

INDIAN RAILWAYS



SCHEDULE OF TECHNICAL REQUIREMENTS FOR IMPROVED HIGH TENSILE TIGHTLOCK CENTRE BUFFER COUPLER WITH AAR 'H' TYPE HEAD AND BALANCED DRAFT GEAR FOR FITMENT ON BROAD GAUGE (BG) PASSENGER COACHES OF INDIAN RAILWAYS

S. No.	Month/Year of issue	Revision	Page No.	Details of Revision	Remarks
1.	October 2011	--	--	First issue	First issue
2.	January 2014	Revision - 1 (For bulk procurement)	10,11, 12 & 15	Cl.8.1(i) - Revised, Cl.8.21 added Cl.9.7 - Revised & Annexure-B 11, Revised.	First revision
3.	June 2014	Revision - 2 (For one time trial purpose only)	6,9,11, 17 & 18	Clause 3.5.5 added, Clause 5 revised, Clause 8.6 Revised & Annexure-B 12. (ii) Revised.	2nd revision for one time trial purpose
4.	April 2019	Revision - 3 (For Regular Procurement)	1 to 15, 20, 21, 22, 23, 24, 25, 26 & 27.	With reference to previous specification no. RDSO/2011/CG-03 Rev.1 for bulk procurement - Title revised. Preamble revised. Contents revised. Clause 2.4, 2.5 & 2.6 revised, Clause 27 revised & renumbered as 2.6, Clause 29 renumbered as 2.7. Clause 3.2, 3.5, 3.5.1, 3.7.1, 3.8, 3.9, 4.2.1, 4.4.1, 4.5.1, 4.5.2, 4.6, 5, 5.1, 6.1, 7.1, 8, 8.1 (i) & (iv), 8.2, 8.3, 8.5, 8.6, 8.7, 8.8, 8.9, 8.11, 8.13, 8.16, 8.18, 8.19, 8.20, 8.21, 8.22, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 10.1, 10.1.3., 11.1, 11.2, 11.4, 12.1, 12.1.5 & 13.1 revised. Clause 4.6 renumbered as 4.7 & clause 4.6.1 renumbered as 4.7.1 (revised also). Clause 3.5.5, 3.5.6, 3.5.7, 3.5.8, 3.10.1, 4.1.4, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.6, 4.7.2, 4.7.3, 4.7.4, 8.11, 8.23 & 9.9 added. Clause 2.6 & 2.8 deleted Annexure-A, S. No. 8 revised Annexure-B, S. No. 12 (ii) revised Annexure-C, S.No.2 revised, S. Nos.3,7,8 & 9 deleted Annexure-D, E, F, G, H, I & J added	3rd revision for regular procurement
5	July 2024	Amendment No 1		Clause added 3.5.1.1, 3.6.3, 4.5.3, 6.2, 8.5.1 & Clause 7.1, 3.5.6, 3.5.7, 8.13 & 12.1.7 modified Annexure- K added	Standardization & reliability improvement




Issued by
RESEARCH DESIGNS AND STANDARDS ORGANISATION
Manak Nagar, Lucknow - 226 011

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IMPORTANT

Vendors are advised to go through this specification carefully. In case they need clarification regarding any of the clauses of this spec, they should contact to Director/CD/Carriage, Research Design and Standard Organisation, Manak Nagar, Lucknow-226011.

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Amendment Slip No 1. of July 2024 to Specification No. RDSO/2011/CG-03 (Rev- 3) for SCHEDULE OF TECHNICAL REQUIREMENTS FOR IMPROVED HIGH TENSILE TIGHTLOCK CENTRE BUFFER COUPLER WITH AAR 'H' TYPE HEAD AND BALANCED DRAFT GEAR FOR FITMENT ON BROAD GAUGE (BG) PASSENGER COACHES OF INDIAN RAILWAYS.

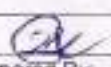

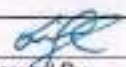
Clause No 3.5.1.1

A tertiary lock arrangement to be made for locking the toggle by inserting a locking pin through its hole/slot for preventing unintended lifting of lock. This locking pin arrangement should provide positive locking. The tertiary arrangement of locking shall be as per Annexure -K. Length (L) of Tertiary key will be 180 mm (Min.)

Clause No 3.6.3

Detail of material (s) to be used for various components is tabulated as below:

SN	Item Description	Material
1	Coupler Head Assembly	
	Main Body	AAR M 201 Grade - E
	knuckle	AAR M 201 Grade - E
	Lock	AAR M 201 Grade - E
	Knuckle thrower	AAR M 201 Grade - E
	Toggle	AAR M 201 Grade - E
	Double Rotary Lock lift	AAR M 201 Grade - E
	Main pin for knuckle	EN 19 or 42 Cr 4 Mo2
	Support pin of main pin for knuckle	EN-8
	Wear Plate of coupler body	EN -31 or IS 3885 Pt -I Gr -IV
2	Verical Supporting Device Assembly	
	Base Assembly	E-250 IS:2062/2011
	Rest plate	E-250 IS:2062/2011
3	Manual Uncoupling Assembly	
	Support bracket inner/outer	E-250 IS:2062/2011
	Mounting bracket	E-250 IS:2062/2011
	Rotary Bar with handle assembly	E-250 IS:2062/2011
	Uncoupling Bar/ Rod	E-250 IS:2062/2011
4	Front Support plate & Rear Support plate	
	Base plate and its supporting plates	E-250 IS:2062/2011
	Stiffener Plate	EN -31 or IS 3885 Pt -II Gr -V
5	Balance Draft Gear Assembly	
	Front Fork plates and H-Housing	SAILMA 350 HI
	Main Bolt /Spindle	EN-19
	Wedge Block	SAILMA 350HI
	Wedge Block Bolt	EN 19
	Yoke Pin	AISI AH 11 or AISI C 1060

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Clause No 4.5.3

To identify the CBC supplied as per cation No RDSO/2011/CG-03 (Rev-3), provision of marking as in cast condition "REV-3" in appropriate letter size at coupler head neck portion as indicated below. Based upon OEM input, marking to be modified. Marking to be as below.

