

**TR 2130
Issue C
February 2002**

Environmental Tests for Motorway Communications Equipment and Portable and Permanent Road Traffic Control Equipment

© Crown Copyright 2002

Applications to reproduce this material should be made to The Controller of Her
Majesty's Stationery Office
First published 1991



Printed and published by the Highways Agency

(This page is intentionally left blank)

REGISTRATION OF AMENDMENTS

{PRIVATE }Amend No	Page No	Signature & Date of Incorporation of Amendments	Amend No	Page No	Signature & Date of Incorporation of Amendments

(This page is intentionally left blank)

TR2130C**ENVIRONMENTAL TESTS FOR MOTORWAY
COMMUNICATIONS EQUIPMENT AND
PORTABLE AND PERMANENT ROAD
TRAFFIC CONTROL EQUIPMENT.****Contents****Chapter**

1. Introduction
2. Regulations
3. Environmental Tests for Road Traffic
Signalling Systems
4. Additional Tests for Portable Traffic Signals
5. Additional Test for Motorway Communications
Equipment
6. References
7. History

(This page is intentionally left blank)

1. INTRODUCTION

General

1.1 This specification supersedes TR 2130B, which is withdrawn.

1.2 This specification shall be used in conjunction with BS 7987 (HD 638).

1.3 BS 7987 specifies the environmental test requirements for Road Traffic Signal Systems. "Road traffic signal systems" are defined by BS 7987 to include systems and devices, provided they are affiliated to them in terms of circuitry.

1.4 BS 7987 lists the following elements as examples of equipment included in Road Traffic Signal Systems but indicates that this is not in itself a complete list:

Controllers,

Signal heads, signalling devices and traffic signs,
e.g. signal heads for traffic signals,
acoustic signal generators,
mechanical signal generators,
traffic signs connected to the Road Traffic Signal System

Traffic sensors and detectors,
e.g. request push buttons,
vehicle detectors /pedestrian detectors,

Monitoring equipment,
e.g. photographic monitoring devices,

Equipment Enclosures,

Electrical Supply,

Cables,

Interconnections,

Supports.

1.5 BS 7987 now covers all elements of permanent road traffic signal installations and environmental testing for this class of equipment. It defines environmental tests in terms of the BS EN 60068 series of specifications which covers environmental test methods and defines classes for some tests depending

on the environmental performance required. For traffic control equipment covered by BS 7987 the role of TR 2130 is reduced to specifying the appropriate class for each test.

Scope

1.6 This specification applies to all traffic control equipment including portable traffic signal equipment and motorway communications equipment installed on site. For portable equipment and motorway communication equipment (which are not covered by BS 7987) this specification defines additional tests appropriate to the environmental conditions experienced by that equipment.

Implementation

1.7 This specification will be immediately implemented from the date of issue. All new submissions of equipment for approval will require environmental testing to this specification.

2. REGULATIONS

2.1 The product shall comply with all relevant statutes in force at the time of supply, and particular attention is drawn to those implementing European Directives.

is performed by the Department for Regional Development.

2.2 Any requirement of the specification for goods or materials must be made in accordance with the general introduction and clauses 104 and 105 of Volume 1 of the Specification for Highways Works.

Approval

2.3 Equipment manufactured to this Standard will require to be Statutory Type Approved (hereafter referred to as Approval) before it may be operated on public roads within the United Kingdom.

Procedures for Statutory Type Approval

2.4 Details of the Approval procedure may be found in Highways Agency standard TRG 0500.

2.5 TRG 0500 details the relationship between the UK Approval and EC Standards Certification.

2.6 Any anomalies or interpretation of requirements of this standard must be resolved with the Approval Authority.

Applications for Approval

2.7 Applications for Approval of equipment or any queries regarding such Approval should be addressed to:

Traffic Systems and Signing Division
Highways Agency
Temple Quay House
2, The Square
Temple Quay
Bristol
BS1 6HA
England

Authorisation

2.8 In the UK, apart from Northern Ireland, any symbols to be displayed on a signal or sign that are not prescribed in the TSR&GD are authorised by the Department for Transport, Local Government and the Regions (DTLR). In Northern Ireland a similar function

3. ENVIRONMENTAL TESTS FOR ROAD TRAFFIC SIGNALLING SYSTEMS

General

3.1 The test methods and parameters for road traffic signal systems are set out in BS 7987 clause 11. These tests are potentially relevant to all equipment covered by this specification.

Dry Heat

3.2 Dry Heat test should be carried out in accordance with BS 7987 Class AB3 (60°C)

Cold

3.3 Cold test should be carried out in accordance with BS 7987 Class AE2 (-15°C)

Change of Temperature

3.4 As defined in BS 7987 Clause 11 (as an alternative to the Dry Heat and Cold tests)

Damp Heat

3.5 Damp Heat test should be carried out in accordance with BS 7987 Class AK2 (2 cycles)

Solar Radiation

3.6 The heating effect of solar radiation is normally taken into account by carrying out the Dry Heat test as specified above. The Solar Radiation test defined in BS 7987 may be carried out as an alternative for equipment which is exposed to solar radiation in which case the Dry Heat test is not required.

