TECHNICAL SPECIFICATION
FOR
NON-METALLIC COLOUR LIGHT SIGNAL HOUSINGS OF VARIOUS TYPES
FOR
RAILWAY SIGNALLING
(TENTATIVE)

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Abstract This document specifies Technical Specification for Non-Metallic Colour Light Signal Housings of various types for Railway Signaling.			

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Technical Specification for Non-Metallic Colour Light Signal Housings of various types for Railway Signalling (TENTATIVE)

0. FOREWORD

0.1 This specification is issued under the fixed serial number RDSO/SPN/194/2006.

0.2 This specification requires reference to the following Indian Railways Standards / Indian Standards / International Standards specifications:

IRS: S 23	Electrical Signalling and Interlocking Equipment.
IRS: S 26-64	Colour light signal, multi- unit type.
IRS: 10-78	Specification for Mechanical Signalling and Interlocking Equipments
RDSO/SPN/151/1997	FRP material to be used for signalling equipments.
S 75-2006	Terminal blocks & Fuse blocks for signalling installations
RDSO/SPN/189/2004	Terminal blocks, fuse terminal blocks and miniature fuse links of international standard for railway signalling.
RDSO/SPN/153/2011	LED Signal Lighting Units for Railway Signalling
IS: 6745	Methods for determination of mass of zinc coating on zinc coated iron and steel articles.
IS: 266	Specification for sulphuric acid.
IS: 1573-1986	Specification for electroplated coatings of zinc on iron and steel.
IS: 154	Ready mixed paint, brushing, dead black, for use on metals.
ASTM: D256	Standard test methods for impact resistance of plastics and electrical insulating materials.
ASTM: D790	Standard test methods for flexural properties of unreinforced and reinforced plastics and electrical insulating materials.

0.3 Wherever in this specification any of the above mentioned specification is referred to by number only without mentioning the year of issue, the latest issue of the specification is implied, otherwise the particular issue referred to is meant.

0.4 This specification is intended to cover the technical provisions and it does not include all the necessary provisions of a contract.

1.0 SCOPE

1.1 This specification covers technical requirements and tests of non-metallic Colour Light Signal housing multi unit type for 2, 3 & 4 main colour light signal aspects as well as Direction Type Route Indicator, Shunt & Calling On Signals suitable

for installation of LED signals aspects (RDSO specification no. RDSO/SPN/153/2011 as well as RDSO/SPN/199/2010 (with latest amendments) for railway signaling and made of Fiber Reinforced Plastic (FRP) material.

1.2 This specification does not cover the wiring and other devices used in conjunction with Colour Light Signals in their installation.

1.3 Any recognised non-metallic material other than FRP with well established processing method may also be considered depending on its merits, compliance of this specification and subject to prior approval of RDSO.

2.0 TERMINOLOGY

2.1 The terminology referred to in this specification is covered by IRS Specification No. S23.

2.2 The terms referred to in this specification but not covered in IRS Specification Nos. S23 are defined below:-

2.2.1 Colour Light Signal (CLS) - A fixed signal, the aspects of which are given by the colour of a light.

2.2.2 Signal Light Unit- An LED signal aspect in accordance with RDSO/SPN/153/2011 as well as RDSO/SPN/199/2010 (with latest amendment).

3. TECHNICAL REQUIREMENTS

3.1 Fibre Reinforced Plastics (FRP) material shall comply RDSO/SPN/151/1997 except for the deviations as specified in this specification. This may contain colouring agents.

3.2 FRP material shall be weatherproof and shall not loose shape or rot in service. This shall be anti termite/ fungus/ borer. This shall withstand attack by vermin. This shall not warp, split, delaminate or blister. Expansion or contraction due to thermal changes shall be negligible.

