INDIAN RAILWAYS

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SCHEDULE OF TECHNICAL REQUIREMENTS FOR SUPPLY AND ACCEPTANCE OF HIGH CAPACITY SEMI-PERMANENT COUPLER AND DRAW GEARS FOR ELECTRICAL MULTIPLE UNIT / MAINLINE ELECTRICAL MULTIPLE UNIT AND DEISEL MULTIPLE UNIT

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(BROAD GAUGE – 1676 mm)

ISSUED BY

RESEARCH DESIGNS AND STANDARDS ORGANISATION
MINISTRY OF RAILWAYS
MANAK NAGAR, LUCKNOW – 226011

	Prepared by	Checked by	Approved by
Signature			
Name and Designation			

IMPORTANT

Tenderers are advised to go through this schedule carefully. In case they need clarification regarding any of the clause of this schedule they should contact Director General (Carriage), RDSO, Manak Nagar, Lucknow-226 011.

FAX No.-91-0522-2450679

Preamble

In view of increasing demand of passengers for suburban trains, there is a need for longer EMU/MEMU/DEMU trains. In 18th MSG meeting, it was recommended to develop suitable coupler to haul 27 EMU/MEMU/DEMU coaches.

Longer EMU/MEMU/DEMU require higher strength of a coupler. Also, existing design of under-frame support arrangement uses fork eye with complex design. The design is more than 40 years old.

It is proposed to adopt the new specification for developmental purpose only and the technical parameters may be considered as tentative which may be modified once sufficient experience is gained in to products supplied under the specification. This specification is for developmental purpose only. All the products supplied under the specification shall be put in service trials for a period of not less than 12 months before decision on adoption of the specification for bulk purchase is made.

The existing specification may be continued for bulk purchase till sufficient experience is gathered in service trials of the coupler, as per the proposed specification.

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SCHEDULE OF TECHNICAL REQUIREMENTS FOR SUPPLY AND ACCEPTANCE OF HIGH CAPACITY SEMI-PERMANENT COUPLER AND DRAW GEARS FOR ELECTRICAL MULTIPLE UNIT/ MAINLINE ELECTRICAL MULTIPLE UNIT AND DEISEL MULTIPLE UNIT

1.0 SCOPE

1.1 This specification covers the design, manufacture, supply and acceptance of couplers and its associated components like draw and buff gear mounting gear etc. for EMU / MEMU & DEMU rolling stock.

1.2 This specification is intended to include everything requisite to the manufacture of the couplers, notwithstanding that everything required may not be mentioned herein.

2.0 DEFINITIONS

2.1 "PURCHASER" means the Ministry of Railways, or an administration under the Ministry of Railways, on behalf of the President of the Republic of India

2.2 IR means Indian Railways.

2.3 RDSO means Research Designs and Standards Organization, Manak Nagar, Lucknow 226011.

2.4 INSPECTING AUTHORITY means the representative of RDSO nominated by Director General, RDSO to inspect the supply on behalf of the purchaser.

2.5 Vendor means the firm/company that submits offer for supply of High capacity Semi-Permanent Couplers (herein after referred to as couplers) draw and buff gears and associated components as per this specification.

2.6 Vendor means the firm/company on whom order, for supply of couplers, draft gears and associated components, in full or parts as per this specification is placed.

2.7 Sub-vendor means any firm or company from whom the vendor may obtain an item of supply not necessarily manufactured by the vendor himself.

2.8 Sub-vendor means any firm or company from whom the vendor may obtain any material, assemblies or sub-assemblies used for the manufacture of couplers, draft gears and other associated components.

2.9 SPECIFICATION unless otherwise mentioned, refers to specifications of IR/RDSO and the same could be procured from DG/RDSO on normal payment basis.

3.0 PARTICULAR REQUIREMENTS

3.1 All the couplers in the rake shall be mechanically and pneumatically couplable with existing Scharfenberg type High capacity Semi-Permanent type couplers which are already in service over IR as per RDSO specification IRS 61-B-36/Rev.-68-1 except for driving end where provisions shall be made for mechanical couplability with screw coupling and AAR 'H' type CBC and 'E' type CBC.