**Clause No 6.2**

For procurement of Silent Block, the vendor will include the details of their silent block supplier/ manufacturer in their QAP & will procure silent block from those vendors only. Vendor will take prior permission before any change w.r.t. supplier/manufacturer for silent block. Max ash content should be less than 5% and specific gravity of silent block rubber will be 1.1 gm/cc -1.2 gm/cc.

Clause No 8.5.1

For designs having provision of front carrier plate, the diameter of hole in front carrier plate should be 50 ± 2 mm.

Clause No 3.5.6

While achieving all other requirements of the specification, the AAR 'H' type CBC with Balanced Draft Gear has to be so designed that it is relatively jerk free (longitudinal jerks) compared to ride of screw coupling equipped rakes. Assessment of jerk free performance will be done as per norms decided by RDSO. A uniform test scheme/procedure for the same shall be utilized. The couplers shall be monitored and accessed for comfort and performance of sub- assemblies / components for period of one year by RDSO. If the performance is not found satisfactory, trials with modified /upgraded supplies will again be carried out for period of one year {(Related to spec para (iii) of clause 8.1)}. If performance is not found satisfactory even with modified /upgraded supplies, the registration of the firm will be suspended".

Clause 3.5.7

Elastomer pads of Draft gear should be service proven in Rail coupler application over Railway System Elastomer pads of draft gear should be UV protected".

Clause No 7.1

The 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 2000 kN and should absorb energy at a rate of approximately 1600kJ for displacement of 200 mm in irreversible mode".

Clause 8.1.3

The VENDOR will specify the in service wear limits in their QAP/Maintenance manual for the components of the coupler head and demonstrate the functioning of the coupler head with fully worn components. In service limits for various components as well as gauges to measure these in-service limits will be provided by the vendors. The prices for the gauges to be quoted separately during procurement of CBC by PU's /ZRs so that Zonal railways can purchase the same as per requirement".

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Clause No 12.1.7

Inspection shall be carried out by following APTA gauges.

S.No.	Gauge no.	Description
1.	31000	Contour Maintenance Gauge
2.	32600	Aligning Wing limit Gauge
3.	34100-1	Contour condemning limit gauge
4.	34100-2A	Knuckle nose Wear and Stretch Limit Gauge
5.	34101-4	Vertical Height Aligning wing Pocket and Guard Arm gauge
6.	44250-5	Vertical height condemning limit Aligning wing Pocket and Guard Arm Gauge

The vendors will supply the Winchester make/USA or any AAR recommended make maintenance gauges along with supply of each 100 sets of CBC with BDG assembly unless categorically denied by procuring Zonal Railways/PU. Further, the prices for the gauges to be quoted separately also during procurement of CBC by PU's /ZRs so that Zonal Railways can purchase the same as per requirement.

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Preamble

Since the introduction of Centre Buffer Coupler (CBC), Indian Railways (IR) are facing problem of longitudinal jerks. Though various measures were taken in the past to deal with the problem of jerks, no significant improvement was observed. RDSO has done a comprehensive analytical study on causes for Longitudinal jerks and based on the findings, it was concluded to use balanced type draft gear for coaching stock. A new specification of CBC with balanced type draft gear no. RDSO/2011/CG - 03 was prepared in 2011. The specification was made to meet IR's specific requirement and on the basis of experience of using CBC in passenger stock for approx. one decade.

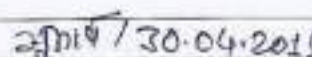


The main purpose of Rev.- 03 is to incorporate shear strength and torsional strength criteria, revise the energy storage capacity (dynamic) in buff mode from 35 kJ (min.) to 20 kJ (min.) upto 35 kJ (max.) and to remove the "niche" item status of CBC. Further it has also been specified that while achieving all the other requirements of the specification, the AAR 'H' Type CBC with balanced draft gear has to be so designed that it is relatively jerk free (longitudinal jerks) compared to ride of screw coupling equipped rakes. Assessment of jerk free performance will be done as per norms decided by RDSO.

Based on inputs of the consultancy provided to RDSO, measures that can be taken for the elimination of the jerks have been incorporated to refine the draft gear characteristics. Further, in order to achieve a certain amount of interchangeability various critical dimensions have been standardised in this spec. At present, the supporting arrangement inside the under frame of the coach has provision of front stopper and rear stopper which is suitable for single pack draft gear. It has been kept as it is. However, decision can be taken for its modification based on the design improvements suggested, if any.

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**SCHEDULE OF TECHNICAL REQUIREMENTS FOR PURCHASE AND
ACCEPTANCE OF IMPROVED HIGH TENSILE TIGHTLOCK CENTRE BUFFER
COUPLER WITH AAR 'H' TYPE HEAD AND BALANCED DRAFT GEAR
FOR FITMENT ON BROAD GAUGE (BG) PASSENGER COACHES OF INDIAN
RAILWAYS**

1. SCOPE

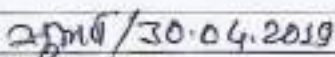


- 1.1 This schedule covers the technical provisions relating to material, purchase and acceptance requirements for high tensile tight lock centre buffer coupler and its associated components including AAR 'H' type coupler head assembly, yokes/front fork, draft gear, front and rear carrier plates, coupler operating mechanism with mounting brackets and coupler carrier for fitment on all types of Broad Gauge passenger coaches of Indian Railways.

