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Indian Standard

SPECIFICATION FOR ROAD TRAFFIC SIGNALS

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INDIAN STANDARDS INSTITUTION
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NEW DELHI 110001

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ROAD TRAFFIC SIGNALS

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SPECIFICATION FOR ROAD TRAFFIC SIGNALS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 21 November 1974, after the draft finalized by the Illuminating Engineering Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This Indian Standard has been prepared in response to a request from the Study Group on Road Safety of the Government of India. While formulating this standard the need for specifying higher optical requirements which recent research by the Road Research Laboratories has shown to be essential for modern traffic systems control, has been kept in view.

0.3 The Committee responsible for the preparation of this standard took cognisance of the effect of transmitted vibration due to traffic on road traffic signals and felt that at the moment it was not possible to exactly specify requirements in this regard and that manufacturers should take adequate care in the design of the equipment by providing means, such as anti-vibration mount.

0.4 In preparing this standard assistance has been derived from B.S. 505-1971 'Road traffic signals', published by British Standards Institution.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard specifies requirements for fixed and portable electric light signal installations operated from mains, generator or battery supply for controlling road traffic. It also includes reference to operational requirements for the signals and their controller.

1.2 The information which should be given with enquiries and orders for equipment is covered in Appendix A.

*Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Beam Axis — The straight line passing through the light centre of the optical system in the direction of maximum intensity of the beam.

2.2 Co-ordinated Control System — A system in which the changes of the signals at a series of road junctions are interrelated.

2.3 Geometric Axis — A straight line passing through the centre of the lens and perpendicular to it.

2.4 Isolated Controller — A device which governs the time of the cycle and changes the signals without reference to any other controller.

2.5 Local Controller — A device which controls the signals and which is subject to the governing influence of another controller, a master controller or a co-ordinated control system.

2.6 Master Controller — A device which governs the time of the cycle and the changes of signals controlled by local controllers in a local co-ordinated control system.

2.7 Nominal Time — A given time period which may be selected from a range of available time periods.

2.8 Optical System — An assembly of components to produce a light or light pattern of specified size, colour, intensity and shape.

2.9 Phantom Mask — A built-in device to reduce phantom effects as produced by direct incidence of external light on the signal face.

2.10 Restrictive Traffic Signal — The light signals exhibited by a signal face at any given time, consisting of or including one or more optical systems presenting a symbolic appearance when such light signals are required to have application only to a particular class of traffic or to a particular movement of traffic.

2.11 Signal Face — That part of a signal head provided for controlling traffic in a single direction.

2.12 Signal Head — An assembly consisting of one or more signal faces which may be designated accordingly as one-way, two-way, etc.

2.13 Visor — A hood attached to the signal face to minimize phantom effects due to extraneous light sources and to reduce the possibility of a signal being seen by traffic for which it is not intended.

2.14 Way — The term 'one-way', 'two-way' etc, as applied to signals, indicates the number of signal faces used in a signal head assembly.

3. CONSTRUCTIONAL REQUIREMENTS

3.1 Signal Head Assembly — The signal head assembly shall be suitable for the type of mounting specified by the purchaser. The signal head, the fixing brackets and the necessary parts thereof shall be so designed that, when installed, the signals shall be capable of adjustment both vertically and horizontally to meet the requirements of **4.2** in respect of all approach roads and pedestrian crossings to which the signals apply. The adjustment shall be such that no signal shall obstruct the view of optical systems of any other signal head within 25° of the axis of the beam. The signal head assembly shall be capable of being locked securely after adjustment.

Unless otherwise specified, a backing board (*see* Fig. 1) shall be provided with each signal face intended for vehicle drivers, extending not less than 300 mm above the centre of the upper optical system nor less than 230 mm below the centre of the lower optical system. It shall extend not less than 280 mm horizontally either side of the vertical centre line of the optical system, unless there is an adjacent backing board associated with another signal face in which case this dimension may be reduced to 220 mm on the adjacent side. Where there are subsidiary signal heads attached to the main signal head, the backing board shall extend not less than 230 mm vertically above the centre of the upper subsidiary signal optical system and below the centre of the lower subsidiary signal optical system, and horizontally not less than 230 mm from the vertical centre line of the subsidiary signal optical system. The backing board shall have a white border not less than 45 mm nor more than 55 mm wide. Backing boards are not required with portable signals.

3.2 Signal Head — The signal head shall be reasonably weatherproof and dustproof and neither corrodible nor brittle over a temperature range of −10°C to +70°C*. It shall be of such form as to resist deterioration over this temperature range and to resist distortion in wind velocities up to 145 km/h. Means shall be provided for securely fixing and accurately locating the optical systems into the signal head.

Where non-metallic material is used, special precautions shall be taken to ensure that all fixings are firmly anchored in the material.

The lamp holders shall be suitable for lamp caps of type E27/27 cap as specified in IS : 6701-1972†.

The lamp holders for halogen lamps shall be suitable for lamp bases of type GY 6·35-13 and shall be checked with gauges given in Appendix B.

The dielectric of the lamp holder shall be of porcelain or tough incombustible insulating material which will not soften when heated to a temperature of 250°C and, after 24 hours' immersion in water, it shall not have increased in weight by more than 0·5 percent after all moisture has been removed

*Any other lower temperature shall be a matter of agreement between the purchaser and the supplier.

†Specification for tungsten filament miscellaneous electric lamps.

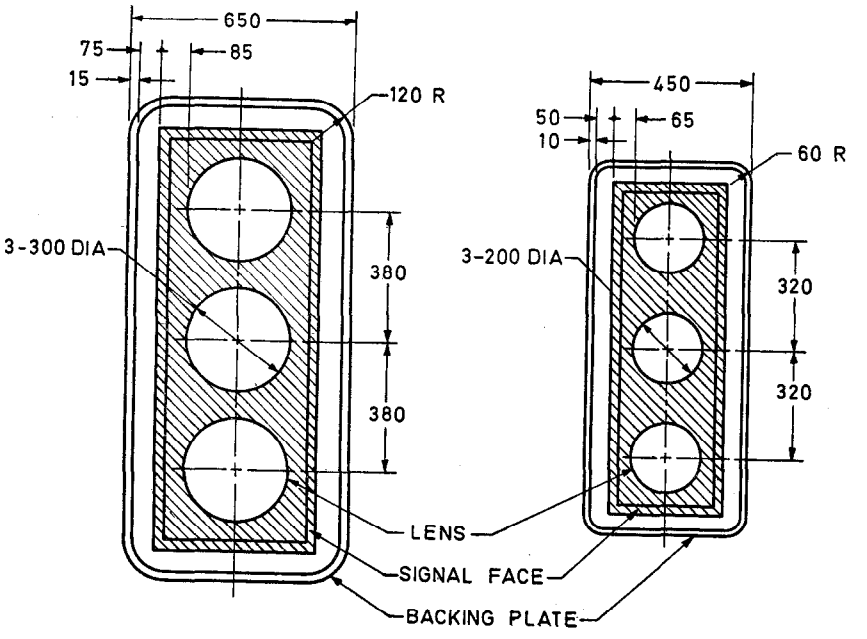


FIG. 1 LIGHT SIGNAL HEAD

from the surface. The spring contact material shall be so designed as to maintain adequate electrical conductivity and to ensure that the lamp remains securely located under traffic vibration.