3.2 All couplers except driving end in the four car / three car units shall be of the semi- permanent type.

3.3 The vendor shall develop a design based on sound engineering practice and submit general arrangement and working drawings and all technical data to RSDO, Lucknow for approval before commencing manufacture.

3.4 This specification is for developmental purpose only. All the products supplied under the specification shall be put in service trials for a period of not less than 12 months before decision on adoption of the specification for bulk purchase is made.

4.0 GENERAL DESIGN FEATURES

4.1 The fixing of coupler to under frame shall be as per RDSO`s drawing no. CG-10016. The fixing arrangement and under frame cutaways shall be identical for all couplers (end and intermediate).

4.2 The draft / buffing gear shall be with elastomeric springs.

4.3 The distance between the headstock and coupling line shall be 400 mm when semi- permanent couplers are fitted.

4.4 The High capacity Semi-Permanent Couplers shall be provided with arrangement for coupling of brake pipes.

4.5 The mounting arrangement for High Capacity Semi-Permanent shall be as per RDSO drawing no. CG-10016 (Annexure-B).

4.6 The coupler design shall meet the requirements of vertical shear strength and Torsional resistance as laid down in APTA PR-003-98 dt. 13-02-2004.

5.0 Material

5.1 The material used for the load bearing parts of coupler shall be High strength steel casting to AAR M-201 Grade 'E' standard.

5.2 CHEMICAL COMPOSITION

5.2.1 The percentage by weight of different elements in Grade 'E' steel of specification M-201 shall not exceed the following limits:

Carbon, Maximum percent	0.32
Manganese, maximum percent	1.85
Phosphorus, maximum percent	0.04
Sulphur, maximum percent	0.04
Silicon, maximum percent	1.50

5.3 CHEMICAL ANALYSIS

All relevant chemical analysis shall be done as per AAR specification M 201, Grade 'E' steel.

5.4 HEAT TREATMENT

Heat treatment process shall be done as per AAR specification M 201, Grade 'E' steel.

5.5 MECHANICAL PROPERTIES AND TESTS

All relevant mechanical properties and tests shall be done as per AAR specification M 201, Grade 'E' steel. The hardness shall be checked on the location as shown in fig.1 for hardness.

Each melt shall be tested for mechanical properties after heat treatment. The coupons from each melt shall be heat treated with castings of the same grade, in the same manner as the casting they represent.

All the tests conducted as per AAR specification M 201, Grade 'E' shall be clearly brought out in QAP and their results maintained in the test records.

5.6 Material for Mounting Plates and Ribs:- IS:10787-1984

5.6.1 The percentage by weight of different elements in steel of specification IS:10787-1984 shall not exceed the following limits:

Carbon, Maximum percent	0.20
Manganese, maximum percent	1.50
Phosphorus, maximum percent	0.035
Sulphur, maximum percent	0.035

5.6.2 Material for Mounting Bolts:-

M30, Grade 12.9 Hexagon socket head cap screw.

6.0 Welding Procedure of mounting plates:-

6.1 Filler metal

MIG welding process using CO2 gas as shielding media shall be used for curved areas whereas submerged arc welding shall be used for straight areas. RDSO approved brand of filler wire shall be adopted.

6.2 Welders Qualification

Qualified welder shall be employed for fabrication work and Radiographic test shall be carried out. The edge preparation shall be in accordance with the thickness of the plates. The welding shall reveal high standard of workmanship

6.3 Joints:-

(i) Gaps and fit-ups shall be checked before starting the welding.
(ii) Use of Backing plates below the gaps of the joints is not permitted

6.4 Position

As far as possible, all the weld joints shall be welded in down hand position, if necessary by using manipulators.