3.3 Chemical and Physical properties of FRP parts of Non-Metallic Colour Light Signal Housing, Multi Unit Type, Direction Type Route, Shunt & Calling on shall be as under -

Sl. No.	Property	Specified value	Test procedure
1.	Flexural strength	150 MPa (min.)	ASTM: D790
2.	Izod impact strength	1100 Joules/m (min.)	ASTM: D256
3.	Glass filler by ash (%)	30 $\pm$ 5	Appendix ‘A’

4.	Flammability	Self-extinguishing	Appendix 'B'
5.	Resistance to ageing	To Pass	Appendix 'C'
6.	% Water absorption (max.)	0.5	Appendix 'D'
8.	Resistance to dilute acid	To Pass	Appendix 'E'
9.	Resistance to drop impact	To Pass	Appendix 'F'

Table-1

3.4 CLS Multiunit type and Direction Type Route signal (with all arms) housing when mounted on a 3 m high signal post rigidly connected on signal foundation shall be tested for strength to resist wind pressure as per Appendix 'G'.

4. DESIGN CRITERIA

4.1 Dimensions shall be as per drawings no. given below:

S. No.	CLS Unit type	Drawing No.*
1	2 Aspect CLS Unit	SA 23003A/M
2	3 Aspect CLS Unit	SA 23002A/M
3	4 Aspect CLS Unit	SA 23001A/M
4	Junction Type Route Indicator with Arms	SA 23401-06
5	Shunt Signal Unit	SA 23840
6	Calling On Signal Unit	SA 24351/Adv

Table-2

* with the following deviations:

(i) The diameter of hole in the unit for LED aspect in 2-aspect, 3- aspect and 4-aspect CLS units should be 130 mm instead of 180 mm as in the drawing.

(ii) Signal lenses, lamp holder units & electric filament lamps are not required in FRP signal units.

(iii) There shall be no redundant holes etc. in the housing which may be a potential source of water ingress. All redundant holes in the CLS units meant for lamp assembly etc. shall be closed.

(iv) Tolerance of $\pm$ 5 mm may be allowed in all outer dimensions. `More thickness of the FRP material may be permitted (especially in Direction Type Route Indicator), if required for adequate strength of the unit. Tolerance of +20 mm may be permitted in outermost vertical dimensions for Direction Type Route Indicators subject to satisfactory fitment of all internal components including LED signal aspects.

(v) For inner dimensions, tolerances given in the relevant drawings shall generally be followed. Minor variations in internal dimensions due to more thickness of FRP material may be permitted subject to satisfactory fitment of all internal components including LED signal aspects.

(vi) Thickness of a non-metallic part/ component should be such that it has the adequate strength and meets the requirements of this specification. Deviation if any other than those mentioned above, from the drawings will require prior approval of RDSO.

4.2 Surface of FRP parts of CLS housing shall not show blisters, porosity or cracks. The surface shall be reasonably smooth and even.

4.3 Surface of FRP parts of CLS housing shall be free from exposed pin holes. No holes etc. should be left in the unit which may be potential source of water ingress.

4.4 CLS housing should be of sound construction. Mating surfaces should mate squarely and should be securely fixed with proper alignment.

4.5 Exposed edges of FRP housing shall be rounded off.

4.6 CLS housing shall be weatherproof and shall not change in shape during any season / climatic condition. This shall not rot, crack, warp or splinter.

4.7 CLS housing shall be anti termite/ fungus/ borer. This shall withstand attack by vermin.

4.8 CLS housing shall be cold and boiling water resistant. This shall also be resistant to oil, gasoline, dilute acid / alkali and salted water.

4.9 CLS housing shall be Fire Retardant.

4.10 Waterproof gasket lining in groove shall be provided in CLS housing at housing of door to prevent ingress of rain, insects etc. Gasket shall be of good quality of long lasting rubber and should flush with the unit housing.

4.11 Hinge arrangement of doors shall be sufficiently robust and durable.

4.12 Suitable metal inserts may be used in moulding to achieve adequate strength, especially for hinges, hasp and parts used for fixing in mounting socket, top plate etc.