3.3 Optical Systems — The optical system shall be rainproof, reasonably dustproof and manufactured from materials which are neither corrodible nor brittle over a temperature range of −10°C to +70°C. It shall be of such form as to resist deterioration over this temperature range. The component parts shall be so designed that when assembled they shall be accurately located relative to one another. Means shall be provided so that when mounted the optical system cannot be rotated from its normal position.

If the lens be of plastics, it shall have a Vicat softening point of not less than 109°C.

3.3.1 Consideration should be given to the permanence of the colour of lenses at the operating temperatures specified and to the mounting of the lenses, to avoid undue deformation within this temperature range.

3.4 Reflector — Where a reflector is fitted it shall comply with the requirements of **3.4.1, 3.4.2** or **3.4.3**.

3.4.1 *Silvered Glass Reflector* — The silvering and its protective backing

shall be in accordance with the provisions of IS : 3438-1965* for general service use.

3.4.2 *Aluminium Reflector* — It shall be of aluminium alloy according to IS : 736-1965† with an anodic coating of grade AC 25 conforming to IS : 1868-1968‡.

The reflector shall be of sufficient thickness to retain its shape during assembly relamping or cleaning operation. Reflecting surfaces shall be free from flaws, scratches, defacement or mechanical distortion.

3.4.3 *Other Reflector* — Reflectors of this class shall have a general performance equivalent to that of **3.4.1** and **3.4.2**. They shall be sufficiently strong to retain their shape and position during assembly, relamping and cleaning, at temperatures to which they are exposed in normal operation and over the temperature range given in **3.3**.

3.5 Lamp and Lamp Holder

3.5.1 *Tungsten Lamp* — The lamp used in the optical system shall meet the requirements of IS : 6701-1972§.

3.5.2 *Halogen Lamp* — The lamp used in the optical system shall be a 12 V, 50 W long life tungsten halogen lamp.

The bulb shall be clear, uncoloured and the filament shall only be used in the horizontal position. The lamp shall meet the following specification:

Nominal lumens	900 lm at 12 V input
Nominal Life	2 000 hours continuous burning at 12 V input
Nominal colour temperature	2 850 K at 12 V input
Overall length	44 mm maximum
Overall diameter	12 mm maximum
Light centre	$30 \pm 0{\cdot}25$ mm
Base	Single ended bi-pin to International designation GY 6.35-13
Nominal operating voltage	11·7 V

3.6 Visor || — A visor shall be fitted to each of the optical systems and, unless otherwise specified, shall be as shown in Fig. 2 for visors for 200 mm signals and as in Fig. 3 for visors for 300 mm signals. It shall be manufactured from material which is neither corrodible nor brittle over a temperature range of $-10°C$ to $+70°C$. It shall be of such form as to resist deterioration over this temperature range, to resist substantial distortion in winds of up to 145 km/h and to prevent permanent deformation from the same cause.

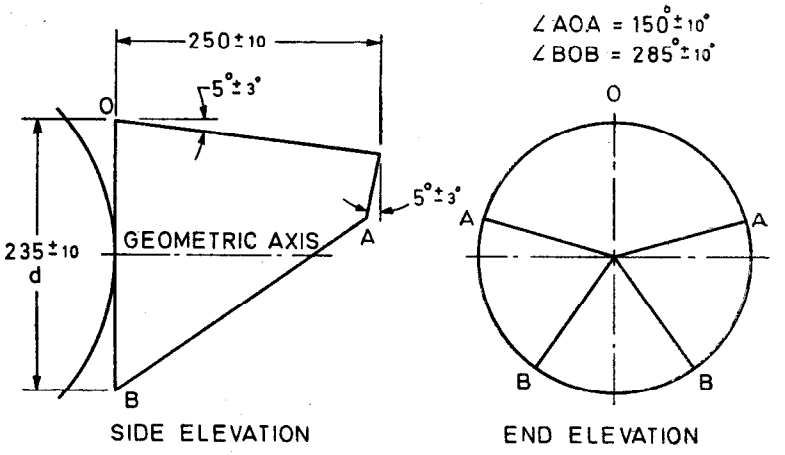
*Specification for silvered glass mirrors for general purposes.

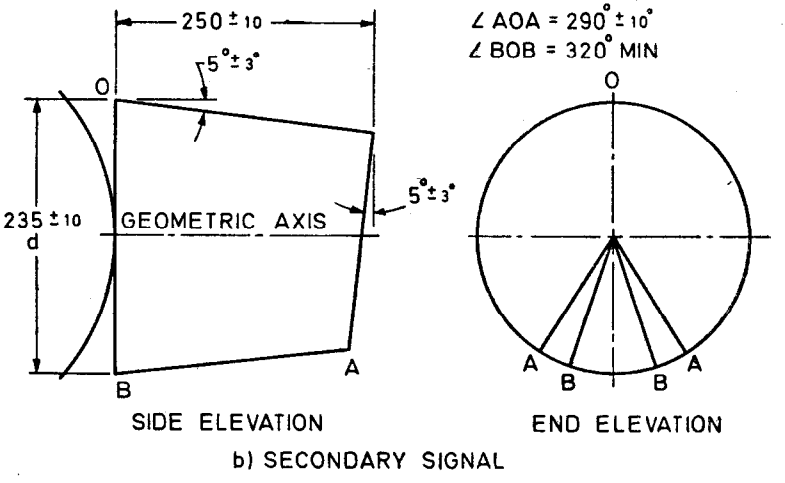
†Specification for wrought aluminium and aluminium alloys, plate (for general engineering purposes) (*revised*).

‡Specification for anodic coatings on aluminium (*first revision*).

§Specification for tungsten filament miscellaneous electric lamps.

|| Square type of visors may also be used, provided they fulfil the requirements given in **5.8**. The dimensional requirements for such visors are under consideration.