6.5 Weaving bead Technique and Inter pass cleaning technique shall be adopted by grinding and using wire brushes

6.6 Welding parameters as recommended by the electrode manufactures may be followed.

6.7 Pre-Heat

(i) Inter pass temperature of 150 degree C to 200 degree C shall be maintained throughout the welding.
(ii) Electrodes shall be – heated, in the electric ovens, to a temperature of 150 degree C to 250 degree C for 2 hours before they are used.

6.8 Quality of Welds:-

6.8.1 Visual (By using magnifying glass if required)

(i) Weld joints shall have uniform beading and smooth change over from weld deposit to the parent metal and thorough fusion between adjacent layers of weld metal and between weld metal and parent metal.

(ii) They shall be free from cracks, craters, undercuts, overlaps, porosities, inclusions, blow-holes etc

(iii) The fillet weld profile shall be made concave by grinding so that smooth transition occurs at the toe of weld maintaining correct size of the welds.

(iv) The slags shall be thoroughly removed and cleaned after each inter pass.

(v) The welds shall be ground to eliminate stress raisers and to improve fatigue life.

(vi) Members distorted by welding shall be straightened by carefully supervised application of heat. The temperature of heating areas shall not exceed 650 degree centigrade. Mechanical method may also be used with application of heat. All the rework and straightening operations shall be completed before stress relieving.

6.8.2 Magnetic Particle Test/Dye Penetrate Test of welded joints:-

(i) All the fillet weld joints shall be subjected to Dye Penetrate Test on all critical areas, as indicated in relevant Drawings listed in Annexure-I and all the butt weld joints (100%) shall be subjected to Magnetic Particle Test/Dye Penetrate Test for detection of weld flaws. The procedure and acceptance standard shall be as per IS specification no.5334/3658 respectively.

(ii) Evaluations

Discontinuities and defects shall be indicated by retention of the magnetic particles and rise of Dye Penetrating after applying developer on the surface of welds shall indicate discontinuities and defects. All such indications are not necessarily the defects, since excessive surface roughness, and the heat-affected zones etc. may produce similar indications. Even if indications are believed to be non-relevant, each type of indication shall be explored to determine if linear discontinuities are present.

6.9 Acceptance Standard

(i) All linear discontinuities are un-acceptable and shall be removed and repaired by chipping or grinding and subsequent welding.

(ii) When defects appear, they shall be rectified and the area shall be re-examined by the same method to verify that they have been rectified completely.

(iii) All test reports of Magnetic particle inspection/Dye Penetrate Test will be submitted for review to the Inspecting Agency.

6.10 Radiographic/Ultrasonic Examination

(i) All the Butt weld Bevel joints shall be subjected to 100% Radiographic Tests at 2% sensitivity and 2.0-2.2 film density conforming to Blue Standard of International Institute of Welding (IIW).

(ii) As per the specified standards IIW Weld joints having cavities, undercuts and porosities shall be within the acceptable limits as per the specified standards.

(iii) The Radiographic examination shall be carried out by qualified personnel and radiographs shall be submitted to the inspecting agency for interpretation. In case of difference of opinion, the interpretation of Inspecting Agency will be final.

(iv) Alternatively Ultrasonic testing of welded joints shall be carried out as per M&C dte's Code of Practice No. MC-4 of November 1994 (Reaffirmed in March 2005).

6.11 Stress Relieving:-

The stress relieving of the bogie frame/bolster shall be carried out in an oil-fired furnace equipped with thermocouples and recorders. Adequate measures shall be taken to avoid any appreciable distortion of the bogie/bolster during heat treatment. If any resetting is required to be done after heat treatment in order to achieve required dimensions, the bogie frame/bolster shall be again suitably heat treated after such re-setting.

7 CASTING FINISH

7.1 Riser pads and gate stubs shall not project more than 6mm above the surrounding surface at any location, where interference would exist in the operation or application or where serviceability would be affected, the riser pads and gate stubs shall be contoured to surrounding areas.

7.2 Castings shall be blasted sufficiently clean to permit thorough, visual Inspection. Prior to shipment, castings shall be free of dirt, rust, or loose material that would affect operation. Couplers must not be sand or shot blasted when completely assembled.

