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सत्यमेव जयते

भारत सरकार  
रेलमंत्रालय

GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS

अनुसंधान अभिकल्प एवं मानक संगठन  
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RESEARCH DESIGNS AND STANDARDS ORGANISATION  
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यूनिट 500 ऐम्पियररेटिंग की विशिष्टि

**SPECIFICATION FOR HIGH CAPACITY INTER VEHICULAR COUPLER UNIT (500  
AMPS. RATING) FOR EOG TYPE AC COACHES/POWER CARS/ LOCOS**

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S. No.	Date of amendment	Revision	Reason
1	29.11.2021	1	Change of the material of socket housing assembly from aluminum to stainless steel & revised the some drgs for use in locomotives.

अनुमोदित  
APPROVED

*[Signature]*  
29/11/2021  
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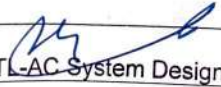
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## **SPECIFICATION FOR HIGH CAPACITY INTER VEHICULAR (IV) COUPLER UNIT (500 AMPS. RATING) FOR EOG TYPE AC COACHES/POWER CARS/ LOCOMOTIVES**

### **FOREWARD**

At present Rajdhani/Shatabdi trains are working on End on Generation (EOG) system. Power generated in the power car at the ends of the rake is fed to each coach of the rake through inter vehicular coupler. The existing Inter Vehicular (IV) couplers used in LHB AC Coaches (Rajdhani/shatabdi trains) are rated for 400 Amps, which is suitable for 18-19 LHB coaches. For rake having 24 number LHB AC coaches, there is need to enhance the current carrying capacity of the inter vehicular coupler up to 500 Amps. Therefore, it has been decided to develop high capacity Inter Vehicular Coupler for use in LHB type rake having 24 numbers EOG type coaches.

Most of the Electric loco shed of Zonal Railways have reported the failures of breakage of socket of the IV coupler (500 Amp) fitted in Electric Loco. Failures are of mainly related to breakage of Aluminum housing flashing and locking of coupler pins, lever tie bow gap, etc, which affects the reliability of HOG operations.

Western Railway has reported the failures of Inter Vehicular (IV) couplers of WAP7 locos provided with Hotel Load Converters (HLC), in which it is mentioned that the failures in IV couplers are mainly attributed to breakage of body/base of IV coupler and damage of phase pins. Western Railway has suggested that the Aluminum cast housing to Grade 4600 conforming to IS 617 as per RDSO's specification no. RDSO/PE/SPEC/AC/0177-2013(Rev-0) needs a material quality review for better performance.

Therefore, keeping in view of high failure of socket assembly due to breakage of Aluminum housing, flashing and locking of coupler pins, lever tie bow gap, etc used in loco has been reviewed. This specification has been revised keeping the change in the material of socket assembly from Aluminum casting to Stainless steel.

### **1.0 SCOPE**

- 1.1 This specification covers the design, manufacture and test requirement of IV coupler unit for EOG type AC coaches/locos for transmission of 3 phase, 5 wires, 750 V, 50 Hz power supply from power car to individual coaches.

### **1.2 SCOPE OF SUPPLY**

The scope of supply for each IV coupler unit shall include the following unless otherwise stipulated in the tender:

A) For coaches and Power cars

1	Jumper plug assembly	2 Nos.
2	Coupling socket assembly	2 Nos.
3	Dummy socket assembly	2 Nos.
4	Jumper cable duly crimped with each jumper plug and covered with flexible polyamide conduits and its fittings.	2.6 meters
5	Jumper cables duly crimped with each coupler socket	400 mm

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B) For Loco side

1	Coupling socket assembly for loco	4 Nos
2	Jumper cables duly crimped with each coupler socket	1 meter or suitable length

## 2.0 GOVERNING SPECIFICATION

2.1 The IV coupler unit shall, unless otherwise Specified here in, conform to the Indian Standards Specification/IEC recommendations as indicated below and the Indian Electricity rules, wherever applicable.

In case, there is any revision/amendment to these specifications/ rules/recommendations, the latest version shall be applicable.

