GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

SPECIFICATION FOR "TRIANGULAR BEAM PATTERN HEADLIGHT" - SINGLE BEAM XENON LAMP MAIN HEADLIGHT AND SINGLE BEAM HALOGEN LAMP AUXILIARY LIGHTS – FOR MAINLINE LOCOMOTIVES.

Specification No:ELRS/SPEC/PR/0020, Rev.'0'
Issue Date/Year – July 2002.

RESEARCH DESIGNS & STANDARD ORGANISATION
MANAK NAGAR, LUCKNOW – 226 011.

SPECIFICATION NO: ELRS/SPEC/PR/0020, Rev.'0' FOR "TRIANGULAR BEAM PATTERN HEADLIGHT" - SINGLE BEAM XENON LAMP MAIN HEADLIGHT AND SINGLE BEAM HALOGEN LAMP AUXILIARY LIGHTS – FOR MAIN LINE LOCOMOTIVES.

0. FOREWORD

0.1 Headlight is provided in front and rear of Locomotives to illuminate track ahead at night time for driver to look for any obstruction or any abnormality on track etc. to facilitate him to take necessary action for ensuring safe and efficient operation of the train. It is also necessary for people on ground in vicinity of track including level crossing to spot incoming train for their safety.

0.2 Locomotives on Indian Railways have traditionally been provided with a headlight with single reflector and 32V, 250 W incandescent lamps to RDSO specification No. EL/TL/41-1984. This headlight is fed from step down transformer (RTPR) on electric locomotives and HLPR on Diesel Electric Locomotives. Railways later on switched over to Twin Beam Headlight using Halogen lamps and DC/DC converter in place of single beam headlight to RDSO specification No. ELPS/SPEC/HL/01:JULY 1997 for Electric Locomotives and RDSO/PE/SPEC/Genl/007 for Diesel Electric Locomotives.

0.3 Twin beam headlight gave improved performance and reliability but it suffered from problem of deterioration in reflectivity of metal reflectors due to heat and moisture and also of difficulty in ensuring focussing of twin beams to same spot. Now with availability of xenon lamps for automobile headlight and need to further improve illumination in front of locomotive, work was taken up and development of triangular beam pattern headlights i.e. single beam main headlight using high efficiency xenon lamp and glass reflector and two auxiliary lights using halogen lamp and glass reflectors was finalised by RDSO.

1.0 SCOPE.

This specification covers construction features, technical requirements and testing procedure for "Triangular beam pattern headlight suitable for mainline locomotives".

2.0 TERMINOLOGY

2.1 For the purpose of this specification, following definitions shall apply:

2.2 **Beam:** - A distribution of radiation characterized by a concentration of luminous flux within a small solid angle substantially greater than the concentration in directions outside the solid angle.

2.3 **Beam Axis:** - It is the line through the effective light centre of the headlight in the principal direction of the beam. The principal direction may be found by taking the centre of the solid angle subtended at the effective light centre of the headlight and bounded by the intensity vectors equal to 90% of maximum intensity.

2.4 **Beam spread:** - The angular extent of a beam, in a specified plane passing through the beam axis, which contains all the radius vectors of the polar curve of luminous intensity having lengths greater than 1/10 of the maximum.

3.0 CLIMATIC, ENVIRONMENTAL AND SERVICE CONDITIONS

Equipment shall be designed to work / withstand satisfactorily under climatic, environment & service conditions as mentioned below:

3.1	Max. Temperature (Atmospheric)	:	Under sun - 70 deg. c.
3.2	Humidity	:	100%.
3.3	Altitude	:	1200 meter above mean sea level
3.4	Rainfall	:	Very heavy.
3.5	Atmosphere	:	Extremely dusty. Hot weather and desert terrain in certain areas.
3.6	Coastal area	:	Equipment shall be designed to work in coastal areas in humid and salt-laden and corrosive atmosphere.

3.7 Vibrations and Shocks

The main headlight and auxiliary lights shall withstand satisfactorily vibrations and shocks normally encountered in service as indicated below: -

a) Maximum vertical acceleration : 3.0 g
b) Maximum lateral acceleration : 3.0 g
c) Maximum longitudinal acceleration : 3.0 g

('g' being the value of acceleration due to gravity).