7.3 The castings shall not be painted or covered with any substance that will hide defects prior to inspection. Manufacturer's and/or purchaser's identification marks shall be put after the complete inspection and acceptance of the parts by the purchaser. The supplier shall paint the coupler exterior except at mating parts to protect the coupler from corrosion.

7.4 GENERAL REQUIREMENT FOR CASTING ACCEPTANCE

This section defines and classifies casting defects. Visual inspection and gauging of coupler casting parts to be complied as per clause 14 of AAR M–211 by the manufacturer before offering for Purchase Inspection.

7.4.1 SURFACE ACCEPTANCE LEVEL

Coupler casting parts shall conform to the requirements of AAR M –211, Surface Acceptance Level Specifications.

7.4.2 EVIDENCE OF IMPROPER HEAT TREATMENT

Evidence of improper Heat Treatment as shown from manufacturer's records shall not be accepted. Heat treatment lugs may be used by Inspecting Authority to assist in the determination of improper heat treatment.

8 PERFORMANCE AND TEST REQUIREMENTS

8.1 (i) The complete High capacity Semi-Permanent Coupler assembly shall withstand tensile load of 1000 kN with the residual strain being below 2% after release of load and tensile load of 1500 kN without any rupture of any part of the assembly.

(ii) The complete High capacity Semi-Permanent Coupler assembly shall withstand compressive load of 1300 kN without showing any permanent deformation and compressive load of 1500 kN without any rupture / fracture of any part of the assembly.

(iii) Bending test of the complete High capacity Semi-Permanent Coupler assembly shall be carried out by applying a force of 300 KN in graduated steps at the centre of the coupler shank. The residual strain should be below 0.2%. No fracture should be observed on application of load of 500 KN.

8.2 **Draft gear characteristics**- The draft gear characteristics shall be-

1.	Travel (in draw mode)	28mm (maximum)
2.	Travel (in buff mode)	56mm (maximum)
3.	End force	800kN (maximum)
4.	Energy storage capacity (dynamic). The energy storage capacity shall be obtained observing both the limits of travel and end force as mentioned above simultaneously	Buff mode 12kJ
		In draw mode: (1-Damping Factor)* Energy storage in Buff mode (minimum)
6	Damping Factor	0.6 (minimum)

Draft gear Pad shall be made of elastomer having non- linear characteristic with low spring rate at low travel and significantly higher rates at high travel.

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In the case of draft gears with internal articulation, it shall be the responsibility of the supplier to certify suitability of the same for use in Indian Railways applications.

8.3 The couplers shall allow coupled coaches to negotiate curves of radius 152.4 meters and shall be capable of passage in either direction over standard 1 in 8 1/2 turnouts and shall function satisfactorily with a 75 mm difference in headstock heights of adjacent coaches.

8.4 The couplers shall be tight lock and shall not develop slack in service.

8.5 Coaches with coupled condition the coupler should take minimum vertical swing 75 mm. in either direction.

8.6 Coaches with coupled condition the coupler should take minimum horizontal swing 284 mm. in either direction.

8.7 Required type testing shall also be carried out as per RDSO approved test plan for vertical shear strength and Torsional resistance for the requirements laid down in APTA PR-003-98 dt. 13-02-2004.

9 CRASH ELEMENT (if required by the purchaser)

9.1 Vendor shall include crash element in his offer, if so required by the purchaser at the time of purchase. The crash element should trigger at 1000 kN and should absorb energy at a rate of approximately 800KN for displacement of 400mm. Energy absorption should be more than 320 kJ.

9.2 Service trial of the couplers shall be carried out post fitment for a period of 12 m0nths foe assessing the field performance.

10 SUPPLY OF TECHNICAL DATA

10.1 Vendor shall develop/adopt a design based on sound engineering practice and submit complete assembly drawings and related specifications of the coupler and assembly being offered by him.