S.N	Standards	Description
1	ASTM A351/Gr-CF8	Specification for stainless steel casting
2	IS: 319	Free cutting leaded brass bars, rods and sections
3	IS: 613	Copper rods & bars for electrical purposes
4	IS: 617	Cast Aluminum & its alloys ingots and casting for general engineering purpose.
5.	IS:4454(IV) and IS:7906(I) and (II)	Cold rolled springs (stainless spring steel wires grade 2)
6	AISI-304	Specification for Stainless steel Bars & section
7.	IEC 60947-1 2004	Specification for low voltage switchgear and control gear – part 1 General rules.
8.	IEC: 60529-1	Classification of degree of protection provided by enclosures.
9.	UIC: 532	Electric power supply for trains taken from the train vehicle
10.	UIC: 554-1	Power supply to electrical equipments on stationary railway vehicles from local mains system or another source of energy at 220 V or 380 V, 50 Hz
11.	DIN EN 15085-2-2008	Welding of Railway vehicles Part – 2: Qualification of manufacturer of welded rolling stock materials, Quality Assurance.
12.	EIA 364E-2008/IEC 60352	Method 2009.1 - Cable pull out
13.	EIA 364E-2008/IEC 60352	Method 2014 - Contact engagement and separation force
14.	RDSO/PE/SPEC/AC/013 8-2009(Rev-1) or latest	Flexible polyamide conduits with its accessories.
15.	ELRS/SPEC/ELC/0019 (Rev-4)-Feb-2018 or (latest)	Electron beam cable

2.2 Any deviation from this specification proposed by the firm, aimed to improve upon the performance, utility and reliability /efficiency of the equipment will be given due consideration, provided full particulars of the deviations with justification are furnished.

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### 3.0 BASIC GENERAL REQUIREMENTS AND SERVICE CONDITIONS

- 3.1. The IV coupler unit shall be suitable for rugged service normally to be met within Railway Rolling Stock, where coaches/locos are expected to run up to a maximum speed of 200 kmph in varying climatic conditions existing throughout India as under:-

Ambient	-4 to 55deg C
Average ambient	35 deg. C
Train speed	200 Km/h
Relative Humidity	Upto98%
Altitude	Max 1200 m above sea level
Atmosphere	Extremely dusty and desert weather. The dust contents in the air may reach as high value as 1.6 mg/cubic meter.
Annual rain fall	Very heavy in certain areas: between 1750 to 6250 mm.
Coastal area	The equipment shall be designed to work in humid salt laden and corrosive atmosphere. The maximum values of the condition shall be as under : Maximum pH value 8.5 Sulphate 7 mg/liter Max. concentration of chlorine 6 mg/liter Max. conductivity 130 micro siemens/cm
Shocks and Vibration	The IV coupler shall withstand satisfactorily vibrations and shocks normally encountered in service as indicated below: a) Max. vertical acceleration - 3.0 g b) Max. lateral acceleration - 3.0 g c) Max. longitudinal acceleration - 3.0 g (‘g’ being the value of acceleration due to gravity)

- 3.2. The supplier shall be fully responsible for ensuring that all equipments forming part of the supply are entirely fit for purpose and no part of this specification shall in any way remove or reduce this obligation in this respect. In addition, it is the supplier's responsibility to under write the complete IV coupler unit design and ensure that it is compatible with, and will, in no way, compromise, the design and performance of IV coupler unit of this supply.
- 3.3. The supplier shall provide "In the field" service support during the guarantee period."
- 3.4. The supplier shall supply any purpose built or special tools or equipment that may be necessary for the correct operation, servicing, testing or installation of the IV coupler unit.
- 3.5. The supplier will provide assistance, both material and technical, in the development of the system as a whole to ensure that when this IV coupler unit is installed as part of the integrated vehicle system the performance of the unit meets or exceeds the requirements specified.
- 3.6. Should the IV coupler unit fail to achieve these requirements, then the unit shall be modified at the supplier's expense and within a time scale to be agreed with purchaser/consignee/RDSO.

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#### 4.0 DESIGN AND TECHNICAL REQUIREMENTS

- 4.1 The mounting dimensions of Jumper plug assembly, Coupling socket assembly and (Dummy) socket assembly of the coupler shall generally confirm to RCF drawing no. LW71301 alt a, LW71300 alt nil, LW 71302 alt nil respectively. The dimensions of other parts like insulating base, design of pin contact & socket contact, circular ribs around contact pin holes of plug assembly and sub-assemblies shall be approved at design stage. The jumper plug assembly shall be in one piece.

For locomotives, socket housing shall be of stainless steel casting along with some associated drgs has been revised as per following RDSO's drawing:

- RDSO's drawing no. RDSO/PE/SK/AC/0226-2021 (Rev-0) for Socket assembly for locomotives.
- RDSO's drawing no. RDSO/PE/SK/AC/0227-2021 (Rev-0) of hinged cover for socket assembly for locomotives.
- RDSO's drawing no. RDSO/PE/SK/AC/0228-2021 (Rev-0) of complete ratchet assembly for locomotives.
- RDSO's drawing no. RDSO/PE/SK/AC/0235-2021 (Rev-0) of sealing ring gasket for locomotives.
- All the other relevant Drgs of Socket assembly for locomotives will remain same.