2. 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 Organisation, Manak Nagar, Lucknow - 226 011.
- 2.4 'Inspecting Authority' means the representative of RDSO nominated by Director General/RDSO or authorised representative of purchaser to inspect the supply on behalf of the purchaser.
- 2.5 'VENDOR' means the approved firm/company that submits offer for supply of centre buffer couplers (hereinafter referred to as couplers), draft gears and associated components as per this schedule.
- 2.6 'SUB-VENDOR' means any firm or company from whom the VENDOR may obtain an item of supply not necessarily manufactured by the VENDOR himself.
- 2.7 'Specification', unless otherwise mentioned, refers to specifications of IR/RDSO and the same could be procured from Director General/RDSO on normal payment basis.




3. PARTICULAR REQUIREMENTS

- 3.1 The coupler shall be of non-transition type and also couplable with the existing AAR E Type couplers, to RDSO Specification No. 56-BD-07 and drawing number SKDL-3430, being used on locomotives as enlisted in Annexure 'A'.
- 3.2 Coupler head should be of AAR 'H' type and conforming to the strength requirements laid down in this specification (clause 4.1.4). The connection between coupler and draft gear should have sound design concept suitable for main line passenger trains.
- 3.3 All components and sub-assemblies of the coupler (including draft gear) shall be interchangeable with corresponding parts of another coupler of the same make and design. The coupler and its sub-assemblies shall meet the operating conditions indicated in Annexure-B of this schedule.

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- 3.4 Coupler mounting arrangement on under frame shall be generally to drawing No.CG-K4012.
- 3.5 Length from coupling line to pivot point as 1030 mm shall be mandatory. The head contour shall be as per S-168 of APTA SS-M-002-98 (completely machined). The guard arm of coupler head shall be at the vertical centre of the coupler head. The slack when two couplers of same make are coupled together shall be up to 2.0 mm only in new condition. Vendor shall provide the value in new condition in their static test results/QAP.
- 3.5.1 Double Rotary lock lifter should be provided with an additional anti-creep mechanism by providing rib in addition to existing rib to prevent unintended lifting of lock lift lever with maximum gap of 37 mm between them (the hook of the uncoupling rod with dia.1" should be in between ribs). A tertiary arrangement of locking the toggle by inserting a locking pin in its bottom hole/slot for preventing unintended lifting of lock to be made. This locking pin arrangement should provide positive locking by means of its own gravity.
- 3.5.2 The coupler operating mechanism shall comprise of rigid steel members for articulation. Use of wire or any other limp / flexible material in the articulation shall not be accepted. The coupler operating mechanism should have proper locking arrangement for anti-vandalism. Locking screw arrangement with protective cover to prevent lifting of uncoupling rod by unauthorized persons shall be provided. It should be possible to operate the locking mechanism with the help of a key as per RDSO drg. No. CG-10100.
- 3.5.3 The design of coupler head shall enable coupling of two couplers with a maximum vertical displacement of their centre lines by 90 mm, without manual assistance.
- 3.5.4 The horizontal gathering range of the coupler heads shall be 110 mm on either side of the longitudinal centre lines of the coaches without manual assistance on straight track.
- 3.5.5 The couplers should couple at maximum range as mentioned above. Moreover, Couplers should be able to negotiate on steepest curve of 175m radius throughout the IR track.
- 3.5.6 While achieving all other requirements of the specification, the AAR 'H' type CBC with balanced draft gear has to be so designed that it is relatively jerk free (longitudinal jerks) compared to ride of screw coupling equipped rakes. Assessment of jerk free performance will be done as per norms decided by RDSO. A uniform test scheme/procedure for the same shall be utilized. The couplers shall be monitored and accessed for comfort for a period of one year by RDSO. If the performance is not found satisfactory during the developmental stage or any later stage, the registration of the firm may be suspended.
- 3.5.7 Elastomer pads of draft gear should be service proven in rail coupler application over railway system.
- 3.5.8 Suitable mechanism may be provided by the vendor for limiting the horizontal articulation of the coupler to a maximum of 18° on each side of the coupler centre line, however this articulation should not be less than 10°. Similarly, the vertical articulation should be in the range 4-7°.
- 3.6 MATERIAL AND MANUFACTURE OF STEEL CASTINGS**
- 3.6.1 Steel castings shall be heat treated and marked in accordance with AAR specification M-201 Grade E. The locks and knuckles shall be furnished in accordance with para 3.6.2.

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- 3.6.2 Knuckles and locks shall be heated to the proper temperature above the critical range for the required time and upon removal from the furnace shall be subjected to accelerate cooling by immersion in a suitable liquid medium. All E grade knuckles and locks shall have Brinell hardness range of 241-291. All quenched castings (except knuckles and locks) shall be tempered immediately following the quenching operation to a hardness of Brinell number range of 241- 311.

3.7 CHEMICAL COMPOSITION

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

Elements	Maximum %	Minimum %
Carbon	0.32	0.25
Manganese	1.85	0.60
Phosphorus	0.035	--
Sulphur	0.035	--
Silicon	1.50	0.40

3.8 CHEMICAL ANALYSIS

All relevant chemical analysis shall be done as per AAR specification M 201, Grade E steel latest version and may be cross verified by Inspecting official during inspection, however the composition shall be as per clause 3.7.1.

3.9 HEAT TREATMENT

Heat treatment process shall be done as per AAR specification M 201, Grade 'E' steel latest version and records should be maintained for each heat and to be produced to Inspecting official during inspection.

3.10 MECHANICAL PROPERTIES AND TESTS

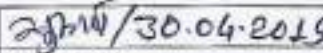


All relevant mechanical properties and tests shall be done as per AAR specification M 201, Grade 'E' steel latest version. The hardness shall be checked on the locations as shown in Annexure - F.

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.

3.10.1 Test lug and Tensile test coupon

Test lug of standard size should be cast attached on each Knuckle and head. Also, Tensile test coupon which shall be prepared as per ASTM-A370 should be cast attached or prepared from the keel blocks of same heat, clearly indicating month and year of mfg. and heat no. in as cast condition as per Annexure-G (Drawing No.-CG-17058). Location of test lug and tensile test coupon for above shall be approved by RDSO.

