2.5 All internal parts shall be accessible and changeable from the rear.

3.3 Fixing

- 3.3.1 A flat base mounting with provision for fixing with M16 bolts as shown in Appendix 'B'.

3.4 Environmental Conditions

- 3.4.1 The unit shall operate satisfactorily under environmental conditions in accordance with BR 967 Category E.

3.5 Ventilation

- 3.5.1 The internal temperature of the unit shall not rise under any normal operating conditions such that the plastics begin to flow.
- 3.5.2 Ventilation, if provided, shall be properly weatherproof and insect proof.

3.6 Cable Entry

- 3.6.1 A central cable entry shall be provided in the base as shown in Appendix 'B', properly weatherproof and insect proof.
- 3.6.2 Provision shall be made to adequately support the entry cable independently of the terminal.

3.7 Hoods

- 3.7.1 Hoods shall be of non-ferrous material which does not interact with the case material and shall be of adequate strength and rigidity.
- 3.7.2 The shape and length of hoods shall be as shown in Appendix 'B' or as specified on order.

3.8 Finish

- 3.8.1 All exterior and interior surfaces of the unit to be matt black.
- 3.8.2 All surfaces to be prepared, primed and finish coated in accordance with BR 10.
- 3.8.3 All metallic components to be corrosion resistant and protected where suitable by EZP and passivated to BS 1706 Class B.

4. ELECTRICS

4.1 Lamps

- 4.1.1 Lamps shall be fitted inside an appropriate light box and be of type H3 / 12V / 55W with the following characteristics :
 - a) Nominal luminous flux at 12 Volts = 900 lumens.
 - b) Nominal life at 11.5 Volts = 1000 hours.
 - c) Nominal colour temperature at 12 Volts = 2850 K.
- 4.1.2 The equipment must be designed to ensure that under normal operating conditions the lamp voltage does not drop below 9 volts.
- 4.1.3 A notice warning staff not to touch the lamp envelope shall be displayed in a prominent position inside the case.

4.2 Lamp Lighting Transformers

- 4.2.1 The lamp lighting transformers for AC lit fibre optic indicators are to be housed in the case unit. Each transformer is required to supply a single tungsten halogen lamp with a normal rating of 12V 55W. The transformers shall generally comply with BR 924A except as otherwise specified below. Toroidal transformers may be used but must be isolated from induced currents.

- 4.2.2 Each transformer will be supplied from the nominal 110V 50Hz signalling supply.
The input voltage has an overall variation of +10%, -20% on the nominal value and can be expected to vary by $\pm 10\%$ of the value of each tapping within the overall range.
The frequency can be expected to vary by $\pm 4\%$.
- 4.2.3 Each transformer shall have a nominal rating of not less than 60VA and shall be rated for continuous operation supplying 130% nominal power at 110% of the nominal input voltage.
The transformer secondary voltage shall be a nominal 12V with tappings provided as detailed below.
- 4.2.4 Each transformer shall have the following tappings :-
- | | |
|--------------------|-------------------------|
| Input (primary) | 0 / 6 / 86 / 98 / 110V |
| Output (secondary) | 0 / 0.5 / 10 / 11 / 12V |
- 4.2.5 The voltage regulation no load to full load at unity power factor shall not exceed 10%.
The variation in voltage ratio from input to output, for all combinations of inputs and outputs, shall not exceed $\pm 2\%$ or 0.1volt (whichever is greater) from the nominal voltage ratio at the nominal load of 55 watts.
- 4.2.6 The magnetising, primary no load, current shall not exceed 0.1A with 110V 50Hz connected between the 6V and 86V tappings.
- 4.2.7 The construction details for the transformer giving maximum overall size, fixing dimensions and location of the terminal block are given in Appendix 'D'.
The terminal block shall be capable of accommodating conductors of between 0.5 mm and 2.5 mm c.s.a.
The terminal block shall have corrosion resistant clamp type connectors so designed to avoid nicking the conductors.
Suitable terminals are Klippon BK range.
A divider shall be provided between primary and secondary terminals.
- 4.2.8 The transformer shall have a nameplate attached in a conspicuous place and provide the following information :-
- Name of manufacturer and serial number.
Rated VA ; Frequency ; Number of phases
Rated primary voltage
Full load secondary voltage
This specification number, i.e. BR 1651 Part 5
Class of insulation
- The terminals shall be labelled in accordance with BR 924A.

4.3 Internal Wiring

- 4.3.1 Internal wiring to BR Spec 872 type A1 or an equivalent flame retardent insulated cable with minimum c.s.a. 0.65 mm copper.
- 4.3.2 Internal wiring to be terminated with 2BA ring-tongue pre-insulated compression type terminals (PIDG AMP Ltd ref 151730). Joint to conform with BS 4579 Part 1.