The vibrations are of sine wave form and the frequency of vibrations is between 1 Hz and 50 Hz. The amplitude 'a' expressed in mm is given as a function of 'f' by a = 25/f for value of 'f' from 1 to 10 Hz. and a = $250/f^2$ for the value of 'f' exceeding 10 Hz and up to 50 Hz.

4. 0 TECHNICAL REQUIREMENTS.

4.1 The headlight system will be suitable for illuminating track and also OHE and masts in electrified sections to enable driver to control speed of train and look at caution boards etc.

4.2 For meeting illumination requirements of track at distance and caution boards/OHE/mast etc. in vicinity, the triangular pattern headlight will consist of one main headlight and two auxiliary lights mounted in triangular pattern. The main headlight will be mounted on top of front of driver's cab in locomotive and auxiliary lights will be mounted below marker lights in electric locomotives and by the side of marker lights in diesel locomotives. General arrangement is shown in Annexure –A.

4.3 While MAIN HEADLIGHT will provide long distance illumination of track, AUXILIARY LIGHTS will mainly provide short distance illumination in front of locomotives. Under normal working condition, main headlight as well as auxiliary lights will work together to provide illumination.

4.4 The requirements of headlight are stipulated in para – 4.14 of General and Subsidiary Rules, which are reproduced as under :-

1. A train shall not be worked at night or in thick, foggy or tempestuous weather impairing visibility or in long tunnels, unless the engine carries an electric headlight of an approved design and, in addition, two oil or electric white marker lights.

2 An engine employed exclusively on shunting at stations and yards shall, at night or during thick, foggy or tempestuous weather impairing visibility, display such headlights as are prescribed by the Railway Administration and exhibit two red marker lights in front and in rear.

3. The electric headlight on the engine shall be fitted with a switch to dim the light and shall be dimmed –

(a) when the train remains stationary at a station ;

(b) when the train is approaching another train which is running in opposite direction on double or multiple track of same or different gauges; and

(c) on such other occasions as may be prescribed by special instructions.

4. In case the electric headlight fails or a train has to be worked with the engine running tender foremost in an emergency, the engine shall display the two oil or electric white marker lights referred to in sub-rule (1) pointing in the direction of movement and the train shall run at a speed prescribed by special instructions.

4.4.1 **For achieving dimming function, the electrical connections of main headlight and auxiliary lights shall be such that after operating BL key for dimming headlight, the main headlight will be switched off and auxiliary lights will work in dipper mode.** The electrical connections of main and auxiliary lights are shown in Annexure – F.

4.5 The main headlight will have a beam spread of 4 to 5° and auxiliary lights will have beam spread of 6 to 7°.

4.6 The headlight will operate on 24V(nominal) power supply from DC-DC converter provided on locomotive. The DC-DC converter shall conform to RDSO Specification No.ELRS/Spec/DC-DC converter/0021, Rev.'0'.

4.7 The illumination level at 300 meters shall not be less than 5.5 lux at a height of 1 m above the rail level with all the lights, i.e. main headlight as well as auxiliary lights working and not less than 4.5 lux with main headlight alone .

4.8 The **main headlight** shall be equipped with 24V, 35 Watt Xenon short arc lamp type Xen Start D1R with igniter and Xen Drive standard XLD 924 ballast of **Philips make** or similar with parameters as under -

4.8.1 Characteristics of Xenon short arc lamp. Model Xen Start D1R of Philips make.

1	Power	35W $\pm$ 0.3 W
2	Luminous flux	3000 lumen $\pm$ 250 lumen
3	Lumen maintenance	1500 hours
4	Service life to 3% failures	2000 hours.

4.8.2 Characteristics of Xen Drive standard XLD 24 Ballast of Philips make for Xen Start D1R lamp.

1. Nominal voltage - 24V.
2. Operating voltage Range - 18 to 32 V
3. Under lockout voltage - less than 12V.
4. Over lockout voltage - more than 32V.
5. Steady state supply current - 2 A.

4.8.3 The xenon lamp shall be of pre-focussed type and will be held together with reflector by a non-ferrous lamp holder of suitable design.