Water Penetration

3.7 As specified in BS 7987 (to meet the required IP rating)

Random Vibration

3.8 This test is included to simulate the mechanical hazards experienced by an equipment during

transportation by road. This test should be carried out in accordance with BS 7987 Class AJ2 (2 hours)

EMC Test

3.9 An EMC test should be carried out in accordance with BS 7987 for equipment which may emit or may be susceptible to electromagnetic radiation

Impact for Equipment Enclosure

3.10 Impact test should be carried out in accordance with BS 7987 for the enclosures of equipment.

Impact for Signal Heads

3.11 Impact test for signal heads should be carried out in accordance with BS 7987 Class AC2 (0.51kg ball of 50mm diameter dropped from 0.4m)

4. ADDITIONAL TESTS FOR PORTABLE TRAFFIC SIGNALS

General

dimension in the vertical – with the agreement of the Authority)

4.1 These tests are required for Portable Traffic Signal Equipment in addition to those required for Road Traffic Control Systems as set out in BS 7987.

State of the specimen during conditioning:

Non-operating

Immersion

Intermediate

Measurements:

None

4.2 This test is normally only to be carried out on sealed equipments (e.g. above ground detectors). The immersion test may not simulate the actual environment but is considered to be a simple, realistic method for determining if the equipment leaks. The test is intended to simulate the conditions where equipment may be situated in a water filled ditch for considerable periods of time.

Recovery:

Removal of surface water.

Final measurements:

Visual inspection including quantification of amount of water (if any) found inside, and if possible the point(s) of entry
Function test to specification

4.3 The test shall be carried out in accordance with BS EN 60068-2-18 Test R, test method Rc1.

Shock

4.4 The information required by BS EN 60068 to define this test is:

4.5 This test is applicable normally only to the detector of portable traffic signalling equipment when tested separately. In this case it should be mounted to the shock test jig in a similar manner to that in which it is secured to the signal head.

Water: Tap Water

Severity: Head of Water: 0.15m
(measured from uppermost part of equipment)
Duration 12 hours

4.6 If a detector is submitted for test as part of a system, this shock test would not be performed. The complete signal, including the detector should be toppled over (see Drop and Topple test).

Pre-conditioning: The temperature of the water shall be measured. The equipment shall be pre-heated to a temperature 30° above the water temperature for a period of 4 hours.

4.7 The test shall be carried out in accordance with BS EN 60068 – 2-27 Test Ea

4.8 The information required by BS EN 60068 to define this test is:

Initial Measurements: Visual inspection and function test to specification prior to pre-conditioning.

Pulse shape:

Half sine

Tolerances, special cases

Not applicable

Velocity changes, special cases

Not applicable

Mounting of specimens: Normal operating attitude
(If the vertical dimension is greater than either of the other two dimensions, the equipment may be tested with the shortest

Transverse motion, special cases

Not applicable

Method of mounting	Rigidly fixed to the shock machine by its normal means of attachment	The height of drop on to a face	50mm
Severity	4000m/s ² ; 2ms duration	The height of drop on to a corner	50mm
Pre-conditioning	None	Final measurements	Visual inspection after each drop and topple. Function test to specification at completion of all drops and topples
Initial measurements	Visual inspection and function test to specification		
Direction and number of shocks in special cases only	Not applicable	Free Fall	
Operating modes and functional monitoring	Equipment switched off	4.11 This test is intended to simulate handling of the equipment on site. It should be applied to equipment as delivered on site – unpackaged, with detectors fitted.	
Acceptance and rejection criteria	The equipment shall withstand the shocks and shall function to specification at the end of the test	4.12 The test shall be carried out in accordance with BS EN 60068-2-32 Test Ed, Procedure 1 – Free Fall.	
Recovery	Not applicable	4.13 The information required by BS EN 60068 to define this test is:	
Final measurements	Visual inspection and function test to specification	Test surface if other than concrete or steel	--
High frequency cut-off	Not applicable	Height of fall	1000mm
Drop and Topple		Initial measurements	Visual inspection and function test to specification
4.9	The test shall be carried out in accordance with BS EN 60068-2-31 Test R, test method Ec.	Attitude from which the specimen is to be dropped	The equipment shall be dropped such that it impacts in turn on to:
4.10	The information required by BS EN 60068 to define this test is:		i) Each top corner ii) Top rear edge
Initial measurements	Visual inspection and function test to specification	Number of falls, if other than two	--
Conditioning procedure	Tested unpackaged	Bump	
Fitting of cables, covers, etc	As handled at site. Covers fitted, cables not fitted	4.14 This test is included to simulate the shocks experiences by an equipment during transportation by road. Portable Traffic Signal equipment shall be tested unpackaged.	
Whether the specimen is operational or not during the test	Not operating	4.15 The test shall be carried out in accordance with BS EN 60068-2-29 Test Eb.	
Edges to be used in the test where there are more than four bottom edges	Bottom edges only All edges for which the test is practicable. If more than four, select the worst case four	4.16 The information required by BS EN 60068 to define this test is:	

