BRITISH STANDARD

BS 6102-3:1986

Incorporating Amendment Nos. 1, 2 and 3

Cycles —

Part 3: Specification for photometric and physical requirements of lighting equipment

ICS 43.150

BSI British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee GME/25, Cycles, upon which the following bodies were represented:

Association of Cycle Traders

Association of Consulting Scientists

Bicycle Association of Great Britain

British Cycling Federation

British Retail Consortium

British Rubber Manufacturers' Association Ltd

Consumer Policy Committee of BSI

Cyclists Touring Club

DfT — (DTLR — Central Transport Group)

Royal Society for the Prevention of Accidents

Co-opted

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Contents

Foreword

This Part of BS 6102 has been prepared by Technical Committee GME/25, Cycles. This standard follows the presentation and, to a large extent, the technical content of the corresponding international standard ISO 6742-1, *Cycles — Lighting and retro-reflective devices — Photometric and physical requirements — Part 1: Lighting equipment*, published by the International Organization for Standardization (ISO). The differences are as follows.

a) *Luminous intensity of the headlamp.* The luminous intensity requirements of ISO 6742-1 have been adopted, but additional test points have been specified above the horizontal plane in compliance with the marker light requirements of the Department of Transport.

b) *Colour of light from headlamp.* The selective yellow light, permitted by ISO 6742-1 as an alternative to a white light, has not been included.

c) *Luminous intensity of the rear lamp.* Higher luminous intensity requirements than those given in ISO 6742-1 have been specified over the whole range of test points, and additional test points at 5° from the vertical and horizontal planes have been included.

The vertical cone of light from the rear lamp has been restricted to the forward sector of the cone.

d) *Instructions.* Instructions are required to be supplied with all types of lamp.

This standard supersedes British Standard AU 155 which is withdrawn.

This standard also replaces BS 3648 as the current British Standard for cycle rear lamps, but because BS 3648 is referred to in UK legislation, it will not be withdrawn until such time as the Department of Transport indicates that it no longer applies to cycle rear lamps for regulatory purposes.

BS 6102-1 specifies safety requirements for bicycles.

BS 6102-2 specifies requirements for reflective devices for cycles.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 11 and a back cover.

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Sidelining in this document indicates the most recent changes by amendment.

Introduction

This Part of BS 6102 has been prepared in order to specify photometric and physical requirements for lighting equipment for cycles intended for use on public roads.

The provision of such equipment is intended to make other road users aware of the presence of cyclists, especially under conditions of poor visibility or at night. In addition, headlamps made in conformity with the requirements of this British Standard will provide sufficient lighting to enable cyclists at night to detect road conditions immediately ahead and, if necessary, to take action to avoid potential hazards.

It has been assumed, for the purposes of this standard, that the headlamp is mounted in the usual position on the headtube of a cycle, and that the beam centre will strike the road at a distance of about 16 m in front of the lamp, hence the positioning of point A in Figure 2 at 3.5° below the horizontal plane. This distance equates with the braking distance under wet conditions specified in BS 6102-1, plus an allowance for the rider's perception and reaction time.

Appendix A describes a suitable vibration test machine.

1 Scope

This Part of BS 6102 specifies photometric and physical requirements, methods of test, and marking requirements for lighting equipment for cycles.

2 Field of application

This Part of BS 6102 applies to lighting equipment for use on cycles intended to be used on public roads and, in particular, for use on bicycles complying with BS 6102-1.

3 References

BS 397, *Primary batteries*.

BS 5101, *Lamp caps and holders together with gauges for the control of interchangeability and safety*.

BS 5466, *Methods for corrosion testing of metallic coatings*.

BS 5466-1, *Neutral salt spray test (NSS test)*.

BS 5932, *Specification for sealed nickel-cadmium cylindrical rechargeable single cells*.

BS 6102, *Cycles*.

BS 6102-1, *Specification for safety requirements for bicycles*.