4.13 Mounting socket including its material for 2/3/4 Aspect unit shall be as per RDSO Drg. No. S 23005/M for post mounting on 140 mm outside dia. post. Mounting socket for route, shunt and calling ON signals shall be as per drawing no. S 23005, S 23845 & S 23844 respectively.

4.14 Top plate and an eye bolt on its top for convenience in handling of multi unit type CLS housing including their material shall be as per RDSO Drg. Nos. S-23022/M and S-23021/M respectively.

4.15 Hasp and Hinge arrangement for doors shall be metallic with either FRP lining or Zinc coating for adequate strength and corrosion free life.

4.16 The doors when open shall permit easy access to all inside fittings. Arrangements shall be provided for rigidly securing and pad locking the doors of terminal box and aspect units of CLS housing.

4.17 Screened breather as per drawings shall be provided to ensure ventilation in all aspect units of CLS housing. Wire mesh used for ventilation shall be of stainless steel.

4.18 Zinc coated Mild Steel nuts, bolts, screws and washers shall be used. Nuts may be moulded in FRP parts, wherever feasible.

4.19 Provision of Stainless Steel wire mesh suitably moulded in between the layers of FRP material duly interconnected in cyclic fashion for continuity with two earth terminals (one terminal each provided on each side of CLS housing near bottom of the unit) for electrostatic shielding for use in AC RE area as per details given below:
(i) Gauge and grade of SS wire mesh: 22G, 8 mesh or 8 hole per sq. inch as per AISI 304 quality "18-8" non magnetic.
(ii)Material and diameter of each terminal: 8 mm Galvanized MS bolt alongwith corresponding nut and 2 washers.
(iii) Marking of each terminal on CLS unit.

4.20 Metallic parts/components (including locking arrangement, excluding mounting base, top plate and stainless steel wire mesh) wherever used, shall be Zinc coated as per Service Grade no. 1 of IS:1573-1986 to provide corrosion free life.

4.21 Top plate, Mounting sockets and other exposed metallic parts/components shall be painted with non- reflecting dead black paint to IS:154 after two primary coats- one of zinc chrome to IS: 104 followed by another of red oxide- zinc chrome to IS 2074.

4.22 Non-Metallic Colour Light Signal Housing shall be moulded in non- reflecting dead black colour similar to IS 154. Painting of FRP material is not allowed.

4.23 Means shall be provided for independent vertical and horizontal adjustment of the signal for accurate alignment of the projected light beams in respect to the track which it controls.

4.24 Two holes in true horizontal alignment shall be provided on the terminal box as per RDSO Drg. No. S 23009/M for the purpose of checking the alignment of the signal in respect to the track it controls.

4.25 There shall be provision for fixing appropriate type of LED signal lighting unit with or without its current regulator (current regulator applicable for 2/3/4 aspect CLS housing) in every signal aspect unit.

4.26 Four Modular type terminal strips as per RDSO specification no. RDSO/SPN/189/2004 (latest) shall be mounted on common rail in the terminal box of the Multi Unit type CLS housing. Every terminal strip shall comprise of 3 no. of Screwless Disconnect type terminal blocks (2 terminal type). Provision of mounting terminals as per IRS S 75-2006 instead of modular type terminals should also be there.

4.27 A hood shall be provided for each signal aspect unit projecting substantially at right angles to the body of the CLS housing and extending one half way around the front opening and shall be not less than 300 mm long for 2/3/4 aspect CLS housing. The length of the hood shall not be less than 305 mm, 75 mm & 200 mm for route, shunt and calling ON CLS housings respectively.

4.28 Hood shall be designed to prevent possibility of Phantom-indication due to sun at low altitudes as also to minimize the likelihood of snow or dust accumulating on the front opening.

4.29 Background of suitable size shall be provided.

4.30 Weight of Non-Metallic Colour Light Signal Housing (complete except mounting socket) shall be in the following range.