4.8.4 The main headlight shall be provided with an antiglare hood 300 mm long and having a dia of 260mm made from 1.6mm thick MS sheet

4.8.5 The maximum impedance of lead wire from input supply to ballast shall not be more than 50 milli ohms (including terminals, fuse holder contacts, relay and any connector resistance).

4.8.6 The maximum distance between ballast and lamp shall not be more than 3000mm.

4.8.7 A 10 amp. slow fuse shall be added in series with the ballast.

4.8.8 The main headlight shall be equipped with glass reflector of 210mm face dia. The glass reflector shall be of parabolic profile and geometry of parabola will be as shown in Annexure - B.

4.9 The single beam **auxiliary lights** shall be equipped with H4-24V 75/70watt halogen lamp with P45t type base with following parameters :

1. Voltage : 24V.
2. Wattage : (a) Main filament - 75 Watt.
   : (b) Secondary filament - 70 Watt.

3.	Lumen output	: (a)	Main filament	-	1900 lumen.
		: (b)	Secondary filament	-	1200 lumen.
4.	Rated average life	: (a)	Main filament	-	150 hours.
		: (b)	Secondary filament	-	300 hours.

4.9.1 Auxiliary light will have glass reflector of 180 mm face diameter. The reflector of auxiliary lights will be of parabolic profile and geometry as given in Annexure – B.

4.10 Each locomotive shall be provided with 2 sets of triangular beam pattern headlights one set on each end. One set of triangular beam pattern consists of one number single beam main headlight with 35 W xenon short arc lamp and 2 nos. single beam auxiliary lights with 75/70 W halogen lamp.

4.11 All the 3 light assemblies , i.e. main headlight as well as auxiliary lights shall be protected by toughened glass front cover with suitable gaskets to prevent entry of rain water as well as dust and moisture into headlight. The light assemblies shall also be provided with a charcoal filter to prevent staining of reflectors.

5.0 MECHANICAL AND PHYSICAL REQUIREMENTS

5.1.0 General: - (a) The **main headlight** shall consist of 24V/35W Xenon lamp, high voltage starter, lamp holder, ballast, glass reflector, die cast aluminium housing to protect glass reflector assembly, toughened glass front cover, rim holding front cover glass and reflector and having an antiglare ring around periphery of front glass, bird guard, antiglare hood of MS sheet and die cast aluminium base plate. The general arrangement of various components is shown in Annexure – 'D' and 'E'.

(b) The **auxiliary light** shall consist of 24V, 75/70W halogen lamp, lamp holder, glass reflector, toughened glass front cover, rim holding front cover glass and reflector and having an antiglare ring around periphery of front glass and housing of MS sheet with a square base to mounting on L-Channel. A visor made of 1.6mm MS sheet shall be welded to housing of auxiliary light. The visor shall project 125 mm in the front and will cover approximately one third of reflector. The general arrangement is shown in Annexure – 'C'.

(c) The headlight beams shall be of pre- focussed type housed in totally enclosed housing with reflector, lamp, lamp holder, terminals, and front glass etc. It shall be simple in design, rugged/robust in construction and easy in maintenance and operation. All of its

components shall be rust and corrosion resistant and the complete assembly shall be water- tight and splash proof after fitment on the locomotive.

(d) The rim, holding glass reflector and toughened glass front cover of main and auxiliary lights, shall be such that it covers front glass cover by 10mm $\pm$ 1mm from outer edge all around periphery to block light diffusing from edge of reflector to reduce glare. The rim shall be made from die cast aluminium.

(e) The profile of hood is shown in Annexure –'D'. 20 Nos. holes of 8 mm dia shall be made on the body of hood for reducing wind pressure. The hood shall be bolted to base plate and will be provided with a hinge on lower side of its base, so that the same can be opened for maintenance work and supported on hinge.

(f) The glass reflectors of main and auxiliary lights shall be made of glass suitable to withstand vibrations and shocks on locomotives as stipulated in clause – 3.7.

(g) The reflector of main headlight and auxiliary lights shall be provided with aluminium coating by vacuum metallising process to obtain high reflectance. The purest form of aluminium shall be used for vacuum metallising. Protective coating as necessary will also be provided.