10.2 Vendor should prepare QAP for the manufacture and inspection of the coupler and draft gear system /sub-vendor and it should be submitted to RDSO for approval. The heat treatment processes shall be verified at the supplier`s end through process flow and control plan defining all critical processes and characteristics, to be confirmed by test reports.

10.3 List of the manufacturing and acceptance gauges used by the vendor or the Sub-vendor to check the components of the coupler to ensure interchangeability should be submitted to RDSO.

10.4 Onus of obtaining license if required any shall lie with vendor.

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10.5 Separate drawings in A1/A2/A3 size for each of the coupler assembly shall be submitted with the offer. Each drawing shall indicate sufficient sectional views of the component. These drawings shall be complete in respect of:

a) Material specification
b) Estimated weight
c) Dimensions
d) Reference of detailed manufacturing drawings.

10.6 Following parameters shall also be furnished:

a) Characteristics of Draft gear
b) Energy absorption capacity
c) Initial pre-compression

11 Qualifying Requirements

11.1 Vendor meeting any one of the following criteria shall qualify:-

(i) Vendor having experience in supplying Semi-Permanent coupler to INDIAN RAILWAYS or Metro Railways of India.

(ii) Vendor having experience in supplying AAR 'H' type coupler to INDIAN RAILWAYS.

(iii) Vendor having experience in manufacturing of High capacity Semi-Permanent Coupler / AAR 'H' type coupler and supplying to reputed international Railway like European, American, Japanese or any other developed country. Subsidiary of such a manufacturer and supplier which are located in India is also eligible to submit the offer.

11.2 Vendor or Sub-vendor should have adequate plant and manufacturing capacity to manufacture and supply the couplers within the delivery schedule.

11.3 Vendor should have a well established quality control system and organizational set up to ensure adequate quality at all stages of manufacture.

11.4 Vendor not submitting the above mentioned requisite information should note that incomplete offer is liable to be rejected.

11.5 In addition to the above, further information, if required by the PURCHASER, shall be promptly provided by the Vendor.

12 GENERAL REQUIREMENTS

12.1 Inspection of coupler assemblies and associated components shall be carried out by the INSPECTING AUTHORITY and notwithstanding what has been specified in this specification, inspection shall be conducted as per relevant standard international practices/specifications and as mutually agreed to by the INSPECTING AUTHORITY and vendor. In case of a dispute, however, the decision of the PURCHASER shall be final. If purchaser desires in process inspection can be carried out at the manufacturing stage also.

12.2 A test plan should be submitted by the vendor and after the assessment of the test plan, RDSO may modify or supplement the test plan before granting approval to it.

12.3 The general design and the arrangement drawings of the coupler and draft gear system should be got approved from RDSO. Further modifications and improvements to the product design if any in future, should be got approved from RDSO.

12.4 The inspection of coupler assemblies and associated components shall be done at the vendor's premises. Vendor shall also provide at his cost, labour and appliances/gadgets required by the INSPECTING AUTHORITY for conducting complete inspection as required under the contract.

12.5 Vendor shall be responsible for execution of the contract in accordance with this specification and for satisfactory fitment and operational performance of the couplers supplied, irrespective of any approval which the PURCHASER/RDSO may have given.

12.6 Vendor shall provide adequate supervision to ensure satisfactory fitment of 10 coupler sets and satisfactory service performance.

12.7 Vendor shall also provide training to IR officials at his own cost, regarding maintenance practices of the coupler system.

13 SUBMISSION OF OFFERS

13.1 Vendor shall offer clause by clause comments on this specification, confirming compliance with all the clauses and elaborating wherever necessary. In case there are any deviations, complete details of alternative proposal against the clause (s) shall be given as a consolidated `STATEMENT OF DEVIATIONS'. In the absence of any deviation, however, a `NO DEVIATION SATEMENT' shall be necessarily given.

13.2 Offers, which are incomplete in respect of details indicated, vide clauses 7.0 is liable to be ignored.

14 MAINTENANCE OF COUPLERS

Vendor shall provide detailed instructions for day-to-day and workshop maintenance and shall include the following: -

14.1 Detailed work content of various inspection/maintenance practices including procedure for assembly and fitment of couplers. The work content of each schedule shall also be intimated.