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.

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4. COMPONENTS PERFORMANCE AND TEST REQUIREMENTS

4.1 PROOF TESTS (force loading sketch/scheme should get approved from RDSO)

- 4.1.1 Duly strain gauged coupler head and the draft gear housing (including) draft gear pads will be tested by applying a tensile load of 1000 kN. The residual strain should be below 0.2% after release of load. No fracture should be observed at a load of 1500 kN.
- 4.1.2 Duly strain gauged coupler head and the draft gear housing (including) draft gear pads will be tested by applying a compressive load of 2000 kN. The residual strain should be below 0.2% after release of load.
- 4.1.3 Bending test of the coupler body shall be carried out by applying a concentrated force of 300 kN in graduated steps at the centre of the coupling length of 1030 mm. The residual strain should be below 0.2% after load release. No fracture should be observed on application of load of 500 kN. Load application step will be in multiple of 100-200 kN.
- 4.1.4 Coupler shall meet torsional resistance & shear strength criteria as per APTA standards (APTA PR-CS-RP-019-11 & APTA RP-M-003-98). However, in order to ensure that the reaction from the coach body remains within permissible stress value; the torsional strength may be optimised upto 135 kN. The firm shall submit the actual torsional & shear strength values for the design offered by them. Testing for shear and torsional strength shall to be carried out on an arrangement which is similar to the way the coupler is mounted on the coach and the firm should submit details of testing arrangements along with the test plan for approval to RDSO.

4.2 COUPLER OPERATION

- 4.2.1 The coupler assembly shall be checked in accordance with clause 7.9 of APTA PR-M-RP-003-98 edited 02-13-04 (Authorized March 17, 1999).

All completely assembled couplers must be carefully checked for operation. The knuckles and other operating parts must perform their functions in an entirely satisfactory manner.

4.2.2 Opening

Coupler knuckle must throw to the open position by a continuous rotary force applied by hand through the operating rod from rod handle.

4.2.3 Closing

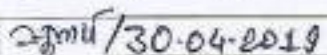


Coupler knuckle must rotate to the fully closed position to permit drop of the lock to the locked position by a continuous steady force applied by hand on the knuckle nose.

4.2.4 Lock shut

Coupler lock must automatically drop to the locked position when the knuckle is closed as Described in Section 4.2.3 Coupler knuckle is locked shut when the lock drops to seat on, or to within 1/8 inch (.32 cm) of seating on the knuckle tail lock shelf.

4.2.5 Lock set (Such that single person is able to perform uncoupling operation)

Coupler is put on lock set when the knuckle is restrained from opening while force is applied through the operating /uncoupling rod to raise the lock above the knuckle tail.

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When the rod is eased back and released, the lock must rest on the forward top edge of the knuckle thrower lock leg. The knuckle then must be free to rotate open by hand force applied on inside face of the knuckle nose. Coupler then must perform the functions of knuckle closer and lock drop as mentioned above.

Note: Lock should only be lifted within 20 mm from tail self when prying it upward by a pry bar even when rotary system is free to rotate and simultaneously there should be surface contact between bottom of Knuckle tail self & Toggle top face.

4.3 CASTING FINISH

- 4.3.1 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.
- 4.3.2 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.
- 4.3.3 The castings shall not be painted or covered with any substance that will hide defects prior to inspection. Manufacturer's 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 after the inspection and before despatch.

4.4 LUBRICATION

- 4.4.1 Only dry lubricant shall be applied to the coupler head or the coupler head fittings and not on knuckle-lock-head mating surfaces. This lubricant may be applied using water, alcohol, or other non-petroleum based carrier.

4.5 MARKINGS

- 4.5.1 The coupler and subassemblies shall be marked in accordance with clause 6.12 of APTA RP-M- 003-98 (of March 17, 1999)/clause 7.13 of APTA PR-M-RP-003-98 (edited 13-02-2004) Or clearly indicate the Manufacturer trademark, month & year of mfg., sr. no., heat no. & name of product at casting stage and same should be punched on all fabricated parts.
- 4.5.2 The vendor shall ensure that marking details are legible and are of good quality, which shall remain legible throughout the entire service life of coupler and its components. The marking shall be done at the casting stage itself. The vendor will not be permitted to provide vendor's code and marking by electric arc welding in case these are not visible at casting stage.

4.6 STORAGE

Couplers, draft gears and attachment must be stored in dry places under cover to prevent rusting.

4.7 GENERAL REQUIREMENT FOR CASTING ACCEPTANCE

This section defines and classifies casting defects. Visual inspection and gauging of coupler bodies, knuckles, locks, and front fork (if casted) to be complied as per clause 14 of AAR M-211 by the vendor before offering for Prototype/Purchase Inspection.

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4.7.1 SURFACE ACCEPTANCE LEVEL

Coupler bodies, knuckles and front fork (if casted) shall conform to the requirements of AAR M-211, Surface Acceptance Level as per SCRATA comparator.

Surface conditions evaluated with SCRATA comparators and acceptable:

		Critical Area	Non Critical Area
A	Surface Roughness	A3	A3
B	Surface Inclusion	B2	B4
C	Gas Porosity	C2	C3
D	Laps	D1	D4
E	Scabs	E2	E2
F	Chaplets	F2	F4
G	Thermal Dressing	G2	G3
H	Mechanical Dressing	H3	H4
J	Welds	J2	J3

Surface conditions B and C are acceptable if the depth of the defect does not exceed ten (10) percent of the section thickness at critical areas and twenty-five (25) percent of the section thickness in non-critical areas.

- 4.7.2** Wall Thickness: the firms shall submit the internal solidity details of the castings and should mention min. wall thickness alongwith cross sectional area of coupler shank critical area in their drawing and sectioning (as per AAR M211 fig.-10) of the castings shall be conducted by firm at their respective foundries periodically in every six months - and the proof for the same shall be submitted to RDSO for every casting supplier(s) of the firm.