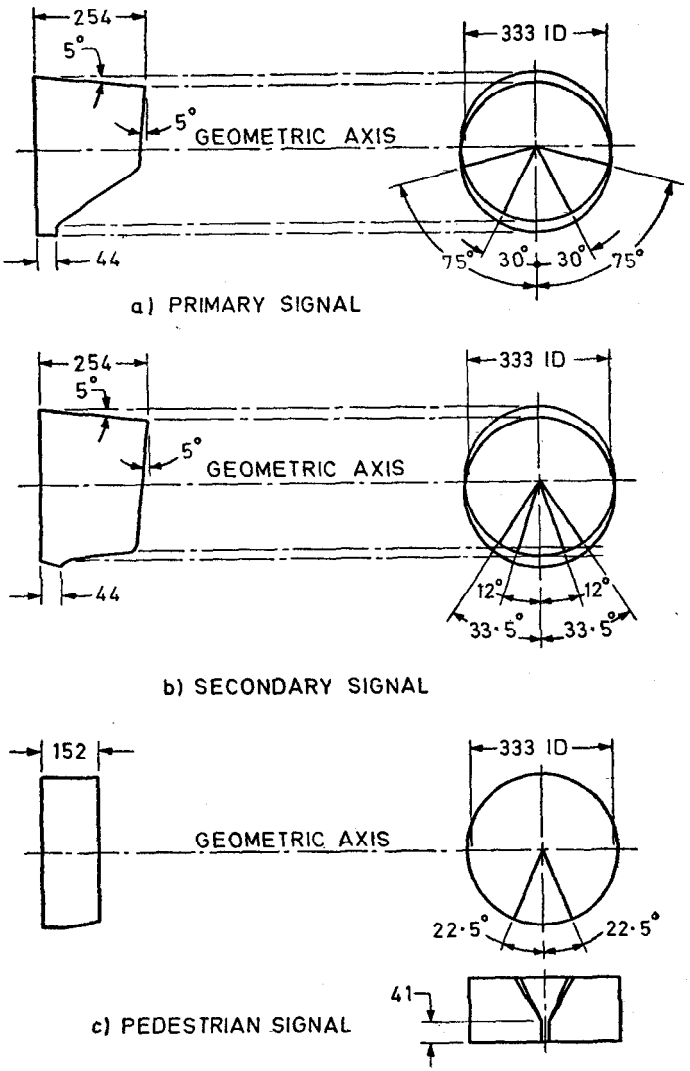




All dimensions in millimetres.

FIG. 2 200 mm SIGNAL VISOR

3.7 Post — The post shall have an outside diameter of between 100 mm and 115 mm and a strength and rigidity at least equivalent to that for a seamless steel tube of outside diameter of 100 mm and 3 mm thickness and a tensile strength of 375 MN/m².



All dimensions in millimetres.

FIG. 3 300 mm SIGNAL VISORS

It shall be so designed and constructed as to provide adequate support and stability for the signal head and shall be fitted with a weatherproof cap. At the request of the purchaser it may also be fitted with a groundplate.

Where an aperture is required to permit the entry of an electric supply cable, unless otherwise specified by the purchaser, it shall be not less than 150 mm high and 50 mm wide and the top of the slot shall be between 75 mm and 130 mm below ground level. The top and bottom of the aperture shall be radiused with radii equal to half the slot width. Where an aperture is required to permit the entry of cables which are not supply cables, it shall be capable of accommodating four cables each of 32 mm diameter and any aperture above ground level shall be fitted with a suitable gland or grommet maintaining as far as possible a smooth surface of the same colour as the post.

A pole cap of helmet shape of any suitable material shall be provided. It shall be finished either with white or aluminium colour.

Unless otherwise specified the post shall be of sufficient length to allow a minimum of 700 mm below ground level when correctly erected.

The interior of steel posts shall be protected by:

a) a finish complying with the requirements of IS : 1340-1959*; or
b) an anti-corrosive paint which shall be effective over the temperature range −10°C to +70°C.

The exterior portion of the steel posts below ground level, and extending to at least 450 mm above ground level, shall be protected:

c) by spraying with molten zinc; or
d) as in (a) or (b).

Any surface cut after galvanizing, painting, or the application of the plastics finish shall be protected by one of the methods (a) to (c) as appropriate. The following colours shall be applied for the different parts of the traffic signal:

Yellow (traffic yellow)	.. for pole and signal head
Dull black	.. for internal portion of visor and signal face
Dull black and white	.. for backing board

Although not essential, it is preferable that the supports for portable signals should comply with the requirements of this clause, where applicable. Supports shall meet the mounting height requirements of **4.8**. In addition, the supports shall be suitable for use on uneven ground on gradients of up to 1 in 5. Winds of up to 145 km/h shall not cause the signal to be blown over when positioned on level ground.

3.8 Supports for Overhead Mounted Signals — Overhead signals may be mounted on mast arms or gantries, finished grey or on double catenaries supporting the top and bottom of the signal head or heads. The assembly shall be of such a form as to resist distortion in wind velocities up to 145 km/h and shall provide minimum clearance of the carriageway of 5·5 m.

Backing boards are to be provided with overhead signals in accordance with the requirements of **3.1**. When an acceptable black background can

*Code of practice for protective coating of zinc base alloys.

be provided as part of the gantry structure separate backing boards need not be provided.

3.9 Equipment Housing — Housings for the control mechanism, push buttons, detectors and other auxiliary apparatus shall be rainproof, reasonably dustproof, and shall be constructed of one of the following:

a) Cast iron;
b) Cast aluminium;
c) Sheet steel. The interior of housings constructed from sheet steel shall be protected against corrosion by an anticorrosive paint which shall be effective over the temperature range −10°C to +70°C or by one of the finishes specified below for the exterior of such housings. The exterior of sheet steel housings shall be protected against corrosion;
d) Sheet aluminium; or
e) Non-metallic material which is neither corrodible nor brittle, reinforced where necessary by internal framework so as to give at least equal protection to equipment as that provided by housings (a), (b), (c) or (d).

Sheet metal housings as in (c) and (d) shall be constructed of not less than 2 mm thickness material where the unsupported area is not greater than 0·25 m^2, or not less than 3 mm thickness material where the unsupported area is greater than 0·25 m^2. Areas over 0·75 m^2 shall be adequately stiffened or supported. In all cases the length to breadth ratio shall not exceed 3:1.

Where any part is below ground level it shall be constructed of cast iron or non-ferrous material, or hot-dip galvanized steel.

The equipment shall be easily removable and apparatus readily accessible for maintenance purposes.

All external corners and edges in excess of 40 mm, excepting lower edges, shall be rounded to at least 4 mm radius and all other external edges shall have a radius of at least 1·5 mm.

Appropriate means of entry and support for cables shall be provided.

Equipment housings and pedestrian push-button signal housing, wherever provided, shall be grey in colour.

3.10 Locks — Access to the switch for selecting hand-operation, fixed-time working or automatic operation, the lamps' on/off switch, detector fault alarm test and re-set special facility keys and the telephone jack if provided shall be by means of a door separate from that giving access to the control apparatus, including cables, wiring terminations and the timing adjustments. All means of access shall be protected by locks of different patterns and the corresponding locks and keys shall be identical for controller housings of the same make, type and series. Not less than two keys of each type shall be supplied with each controller.

Portable signals are not required to comply with the above, but means of access to the controller and manual controls or adjustments shall be protected by at least one lock provided with not less than two keys.

3.11 Interconnecting Cables — Interconnecting cables shall have conductors cross-sectional area not less than 1·0 mm² in case of copper and not less than 1·5 mm² in case of aluminium cables, and if not laid in duct or conduit shall be armoured and comply with IS: 1554 (Part I)-1964*.

3.12 Earthing — Non-current carrying metal parts of the equipment, including signal posts and housings, shall be bonded together and effectively earthed in accordance with IS : 3043-1966†.

3.13 Mains Termination — A single pole fuse in accordance with IS: 2208-1962‡, a neutral link and a double pole switch to IS: 2607-1967§ shall be provided for connection to the mains supply. Sufficient space shall also be provided for mounting the electricity supply authority cable termination.