4.4 Terminal Blocks

- 4.4.1 Terminal blocks, generally in accordance with Appendix 'C', shall be fitted with two full nuts to BS 57 and two plain washers to BS 3410 to each terminal.
- 4.4.2 Incoming cables shall terminate on the terminal blocks.
- 4.4.3 Terminal blocks shall be positioned so that cables may be run in a tidy manner.
- 4.4.4 Terminals are to be adequately identified and a weatherproof wiring diagram permanently fixed in a suitable position.

5. INDICATIONS

- 5.1 The unit shall be able to display either of two indications :-
 - a) a red rectangular area of light 150 mm x 150 mm.
 - b) a yellow circular area of light 170 mm in diameter.
- 5.2 Graphical layouts of the fibre points are shown in Appendix 'A'.
- 5.3 The red indication comprises 113 fibre points which are to be driven by a single fibre optic harness and the coordinates of each point are as listed in Appendix 'A', Table 1.
- 5.4 The yellow indication comprises 101 fibre points which are to be driven by a single fibre optic harness and the coordinates of each point are listed in Appendix 'A', Table 2.

6. MATRIX

- 6.1 The matrix comprises the two indications side by side on the same plate and must be produced by custom drilling.
- 6.2 The use of standard pre-drilled plates does not allow sufficiently accurate positioning of fibres and is not appropriate.

7. FRONT SCREEN

- 7.1 The front screen of the signal shall be protected by a 3mm thick clear polycarbonate screen.
- 7.2 This should have an anti-glare treatment provided to its outer surface.

8. OPTICS

- 8.1 The positions of the light points are specified in Tables 1 and 2 of Appendix 'A' and shown in Graphs 1 and 2 of Appendix 'A'.
- 8.2 The diameter of the active optical area of each fibre point shall be nominally 4mm.
- 8.3 The average intensity of light points within the harness shall be between 0.6 and 1.0 candelas for the red indication and between 0.9 and 1.5 candelas for the yellow indication.
- 8.4 The coefficient of variation in the luminous intensity between light points on a single harness shall not exceed 20%.
- 8.5 The luminous intensity of each light point must be maintained at above 50% of its on-axis value at all points within 6° of the optical axis indication.
- 8.6 The luminous intensity of each light point must not exceed 1.5 times its on-axis value at any off-axis angle.
- 8.7 The colour of the red indication should conform to specification BR 820 Class RC1 and the colour of the yellow indication should conform to specification BR 820 Class B.
- 8.8 All unused fibre arms are to be blanked off.
- 8.9 The operating temperature is between -20°C and 60°C in accordance with specification BR 967.
- 8.10 When an optical system is operated it must not produce a signal of more than 1/1000 of its normal value in the adjacent system.

9. RANGE

- 9.1 When all the optical requirements specified are met it is expected that the readability range (95% certainty of colour and shape) will be as follows :-
 - a) 125 metres in daylight
 - b) 100 metres at night
- 9.2 The signal shall give a clear indication when viewed at an angle of 45° from a distance of 5 metres.

10. MAINTAINABILITY

- 10.1 The design, construction and layout of the components shall have ease of maintenance as a primary objective.
- 10.2 It shall be possible to change bulbs, measure voltages and clean optical surfaces using one hand without the use of tools.

11. TYPE APPROVAL

- 11.1 The supplier shall submit full details of the offered design for type approval by the Engineer before commencing production.
- 11.2 Any subsequent change to an approved design shall be authorised by the Engineer before introduction.

12. QUALITY ASSURANCE

- 12.1 The contractor shall comply in full with the requirements of this specification and, in addition, shall comply with BRB Supplier Quality Assurance Requirements which includes compliance with BS 5750 Quality Systems.
- 12.2 Where a BR requirement exists for a certificate of conformity to be provided with the goods, a copy is to be forwarded to the BRB QA representative.
- 12.3 For the purposes of this specification, the BRB's responsible QA representative is:-
British Railways Board
Director of S & T. Engineering
Quality Assurance Engineer
Macmillan House
Paddington Station
London W2 1FT
- 12.4 Material supplied against this specification is in classification QA2.

END

TABLE 1 PAGE 1 of 3

CO-ORDINATES OF FIBRE POINTS FOR RED INDICATION

POINT IDENTIFICATION	X CO-ORDINATE mm	Y CO-ORDINATE mm
1	0	0
2	21.4	0
3	42.9	0
4	64.3	0
5	85.7	0
6	107.1	0
7	128.6	0
8	150	0
9	0	150
10	21.4	150
11	42.9	150
12	64.3	150
13	85.7	150
14	107.1	150
15	128.6	150
16	150	150
17	0	21.4
18	0	42.9
19	0	64.3
20	0	85.7
21	0	107.1
22	0	128.6
23	150	21.4
24	150	42.9
25	150	64.3
26	150	85.7
27	150	107.1
28	150	128.6
29	10.7	10.7
30	32.1	10.7
31	53.6	10.7
32	75	10.7
33	96.4	10.7
34	117.9	10.7
35	139.3	10.7
36	10.7	139.3
37	32.1	139.3
38	53.6	139.3
39	75	139.3
40	96.4	139.3