Wall thickness tolerances except where controlled by gauges or RDSO's drawings, are:

6 mm up to, not including 11mm wall,	+ 3 mm	- 1 mm
11 mm up to, not including 19mm wall,	+ 3 mm	- 2 mm
19 mm up to, not including 32mm wall,	+ 3 mm	- 2 mm
32 mm and over,	+ 4.8 mm	- 3 mm

4.7.3 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

4.7.4 ACCEPTANCE STANDARDS FOR RADIOGRAPHIC EXAMINATION

Radiographic examination shall be conducted on Knuckle, coupler body, lock and draft gear body(if casted) to the extent of 5% and level of acceptance shall be as per ASTM E446 Level-II for all critical area and Level-III for non critical area.

5. DRAFT GEAR

Draft gear - shall be balanced with force flow diagram as shown in diagram in sketch CG- K8207 alt.1. The draft gear shall be with elastomeric springs and suitable for running long train.

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Draft gear characteristics - The draft gear characteristics shall be-

1.	Travel (in draw mode)	58 mm max.
2.	Travel (in buff mode)	90 mm max.
3.	Initial pre compression	(Preload/pre-compression setting between 10 kN to 20 kN)
4.	End force (Dynamic)	1600 kN (maximum)
5.	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 20 kJ (minimum) but not exceeding 35 kJ (maximum) In draw mode: (1-Damping Factor) X Energy storage in Buff mode (minimum) or 8kJ min.
6.	Dynamic Damping Factor	0.6 (minimum)

Draft gear Pad shall be made of elastomer having non-linear characteristics with low spring rate at low travel and significantly higher rates at high travel. No gap/slack should be created in Draft Gear during quick transition from buff to draw mode or vice versa. 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. The draft gear characteristics have been laid down on basis of experience gained /consultancy done by RDSO which indicates that lower preload setting results in better ride and improved jerk performance.

- 5.1 The vendor shall also submit validated static and dynamic force travel diagram indicating the pre-compression, end force, energy absorbed, energy storage and the damping factor (both in draw and buff modes) of the draft gear along with the offer.

6. PIVOT AND THE COUPLER SHANK PIN ARRANGEMENT

- 6.1 Pivot and the coupler shank pin arrangement (as per Annexure-E) shall have spherulastic bearing for providing slack free service for long period. Or, alternatively, use of socket type joints between the mechanical coupler head and the draft gear without pivot and pin arrangement and with service proven draft gear pads, designed to take asymmetry load during horizontal or vertical swing, shall be provided.

7. CRASH ELEMENT (If required by the purchaser)

- 7.1 The 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 2000 kN ($\pm 10\%$) and should absorb energy at a rate of approximately 1600kJ for displacement of 200mm. Energy absorption should be more than 320 kJ.

8. QUALIFYING REQUIREMENTS

The VENDOR shall meet the qualifying requirements listed below and submit the documents in support thereof for registration with RDSO.

- 8.1 The VENDOR meeting any one of the following criteria shall qualify for registration.

- i) Vendor offers AAR 'H' type coupler designed by any member of MCSCM. Vendor shall have all design and manufacturing drawing details of such 'H' type coupler. Vendor shall submit proof in support to RDSO, having design and manufacturing drawing details from any member of MCSCM.

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OR

- ii) Vendors having tie up with reputed foreign company that manufactures and supplies 'H' type coupler to reputed international Railway like European, American, Russian, Japanese or any other developed country or the Vendor/manufacturer having successfully manufactured and supplied AAR 'H' type coupler to reputed international Railway like European, American, Russian, Japanese or any other developed country against regular supply order. Vendor shall have all design and manufacturing drawing details of such 'H' type coupler. Vendor shall submit proof in support to RDSO, of having design and manufacturing drawing details from reputed R&D agency of established Railways/companies.

OR



- iii) The vendors who have developed their own design of 'H' type coupler shall be considered based on the satisfactory performance of their product. However, these firms shall be in the business of manufacturing of couplers and design/manufacture of draft gear and should submit detailed calculations and technical basis of the design offered. Where the product shall be used for the first time on the Indian Railways, the firm shall be considered suitable after satisfactory performance in the field trials.

OR

- iv) The firm offering 'H' type coupler is having MOU with RDSO approved firms for design and manufacturing. The firm shall have all the design and manufacturing drawing details of such 'H' type coupler. The firm shall submit proof in support to RDSO, having design and manufacturing drawing details from RDSO approved firms.



OR

- v) Firm is proven and approved source of RDSO for 'H' type coupler and draft gear for locomotives can be considered for coaches.
- 8.2 The VENDOR should have in-house machining and all testing facilities to manufacture and supply the couplers within the delivery schedule. Existing firms will be given 1 year time for complying the requirements.
- 8.3 The VENDOR should have a well-established quality control system and organizational set-up, to ensure adequate quality, at all stages of manufacture. The vendor should have ISO 9001:2015 certification. However, vendors shall obtain IRIS/AAR M1003 certifications within 3 years after approval for quality assurance.
- 8.4 The VENDOR shall give documentary evidence indicating latest supply of the type of coupler being offered. In case the vendor is manufacturing the coupler or draft gear for the first time, it should indicate specifically as "New Offer".
- 8.5 The general design and the arrangement drawing of the coupler and the draft gear system should be got approved from RDSO.
- 8.6 QAP for the manufacture and inspection of the coupler and draft gear system should be prepared by the vendor as per the latest QAP preparation guidelines and it should be submitted to RDSO for approval.