In addition to the main switch and fuse, a switch to control the lamp current only shall be provided. Unless the control is designed to be intrinsically immune to the effect of a lamp becoming short-circuited or to other surges, a fuse of suitable rating or a similar device shall be provided for this purpose.

The controller mechanism shall be separately and suitably fused or protected.

This clause is not applicable to battery or low-voltage generator operated equipment.

3.14 Safety — Where right of way signals are provided for any controlled traffic, the design of any control equipment shall be such that when the right of way signal is shown to one phase, it shall not be possible through failure of any operating component of the controller to give a right of way signal to a conflicting traffic signal. A device shall be provided in the equipment housing which continuously monitors the controller signal and if the controller fails to cycle for any reason (other than power failure), it shall cause automatic change over to flashing of amber lights or turn off all signal lights.

3.15 Controller Electrical Components — The controller components including the lamp switching arrangements shall be of adequate rating to ensure a normal life of at least five years ||.

The control circuitry shall be designed to preclude as far as is reasonably possible the chance of wrong switching and shall be proof against failure from current or voltage surges present in the electric mains or signal cables.

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*Specification for PVC insulated (heavy duty) electric cables: Part I For working voltages up to and including 1 100 volts (*revised*).

†Code of practice for earthing.

‡Specification for HRC cartridge fuse-links up to 65 V.

§Specification for air-break isolators for voltages not exceeding 1 000 volts (*first revision*).

||By agreement with the purchaser, alternative components with a more limited life may be acceptable provided they are easily replaceable.

The construction of the controller shall be in accordance with the relevant Indian Standard, where appropriate, in regard to insulation, rectifiers, capacitors, resistors, transistors, any other solid state switching devices and any motors. The general construction and finish shall be in accordance with accepted standards of good workmanship.

3.16 Time Switch — Provision shall be made for a time switch to be accommodated. The time switch shall be of carry-over type conforming to IS : 1766-1973*.

NOTE — Alternatively, electronic type time switch may be used; in such cases they shall be fitted with standby batteries and shall have an accuracy not less than that specified in IS : 1766-1973*.

3.17 Cable and Wiring — The installation of cables and cable terminations shall comply with IS : 732-1963†.

3.18 Interchangeability — All parts shall be interchangeable with like parts for equipment of the same make, type and series.

3.19 Vibration and Noise — The apparatus shall be reasonably quiet and the mechanism shall not cause undue vibration. The apparatus shall be constructed so as to reduce to a minimum any damage to lamps and equipment due to vibration caused by traffic.

3.20 Radio Interference — The design of equipment shall be such as to prevent telegraphic, telephonic or radio interference.

3.21 Ambient Air Temperature — The equipment shall operate satisfactorily within an ambient air temperature range of 0°C to 55°C under normal operating conditions except where otherwise specified.

NOTE — Where specially agreed between the purchaser and the supplier, the lower limit may be −15°C.

4. OPTICAL REQUIREMENTS

4.1 Distribution of Light

4.1.1 *Optical Systems for Providing Non-restrictive Traffic Signals* — When fitted with the appropriate standard lamp in accordance with the requirements of **3.5**, with a coloured lens such that the colour of the light transmitted falls within the limits specified in **4.7** for the red, amber and green signals as appropriate; and without any signal visor the distribution of light shall, for red and green signals, be not less than the values set out in Table 1 for signals on normal roads or in Table 2 for signals on high speed roads; and for amber signals shall be not less than twice the values set out in Tables 1 and 2 respectively.

*Specification for time switches.

†Code of practice for electrical wiring installations (system voltage not exceeding 650 volts) *revised*).

Each signal shall present a uniform appearance, free from excessively bright spots or sectors, over the whole area of the lens when viewed from any direction within the cone of directions for which the intensities are specified in Table 1 or Table 2. Polar curves shall be reasonably smooth and reasonably free from secondary maxima.

Phantom effects, when measured by the method specified in **5.8**, shall not, for signals on normal roads and on high speed roads, have an intensity greater than $1{\cdot}5 \times 10^{-3}$ cd/lux of incident light.

Subject to agreement between the purchaser and supplier, the lamp intensities shall be capable of an automatic reduction during the hours of darkness to between $\frac{1}{4}$ and 1/12 of the normal intensities. When the light intensity of any signal is so reduced it shall still comply fully with the requirements of colour given in **4.7**.

The light intensity requirements of this subclause will not necessarily apply to traffic signals at railway level crossings or to portable signals.

NOTE — Normally, high speed road optical systems will be appropriate where approach speeds greater than 80 km/h are expected and where signals are visible on approaches greater than 200 m.

TABLE 1 DISTRIBUTION OF RED AND GREEN LIGHT FOR SIGNALS ON NORMAL ROADS

(*Clause* 4.1.1)

HORIZONTAL/VERTICAL	ON GEOMETRIC AXIS	10° ON EITHER SIDE OF GEOMETRIC AXIS	25° ON EITHER SIDE OF GEOMETRIC AXIS
(1)	(2)	(3)	(4)
	cd	cd	cd
On geometric axis	400	150	25
1° below geometric axis	475	200	30
10° below geometric axis	200	100	25

TABLE 2 DISTRIBUTION OF RED AND GREEN LIGHT FOR SIGNALS ON HIGH SPEED ROADS

(*Clause* 4.1.1)

HORIZONTAL/VERTICAL	ON GEOMETRIC AXIS	10° ON EITHER SIDE OF GEOMETRIC AXIS	25° ON EITHER SIDE OF GEOMETRIC AXIS
(1)	(2)	(3)	(4)
	cd	cd	cd
On geometric axis	800	380	50
10° below geometric axis	375	200	40

4.1.2 *Optical Systems for Providing Restrictive Traffic Signals*

4.1.2.1 *Green arrow and pedestrian optical systems* — When fitted with the appropriate standard lamp in accordance with the requirements of **3.5**, with a coloured lens such that the colour of the light transmitted falls within the limits specified for the green arrow or pedestrian symbol in **4.7**, and without any signal visor, the mean minimum luminance values shall be as specified in Table 3 when tested in accordance with the requirements of **5.6**.

Subject to agreement between the purchaser and supplier, the lamp intensities shall be capable of an automatic reduction during the hours of darkness to between 1/4 and 1/12 of the normal intensities. When the light intensity of any signal is so reduced it shall still comply fully with the requirements of colour given in **4.7**.

TABLE 3 MINIMUM VALUES OF LUMINANCE FOR GREEN ARROW AND RED AND GREEN PEDESTRIAN SIGNALS

(*Clause* 4.1.2.1)

Horizontal/Vertical	On Geometric Axis	10° on Either Side of Geometric Axis	30° on Either Side of Geometric Axis
(1)	(2) cd/m²	(3) cd/m²	(4) cd/m²
On geometric axis	3 500*	2 200	700
10° below geometric axis	2 500*	1 350	600
15° below geometric axis	1 500*	1 000	400

*The variation of luminance over the surface of the green arrow or pedestrian symbol shall not exceed the ratio 10:1, at the test points marked with an asterisk.