- 4.2 Insulating base for jumper plug shall be modified by providing circular rib of 2mm height and thickness around each contact pins hole on mating surface area to increase creepage distance as per drawing no. LW71304 Alt "c".
- 4.3 There shall be 5mm collar in the upper half of socket housing assembly as per drawing no. LW71306 Alt "b" for coach and for locos as per RDSO's drawing no. RDSO/PE/SK/AC/0226-2021 (Rev-0).
- 4.4 The hinged cover for socket assembly shall as per drawing no. LW71309 Alt "a" & for locos as per RDSO's drawing no. RDSO/PE/SK/AC/0227-2021 (Rev-0) and blind socket housing shall be as per drawing no. LW71341 Alt "b".
- 4.5 The jumper plug housing shall be as per drawing no. LW71380 alt nil.
- 4.6 The fixed/mobile contact pins shall be rated for a continuous current rating as detailed below :

Phase (R, Y, B)	500 AMPS at 0.8 P.F, 750 V, 50 Hz.
Neutral (N)	400 Amps at 0.8 P.F, 750 V, 50 Hz.
Earth pin (E)	260 Amps at 0.8 P.F., 750 V, 50 Hz.
Control pins (C1&C2)	25 Amps at 0.8 P.F., 750 V, 50 Hz.

Above current ratings are taken at 50°C ambient temperature.

- 4.7 The terminal connections on jumper plug unit and coupling unit shall be of crimping type suitable for the appropriate sizes of cables. Heat shrinkable polyolefin sleeves or similar insulating material shall be provided over the terminations of each core of cable to prevent any accidental contact between the adjacent terminals.

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- 4.8 The complete coupler assembly shall have IP protection IP65 as per IEC 60529(latest version).
- 4.9 There shall be a provision of bus bar on the cover of coupling socket for shorting of control contacts (C1 & C2) when they are not in use.
- 4.10 The dummy socket shall be used when plug is not connected between coach to coach and shall have terminals for control contacts shorted with the help of 4 mm<sup>2</sup> electron beam cable. The electron beam cable shall be as per RDSO specification ELRS/SPEC/ELC/0019 (Rev- 4)-Feb-2018 or latest. Suitable locking arrangement shall be provided so that the plug does not come out due to its own weight and vibration.
- 4.11 Locking arrangement shall be provided on the IV coupler socket and dummy socket so the inserter/extractor ratchet arrangement does not disengage due to its own weight (including inter connecting cables) and vibration encountered in service during running of the train.
- 4.12 The design of the coupler unit shall be of waterproof construction and when the jumper plug and coupling socket are coupled together they shall be completely water tight so that water does not find access to the internal assembly. The coupler assembly shall be provided with fire retardant high quality neoprene / EPDM gasket between the mating surfaces to avoid water ingress. It shall be ensured that in any circumstances, neoprene/EPDM rubber gasket between the mating surfaces could not come out.
- 4.13 Plug pin contact and socket contact shall be of self-adjusting type, so that they align themselves to establish a firm contact between pins & socket tube by providing multi point contacts. The displacement, loosening and extraction of the spring shall be checked after 500 mating cycles.
- 4.14 With a view to ensure interchangeability, all parts shall strictly conform to the requirement of the detail drawing of each component prepared by the firm and duly approved by RDSO so that the corresponding part of one coupler unit can be assembled in any other make coupler unit and shall also apply to manufacture of the component spares for all sub-assemblies of the coupler unit.
- 4.15 The insulating material shall have the fire/flammability retardant property of V0 when tested as per UL94. The manufacturer shall submit the certificate from any NABL approved laboratory.
- 4.16 Necessary partition/bridges shall be made in jumper plug and coupling socket. The insulating barriers shall be moulded with main insulating base in one single piece. Firm shall submit the detailed drawing during prototype testing to the inspecting official.
- 4.17 Cable shall be crimped at minimum 4 points in plug pins & socket tubes, so that possibilities of loosening of cable & presence of air may be eliminated during service. The arrangement to escape air from the tube & pins shall be provided.
- 4.18 The cables shall be crimped on both plug pins and socket tubes. The crimping socket shall be of appropriate size to match the cables. A heat shrinkable, fire retardant polyteflin sleeve shall be provided covering some portion of lugs and cables.