5.1.1 Headlights shall be suitable for mounting on the front of drivers' cab. The main headlight will have facility to adjust the beam to centre of track at distance of 300 m in front of locomotive. The auxiliary lights shall also have similar beam adjustment facility. The beam adjusting screws shall be lockable type which can be locked in a position after beam adjustment with the help of knurled check nuts and will not get disturbed after it has been locked in a position.

5.1.2 A weather proof-sealing gasket made of Neoprene or superior quality rubber shall be provided between mounting plate and loco body/ L - channel for main & auxiliary lights respectively to make the headlight watertight to prevent entry of rain water.

5.1.3 Headlight assembly shall be provided with toughened glass front cover to protect lamp and reflector from direct hit. A Bird Guard on front glass shall be provided. The bird guard shall be an integral part of die cast aluminium ring holding front glass and reflector. The size of bird guard strips shall not be less than 10 mm x 4mm. Front glass cover assembly with reflector, lamp

holder etc. will be openable on hinge on the front for maintenance and replacement of bulbs of main headlight as well as auxiliary lights.

5.1.4 Base plate/Mounting plate thickness of main headlight shall not be less than 5mm. The collar of mounting plate will be 12 mm. Rear side of the main headlight shall be openable with knurled nut locking arrangement.

The housing of auxiliary lights shall be fabricated from a MS sheet of 3mm thickness and will have square base plate as shown in Annexure -C.

5.1.5 Mounting arrangement for **main headlight** for electric locomotives shall be of suitable for face mounting. The diameter and PCD of the fixing holes shall be as follows : -

	ELECTRIC LOCO	DIESEL LOCO.
P.C.D.	450 mm.	390 mm
Hole diameter	8 mm.	10 mm.
No. of holes	8 Nos.	6 nos.

5.1.6 Mounting arrangement of the auxiliary lights in case of electric loco shall be below marker lights on L-shaped channel welded to body as shown in sketch as Annexure –C. The base plate of auxiliary lights shall be fixed on L-channel with the help of suitable nuts and bolts having a provision for split pin for locking nut in its position.

In case of diesel locomotives, **auxiliary lights** shall be mounted by the side of marker lights, provided in WDM2 locomotive. The mounting arrangement of auxiliary lights shall be similar to mounting arrangement of marker lights in WDM2 locomotives.

5.1.7 **Glass and Gasket**: - Glass used for the front cover shall be of the heat resistant, toughened (TS type), 4.0 mm thick transparent of AA quality and conforming to IS: 2553 (Part-I)-1990. A suitable weather proof sealing gasket of neoprene rubber or superior quality shall be provided for receiving the glass.

The glass used for reflectors shall be suitable to withstand heat generated by headlight lamps and shocks and vibrations as encountered in service and specified in clause – 3.7 of this specification.

Note : Manufacturer may offer other non-metallic reflector with aluminium coating. However, the same will require approval of RDSO.

5.1.8 **Terminals Block/Terminal Connector** : - A terminal block of **DMC** Glass Fiber Epoxy moulded fire retardant suitable to withstand high temperature shall be mounted in the headlight housing for connections of incoming supply. The terminal block shall be free from blowholes and cracks. The nut, bolt, stud washer shall be of stainless steel. It shall be readily accessible and shall be positioned to avoid the possibility of accidental contact during maintenance. Terminal block shall be stud type suitable to receive ring type cable sockets.

5.1.9 **Hinges, catches and locking screws.**

Hinges, catches and locking screws shall be made of material having good corrosion resistance. Otherwise this shall be provided with adequate protection against corrosion. They shall be robust and simple in construction and shall not need use of special tools for opening. Design and fabrication of covers or other enclosures shall be such that they do not open out due to vibration or during maintenance.

5.1.10 **Finish :** The housing and front ring provided over glass shall be suitably pretreated and powder coated with grey colour from inside and outside.

5.1.11 **Wiring/Connections** : The main and auxiliary light assemblies shall be prewired upto terminal block connecting lamp and its controls gear. The connections in main and auxiliary lights shall be made from 2.5 sq. mm elastomeric cables to RDSO specification No.E-14/01, Rev.'2'.