14.2 Vendor shall also submit a list of technical specification (for procurement purpose) of all special purpose tools, gauges and testing /measuring instruments required for examination repair and over hauling / reconditioning of couplers. Price proposal for these tools gauges and testing /measuring instruments shall also be submitted with the offer separately. One set of gauges should be supplied for every supply of 60 (sixty) nos. of couplers.

14.3 Vendor shall make recommendations suggesting scale of spares to be maintained per 100 couplers for a period of 6 (Six) years. Price proposals for these spares shall also be submitted with the offer separately.

14.4 Vendor shall specifically advise criteria for replacement of components of couplers during maintenance.

14.6 Vendor shall supply min. 10 (Ten) copies of Maintenance Manuals for every supply of 500 (five hundred) couplers to PURCHASER. A soft copy of the Maintenance manual shall also be submitted.

15 GUARANTEE

Vendor shall assist the coach builders in the fitting testing and commissioning of these couplers and shall be responsible for their satisfactory working. Vendor shall at his cost replace the couplers and associated components failing prematurely or proving unsatisfactory in service for reasons attributed to defective/faulty design, defective material or poor workmanship within a period of 48 months from the date of delivery or 36 months from the date of fitment, whichever is earlier. This warranty shall survive notwithstanding the fact that the couplers may have been inspected, accepted and payment thereof made by the PURCHASER. For the replaced coupler/components, the period of 36 months shall commence when the replaced coupler /component is commissioned in service. The sole judge in this case shall be the PURCHASER.

16 Any design/ manufacturing/ raw material deviation on the items should be approved by RDSO.

17.0 MARKING:

Each item of scope of supply shall be embossed /punched clearly with UNIQUE numbers along with manufacturer logo and year of manufacture.

18 PACKING:

18.1 All the items shall be covered in polythene cover thickness not less than 25 microns and shall be packed in wooden crates. Machined/unpainted areas shall be treated with rust preventive oil. Items shall be packed separately and labelled in individual wooden boxes. These boxes shall be adequately protected to avoid damage during handling and transit. No organic material such as dry grass shall be used as filling material.

18.2 Air coupling ends shall be provided with dummy caps to avoid corrosion of bushes. Threaded holes to be protected suitably.

18.3 All mounting screws and dowels shall be secured to the respective items. Dummy nuts shall be provided to avoid the missing of the fasteners.