Reference deleted

CIE Publication No. 15 Colorimetry: Official recommendations of the International Commission on Illumination (CIE) 1971[1)].

4 Definitions

For the purposes of this Part of BS 6102, the following definitions apply.

4.1
cycle
any vehicle that has at least two wheels and is propelled solely by the muscular energy of the person on that vehicle, in particular by means of pedals

4.2
bicycle
a two-wheeled cycle

[1)] Available from the National Illumination Committee of Great Britain, The Library, Thorn EMI Lighting Co Ltd., Great Cambridge Road, Enfield, Middx EN1 1UL.

4.3
headlamp
a lamp that shows a white light to the front of the cycle to indicate its presence on the road and also to provide additional illumination of the road ahead

4.4
rear lamp
a lamp that shows a red light to the rear of a cycle and serves to indicate its presence

4.5
filament lamp
a lamp in which light is produced by means of an element heated to incandescence by the passage of an electric current

4.6
axis of reference
the characteristic horizontal axis of the lamp, as determined by the manufacturer to serve as a direction of reference during use in service and during test measurements. See Figure 1

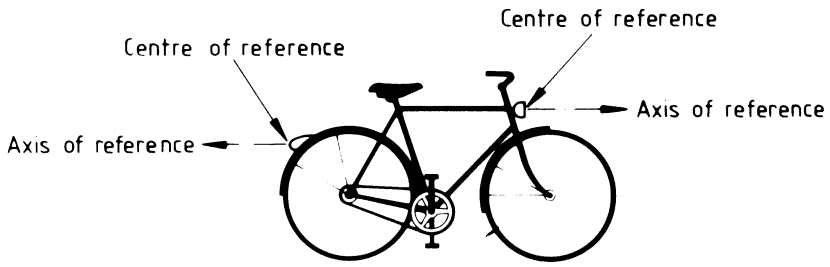


Figure 1 — Axis and centre of reference

4.7
centre of reference
the intersection of the axis of reference with the light output surface of the lamp. See Figure 1

4.8
beam centre
as viewed on the test screen the beam centre is the area at the centre of the light pattern whose intensity is not less than 80 % of the maximum intensity ($I_{max.}$) of the beam

4.9
rated voltage
the voltage marked on the light source of the unit for test

4.10
unit for test
a complete unit, including the requisite electrical supply

Definition deleted

4.11
system
comprises a headlamp, a rear lamp, a battery pack and/or generator and interconnecting cable

5 Photometric requirements for headlamps

5.1 Luminous intensity

5.1.1 *Values of luminous intensity.* The minimum luminous intensity values of the beam at the test points shown in Figure 2 shall be as follows:

at point A : 400 cd or 0.8 $I_{max.}$ whichever is the greater;
at points B : 0.5 $I_{max.}$;
at point C : 11.5 cd;
at points E : 3.5 cd;
at points F : 1.5 cd.

The luminous intensity shall be not less than 0.5 $I_{max.}$ at any position within the area bounded by points B on plane V, and points B on 3.5°D.

The luminous intensity shall be not less than 0.05 cd at any position within the area between 15 °U and 15 °D, and 80 °L and 80 °R.

The luminous intensity shall not exceed 70 cd at any position above plane H.

5.1.2 *Unit for test.* The headlamp shall be fitted with the light source specified by the manufacturer. The light source shall be operated at the voltage specified by the manufacturer.

5.1.3 *Test measurement.* Measurements of luminous intensity shall be made using a test distance sufficiently large for the inverse square law to be effective.

The centre of reference of the lamp as defined in **4.7** shall be used as the light source.

The receptor shall subtend an angle of not less than 10′ and of not more than 1° at the centre of reference of the lamp.

For test measurements, the point A in Figure 2 shall lie within the beam centre. At all points other than the beam centre a geometric tolerance of 15′ is permissible.

The photometer shall have a response that is linear, and measurements shall be corrected to the CIE Standard Colorimetric Observer for photopic vision, CIE Publication No. 15.