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- 4.19 There shall be a suitable guide in plug and socket to ensure its mating in one direction only.
- 4.20 Notching of size 20 x 20 x 4mm shall be provided on the screw side of the pins to lock with the slot provided in insulation base and thus prevent the rotation of the pins during assembly. This shall be as per RCF drawing no. LW 71303 Alt-b, LW 71304 Alt-c, LW 71316 Alt-b, LW 71318 Alt-b, LW 71337 Alt-b.
- 4.21 Stainless steel fasteners as per SS 304 shall be provided to prevent from corrosion & rusting.
- 4.22 The coupler unit shall have seven (7) pin contacts in the plug pin and corresponding seven (7) socket pin contacts in the socket.
- 4.23 The identification, size & length of jumper cable shall be as under:

S. N	Circuit/identification	Cable size in mm <sup>2</sup>	Length of jumper cable on plug side	Length of jumper cable on socket side
1.	R – Phase	150	2.6 meters	400 millimeters
2.	Y – Phase	150	2.6 meters	400 millimeters
3.	B – Phase	150	2.6 meters	400 millimeters
4.	N - Neutral	95	2.6 meters	400 millimeters
5.	E – Earth	70	2.6 meters	400 millimeters
6.	Body earth	35	10"	8"
7.	C-1 Control	4.0	2.6 meters	400 millimeters
8.	C-2 Control	4.0	2.6 meters	400 millimeters

The jumper cables shall be electron beam cables as per RDSO specification ELRS/SPEC/ELC/0019 (Rev 4.)-Feb-2018 or latest.

- 4.24 Fire retardant, halogen free polyamide flexible conduit along with their accessories shall be used. The flexible polyamide conduit and its accessories shall confirm to RDSO/PE/SPEC/AC/0138-2009(Rev-1) or latest.
- 4.25 Terminals for phases, neutral, earth & control shall be suitably marked with legible letters (R, Y, B, N, E, C1 & C2) corresponding to the letter (1, 2, 3, 4, 5E, 7 & 10) on the insulating base in prescribed color.
- 4.26 The tip diameter of fixed contact pin C1 & C2 shall be as per drawing LW 71338Alt 'a'.
- 4.27 The drawing for mobile contacts, fixed contacts and insulator blocks shall be as per LW 71316 Alt-b and LW 71318Alt-b, and the material of the flexible braided wire shall be suitable for 500Amps current rating at 50°C ambient temperature.

## 5.0 MATERIAL OF COMPONENTS

- 5.1 The fixed and mobile contacts shall be made of tough pitch copper as per IS: 613 with silver cadmium oxide tips. The material of the spring inside the mobile contacts shall be SS 304 with CF-8 grade. The pin contact and socket contact shall be made of copper


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with silver plating. The thickness of plating shall not be less than 1.0 microns. All pins shall be silver plated for atmospheric protection from moisture and oxidation.

- 5.2 The control pins contact shall be made of brass as per IS:319 with silver plating having thickness of 1.0 microns.
- 5.3 The housing of jumper plug, coupling socket and dummy socket along with covers shall be protected against rust by giving suitable anti-corrosive and anti-rust treatment with epoxy based powder to shade No. 632 (DA gray) of M/s Nerolac or equivalent to meet the service condition as specified in clause 3.0. Before the application of primer, all the surfaces shall be thoroughly cleaned repeatedly with cleaning agent to ensure removal of rust and greasiness etc. The detailed process to clean surfaces shall be furnished by the firm.
- 5.5 The compression springs must withstand minimum 1 million load cycles.
- 5.6 A compression spring should be preferably designed buckle proof.
- 5.7 The load test shall be in accordance clause no. 7.1 of IS: 7906(part-II) and compression test as per clause no.7 of IS: 7906(part-I).
- 5.8 The coupler socket, plug housing, dummy socket housing and their covers shall be made of die cast Aluminum grade 4600 confirming to IS: 617. Firm will submit the material conformity to the specification along with its test report from any NABL accredited laboratory during prototype inspection. If any other material is used for housing of IV coupler, it shall be require prior approval of RDSO. Firm shall submit the comparative technical justification to RDSO for approval. Coupling socket housing for locos shall be made of stainless steel with Grade CF-8 as per ASTM A 351.
- 5.9 The assembly of coupler unit shall be provided with an inserter/extractor ratchet arrangement to enable insertion and extraction of the coupler plug
- 5.10 The complete ratchet assembly shall be made of stainless steel (SS304) as per RCF drawing no. LW 71330 Alt "a" for coaches and as per RDSO's drawing no. RDSO/PE/SK/AC/0228-2021 (Rev-0) for locomotives.
- 5.11 The insulating base plate shall be of FRP/SMC materials and properties of FRP/SMC components or any other insulating material suitable for withstanding continuous temperature of 50°C above the ambient at full load shall be furnished to RDSO.
- 5.12 The cleating for securing of feeder cables in plug housing assembly shall be of fire retardant high quality neoprene / EPDM gasket with UL 94 V0 (drawing no.LW 71374 Alt nil).
- 5.13 The material of the 'O' ring of the mating surface between socket and plug shall be neoprene/EPDM with UL 94 V0.
- 5.14 The complete material used in IV coupler shall be of fire retardant properties.
- 5.15 The material of the contacts confirming to the specifications and relevant latest standards shall be submitted by the firm.

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