APPENDIX 'A'
Sheet 1 of 8

TABLE 1 PAGE 2 of 3

CO-ORDINATES OF FIBRE POINTS FOR RED INDICATION

POINT IDENTIFICATION	X CO-ORDINATE mm	Y CO-ORDINATE mm
41	117.9	139.3
42	139.3	139.3
43	10.7	32.1
44	10.7	53.6
45	10.7	75
46	10.7	96.4
47	10.7	117.9
48	139.3	32.1
49	139.3	53.6
50	139.3	75
51	139.3	96.4
52	139.3	117.9
53	21.4	21.4
54	42.9	21.4
55	64.3	21.4
56	85.7	21.4
57	107.1	21.4
58	128.6	21.4
59	21.4	128.6
60	42.9	128.6
61	64.3	128.6
62	85.7	128.6
63	107.1	128.6
64	128.6	128.6
65	21.4	42.9
66	21.4	64.3
67	21.4	85.7
68	21.4	107.1
69	128.6	42.9
70	128.6	64.3
71	128.6	85.7
72	128.6	107.1
73	32.1	32.1
74	53.6	32.1
75	75	32.1
76	96.4	32.1
77	117.9	32.1
78	32.1	117.9
79	53.6	117.9
80	75	117.9

TABLE 1 PAGE 3 of 3

CO-ORDINATES OF FIBRE POINTS FOR RED INDICATION

POINT IDENTIFICATION	X CO-ORDINATE mm	Y CO-ORDINATE mm
81	96.4	117.9
82	117.9	117.9
83	32.1	53.6
84	32.1	75
85	32.1	96.4
86	117.9	53.6
87	117.9	75
88	117.9	96.4
89	42.9	42.9
90	64.3	42.9
91	85.7	42.9
92	107.1	42.9
93	42.9	107.1
94	64.3	107.1
95	85.7	107.1
96	107.1	107.1
97	42.9	64.3
98	42.9	85.7
99	107.1	64.3
100	107.1	85.7
101	53.6	53.6
102	75	53.6
103	96.4	53.6
104	53.6	96.4
105	75	96.4
106	96.4	96.4
107	53.6	75
108	96.4	75
109	64.3	64.3
110	85.7	64.3
111	64.3	85.7
112	85.7	85.7
113	75	75

APPENDIX 'A'
Sheet 3 of 8

TABLE 2 PAGE 1 of 3

CO-ORDINATES OF FIBRE POINTS FOR YELLOW INDICATION

POINT IDENTIFICATION	X CO-ORDINATE mm	Y CO-ORDINATE mm
1	170	85
2	168.4	101.6
3	163.5	117.5
4	155.7	132.2
5	145.1	145.1
6	132.2	155.7
7	117.5	163.5
8	101.6	168.4
9	85	170
10	68.4	168.4
11	52.5	163.5
12	37.8	155.7
13	24.9	145.1
14	14.3	132.2
15	6.5	117.5
16	1.6	101.6
17	0	85
18	1.6	68.4
19	6.5	52.5
20	14.3	37.8
21	24.9	24.9
22	37.8	14.3
23	52.5	6.5
24	68.4	1.6
25	85	0
26	101.6	1.6
27	117.5	6.5
28	132.2	14.3
29	145.1	24.9
30	155.7	37.8
31	163.5	52.5
32	168.4	68.4
33	153	85
34	150.7	102.6
35	143.9	119
36	133.1	133.1
37	119	143.9
38	102.6	150.7
39	85	153
40	67.4	150.7

APPENDIX 'A'
Sheet 4 of 8

TABLE 2 PAGE 2 of 3

CO-ORDINATES OF FIBRE POINTS FOR YELLOW INDICATION

POINT IDENTIFICATION	X CO-ORDINATE mm	Y CO-ORDINATE mm
41	51	143.9
42	36.9	133.1
43	26.1	119
44	19.3	102.6
45	17	85
46	19.3	67.4
47	26.1	51
48	36.9	36.9
49	51	26.1
50	67.4	19.3
51	85	17
52	102.6	19.3
53	119	26.1
54	133.1	36.9
55	143.9	51
56	150.7	67.4
57	136	85
58	133.5	100.8
59	126.3	115
60	115	126.3
61	100.8	133.5
62	85	136
63	69.2	133.5
64	55	126.3
65	43.7	115
66	36.5	100.8
67	34	85
68	36.5	69.2
69	43.7	55
70	55	43.7
71	69.2	36.5
72	85	34
73	100.8	36.5
74	115	43.7
75	126.3	55
76	133.5	69.2
77	119	85
78	116.4	98
79	109	109
80	98	116.4

APPENDIX 'A'
Sheet 5 of 8