5.2 Colour of light from headlamp

5.2.1 *Uncoloured light.* The colour of the light shall be located within the area on the chromaticity diagram defined by the following CIE chromaticity co-ordinates.

x	0.285	0.453	0.500	0.500	0.440	0.285
y	0.332	0.440	0.440	0.382	0.382	0.264

5.2.2 *Visual comparison.* For checking visually the colorimetric characteristics of the light emitted, a source of light approximating to Illuminant A, as defined by CIE Publication No. 15, in combination with appropriate filters, shall be used for the comparison field of the colorimeter.

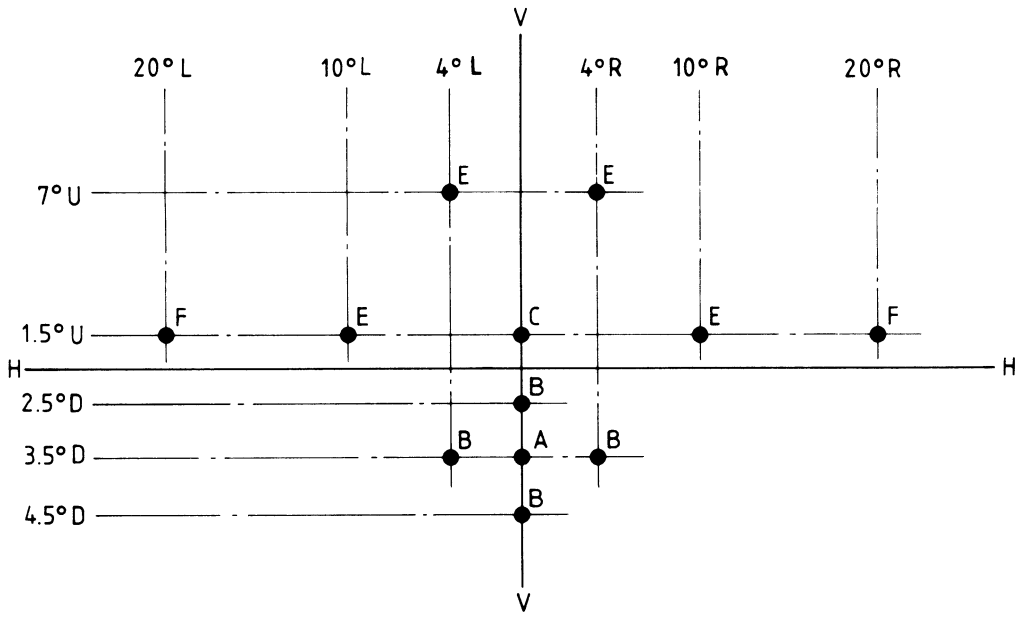
6 Photometric requirements for rear lamps

6.1 Luminous intensity

6.1.1 *Values of luminous intensity*

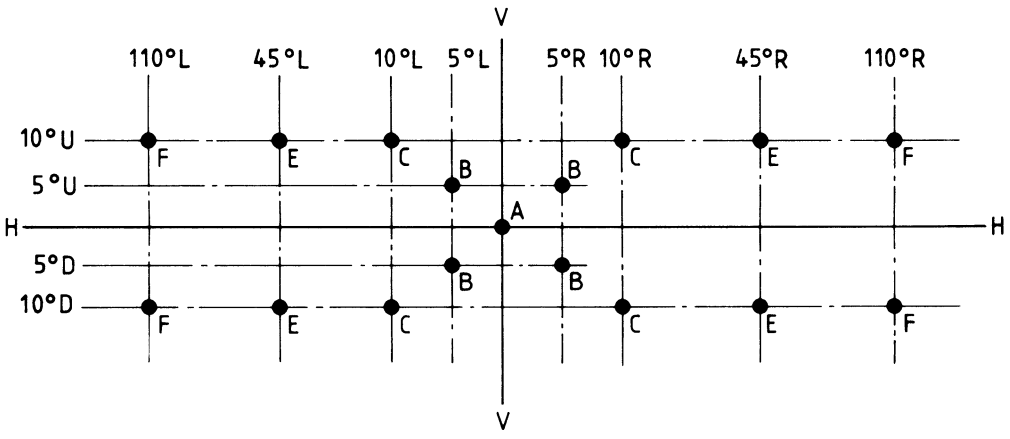
6.1.1.1 The minimum luminous intensity values of the beam at the test points shown in Figure 3, and between points at which the same intensities are required shall be as follows:

at point A : 4 cd;
at points B : 2 cd;
at points C : 0.25 cd;
at points E : 0.075 cd;
at points F : 0.025 cd.



Key
H represents the horizontal plane through the axis of reference;
V represents the vertical plane through the axis of reference;
U and D represent the degrees of arc, respectively, above and below the horizontal plane;
L and R represent the degrees of arc, respectively, to the left and right of the vertical plane.

Figure 2 — Location of test points for headlamps



Key
H represents the horizontal plane through the axis of reference;
V represents the vertical plane through the axis of reference;
A is the point of intersection of planes H and V on the screen;
U and D represent the degrees of arc, respectively, above and below the horizontal plane;
L and R represent the degrees of arc, respectively, to the left and right of the vertical plane.

Figure 3 — Location of test points for rear lamps

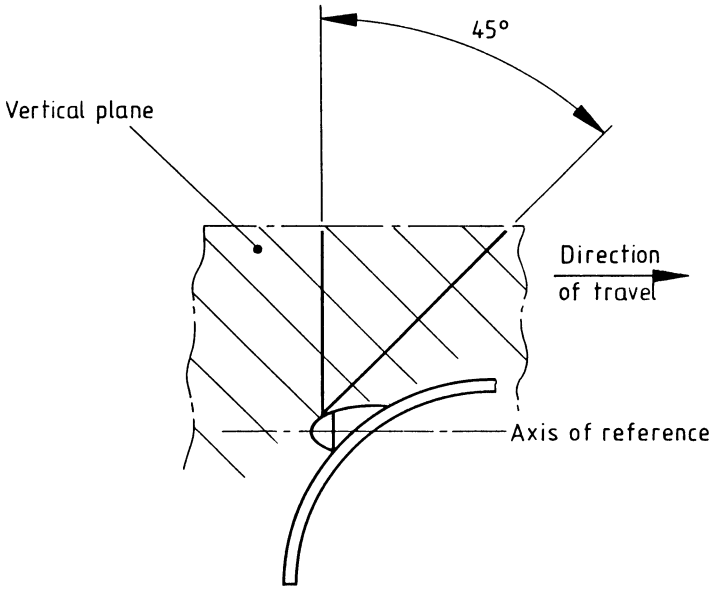


Figure 4 — Indicator light from rear lamp

6.1.1.2 The lamp shall have a visual indicator at the top that emits red light of an intensity not less than 0.02 cd along a line of sight lying on a vertical plane through the axis of reference, at any position between a vertical line and a line at 45° to the vertical, in the direction of travel (see Figure 4).

6.1.2 *Unit for test.* The rear lamp shall be fitted with the light source specified by the manufacturer. The light source shall be operated at the voltage specified by the manufacturer.

6.1.3 *Test measurements.* Measurements of luminous intensity shall be made using a test distance sufficiently large for the inverse square law to be effective.

The centre of reference of the lamp as defined in **4.7** shall be used as the light source.

The receptor shall subtend an angle of not less than 10′ and of not more than 1° at the centre of reference of the lamp.

For test measurements, the point A in Figure 3 shall lie within the beam centre. At all points other than the beam centre a geometric tolerance of 15′ is permissible.

The photometer shall have a response that is linear, and measurements shall be corrected to the CIE Standard Colorimetric Observer for photopic vision, CIE Publication No. 15.