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- 8.7 List of Manufacturing and acceptance gauges, used by the vendor or the sub- vendor to check the internal components and the coupler head to ensure interchangeability, should be submitted to RDSO. The functional similarity of these gauges with the corresponding gauges given in the list in clause 6.7 of APTA RP-M-003-98 including the various dimensions measured should be illustrated.
- 8.8 Coupling and uncoupling operation must be performed on two newly developed couplers on a special test rig able to simulate various coupling scenarios, having one side like real coach end for fitment of coupler subassemblies and Hydraulic/pneumatic pulling force with min. 5 tons, made for this purpose by the vendor to ensure repeatability of the coupling and the uncoupling. The functioning of anti - creep mechanism will be checked before the tests and after every 10 operations thereafter.
- 8.9 Repeated coupling and uncoupling operation must be performed on the newly developed coupler head and the coupler head procured from sources approved by MCSCM/APTA on a special test rig made for this purpose by the tenderer. Alternatively, the firm may take their coupler to any of the nearest production units of the IR for performing this testing in the presence of the RDSO personnel at his own cost to ensure compatibility with coupler from other approved sources. Ten numbers each operation should be carried out for repeated coupling and uncoupling in all possible modes.
- 8.10 The operation of the coupler in respect of coupling, uncoupling and the working of anti-creep-mechanism will be checked. The process will be repeated by changing the internal parts of the coupler head.
- 8.11 Functional tests as well as other chemical-physical tests on the couplers shall be conducted as per the RDSO check sheet prepared as per this spec.
- 8.12 RDSO, in order to ensure certain amount of Interchangeability between the parts/sub-assemblies of various makes, has standardized some drawings of the interfaces provided in Annexures D & E. The inter-changeability of these parts/sub-assemblies shall be checked/ensured during the couplability/functional tests in various modes. The functional test/operation of the coupler in respect of coupling, uncoupling and the working of anti-creep mechanism will be checked during these tests.
- 8.13 The VENDOR will specify the wear limits in their QAP/Maintenance manual for the components of the coupler head and demonstrate the functioning of the coupler head with fully worn components.
- 8.14 Strength tests shall be done on the coupler and the draft gear as per the clause 4.1 of this schedule.
- 8.15 Tests on the draft gear shall be done to measure the energy storage capacity as per specification.
- 8.16 Endurance test shall be conducted on the draft gear as specified in AAR Manual of Standards and Recommended Practices Section B for Couplers and Freight Car Draft Components (The instrumentation of the Tup hammer should be as per spec. WD-71-BD-15) or EN-15551 standard to show that the draft gear will retain its functional and operational reliability between two successive maintenance periods as specified in clause 9.7 of the schedule.
- 8.17 Sturdiness test on the draft gear shall be carried out in case the vendor chooses to conduct endurance test as per provision in AAR. The test is required to show its ability to withstand the impact loads experienced in service.

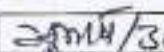

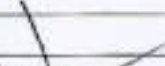
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- 8.18 A test plan should be submitted by the vendor and after the assessment of the test plan along with the design of coupler offered; RDSO may modify or supplement the test plan before granting approval.
- 8.19 The VENDOR should either have a well-equipped foundry or should source its castings from the foundries with requisite heat treatment facilities, sound R&D set-up and regularly manufactures and supplies similar type of coupler offered. The foundry shall be Class 'A' certified from RDSO. Foundries from where the existing vendors are sourcing the casting would be given one year for complying the requirement of class-'A' foundry.
- 8.20 In addition to the above, further information, if required by the RDSO/purchaser, shall be promptly provided by the vendor.
- 8.21 If VENDOR is not submitting the above mentioned requisite information will be considered as incomplete offer and is liable to be rejected.
- 8.22 All the design verification tests/ proof load tests as required by the specification shall be repeated just after supply of every 5000 couplers i.e. 1st of every next 5000 couplers, however purchase inspection will not be stopped till next 400th couplers supply or 3 months after completing 5000 couplers supply whichever is earlier.

9.0 GENERAL REQUIREMENT

- 9.1 The VENDOR shall set aside one set of APTA gauges as per the clause 12.1.7 for the exclusive use of INSPECTING AUTHORITY. The gauges should be calibrated by Govt. of India authorised agency or any approved agency worldwide. The calibration certificate will be provided to inspecting authority for verification before the inspection/commencement of manufacture. Recalibration shall, subsequently, be done at the frequency stipulated in internal Quality Assurance Programme. Gauge drawings, in original along with its references if any, shall also be made available for checking the tolerances of these gauges.
- 9.2 Inspection of coupler and associated components shall be carried out by the INSPECTING AUTHORITY and notwithstanding what has been specified in this schedule, inspection shall be conducted as per relevant standard international practices/specifications (or as per check-sheet). If PURCHASER desires, in process inspection can be carried out at the manufacturing stage also. In the event of dispute between the inspecting official and the firm the decision of the inspecting official shall be final and binding.
- 9.3 The inspection of couplers and associated components shall be done at the VENDOR's premises. The 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/specification.
- 9.4 The VENDOR shall be responsible for execution of the Contract in accordance with this schedule/specification and for satisfactory fitment and operational performance of the couplers supplied, irrespective of any approval which the PURCHASER/RDSO may have given.
- 9.5 The VENDOR shall provide adequate supervision to ensure satisfactory fitment of at least ten (10) coupler sets for the first supply of any new design under this specification by any railway/PU.

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- 9.6 The VENDOR shall also provide, training to IR officials, at his own cost, regarding fitment/maintenance practices of the coupler system if desired by any Railways/PUs.
- 9.7 The design of coupler and associated components must be such that it may not warrant any maintenance/ attention up to 6 years.
- 9.8 The coupler body and draft gear housing offered shall render a service life of 30 years.
- 9.9 All the provisions contained in RDSO's ISO procedures laid down in Document No.QO-D-8.1-11 Version-1.0, dated 12.09.2018 (titled "Vendor-Changes in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways.