Each signal shall present a uniform appearance, free from excessively bright spots or sectors, over the whole area of the signal face when viewed from any direction within the cone of directions for which luminance values are specified in Table 3. Polar curves shall be reasonably smooth and free from secondary maxima.

Phantom effects, when measured by the method specified in **5.8**, shall not, for green arrows and green and red pedestrian signals, have a luminance greater than 4×10^{-2} cd/m² per lux of incident light. Where in particular situations due to exceptional site conditions, optical systems complying with this requirement give rise to unacceptable phantom effects, agreed means of reducing the phantom effect shall be provided.

4.1.2.2 *Optical systems for providing other restrictive traffic signals* — These shall conform to the requirements of **4.1.2.1** so far as is practicable, unless otherwise specified.

4.2 Directions of Beam

4.2.1 *Light Signals Intended for Drivers* — On high speed roads, the light signals shall be directed at a point approximately 200 m from the primary signal face and approximately 1·5 m above ground level at the centre line of the carriageway allocated to approaching traffic. Where signals are mounted above the carriageway on mast arms or gantries or suspended on catenaries, the light signals shall be directed at a point approximately 1·5 m above the carriageway allocated to approaching traffic between 200 m and 400 m (depending on site conditions) from the primary signal face. In other situations, the corresponding distances from the primary signal face shall be approximately 50 m for post-mounted signals and approximately 100 m for overhead signals. These dimensions may be varied where special circumstances require otherwise.

4.2.2 *Light Signals Intended for Pedestrians* — The light signals shall be directed towards the centre line of that part of the carriageway allocated to pedestrian movement unless special circumstances require otherwise.

4.3 Arrangement of Optical Systems

4.3.1 *Traffic Signals at Road Junctions, Road Works, etc and/or Pedestrian Crossings*

4.3.1.1 *Light signals intended for drivers* — Each signal face shall, unless otherwise specified, contain three optical systems arranged vertically, each having a diameter of not less than 200 mm nor more than 215 mm. The coloured lens of the upper optical system shall be red, the middle one amber, and the lower one green. Where green arrows are used they shall have an optical system having a diameter of not less than 295 mm nor more than 305 mm which shall incorporate green arrows in accordance with the requirements of **4.4**. The green arrows may either replace the green light or be additional to such light in one of the permitted arrangements shown in Fig. 4. Where prescribed traffic signs are incorporated in the signal face they shall be internally illuminated and shall have an optical system having a diameter not less than 295 mm nor more than 305 mm. The optical system spacings shall be in accordance with the dimensions given in Fig. 5.

4.3.1.2 *Light signals intended for pedestrians* — Each signal face shall contain optical systems arranged vertically, each having a diameter of not less than 295 mm nor more than 305 mm, which shall incorporate pedestrian symbols in accordance with the requirements of **4.5**. The upper optical system shall illuminate a red symbol and the lower one a green symbol. The optical system spacings shall be in accordance with the details given in Fig. 6.

4.3.1.3 *Light signals for cyclists* — Each signal face shall contain optical systems arranged vertically, each having a diameter of not less than 295 mm nor more than 305 mm, which shall incorporate cyclist symbols in

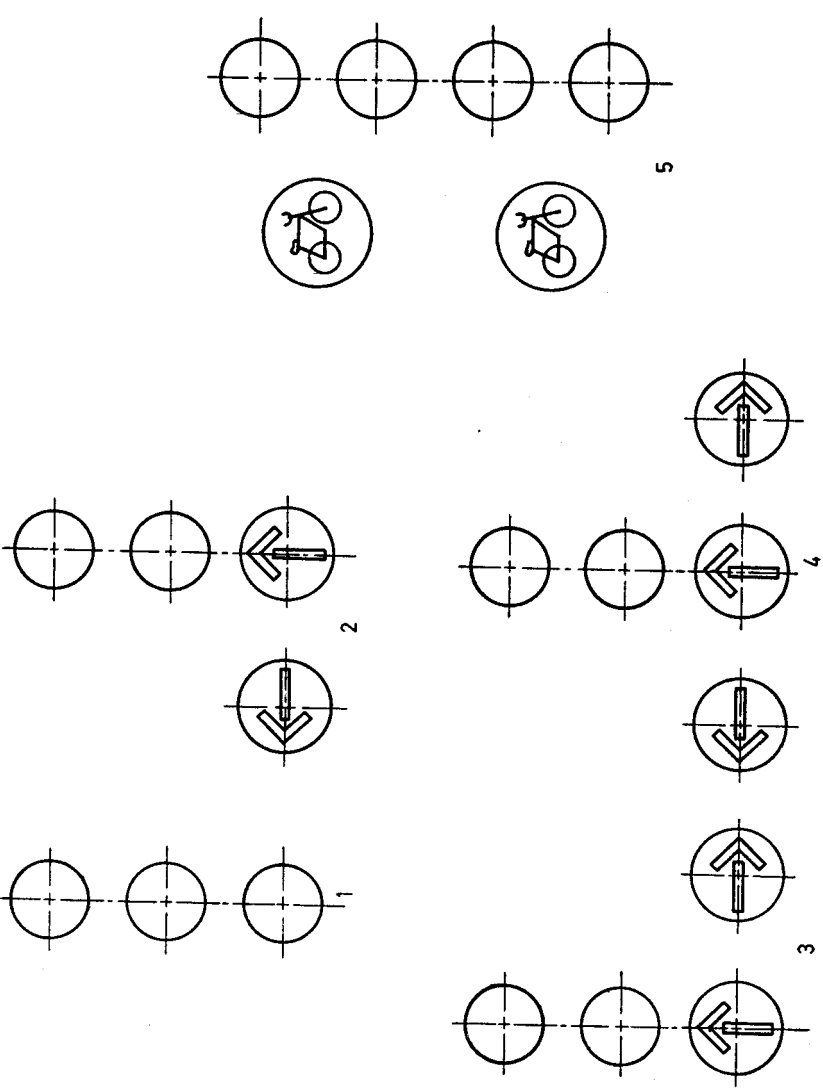
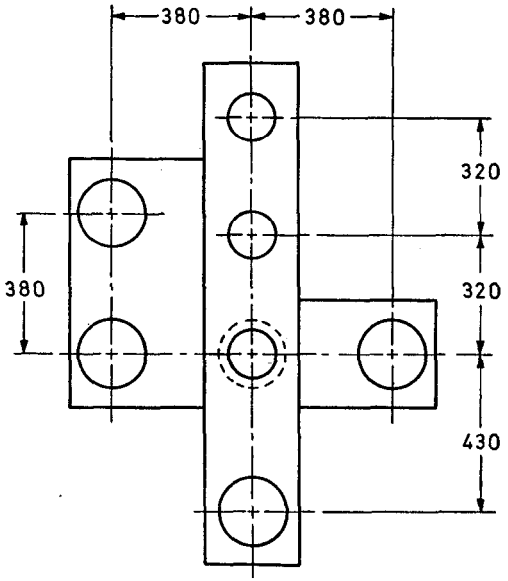


FIG. 4 PERMITTED ARRANGEMENTS OF SIGNALS



All dimensions in millimetres.