6.2 Colour of light from rear lamp

6.2.1 *Red light.* The colour of the light shall be located within the area on the chromaticity diagram defined by the following CIE chromaticity co-ordinates.

x	0.645	0.665	0.735	0.721
y	0.335	0.335	0.265	0.259

6.2.2 *Visual comparison.* For checking visually the colorimetric characteristics of the light emitted, a source of light approximating to Illuminant A, as defined by CIE Publication No. 15, in combination with appropriate filters, shall be used for the comparison field of the colorimeter.

7 Generators

7.1 Output characteristics

The voltage output shall be in accordance with the values specified in Table 1 when the generator is tested against a fixed non-inductive resistive load calculated from the nominal load in the manufacturer's electrical system where it is specified to be used.

A low consumption voltmeter giving the true r.m.s. value shall be used. The resistance of the voltmeter shall be included in the fixed resistive load.

Table 1 — Output characteristics

Road speed	**Voltage output as % of rated voltage**	
	Minimum	**Maximum**
km/h	%	%
5	50	117
15	85	117
30	95	117

7.2 Maintenance of generator output

When operated continuously for 1 h at a speed equivalent to 15 km/h and against the fixed resistive load as calculated, the voltage shall not drop below 85 % of the rated voltage.

8 Batteries

8.1 Primary batteries

8.1.1 *Specification.* Batteries shall comply with the requirements of BS 397.

8.1.2 *Maintenance of luminous intensity*

8.1.2.1 *Headlamp.* After having been subjected to the test in **8.1.3**, the luminous intensity at test point A shall be not less than 100 cd, when the final measured voltage is applied to the lamp.

If the lamp fails to meet the final luminous intensity requirement, repeat the test once more using fresh batteries and a new light source. If the result of the second test is satisfactory, the lamp is deemed to have met the requirement.

8.1.2.2 *Rear lamp.* After having been subjected to the test in **8.1.3**, the luminous intensity at test point A shall be not less than 22 % of the initial luminous intensity as measured at this point in the test in **6.1**, when the final measured voltage is applied to the lamp.

If the lamp fails to meet the final luminous intensity requirement, repeat the test once more using fresh batteries and a new light source. If the result of the second test is satisfactory, the lamp is deemed to have met the requirement.

8.1.3 *Method of test.* Fit the unit to be tested with the light source specified by the manufacturer, and with fresh batteries (i.e. within 4 weeks of their date of manufacture).

Carry out the test at a temperature of 20 ± 2 °C and a relative humidity of 60 ± 15 %.

Operate the lamp on full load (i.e. including any additional light units, where appropriate) for 30 min continuously, once per day for 5 consecutive days per week, for 4 weeks (i.e. a total of 10 h operation).

Measure the voltage on full load at the end of this period, and verify the luminous intensity using this voltage.

If a filament lamp fails during the test, replace it with a new one, and continue the test. If a filament lamp fails for a second time, the test is discontinued at that point.

8.2 Secondary batteries

8.2.1 *Specification.* Nickel-cadmium batteries shall comply with the requirements of BS 5932.

NOTE There is as yet no standard for other types of suitable secondary batteries.

8.2.2 *Maintenance of luminous intensity*

8.2.2.1 *Headlamps.* After having been subjected to the test in **8.2.3** the luminous intensities shall be not less than that required under **5.1.1**, when the final measured voltage is applied to the lamp or, if the headlamp is part of a system, to the system.

8.2.2.2 *Rear lamp.* After having been subjected to the test in **8.2.3** the luminous intensities shall be not less than that required under **6.1.1**, when the final measured voltage is applied to the lamp or, if the rear lamp is part of a system, to the system.

8.2.3 *Method of test*

NOTE Where the unit is part of a system, for “unit” read “system”.

Charge the battery in accordance with the instructions supplied with the unit.

Measure the voltage on full load. Operate the unit until this voltage falls to 75 % of the initial voltage.

Recharge the battery in accordance with the instructions. Leave the unit for 24 h to 30 h in a temperature of 20 ± 2 °C.