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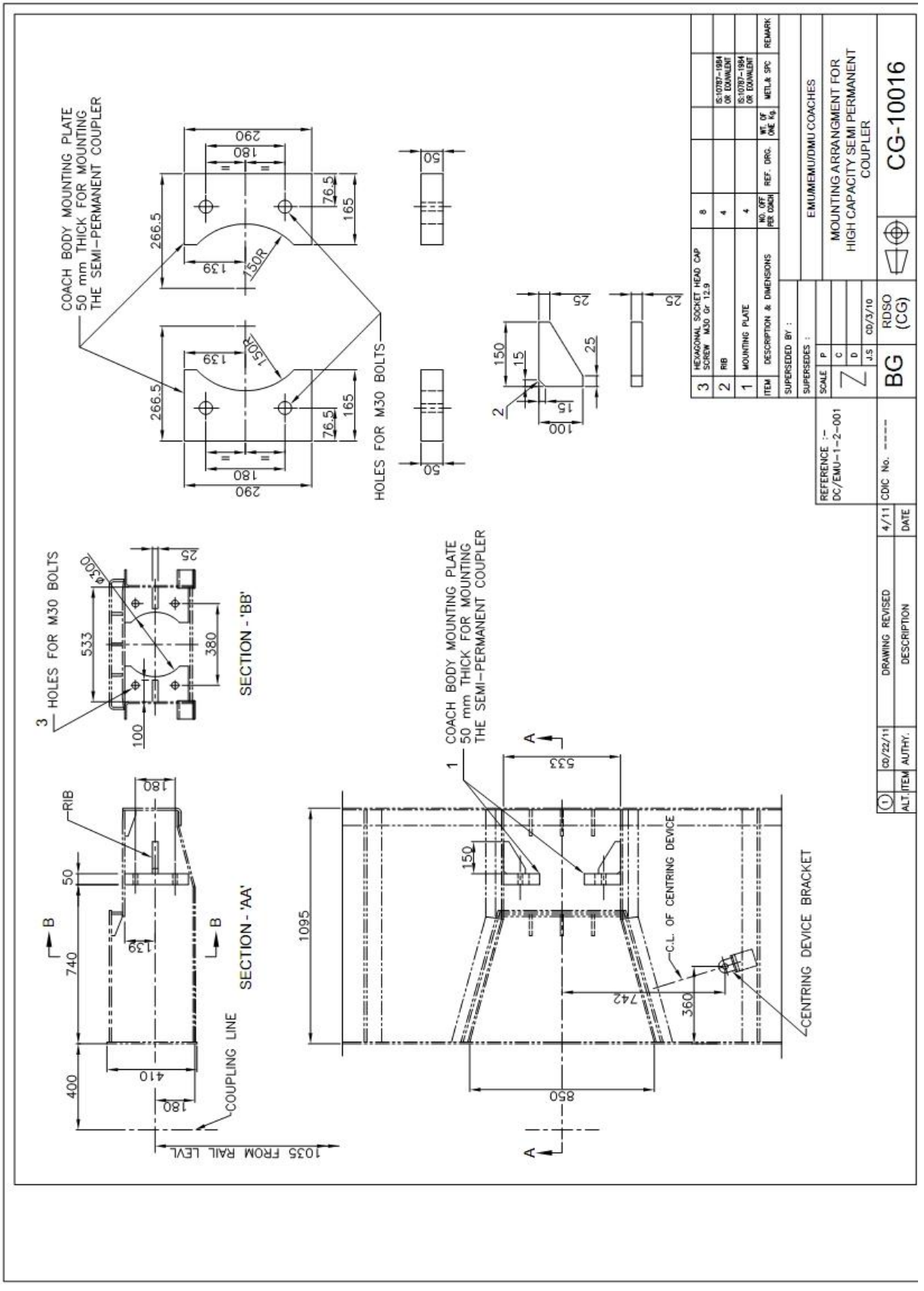
ANNEXURE-A

OPERATING CONDITIONS FOR COUPLERS

1.	Coach Type	: Broad Gauge Passenger Coaches (fitted with High capacity Semi-Permanent Coupler)
2.	Axle Load	: 20.32t (max.)
3.	Gross Load (Coach)	: 80.72t, (max.) to 70.68t (min)
5.	Grade	: 1 in 37 (steepest)
6.	Speed (maximum)	: 160 km/h
7.	Curve (Sharpest)	: 152.4 m (radius)
8.	Climatic & Environmental Conditions :-	
	Maximum Temperature (under the sun)	: 70 ^{0}C
	Maximum Temperature (Under shade)	: 45 ^{0}C
	Minimum Temperature (at night)	: -5 ^{0}C
	Rainfall	: Fairly Heavy
	Humidity	: 100% saturation
	Environment	: Dusty during hot weather and saline in coastal areas
9.	Coupler Height (for coaches)	: 1035 mm (from Rail Level)
10.	Coupler Height (for locos)	: 1090 mm (from Rail Level)
11.	Wheel Diameter (for coaches)	: 952 mm (max.) in new condition and 857 mm. (min.) in condemning limit.
12.	Speed at the time of coupling between Motor coach and trailer coach	: 4 kmph
12.	Type of Brake System	: Electro pneumatic brakes having composition or cast iron brake blocks.
13.	Maximum number of coaches in rake formation	: 27 coaches
14.	Side Buffers	: On end of coaches
15.	Coach Strength	: Satisfies end load requirements as per UIC 566

ANNEXURE-B



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