PERMITTED TOLERANCES

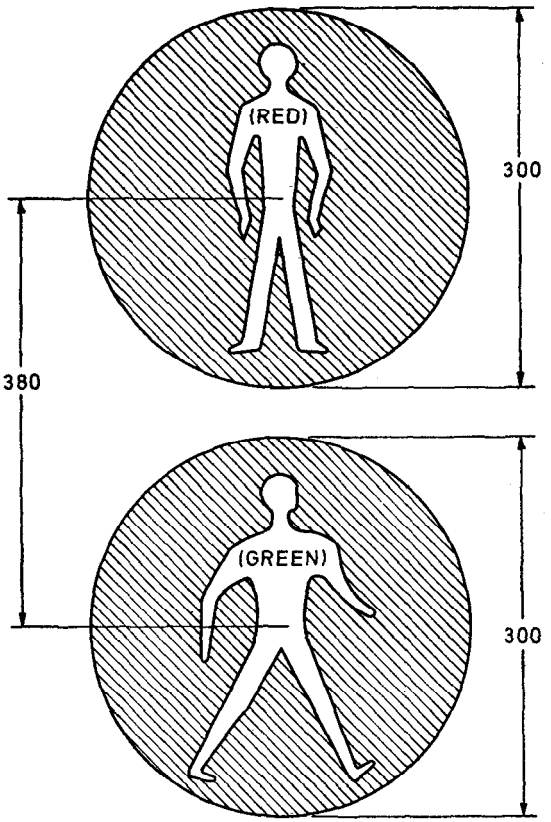
Dimension mm	Minimum mm	Maximum mm
320*	310	355
380†	370	435
430	420	435

*Also applies to Fig. 1
†Also applies to Fig. 6

FIG. 5 OPTICAL SYSTEM SPACINGS

accordance with the requirements of **4.6**. The upper optical system shall illuminate a red symbol and the lower one a white symbol. The optical system spacings shall be in accordance with details given in Fig. 5. The outline of the light signals for cyclists shall be as given in Fig. 7.

4.4 Green Arrow — Where an optical system incorporating a green arrow is used, the background for the arrow shall be obtained by coating the lens or filter as may be appropriate with heat-resisting black paint or enamel, or



All dimensions in millimetres.

FIG. 6 SYMBOLS FOR PEDESTRIAN SIGNALS

by other suitable means, such as stencils. The green arrow shall be of the shape and dimensions shown in Fig. 8.

4.5 Pedestrian Signal — Where optical systems incorporating red or green pedestrian symbols are used, the background for the symbols shall be obtained by coating the lens or filter as may be appropriate with heat-resistant black paint or enamel, or by other suitable means. The red and green symbols shall be of the shape and dimensions shown in Fig. 6.

4.6 Cyclist Signals — Where optical systems for cyclist signals are used, the background for the symbols shall be obtained by coating the lens or

filter as may be appropriate with heat-resistant black paint or enamel, or by other suitable means.

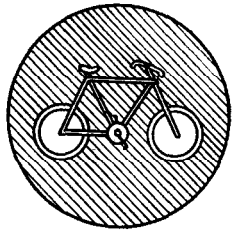
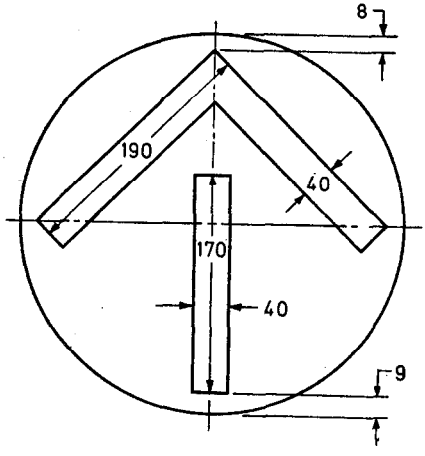


FIG. 7 SYMBOL FOR CYCLISTS



All dimensions in millimetres.

FIG. 8 GREEN ARROW

4.7 Limits of Chromaticity of Signals — The colour of the light transmitted by the signals shall comply with the limits set out as follows:

a) *Vehicle Signal:*	
Red	Signal red class B 1
Amber	Signal yellow class A
Green	Signal green class B 2
Green Arrow	Signal green class B 2
b) *Pedestrian Signal:*	
Red symbol	Signal red class B 1
Green symbol	Signal green class B 2
c) *Cyclist Signal:*	
Red symbol	Signal red class B 1
White symbol	Signal white class B 1

Limits for the colour shall be as given in Appendix C.

4.8 Height of Signal

4.8.1 *Post-mounted Traffic Control Light Signals*

4.8.1.1 *Fixed light signals intended for drivers* — The height of signals shall be such that when erected the centre of the amber optical system shall be not less than 2·4 m nor more than 4 m above the carriageway level.

4.8.1.2 *Portable light signals intended for drivers* — The height of the signals shall be such that when erected the centre of the amber optical system shall be not less than 1·5 m nor more than 3·5 m above the carriageway level.

4.8.1.3 *Light signals intended for pedestrians and cyclists* — The height of signals shall be such that when erected the height of the lower edge of the housing enclosing the green signal shall be not less than 2·1 m nor more than 2·6 m above the carriageway level.

4.8.2 *Overhead Mounted Traffic Control Light Signals* — The height of overhead mounted signals shall be such that when erected the centre of the amber optical system shall be not less than 6·1 m nor more than 9 m above the carriageway level.

NOTE — Variation from the minimum height should only be contemplated when there are definite reasons for making such variations obligatory.

5. TESTS

5.1 Classification of Tests

5.1.1 *Type Tests* — The following shall constitute type tests:

a) Visual examination (*see* **5.2**),
b) Test for insulation resistance and electric strength (*see* **5.3**),
c) Test for optical system (*see* **5.4**),
d) Test for timing (*see* **5.5**),

e) Test for chromaticity (*see* **5.6**),
f) Test for luminance measurements (green arrow and red and green pedestrian and cyclist signals) (*see* **5.7**), and
g) Test for measurement of phantom effects (*see* **5.8**).

5.1.2 *Routine Tests* — Visual examination (*see* **5.2**), the test for insulation resistance and electric strength (*see* **5.3**) and test for optical system (*see* **5.4**) shall constitute routine tests.

5.2 Visual Examination — The traffic signals shall be visually examined for proper functioning and workmanship.

5.3 Test for Insulation Resistance and Electrical Strength

5.3.1 *Controller* — A high voltage test shall be carried out by applying 1 000 volts ac for one minute between the mains line and neutral input terminals coupled together and earth. The low voltage connection to any mains transformer shall be disconnected during this test. The test voltage shall be at 50 Hz $\pm$20 percent and be of approximately sine-wave form. During this test no breakdown of the insulation shall occur.

5.3.2 *Completed Installation* — The insulation resistance of the main leads excluding these to any transformer providing low voltage power supplies which are connected to the main supply by plug and socket shall be tested on a dc supply at 500 volts and shall have a resistance of not less than 1 MΩ.