Weight	Type of housing						
	2 aspect	3 aspect	4 aspect	Route without arm	Each arm of the route	Shunt	Calling ON
	34-40 kg	43-50 kg	55-62 kg	27-32	10-13 kg	4-5.5 kg	3-5 kg

Table-3

Deviation may be allowed subject to compliance of other clauses of this specification.

4.31 The background for the CLS housing shall be moulded using compression moulding technique using Sheet Moulding compound. For other items, hand layup process may be used for moulding instead of compression moulding.

5. MARKING AND IDENTIFICATION

5.1 Manufacturer shall engrave/emboss its recognised trade mark on all FRP parts of Colour Light Signal Housing at conspicuous location.

5.2 The words ‘Indian Railway Property’ shall be engraved /embossed on every CLS housing in letters of not less than 20 mm size at a conspicuous place.

5.3 Manufacturer shall engrave/emboss the following information on every CLS housing at a conspicuous place -

(a) Name or trademark of the manufacturer
(b) RDSO's specification number
(c) Serial No.
(d) Month and year of manufacture

Out of above, Specification No., Serial No. and Month/ Year of Manufacture may be provided on anodized aluminium plate instead of engraving/ embossing.

6. INSPECTION AND TESTING

6.1 Type Tests:

For type test, one sample of every type of Non-Metallic Colour Light Signal Housing (i.e. 2, 3 & 4 Aspect unit) and Route, Shunt & calling ON shall be submitted for type test. Following type tests shall be conducted on the sample-

i) Visual inspection & dimensional check (Clause 4.1 to 4.5, 4.13 to 4.18, 4.20 to 4.29, 5.1, 5.2, 5.3)
ii) Chemical and Physical properties of FRP parts of Colour Light Signal Housing (Clause 3.3)
iii) Check for zinc coating (Clause 4.19, IS:6745)
iv) Resistance to drop impact on CLS housing (Clause "F1")
v) Resistance to wind pressure test (Clause 3.4)
vi) Weight of Colour Light Signal Housing (Clause 4.30)
vii) Drop test (Appendix 'H')

6.1.1 Three test specimens of every type as required for Chemical and Physical properties test of FRP parts of Colour Light Signal Housing as per clause 3.3 shall be submitted for type test. These samples shall be collected through representative of RDSO at the time of fabrication of the products. Three test specimens shall be tested for every test in connection with Chemical and Physical properties of FRP parts of Colour Light Signal Housing unless otherwise specified in the relevant clause. Individual test specimen should pass all the tests.

6.2 Acceptance Tests:

i) Visual inspection & dimensional check (Clause 4.1 to 4.5, 4.13 to 4.18, 4.20 to 4.29, 5.1, 5.2, 5.3)
ii) Resistance to drop impact on CLS housing (Appendix 'F1')
iii) Resistance to wind pressure test (Clause 3.4)
iv) Weight of Colour Light Signal Housing (Clause 4.30)

6.2.1 Lot and Lot size:

Lot is a collection of Colour Light Signal Housing **of one type** and size manufactured by same process under similar conditions of production and offered for inspection at a time and the number of CLS housing in a lot will form lot size.

6.2.2 For acceptance test, sampling criteria shall be as under-

Lot size	**For Visual inspection & dimensional check**		**Weight**	**Resistance to drop impact on CLS housing**	**Resistance to wind pressure**
	No of samples to be tested	**Permissible No. of defects**	**No of samples to be tested**	**No of samples to be tested**	**No of samples to be tested**
Up to 50	2	0	2	2	1
51 -200	3	0	3	2	1
201-300	5	0	5	3	2
301-500	8	1	8	3	2
501& above	10	1	10	3	2

Table- 4

6.2.3 No failure is permitted in resistance to drop impact on CLS housing, resistance to wind pressure and weight tests. In case any sample drawn fails to satisfy the requirements, twice the number of samples shall be drawn and tested. If any of the retested samples also fails, the entire lot shall be rejected.