5.2 Photometric requirements: -

The intensity of illumination measured in a clear atmosphere, free from dust, smoke and fog at a point in the centre of the beam at 1 m level, when focussed accurately at a distance of 300 meters shall be not less than 5.5 Lux with both main and auxiliary lights working and shall not be less than 4.5 lux with only main headlight working. This requirement of illumination has to be met with bird guard fitted on headlight.

Both auxiliary lights working together will deliver an illumination of not less than 10 lux at 1 meter height from ground level in the centre of track at a distance of 100 meters.

The main headlight will have a beam spread of 4 to 5 degrees and individual auxiliary lights shall have a beam spread of 6 to 7 degrees.

6.0 Testing of Headlight & Auxiliary lights

6.1 The prototype test shall be carried out by RDSO at the premises of the manufacturer or at a test house/lab mutually agreed upon.

6.2 Tests as indicated table below will constitute Type, Routine and Acceptance tests. These tests will be carried out as per method detailed in clause –7.0.

S.No.	Test description	Type	Routine	Acceptance	Remarks
1.	Visual inspection and verification of dimensions, materials and finish for components	Y	Y	Y	Clause 7.1
2.	Insulation resistance test	Y	Y	Y	Clause 7.2
3.	High Voltage test	Y	Y	Y*	Clause 7.3
4.	Water proofness test	Y	Y	Y*	Clause 7.4
5.	Thermal shock proof test for cover glass	Y	-	Y*	Clause 7.5
6.	Photometric test	Y	Y@	Y@	Clause 7.6
7.	Dust test	Y	-	-	Clause 7.7
8.	Vibration Test	Y	-	-	Clause 7.8
9.	Dye-penetration test	Y	Y	-	Clause 8

LEGEND: -

Y	:	Test to be conducted .
-	:	Test not to be conducted .
Y*	:	On 10% or minimum 2 numbers of the lot offered.
Y@	:	This test will be done at 8 m distance and illumination obtained at 8 meters shall not be less than 7000 lux for main headlight and 800 lux for auxiliary lights.

7.0 METHOD OF TESTS FOR HEADLIGHT

7.1 **Visual Inspection :-** Materials and finish of all components shall be visually examined for finish and verified for their dimensions and material specification. The manufacturer shall furnish a metallurgical composition certificate for the reflector material and reflector polish.

7.2 **Insulation Resistance Test: -** The insulation resistance shall be measured with 500 V DC meager. The value of insulation resistance shall be not less than 20 Megohms between the live parts and the frame. The test shall be carried out after disconnecting lamp and associated control gear. The test shall be carried out both before and after the illumination test.

7.3 **High Voltage Test: -** Immediately after insulation resistance test, an ac voltage of 1500 V RMS of sine wave form of 50 Hz shall be applied for one minute between the live parts and frame. The tests shall be carried out after disconnecting lamp and associated control gear. The test shall be started at voltage of less than 1/3 of the test voltage and shall be increased gradually to the full test voltage. The high voltage testing equipment shall be set at 20 mA leakage current. Head light shall withstand the voltage without flash over, break down or tripping of supply. The test shall be carried out after disconnecting lamp and control gear including ballast.

7.4 **Water Proofness Test: -** The head light assembly shall be subjected to this test in its unpacked condition without any electric feed. One hour water spray test shall be carried out in accordance with IS 9000 Pt. 16) of 1983 (Specification for Basic environmental testing procedures for electronic and electrical items) and at the end of this test, the assembly shall be examined for any visible evidence of water ingress.

7.5 **Thermal Shock Proof Test for Front Cover Glass: -** The thermal shock proof-ness of the front cover glass shall be tested by operating the headlight in still air until the glass has attained a steady state temperature and then pouring cold water at 10 deg C to 12 deg C on the glass while the lamp is burning. This test shall be repeated four times and the cover glass shall not crack.

7.6 PHOTOMETRIC TEST

7.6.1 **Type tests** : Photometric type tests shall be carried out as laid down under clause – 7.6.1.1 to 7.6.1.3.