Operate the unit for the maximum duration period claimed by the manufacturer as marked on the unit (see **11.3**) in an ambient temperature of 20 ± 2 °C.

Measure the voltage on full load at the end of this period and verify the luminous intensity using this voltage.

9 Switch performance

9.1 Requirements

The action of the switch shall be positive. The on and off operation shall be definite. Operation of this switch shall not cause battery movement. The lamp shall show no visible evidence of flickering when switched to either the on or off position, or in the case of a screw type, when the switch is fully in or out.

9.2 Method of test

The switch shall be tested by making and breaking the circuit 5 000 times under rated voltage conditions. If the battery should fail (e.g. by breakage of the contact strip) it shall be replaced and the test continued. The switch shall still comply with the requirements of **9.1** after the test.

10 Environmental tests

10.1 General

Units shall be tested complete with fittings as recommended by the manufacturer to enable them to be secured in an appropriate manner to a cycle.

Battery lamps shall be tested with the battery in position.

Unless otherwise specified all tests shall be carried out at an ambient temperature of 23 ± 5 °C.

10.2 Vibration resistance test for head and rear lamps

10.2.1 *Requirements.* When tested by the method in **10.2.2** the lamp shall not become loose or detached from its mounting during the test.

After the test the unit shall function correctly and shall not show evidence of material weakness or displacement of parts. For checking the performance after the test, a filament lamp shall be replaced if the filament in the lamp is broken and, if necessary, the battery shall also be replaced. Loosening, or other failure, of the light source shall constitute failure of the unit.

10.2.2 ***Method of test***

10.2.2.1 *Principle.* A unit is mounted to simulate its intended mounting on a cycle and subjected to repetitive vibration to simulate in an accelerated time-scale the use of a cycle on the road.

10.2.2.2 *Apparatus.* A vibration test machine is shown in Appendix A, and with the following characteristics.

The table of the vibration test machine shall be spring mounted at one end and fitted with steel caulks on the underside of the other end. The caulks shall make contact with a steel anvil once during each cycle, at the completion of the fall of the table. The load at the point of contact shall be not less than 265 N and not more than 310 N and shall be provided by means of adjustable tension springs positioned between the cam and the spring-mounted end of the table. The unit shall be secured to a solid concrete base of 150 mm minimum thickness.

10.2.2.3 *Procedure.* Mount the unit in the manner in which it is designed to be fitted to a cycle. Fasten the assembly to a vibration test machine in a position similar to its normal operating position. Vibrate the assembly for 1 h at 750 ± 5 cycles per minute through a distance of 3 mm.

10.3 Temperature test for head and rear lamps

10.3.1 *Requirements.* When tested by the method in **10.3.2** each headlamp and rear lamp shall function correctly and shall comply with the appropriate photometric requirements of clauses **5** and **6**.

10.3.2 *Method of test.* Place the headlamp or rear lamp in a pre-heated oven at 50^{+5}_{-0} °C for 2 h.

Remove the headlamp or rear lamp into ambient conditions.

Remove the light source (when possible) and clean it by wiping (to remove any deposits arising from exposure to an elevated temperature).

Dry the light source and reassemble it into the unit. Do not touch the light emitting surfaces.

Operate the headlamp or rear lamp at 117 % of the rated voltage in its normal operating position for 1 h.

10.4 Temperature test for generator

10.4.1 *Requirements.* When tested by the method in **10.4.2** the generator shall function correctly and, when operated at a speed equivalent to 15 km/h, shall comply with the requirements in **7.1** and Table 1.

10.4.2 *Method of test.* Place the generator in a preheated oven at 50^{+5}_{-0} °C for 2 h.

Remove the generator from the oven into ambient conditions until equilibrium is reached.

10.5 Moisture resistance test for lamps and generator

10.5.1 *Requirements.* After being subjected to the test in **10.5.2** the unit shall function correctly and there shall be no deleterious retention of moisture.