10. SUPPLY OF TECHNICAL DATA OF COUPLER

- 10.1 Vendor shall submit complete assembly drawings (in A₂ size), and related specifications of the coupler and assembly being offered by him. These drawings shall be complete in respect of:

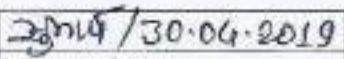
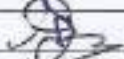

- 10.1.1 Material specification.
- 10.1.2 Estimated weight.
- 10.1.3 Dimensions and load bearing cross sectional areas.
- 10.1.4 Reference of detailed manufacturing drawings.

11. SUBMISSION OF OFFERS

- 11.1 Vendor shall offer clause by clause comments on this schedule, confirming compliance with all the clauses and elaborating, wherever necessary. In case there are any deviations, complete details of alternate proposal against the clause/s shall be given as a consolidated 'STATEMENT OF DEVIATIONS'. In the absence of any deviation, however, a 'NO DEVIATION STATEMENT' shall, necessarily, be given.
- 11.2 Vendor shall also submit complete information listed in Annexure-C.
- 11.3 English translation of Standards quoted (other than those referred to in this schedule) and other documents shall be submitted with the offer.
- 11.4 The vendor shall submit a list of wearable/consumable parts along with the period after which these parts are expected to be changed. The vendor shall quote for the price of these parts along with its offer.

12. MAINTENANCE OF COUPLERS

- 12.1 The vendor shall provide detailed instructions for day-to-day and workshop maintenance and shall include the following:
- 12.1.1 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.

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- 12.1.2 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.
- 12.1.3 Recommendations suggesting scale of spares to be maintained for holding 500 couplers for a period of 10 years. Price proposal for these spares shall also be submitted, with the offer, separately.
- 12.1.4 Criteria for replacement of components of couplers during maintenance. These criteria should further meet the requirements of para 9.7 of this schedule.
- 12.1.5 Copy of Maintenance Manual, which details the maintenance procedures for couplers in workshops and open lines. The manual must necessarily include detailed procedures for building up coupler shank wear, detailed procedure for installation and dismantling of draft gear and detailed procedure for renewal of components of draft gear with requisite tools, jigs and machinery.
- 12.1.6 Maintenance Manuals at the rate of 10 copies of Maintenance Manuals for every supply of 500 couplers and also give a soft copy on CD with every order and subsequently whenever revised.
- 12.1.7 Inspection shall be carried out by following APTA gauges.

S.No.	Gauge no.	Description
1.	31000	Contour Maintenance Gauge
2.	32600	Aligning Wing limit Gauge
3.	34100-1	Contour condemning limit gauge
4.	34100-2A	Knuckle nose Wear and Stretch Limit Gauge
5.	34101-4	Vertical Height Aligning wing Pocket and Guard Arm gauge
6.	44250-5	Vertical height condemning limit Aligning wing Pocket and Guard Arm Gauge

13. GUARANTEE

- 13.1 The 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 72 months from the date of fitment/84 months from the date of supply 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.

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Annexure – A

DESIGN PARAMETERS OF WDP₂ CLASS LOCOMOTIVE

- | | |
|--|--------------------------|
| 1. Length over buffer beams | : 17900 mm |
| 2. Length over buffer face to face | : 19182 mm |
| 3. Distance between bogie pivot centres | : 10700 mm |
| 4. Weight of locomotive | : 117 t |
| 5. Axle load | : 19.50 t |
| 6. Type of brake system | : 28 LAVI/IRABI |
| 7. Theoretical Brake Force | : 23.72t |
| 8. Type of coupler on locomotive | : AAR E/F & AAR H |
| 9. Nominal height of Coupler from rail level | : $1090 \pm 5^{+15}$ mm. |
| 10. Number of Side Buffers per locomotive | : 2 per end (#) |

NOTE:

Locomotives are provided with Centre Buffer Couplers and Side Buffers.

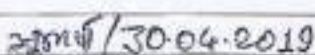

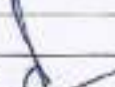


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Annexure – B

OPERATING CONDITIONS FOR COUPLERS

- | | | |
|-----|---|--|
| 1. | Coach Type | :Broad Gauge Passenger Coaches
(Fitted with CBC) |
| 2. | Axle Load | :16.25t (max.) |
| 3. | Gross Load (Coach) | :65t (max.) |
| 4. | Gross Load (Train) | :1700 t (max. Without loco) |
| 5. | Grade | :1 in 37 (steepest) |
| 6. | Speed (maximum) | :160 km/h |
| 7. | Curve (Sharpest) | :175 m (radius) |
| 8. | Climatic & Environmental
Conditions | |
| | - Maximum Temperature:- | :70 ⁰ |
| | - (under the sun) | |
| | Maximum Temperature | :45 ⁰ C |
| | (under shade) | |
| | - 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) | :1105 mm (from Rail Level) |
| 10. | Coupler Height (for locos) | :1090 mm (from Rail Level) |
| 11. | Wheel Diameter (for coaches) | : 915 mm (new)
825 mm (condemning-ICF)
845 mm (condemning-LHB
variants) |
| 12. | (i) Maximum coupling/uncoupling operations: 12 per day. | |
| | (ii) Speed at the time of coupling loco with rake: | |
| | a) On platform line - 3 kmph | |
| | b) In yard shunting – 5 kmph | |

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13. Type of Brake System : Graduated Release Twin Pipe Air Brake System generally as per UIC 540. Coaches shall be equipped with disc brakes or clasp type brakes having composition or cast iron brake blocks.
14. Braking Distance of Train : 1200 m from a speed of 160 km/h
15. Maximum deceleration : 1.3 m/sec²
16. Rolling Resistance of Coaching stock: $R = 0.685 + 0.0211V + 0.000082 V^2$
Where, R= Rolling Resistance in kg/t of coach weight and
V= Speed in km/h
17. Side Buffers : On end coaches next to locos.
(Power Cars and SLRs only)
18. Coach Strength : Satisfies end load requirements as per UIC 566