7.6.1.1 **Test Voltage :-** The test voltage at lamp terminals shall be steady set at 24.0 + 0 / - 0.1V. The momentary fluctuation of the test voltage during the test shall be not more than ± 1%.

7.6.1.2 **Illumination Intensity: - (a)** The main headlight under test shall be mounted on a test stand which shall be put on one end at the centre line (lengthwise) of the level ground, free from obstruction over an area of 300m x30 m. The height of the axis shall be 3.7 m above the ground level for main headlight and 1.8 meters for auxiliary lights. Photometric measurements shall be taken with all the three lights working and readings recorded at centre line, 5 meters and 10 meters right and left of the centre line at the following levels at a distance of 300 meters.

(i) Ground level,
(ii) Height of 1.0 metre above ground level,
(iii) Height of 1.5 meters above ground level.

With above readings, curves of intensity of illumination shall be plotted to obtain the spread over the track.

(b) After above measurements, both the auxiliary lights shall be switched off and readings shall be recorded with main headlight alone working.

(c) After this, main headlight shall be switched off and illumination readings shall be taken at 100 meters distance.

With above readings, curves of intensity of illumination shall be plotted to obtain the spread over the track. The illumination levels obtained shall satisfy requirements laid down in clause –5.2. The measurements shall be taken after removing antiglare hood.

7.6.1.3 **Angle of the Beam:** Main Headlight shall be mounted on a table with beam centre one metre above the ground. Photometric measurement shall be taken in the lateral direction at right angles to the axis of the beam in horizontal plane at one metre height at a distance of 100 metres from the headlight. Move photometer in lateral direction on the left and right so as to read the maximum illumination intensity and locate the point after which the illumination level reaches 1/10th of maximum values. The distance between both the left and right points should be measured as `x' metre: -

Then tan A = x/2 x 1/100
The angle 2 A is the angle of the beam.

Similar readings shall be taken for auxiliary lights and beam angle determined.

7.6.1.4 The headlight shall comply with the requirement of clause 5.2 for tests conducted under clause 7.6.1.2 and 7.6.1.3.

7.6.2 **Routine and Acceptance test:** The routine and acceptance photometric tests shall be conducted in a dark room. The main headlight shall be placed on a table and illumination shall be measured at a distance of 8 meters at the level of headlight. The illumination from main headlight shall not be less than 7000 lux.

Similar readings shall be taken for auxiliary lights. The illumination obtained for individual auxiliary lights shall not be less than 800 lux.

7.7 DUST TEST.

Dust test shall be done, as per IS 9000 (Part-12) -1981. The test results shall be treated as satisfactory if there is no dust entry into reflector beam assemblies.

7.8 VIBRATION TEST.

Vibration test shall be carried out as per IEC-77 on complete head light assembly in working condition. The tests shall be conducted separately for main headlight as well as auxiliary lights. The test results shall be treated as satisfactory if there is no failure/damage noticed.

8.0 DYE-PENETRATION TEST

Dye penetration test for detection of surface defects/cracks on welds shall be conducted as per IS: 3658-1981.

9.0 Testing Facilities

The manufacturer shall offer all the testing facilities free of charge, to the inspecting authority for all the tests conducted at his premises.

10.0 Scope of Supply

The scope of supply of headlight assembly shall be as under: -

Triangular pattern Headlight system for locomotive shall comprise the following:

i)	Single beam main headlight assembly complete with 24 V, 35 W xenon lamp and high voltage starter as well as lamp ballast.	2 Nos. per loco.
ii)	Single beam auxiliary lights complete with 24 V, 75/70 W twin filament halogen lamps.	4 Nos. per loco.
iii)	All other necessary changeover switches required for Head light operation other than existing switches for head light control in the BL key box of locomotive.	As required.

11.0 Prototype Test Report

Complete prototype test report along-with test program circuit diagram, component details, working of the circuit etc. shall be bounded in booklet form and two copies of booklet shall be submitted to RDSO for record.

12.0 Design Manual

Before the prototype is approved, design manual consisting of the following shall be submitted to RDSO.

a) Circuit diagram, component nos., rating of components and data sheets of all components.

b) Drawing of the head light alongwith part drawings.

c) Colour photographs showing the 2/3 views of head light assembly.