10.5.2 ***Method of test***

10.5.2.1 *Apparatus.* A water spray cabinet, containing a revolving mount for the unit, meeting the following requirements.

The revolving mount for the unit under test shall revolve about a vertical axis at a rate of 4 r/min.

Water at 20 ± 10 °C shall be sprayed onto the mounted unit at an angle of 45°, directed downwards, at a precipitation rate of 2.5 mm/min.

10.5.2.2 *Procedure.* Mount the unit in its normal operating position on the revolving mount, and ensure that all drain holes (if any) are open.

Spray and revolve the unit for 6 h continuously.

At the end of this period allow the unit to drain for 1 h.

10.6 Corrosion resistance test for lamps and generator

10.6.1 *Requirement and method of test.* After being tested by the method specified in BS 5466-1 the unit shall function correctly and be free from corrosion detrimental to its use.

10.6.2 *Duration of test.* The duration of the test shall be 50 h comprising two periods of exposure of 24 h each, separated by an interval of 2 h during which time the unit is allowed to dry.

10.7 Fuel resistance test for head and rear lamps

10.7.1 *Requirements.* After being subjected to the test in **10.7.2** the lens surface shall not show any visible signs of deterioration other than slight local surface crazing.

10.7.2 *Method of test.* Prepare a mixture comprising 70 % by volume of *n*-heptane and 30 % by volume of toluene.

Soak a cotton cloth in the mixture.

Lightly wipe the outer surface of the lens with the cotton cloth and allow the lens to dry naturally for 5 min.

Inspect visually.

11 Marking

Units shall be durably marked with the information given in **11.1**, **11.2** and **11.3**.

11.1 Headlamps and rear lamps

a) The light source and battery or generator with which the lamp is designed to be used.

b) The name or other means of identification of the manufacturer.

c) The number of this British Standard, i.e. BS 6102-3[2)], marked in such a position as to be visible when fitted to a cycle.

11.2 Generators

a) Rated output, i.e. voltage(s) and wattage(s).

b) The name or other means of identification of the manufacturer.

c) The number of this British Standard, i.e. BS 6102-3[2)], marked in such a position as to be visible when fitted to a cycle.

[2)] Marking BS 6102-3 on or in relation to a product is a claim by the manufacturer that the product has been manufactured to the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification should be addressed to the appropriate certification body.

11.3 Secondary battery systems

The battery pack, or the lamp unit if it is self-contained, shall be durably and visibly marked with the following, in lettering at least 2 mm in height.

"MAXIMUM USE BEFORE RECHARGING *X* HOURS"

NOTE The duration *X* represents a claim by the manufacturer of the continuous period of time that the battery, when new and fully charged, will provide the voltage necessary to produce luminous intensities not less than those specified in **5.1.1** and **6.1.1**.

12 Instructions

12.1 Lamps powered by a primary battery or dynamo

Instructions shall be supplied with each lamp or system giving information on the following:

a) fitting the unit to the cycle;

b) operation;

c) replacement parts and method of replacement.

In addition, the instructions shall include specific details of the light sources and batteries that have to be used to maintain optimum performance.

NOTE The reference numbers of the filament lamp and battery are additionally marked on the lamp unit.

12.2 Lamps powered by a secondary battery

Instructions shall be supplied with each lamp or system giving information on the following:

a) fitting the unit to the cycle;

b) operation;

c) the type of battery charger to be used;

d) recommended periods of charge;

e) warnings against overcharging or other foreseeable types of abuse that could damage the battery, if relevant;

f) replacement parts and method of replacement;

NOTE The reference numbers of the filament lamp and battery are additionally marked on the lamp unit.