Tolerances, special cases	Not applicable	4.18 The ability to met this requirement shall be demonstrated by testing (such as a wind tunnel test) or by a calculation agreed with the Authority.
Velocity changes, special cases	Not applicable	
Transverse motion, special cases	Not applicable	
Method of mounting	The equipment shall be fixed as rigidly as as possible to the Bump Table by appropriate means	
Severity	100m/s ² peak acceleration; 16ms duration; 1000 bumps, see *	
Pre-conditioning	Not applicable	
Initial measurements	Visual inspection and functional test to specification	
*Direction and number of bumps in special cases only	1000 bumps in what is considered to be the the most vulnerable direction(s) as agreed with the Authority	
Operating modes and Functional monitoring	Non operating. Survival only – see “Final Measurements”	
Acceptance and rejection Criteria	see “Final Measurements”	
Recovery	Not applicable	
Final Measurements	Visual inspection and function test to specification on completion of conditioning work.	

Wind

4.17 The portable equipment when mounted on its support as for use id required to withstand a wind force of up to 26m/s without toppling over or sustaining damage.

5. ADDITIONAL TEST FOR MOTORWAY COMMUNICATIONS EQUIPMENT

General	Tolerances at Check points:	Normally +/- 25%. Any frequency at which this tolerance is exceeded shall be stated in the test report.
5.1 This test is required for Motorway Communications Equipment which is to be installed on site in addition to those required for Road Traffic Control Systems as set out in BS 7987.	Mounting of Specimen(s):	The equipment shall be rigidly mounted in a jig designed to transmit the input vibration with minimum modification should represent, as closely as possible, the method used in practice and should be agreed with the Authority prior to commencement of test. If the equipment is normally mounted in a cabinet then the cabinet is the preferred option as a jig for the test.
Vibration, Random, Operational		
5.2 Vibration which is experienced during transportation is tested under the requirements of BS 7987. Equipment which is installed in the operational environment will be subject to different types of vibration. Random vibration spectra have been derived from measurements taken at a number of motorway sites which have been analysed and factored for life testing.	Frequency range:	5-500 Hz
5.3 The test shall be carried out in accordance with BS EN 60068-2-6 Test Fc.	ASD Spectrum Levels:	Lateral and Fore/Aft axes Frequency Level (Hz) (g ² /Hz) 5 9.50E-06 10-15 2.62E-04 25-48 1.57E-05 54-176 7.40E-06 205-450 1.22E-04 465 1.57E-03 500 8.84E-05 Overall RMS acceleration 2.48E-01g
5.4 The information required by BS EN 60068 to define this test is:		
Measuring points:	The position of the reference points and any other check/control points shall be agreed with the Authority prior to the commencement of test.	
Transverse motion:	Any transverse motion in excess of 50% shall be measured and stated in the test report.	Vertical axis Frequency Level (Hz) (g ² /Hz) 5 1.77E-04 8-15 1.31E-03 32 2.34E-05 197 1.58E-06 215 7.53E-06 315 1.73E-05 436 5.09E-06 464 8.66E-05 500 1.94E-05 Overall RMS acceleration 1.488E-01g
Distortion:	Distortion shall be kept below 25%, using a Tracking Filter, where necessary, to achieve this.	
Derivation of control signals:	Multipoint control using the averaged value of the signal at the check points is preferred.	

