



BRITISH RAILWAYS BOARD

SPECIFICATION BR 3006

ENVIRONMENTAL SPECIFICATION FOR SOLID STATE INTERLOCKING

EQUIPMENT IN TRACKSIDE LOCATION CASES

PART 1 - ELECTRICAL ENVIRONMENT

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1 SCOPE

This specification relates to the immunity of Solid State Interlocking (SSI) equipment installed in trackside location cases, to electrical interference experienced in a railway environment.

2 OBJECT

The object of the specification is to establish a common and reproducible basis for evaluating the performance of SSI trackside equipment in the presence of electrical interference.

3 GENERAL

3.1 EXPOSURE TO INTERFERENCE

The exposure of equipment to interference is related to the electrical environment in which it is situated. The interference may penetrate the equipment on the electrical boundaries between the equipment and the electrical environment. These boundaries are:

- power supply lines
- input lines
- output lines
- equipment enclosure

3.2 NATURE OF THE INTERFERENCE

A feature of the railway environment is the wide range of amplitudes and frequencies of the electrical interference. The specification covers this wide range by defining a number of test conditions. These test conditions cover:

- Supply frequency interference
- High frequency interference
- Fast transient interference

4 TYPES OF INTERFERENCE

4.1 SUPPLY FREQUENCY INTERFERENCE

This interference originates from equipment power supply lines and from the traction supply in electrified areas. In AC electrified areas the dominant frequency is 50Hz, which may be subject to significant harmonic distortion. In DC electrified areas frequencies of 300Hz, 600Hz, and 1200Hz may be present.

Supply frequency interference is characterised by being of generally constant long-term amplitude at each site, but with extreme short-term variations under load change conditions, or supply change-overs.



4.2 HIGH FREQUENCY BURST INTERFERENCE

This interference originates from transients on the AC traction supply network due to actions such as make/break of pantograph contact or operation of traction unit circuit-breaker. The electrical characteristics of the traction supply network contribute significantly to the nature of this interference.

It is characterised by a sequence of sinusoidal bursts with frequencies up to several hundred kilohertz, each burst decaying over several tens of microseconds, with intervals of about 10 milliseconds (half a cycle of 50Hz AC traction supply) between bursts.

4.3 FAST TRANSIENT IMPULSIVE INTERFERENCE

This interference originates directly or indirectly from transients on the AC traction supply network due to actions such as make/break of pantograph contact or operation of traction unit circuit-breaker. The electrical characteristics of the traction unit contribute significantly to the nature of this interference.

It is characterised by several sequences of impulsive bursts in the MHz frequency region, each burst decaying over several hundred nanoseconds, with intervals of a few microseconds between bursts, and with intervals of about 10 milliseconds (half a cycle of 50Hz AC traction supply) between each sequence of bursts.

5 EQUIPMENT IMMUNITY LEVELS

5.1 SUPPLY FREQUENCY (50HZ) IMMUNITY

5.1.1 INPUT/OUTPUT LINES

The equipment must be immune to induced common-mode voltages with respect to earth up to and including 110V RMS per kilometre length of I/O line on any I/O line or combination of I/O lines.

If an induced common-mode voltage with respect to earth greater than 110V RMS per kilometre length of I/O line, but less than or equal to 440V RMS per kilometre length of I/O line, appears on any I/O line or combination of I/O line, then the equipment will be permitted to adopt a temporary loss of availability.

The equipment must not experience a permanent loss of availability or suffer component damage for any induced common-mode voltage within this range.

5.1.2 POWER SUPPLY TOLERANCE

The equipment must operate with full availability over a range of power supply voltage from 93V to 123V RMS inclusive, and a range of power supply frequency from 48Hz to 52Hz inclusive, with a THD up to and including 10%.

When supplied with power at a nominal voltage of 110V RMS and a nominal frequency of 50Hz, the equipment must operate with full availability in the presence of repeated supply interruptions up



to and including 20 milliseconds duration at intervals greater than 1 second, and up to and including 2 milliseconds duration at intervals greater than 100 milliseconds.

The equipment must not become permanently disabled or suffer component damage for any power supply interruptions irrespective of their duration or frequency, and should enter and re-start from the power-down state in a safe and orderly manner.

5.2 HIGH FREQUENCY (200 KHZ) IMMUNITY

This test shall be carried out using the test generator and capacitive coupling clamp described in International Standard IEC 801-4, with an additional inductor and capacitor connected in parallel between the coupling clamp and ground plane.

Suitable equipment shall be used to examine the voltage waveform on the coupling clamp, and shall verify that with the inductor and capacitor connected, operation of the test generator produces a ringing component at between 100kHz and 300kHz, with a decay time of between 10uS and 100uS for each burst.

An inductor may be constructed by winding approximately 110 turns on a nominal 20mm diameter air-cored former, in which case a capacitor with a nominal value of 4.7nF and suitable high voltage and fast pulse characteristics will be required.

5.2.1 INPUT/OUTPUT LINES

The equipment must be immune to high frequency bursts generated as specified in Section 5.2, and which will be coupled into the I/O lines using the Capacitive Coupling Clamp.

The test generator will be set to generate high frequency bursts, measured at the coupling clamp, of the following severity :-

Initial pk-pk voltage	=	1kV
Burst repetition rate	=	5kHz

The test procedure and result evaluation for each item of equipment shall be as specified in the Type Approval for that equipment.

5.2.2 POWER SUPPLY LINES

The equipment must be immune to high frequency bursts generated as specified in Section 5.2, and which will be coupled into the power supply lines using the Capacitive Coupling Clamp.

The test generator will be set to generate high frequency bursts, measured at the coupling clamp, of the following severity :-

Initial pk-pk voltage	=	1kV
Burst repetition rate	=	5kHz

The test procedure and result evaluation for each item of equipment shall be as specified in the Type Approval for that equipment.



5.3 FAST TRANSIENT IMMUNITY

5.3.1 INPUT/OUTPUT LINES

The equipment must be immune to fast transients of the type characterised in International Standard IEC 801-4, and which will coupled into the I/O lines using the Capacitive Coupling Clamp defined in the standard.

The test generator defined in IEC 801-4 will generate transients of the following severity :-

Test Severity Level	=	4
Test voltage level	=	2kV
Repetition rate	=	2.5kHz

The test procedure and result evaluation for each item of equipment shall be as specified in the Type Approval for that equipment.

5.3.2 POWER SUPPLY LINES

The equipment must be immune to fast transients of the type characterised in International Standard IEC 801-4, and which will coupled into the power supply lines using the Capacitive Coupling Clamp defined in the standard.

The test generator defined in IEC 801-4 will generate transients of the following severity :-

Test severity Level	=	4
Test voltage level	=	4kV
Repetition rate	=	2.5kHz

The test procedure and result evaluation for each item of equipment shall be as specified in the Type Approval for that equipment.