13.0 Maintenance Repair Manual

A maintenance manual shall be supplied with each head light assembly.

14.0 Marking.

14.1 An anodized aluminium plate carrying following markings shall be fitted on the casing of headlight assembly at a suitable place :-

(i) Maker's name and trade mark

(ii) Maker's serial number and year of manufacture.
(iii) Size of the beam.
(iv) Specification No....
(v) System Voltage.
(vi) Type of Beam & Lamp.

15.0 Packing

15.1 The complete assembly shall be wrapped in a polythene packing and placed in a craft board box and then packed in a wooden box (having adequate strength) in such a manner that there shall be no damage during transit.

16.0 Guarantee

16.1 The complete headlight shall be guaranteed for a period of one year from the date of commissioning. Any component found defective within one year shall be repaired or replaced by the manufacturer free of cost.

17.0 INFRINGEMENT OF PATENT RIGHTS:

Indian Railways shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, use of components used in design, development and manufacturing of Triangular Pattern Head Light and any other factor which may cause such dispute. The responsibility to settle any issue rests with the manufacturer.

18.0 TYPE APPROVAL.

18.1 Complete set of drawings shall be submitted to RDSO for approval. Material details for various items shall also be furnished as per Annexure-B before the design is approved. Outer dimensions of the fittings can be finalised by actual mounting of the prototype on a locomotive in the electric loco shed of Indian railways. Only after the drgs.and material details are finalised and approved by RDSO,the prototype unit shall be manufactured and offered for prototype tests. Type tests on one unit shall be carried out by the representatives of RDSO at the manufacturer's works. Type approval shall be granted by RDSO in case all the tests are successful. In the event of satisfactory type tests it will be fitted on few electric locomotives in place of existing headlight and performance shall be monitored for six months. After satisfactory performance of these headlights, their provision may be extended on more locomotives.

18.2 Any modification considered necessary shall be carried out by the manufacturers free of cost. Authority for finalising the modification, if necessary, shall be RDSO.

18.3 After the units work satisfactorily in service, no modification in design shall be carried out without prior approval of RDSO.

18.4 Prototype tests shall be repeated by RDSO after a period of two years or earlier for revalidation of the design.

18.5 The tenderer may suggest superior design features if any which can be considered by RDSO/Purchaser based on overall cost benefit and technical superiority of the design proposals simplicity in design, construction and operational reliability etc.

Annexure –'A'

Main Headlight

Marker light
Auxiliary light

Marker light
Auxiliary light.

General Arrangement of Triangular Beam pattern headlight for Electric Locomotives.

Annexure – 'B'

Parabolic profile of Reflector of Main Headlight.

Parabolic profile of Reflector of Auxiliary light.

Note : Above profiles are for guidance only and exact profile and focal point should be decided by the manufacturer based on lamp geometry and holder design.

Annexure –'C'.

LEGEND

No.	Description
1	Fixing Bolts
2	Beam Adjusting Screws.
3	Lamp Holder.
4	Rim with Birdguard.
5	Front cover toughened glass.
6	Hinge.
7	Reflector.
8	Housing.
9	L shape Channel – 50x50x6 mm
10	Halogen lamp.
11	Visor

Mounting Arrangement of Auxiliary lights on Electric Locomotive.

Annexure –'D'

LEGEND

No.	Description	Material
1	Antiglare Hood	MS sheet.
2	Rim	Die Cast Aluminium.
3	Front cover	Toughened Glass.
4	Reflector	Glass.
5	Housing	Die Cast Aluminium.
6	Ballast.	
7	Cushion with locking.	Neoprene Rubber.
8	Charcoal filter	
9	Back cover.	
10	Base plate	Die Cast Aluminium
11	Fixing Bolts	Stain less steel

General Arrangement of Main Headlight Beam showing xenon lamp, lamp holder, front glass, reflector, housing and Base Plate etc.

Annexure –'E'

General Arrangement of Main Headlight Beam showing Xenon Lamp, Lamp Holder, Front Glass, Reflector and Birdguard.

Annexure –'F'

Connection Diagram showing Electrical Connections of Main and Auxiliary Lights.