Duration of Condition:	2 Hours in each of three axes	Bump	
Reproducibility:	Low	5.7 This test is included to simulate the shocks experiences by an equipment during transportation by road. Equipment supplied packaged shall be packaged for this test.	
Initial Measurements:	Visual inspection and function test to specification.	5.8 The test shall be carried out in accordance with BS EN 60068-2-29 Test Eb.	
Functioning During Conditioning:	Equipment on and functioning to specification.	5.9 The information required by BS EN 60068 to define this test is:	
Final Measurements:	Visual inspection and function test to specification.	Tolerances, special cases	Not applicable
Drop and Topple		Velocity changes, special cases	Not applicable
5.5	The test shall be carried out in accordance with BS EN 60068-2-31 Test R, test method Ec.	Transverse motion, special cases	Not applicable
5.6	The information required by BS EN 60068 to define this test is:	Method of mounting	The equipment or package shall be fixed as rigidly as as possible to the Bump Table by appropriate means
Initial measurements	Visual inspection and function test to specification	Severity	100m/s ² peak acceleration; 16ms duration; 1000 bumps, see *
Conditioning procedure	Tested in its transport package	Pre-conditioning	Not applicable
Fitting of cables, covers, etc	Packaged for transport	Initial measurements	Visual inspection and functional test to specification before packaging
Whether the specimen is operational or not during the test	Not operating	*Direction and number of bumps in special cases only	1000 bumps in each of the three major mutually perpendicular axes (ie 3000 bumps total).
Edges to be used in the test where there are more than four bottom edges	All edges of the packages except for any packaging having a dimension greater than 1 metre and clearly labelled for handling purposes – bottom edges only.	Operating modes and Functional monitoring	Non operating. Survival only – see “Final Measurements”
The height of drop on to a face	100mm	Acceptance and rejection Criteria	see “Final Measurements”
The height of drop on to a corner	100mm	Recovery	Not applicable
Final measurements	Visual inspection and function test to specification on removal from package at completion of test.		

Final Measurements Visual inspection and function test to specification on completion of conditioning work and removal from packaging.

Pressure coefficients and force coefficients (paragraph 7) are applied, considering the size and shape of the equipment and the type of materials used. Loads can then be applied to the relevant points on the equipment.

Wind

5.10 The equipment, when erected, complete with associated units, shall be capable of withstanding, without damage, wind velocities of up to 46m/s from any direction. (Resistance to wind speeds up to 52m/s may be required by the Authority for equipment installed outside England)

5.11 Acceptance that the equipment can withstand the above requirement can be shown by carrying out one or more of the three procedures given below. Normally an acceptable calculated justification will suffice, but if considered necessary by the Authority, the Static Loading /test or /wind Tunnel test may be specified.

Wind Tunnel Test

5.12 No specific test available but wind tunnel testing can be carried out to verify the design.

5.13 The equipment shall be securely erected in the wind tunnel and the air velocity shall be increased to the required level (46 or 52m/s). This velocity shall be maintained for 5 minutes and then reduced to zero.

5.14 The test shall be carried out in the worst case orientation and any other orientation required by the Authority.

Static Loading Test

5.15 An alternative to the wind tunnel test is to carry out a static loading test in accordance with CP3 Chapter V – Part 2.

5.16 From paragraph 5, the Basic Wind Speed (46m/s) is converted into the Design Wind Speed by applying one or more factors; topography, ground roughness, size of equipment, height above ground and statistical.

5.17 From paragraph 6, the Dynamic Pressure of the wind is obtained. The susceptible surface areas and their centroids are then calculated to give the force to be applied to that surface.

5.18 n It is emphasised that the Code of Practice upon which this work is based is primarily intended for the design of buildings. Because of this, the calculations, which are based on the size shape and construction materials of a building and the topography of its location may be difficult to make and some broad interpretation may be necessary. In order to achieve some consistency of performance, the calculations should be agreed with the Authority prior to testing.

Calculated Justification

5.19 With the agreement of the Authority, having calculated loads and directions of application as for the Static Loading Test, the loading test can be substituted by a justification based upon stress analysis.

6. REFERENCES

Normative References

6.1 This specification incorporates by dated and undated reference, provisions from other publications. These are cited in the text where appropriate and listed below for reference. Where the reference is undated the latest edition of the publication referred to applies.

British Standards

6.2 British Standards are published by the British Standards Institution, London.

BS 7671	IEE Wiring Regulations
BS 7987	(HD638) Road Traffic Signal Systems
BS EN 12368	Traffic Control Equipment - Signal Heads
BS EN 12675	Controllers for Traffic Signals
BS EN 50293	EMC
BS EN 60068	Environmental testing
BS EN 60529	Degrees of Protection Provided by Enclosures

Specifications

TRG 0500 Statutory Approval of equipment for the control of Vehicular and Pedestrian Traffic on Roads

6.3 Specifications are available from The Highways Agency
Contact: +44 (0) 117 372 8300 tss_plans_registry@highways.gsi.gov.uk

Other Documents

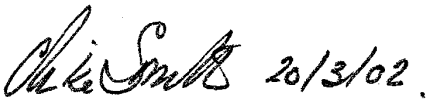
Traffic Signs Regulations and General Directions (The Stationery Office)
BS Code of Practice CP3 Code of basic data for the design of buildings, Chapter V, Loading, Part 2 – Wind Loads

7. HISTORY

TR 2130A November 1991
TR 2130B May 1993
TR 2130C March 2002

Approval of this document for publication is given by the undersigned:

Traffic Control Systems & Lighting
Highways Agency
Temple Quay House
2 The Square
Temple Quay
Bristol
BS1 6HA

 20/3/02.
M.J. SMITH
Team Manager
Traffic Control Systems & Lighting