5.4 Test for Optical System — As agreed between the purchaser and the manufacturer, optical systems may, from time to time, be subjected to photometric tests to check that production units meet the optical requirements of the standard.

The lamp (as specified in **3.5**) used in the optical system under test should have its lumen output at the rated voltage measured in an integrating photometer.

The intensity/luminance values obtained in these tests shall be multiplied by the following factor before comparing them with the values given in the appropriate tables:

$$\frac{900 \text{ lm}}{\text{Measured lamp lumen output}} \text{ OR } \frac{1\,800 \text{ lm}}{\text{Measured lamp lumen output}}$$

as appropriate.

For the purpose of the test, the photometric requirements specified in the appropriate table as specified in **4.1** shall be deemed to have been met when:

a) the mean of the measured intensity/luminance values, corrected as above, for not less than six optical systems is not less than the minimum intensity/luminance values specified in the appropriate table, and
b) no intensity/luminance values obtained in (a) for any optical system are less than the minimum values specified in the appropriate table adjusted in accordance with the factors shown in Table 4.

TABLE 4 MULTIPLYING FACTORS FOR ADJUSTING THE MINIMUM INTENSITY/LUMINANCE VALUES SHOWN IN TABLES 1, 2 AND 3

(*Clause* 5.4)

HORIZONTAL (Clause 4.1)	GEOMETRIC AXIS			
	On Axis	10° Either Side	25° Either Side	30° Either Side
Table 1	1·00	0·85	0·80	—
Table 2	1·00	0·85	0·80	—
Table 3	0·80	0·80	—	0·80

5.5 Test for Timing

5.5.1 *Mains Operated Equipment (Including Generator Operated)* — When the equipment is tested at works the duration of all periods timed by the controller shall be within ±7·5 percent of the nominal time when the applied voltage varies in the range between −20 to +15 percent of its nominal value and ±4 percent of its nominal frequency and over an ambient temperature range of 0°C to 55°C. The equipment shall be tested in its normal housing in accordance with IS : 2106 (Part III)-1963* for the lower temperature limit of 0°C and to IS: 2106 (Part IV)-1963† for the upper temperature limit of 55°C. The period of exposure at these temperatures of 0°C to 55°C respectively shall be 16 hours in both cases. The equipment shall perform within its specification:

a) before the equipment is introduced into the test chamber,
b) after the period of exposure and before the period of recovery,
c) at about 5° increments during the period of recovery, and
d) after the period of recovery.

A visual inspection shall be made before and after the test.

The above applies to those timing arrangements which measure selected fixed periods and those conditioned by variable functions, such as speed or number of vehicles. The controller shall continue to function correctly (except for the accuracy of timed periods) within supply voltage limits of −20 percent and +15 percent from the nominal value.

The flashing rate of any flashing signal shall be within the range 50 to 60 flashes per minute when the applied voltage varies in the range between −20 percent and +15 percent of its nominal value and ±4 percent of its nominal frequency and over a temperature range of 0°C to 55°C.

When installed on site the duration of all periods timed by the controller shall be within −20 and +15 percent of the nominal time when the applied mains voltage is within the range between ±10 percent of its nominal value

*Environmental tests for electronic equipment: Part III Cold test.
†Environmental tests for electronic equipment: Part IV Dry heat test.

and ± 4 percent of its nominal frequency. This shall apply to those timing arrangements which measure selected fixed periods. The flashing rate of any flashing signal shall be between 50 and 60 flashes per minute within the same mains voltage and frequency limits.

5.5.2 *Battery Operated Equipment* — The test requirements for battery operated equipment shall be the same as those for mains operated equipment detailed in **5.5.1**, excepting the provisions relating to variations in supply frequency.

5.6 Chromaticity — The colour of the light emitted for compliance with the requirement of **4.7** shall be measured with a lamp of the correct colour temperature as used in service. The colour shall be defined by the chromaticity of the light reflected at an angle of 45° from a magnesium oxide screen placed normal to the beam axis at a distance of not less than ten signal diameters from the front of the signal. Alternatively, the signal may be operated in an integrating photometer and the colour shall be defined by the chromaticity of the integrated light.

5.7 Test for Luminance Measurements (Green Arrow and Red and Green Pedestrian and Cyclists Signals) — The luminance values for compliance with the requirements of **4.1**, Table 3 shall be taken over circular areas approximately 25 mm in diameter. A matt black mask with circular openings arranged as shown in Fig. 9 shall be placed against the front face of a full green signal, that is, a green signal without the symbol, and the luminance measurements over the nine holes averaged for each direction specified in Table 3.

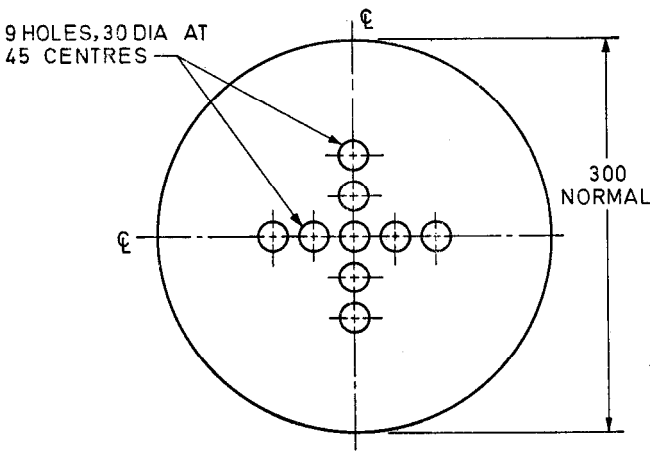
Luminance values for a red signal may be determined from those obtained for a green signal by multiplying the green signal values by the factor:

$$\frac{\text{Red transmission factor}}{\text{Green transmission factor}}$$

5.8 Test for Measurement of Phantom Effects — A light source subtending an angle of approximately $\frac{1}{2}°$ at the signal under test shall be located at a vertical angle of $+10°$ and a horizontal angle of 0° in front of, and shall be aimed at, the signal under test. The illumination from this source measured at the signal shall be not less than 1 000 lx.

The intensity of the resulting phantom signal for optical systems complying with **4.1.1** shall be measured at a vertical angle of 0° and a horizontal angle of 0° in the same manner as that in which the emitted intensity of the signal is measured.

The luminance of the resulting phantom signal for optical systems complying with the requirements of **4.1.2** shall be measured at a vertical angle of 0° and a horizontal angle of 0°. The luminance values shall be averaged over five circular areas approximately 25 mm in diameter at the spacing shown in Fig. 9 but covering the luminous area of the symbol or green arrow. The mask (Fig. 9) shall not be used.



All dimensions in millimetres.

FIG. 9 MASK FOR LUMINANCE MEASUREMENTS ON 300 mm SIGNAL

For the purpose of these tests the visor shall be removed and allowance shall be made for any specular reflection from the front face of the signal.