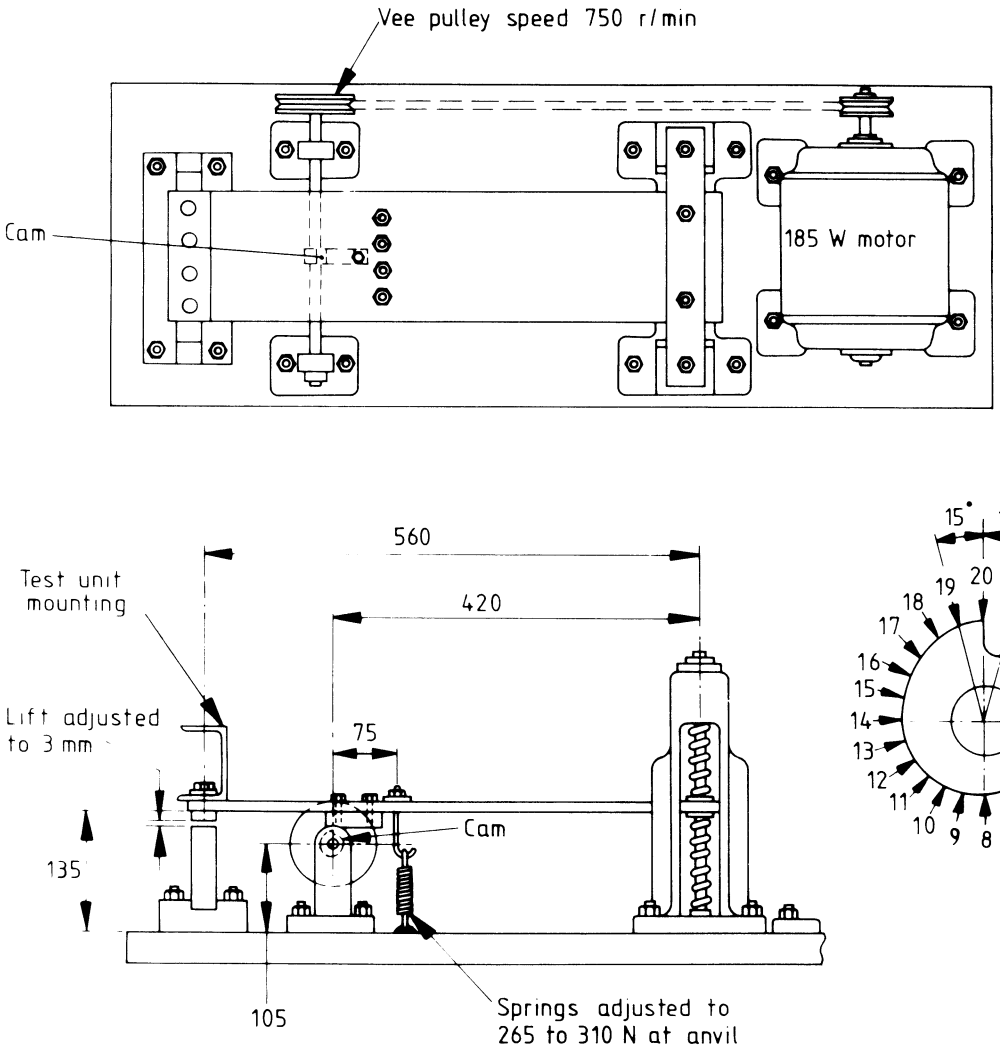
g) the expected life of the battery and a recommended annual check for deterioration;

h) loss of charge during extended periods of non-use.

NOTE Additional information may be provided at the discretion of the manufacturer.

Appendix A
Vibration test machine

Dimensions in millimetres



Cam-profile radii[a]					
Point	**Radius** mm	**Point**	**Radius** mm	**Point**	**Radius** mm
1	14.000	8	15.461	15	17.594
2	14.000	9	15.765	16	17.899
3	14.064	10	16.070	17	18.204
4	14.241	11	16.375	18	18.509
5	14.546	12	16.680	19	18.686
6	14.851	13	16.985	20	18.763
7	15.156	14	17.289		

[a] The cam width is to be between 12 mm and 25 mm.

Appendix B *Deleted*

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