6.3 Routine Tests:

i) Visual inspection & dimensional check (Clause 4.1 to 4.5, 4.13 to 4.18, 4.20 to 4.29, 5.1, 5.2, 5.3)
ii) Chemical and Physical properties of FRP parts of Colour Light Signal Housing (Clause 3.3)
iii) Check for zinc coating (Clause 4.19, IS: 6745)
iv) Resistance to drop impact on CLS housing (Clause "F1")
v) Resistance to wind pressure test (Clause 3.4)
vi) Weight of Colour Light Signal Housing (Clause 4.30)

6.3.1 Visual inspection shall be done on 100% Colour Light Signal Housings. Tests for chemical and physical properties of FRP parts and check for zinc coating shall be done lot wise. Rest tests may be carried out as per sampling plan given for acceptance test.

6.3.2 Test record with due traceability shall be maintained.

7. INFORMATION TO BE GIVEN BY PURCHASER

No. and type of aspects of CLS housing

8. SCOPE OF SUPPLY

8.1 If not asked otherwise by the purchaser, the supply shall include CLS housing for the type & no. of signal aspects asked by the purchaser, complete with mounting

socket and top plate. Scope of supply does not include supply of signal light unit/ LED signal & internal wiring.

9. PACKING

Manufacturer shall be responsible for safe transportation of Colour Light Signal Housings. If there is any damage, manufacturer shall replace the damaged CLS housing free of cost.

APPENDICES

A. Glass filler by ash (%)

C- 1 Method

C- 1.1 Take a crucible and heat it by keeping in a muffle furnace till a constant weight is obtained of the crucible.

Let the weight of the crucible = W1

C- 1.2 Take approximately 2 gm of the specimen of the component in the above crucible and find the weight of the crucible and the specimen as above.

Let the combined weight of the crucible and specimen = W2

C-1.3 Burn the Plastics of the specimen by keeping the crucible in the muffle furnace till shining glass is noticed. Allow it to cool to the room temperature.

C-1.4 Weigh the above crucible and glass after cooling.

Let the combined weight of the crucible and glass = W 3

C-2 Glass fibre percentage calculation:

C- 2.1 The weight of the specimen of the components W 4 = W2 – W1

C- 2.2 The weight of the Glass Fibre content in the specimen W5 = W3 – W1

C- 2.3 Percentage of the Glass Fibre content = (W5/W4) x 100

C- 2.4 This test shall be conducted on two samples only.

B. Flammability Test

(i) Specimen measuring about 150 x 25 x t * mm (t * is the minimum thickness of a FRP part/component used in CLS housing) shall be subjected to the luminous bats- wing flame from a Bunsen burner of 10 mm inside diameter. The specimen shall be held with the flat side up at an angle of 45 deg. to the horizontal. The flame shall be 25 mm in width across the tips. It shall be applied to the specimen for 30 seconds and on removal if the flame extinguished within 30 seconds then applied again for a second period of 30 seconds and then again removed.

(ii) Should the specimen get ignited it shall not continue to burn for more than 15 seconds after the flame has been finally removed. In the event the flame continues more than 30 seconds on removal after first application the specimen shall be declared as failed.

(Reference specification: C-9601)

C. **Resistance to ageing**

i) **Dry Heat Test** - 3 specimens of size 20 x 10 x t * cm. (t * is the minimum thickness of side/door of FRP material used in CLS housing) with edges smoothened through fine emery paper shall be subjected to seven cycles successively, every cycle consisting of the following operations-

a) Heat at 60 ± 2 °C for 8 hours in an air oven
b) Cooling at room temperature for 4 hours.

After completion of 7 cycles, the specimens shall be examined. The specimens shall be considered to have passed the test if no surface defects likely to mar the aesthetic value or protective coating are seen. The specimens should not crack, warp, bend or loose shape/colour after the testing.

ii) **Ageing test** - 3 specimens of size 20 x 10 x t * cm (t * is the minimum thickness of side/door of FRP material used in CLS housing) without edges shall be subjected to seven cycles successively, every cycle consisting of the following operations-

a) Heat at 70 ± 1 deg C for 8 hours in an air oven
b) Immerse in cold water 27 ± 1 deg C for 16 hours.