APPENDIX A

(*Clause* 1.2)

INFORMATION TO BE GIVEN WITH ENQUIRY AND ORDER

A-1. INFORMATION

A-1.1 The following information should be given with enquiry or order:

1) Location of proposed installation.
2) Electricity supply authority and address.
3) Voltage and frequency of electrical supply.
4) Number of stages required in control equipment.
5) Allocation of stages and detector connections.
6) Scale plan(s) to not less than 1/500 scale showing layout of all signal heads; pedestrian push buttons; control equipment including automatic dimming apparatus, if required; associated traffic signs forming an integral part of the signal head assembly, etc; the positions and dimensions of detectors, if required; and any special requirements relating to the omission of backing boards on parti-

cular signals and/or the automatic reduction of light intensities during the hours of darkness. Such places should make use of typical symbols given in Indian Standard Graphical symbols for layout of traffic signals (under preparation).

7) The number and position of signal heads for high-speed roads (*see* **4.1.1**, Table 2).

NOTE—Normally, high speed road optical systems will be appropriate where approach speeds greater than 80 km/h are expected and where signals are visible on approaches greater than 200 m.

8) Details of any special requirement for mounting signals, that is, brackets from existing posts or buildings, mast arm, gantry or catenary suspension and any variation from minimum allowable mounting height of signals or of standard visors.

9) Details of any linking arrangement where isolated controllers are not involved. If a master controller or a co-ordinated control system is to be provided, the number of local controllers to be connected to the master controller within the system is to be stated.

10) Details of any special facilities, traffic or other requirements not already specified under **5** and **8**.

11) Setting and/or ranges of all time periods including intergreen periods. When a required intergreen period following a stage varies according to the next stage to be served, the requirements for each possible change of stage should be scheduled.

12) Proposed maintenance arrangements for optical and equipment maintenance.

13) Address for delivery of equipment.

14) Any special instructions regarding installation work.

15) Whether flashing arrangement during night hours is to be provided or not.

16) Whether provision for manual control of equipment should be provided or not.

17) Whether three cycle timings in each phase for morning, afternoon and evening peaks and timing panel for indicating all such timings should be provided or not.

18) Whether mimic display panel indicating phase diagrams illuminated, should be provided or not inside the control housing.

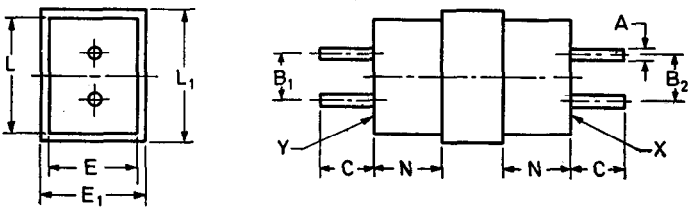
APPENDIX B

(*Clause* 3.2)

GAUGES FOR LAMP HOLDERS GY 6·35

B-1. DIMENSIONS

B-1.1 Dimensions for 'GO' gauges for lamp holders shall be as given in Fig. 10.



The drawing is intended only to illustrate the essential dimensions of the gauges

Reference	Dimension
A	1·32
B_1	6·62
B_2	6·08
C	7·5
C	—
E	9·5
E_1	11·5
L	17
L_1	19
N	9·45

FIG. 10 'GO' GAUGES FOR LAMP HOLDERS GY 6·35

B-2. TESTS

B-2.1 The tests on these lamp holders shall be carried out in the following order:

a) Each end of the 'GO' gauge for the corresponding Gy 6·35 lamp holder (that is with pins of 1·07 mm diameter) shall in turn be inserted into the lamp holder until the pins come to an abutment.

b) The gauge shown on sheet 7 006-61C* shall be used to verify that the lamp holder contacts satisfy the requirements for minimum contact force.

c) It shall be possible to insert each end of the 'GO' gauge for lamp

*IEC Publication 61-3 Lamp caps and holders together with gauges for the control of interchangeability and safety: Part 3 Gauges.

holders GY 6·35 in turn until the pins come to an abutment. In this position there shall be a noticeable clearance between each of the surfaces X and Y and the adjacent surface of the lamp holder.

APPENDIX C

(*Clause* 4.7)

COLOURS FOR SIGNALLING GLASSES

C-1. CHROMATICITY OF LIGHT SIGNALS

C-1.1 The colour of the light emitted by a signal, shall comply with the limits set out below:

Colour Name	*Class*	*Chromaticity Co-ordinates*		
		x	y	z
Signal red	B_1	—	Not greater than 0·320	Not greater than 0·010
Signal yellow	A	Not less than $y+0·120$	Not less than 0·382	Not greater than $0·210-0·333x$
Signal green	B_2	Not greater than $0·650y-0·060$ and not greater than $1·420-2·326y$	Not less than $0·390-0·171x$	—
Signal white	B_1	Not less than 0·285 and not greater than 0·500	Not less than $0·050+0·750x$ or not less than 0·390. Not greater than $0·640-0·400x$ and not greater than $0·150+0·640x$	—

C-2. LIMITS FOR CHROMATICITY CO-ORDINATES

C-2.1 The approximate limits for signal colours in terms of x and y co-ordinates of the colours of their boundaries shall be as follows:

Colour	x	y	x	y	x	y	x	y	x	y	x	y
Red B_1	0·670	0·320	0·680	0·320	0·700	0·300	0·690	0·300	—	—	—	—
Yellow A	0·546	0·426	0·560	0·440	0·618	0·382	0·612	0·382	—	—	—	—
Green B_2	0·004	0·599	0·258	0·489	0·174	0·361	0·027	0·386	—	—	—	—
White B_1	0·285	0·332	0·471	0·452	0·500	0·440	0·500	0·390	0·453	0·390	0·285	0·264

INDIAN STANDARDS

ON

ILLUMINATING ENGINEERING

IS :

1777-1961 Industrial lighting fittings with metal reflectors
1885 (Part XVI/Sec 1)-1968 Electrotechnical vocabulary: Part XVI Lighting, Secti
General aspects
1885 (Part XVI/Sec 2)-1968 Electrotechnical vocabulary: Part XVI Lighting, Secti
General illumination, lighting fittings and lighting for traffic and signalling
1913-1969 General and safety requirements for electric lighting fittings (*first revision*)
1944-1970 Code of practice for lighting of public thoroughfares
1947-1961 Flood lights
2149-1970 Luminaires for street lighting (*first revision*)
2206 (Part I)-1962 Flameproof electric lighting fittings: Part I Well-glass and bulk
types
2493-1963 Well-glass lighting fittings for use underground in mines (non-flameproof
2672-1966 Code of practice for library lighting
3287-1965 Industrial lighting fittings with plastic reflectors
3528-1966 Waterproof electric lighting fittings
3553-1966 Watertight electric lighting fittings
3646 (Part I)-1966 Code of practice for interior illumination: Part I Principles for
lighting and aspects of design
3646 (Part II)-1966 Code of practice for interior illumination: Part II Schedule for v
of illumination and glare index
3646 (Part III)-1968 Code of practice for interior illumination: Part III Calculatio
coefficients of utilisation by the BZ method
4012-1967 Dust-proof electric lighting fittings
4013-1967 Dust-tight electric lighting fittings
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6585-1972 Screwless terminal and electrical connections for lighting fittings
6665-1972 Code of practice for industrial lighting

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