After completion of 7 cycles the specimen shall be dried in folds of blotting paper and examined.

The aged specimens shall not show any surface defects likely to mar the aesthetic value or protective coating. The specimens should also not show any sign of swelling, delamination / deterioration after completion of the test. The specimens should not crack, warp, bend or loose shape/colour after the testing.

D. **Determination of water absorption**

A specimen of size 5 x 5 x t * cm (t * is the minimum thickness of hood of FRP material used in CLS housing) with cut edges shall be weighted and kept suspended in distilled water at 27 ± 1 deg.C for 24 hrs. It shall then be removed. Surface and dried in folds of blotting paper and weighed. Increase in weight expressed as % of the original weight shall give water absorption.

(Reference specification: C-9601)

E. **Resistance to dilute acid**

Immerse a specimen of 75 mm square of FRP part of minimum thickness for 8 hours in battery grade acid (dilute) as per IS-266. Examine the specimen. This shall not show any sign of delamination, deformation, deterioration etc. on surface or edges.

(Reference specification: RDSO/SPN/184/ 2006)

F. **Resistance to drop impact**

Specimen of size 30cm x 30cm x t* cm (t * is the minimum thickness of side/door of FRP material used in CLS housing) is supported in a suitable square (see fig. 3 of IS : 2553 - 1971). The steel ball of 1 Kg. is dropped from a height of 1.5 meters by a suitable device to strike the specimen within 25 mm from its centre.

After the test, the specimen shall not develop any cracks in or around the area of impact.

F1. **Resistance to drop impact on CLS housings**

The steel ball of 1 Kg. is dropped from a height of 1.5 meters by a suitable device to strike the specimen within 25 mm from its centre.

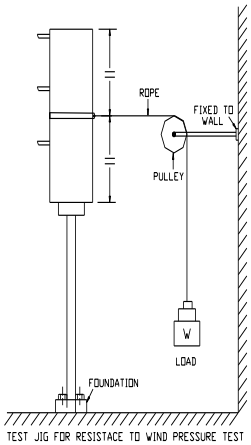
This test shall be conducted on hood fixed in CLS housing, ventilator, extruded portion for padlocking and doors and hasp opened at about 90°.

For acceptance test, this shall be tested on CLS housings only as specified above.

(Reference specification: RDSO/SPN/184/2006)

G. **Resistance to wind pressure test**

CLS housing shall be tested for its strength to resist wind pressure of 122 Kg per sq. m. (Ref. IRS specification no. S 10-78 for Mechanical signalling and interlocking equipment). Test jig and test procedure are given below-



TEST JIG FOR RESISTACE TO WIND PRESSURE TEST

CLS Multiunit housing and Route housing fitted with all arms, as the case may be, should be fixed on a 3 m tall signal post and a load W to be applied to the centre of the housing. Load should be applied starting from 25 kg and thereafter gradually increasing in steps of 5 kg or less till it attains the value as given below.

Load 'W' for various CLS housings shall be as under-

Sl. No.	Type of CLS housing	Load (W)
1.	2 Aspect	55 kg.
2.	3 Aspect	70 kg.
3.	4 Aspect	85 kg.
4.	Route (with all arms)*	85 kg

*NOTE: For testing with route, the rope of the load shall be fixed on centre of the central unit in the above figure.

The test shall be made first on the front and then on the back of the CLS housing.

After either of the above tests, there should not be any damage or permanent set.

H. **Drop Test**

Complete CLS housing shall be subjected to free fall due to gravity from a height of 5 mtrs. No visual cracks should be observed. The drop of the housing shall be vertical on hard metallic surface or concrete floor without hood. For Direction type route indicator, the test shall be performed separately on centre unit and arm.