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Annexure – C

INFORMATION TO BE SUBMITTED BY TENDERER WITH TECHNICAL OFFER

1. Drawing of coupler, yoke/front fork, yoke/draft gear connection, draft gear details, coupler operating mechanism, coupler carrier, etc.
2. Copy of vendor's internal quality assurance programme. In addition, vendor's internal process specification and quality assurance programme certifying the casting integrity shall also be submitted.
3. Drawing of draft gear along with dimensional and material specification details and arrangement of draft gear.
4. Detailed calculations and technical basis for draft gear design offered.
5. Following parameters shall also be advised:
 - 5.1 Actual Characteristics of the draft gear found after testing
 - 5.2 Dynamic & static capacity of the draft gear at various strokes proposed
 - 5.3 Dynamic Capacity of draft gear at half travel
 - 5.4 Max. Dynamic energy storage capacity of draft gear
 - 5.5 Energy absorption capacity of crash element (if required by the purchaser at the time of purchase)
 - 5.6 Initial pre-compression of draft gear pad stack.

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Annexure - D

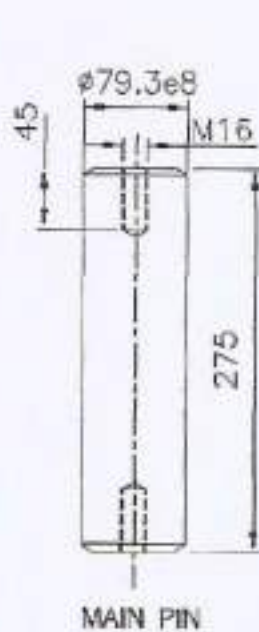


Fig. - 1

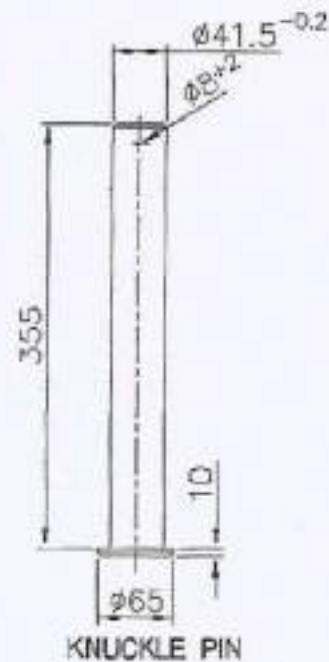


Fig. - 2

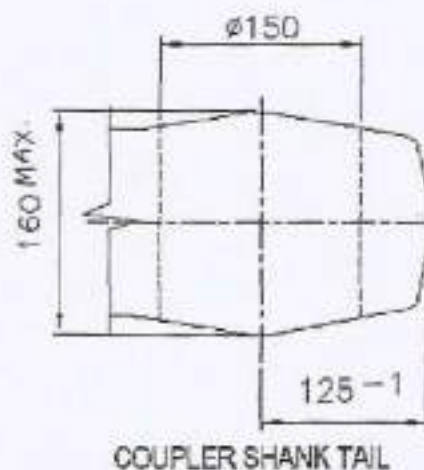


Fig. - 3

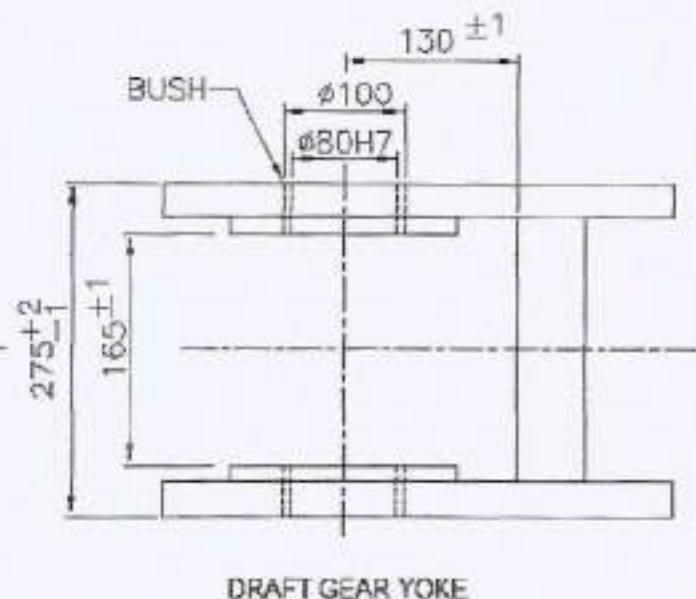
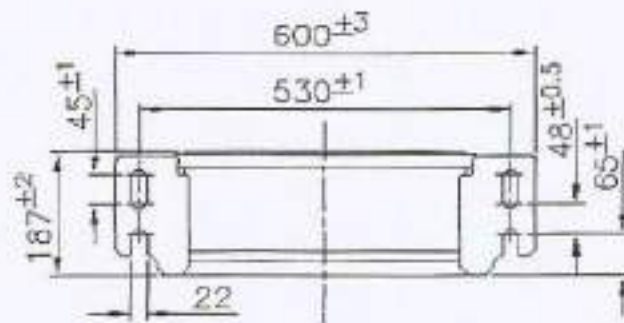


Fig. - 4

Signature	<i>28/04/30.04.2019</i>	<i>[Signature]</i>	<i>[Signature]</i>
Name & Designation	Prepared By:- Subhash Oraon/SSE(D)	Checked By:- S.P. Awasthi/SSE (D)	Approved By:- S.S. Chauhan /Director/CD

Ref: CG-WI-4.2.1-1 (Ver.1)	Page 22 of 27	Date/Month of Issue APRIL - 2019	Specification No. RDSO/2011/CG-03 (Rev-3)
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Annexure – E



SUPPORTING DEVICE

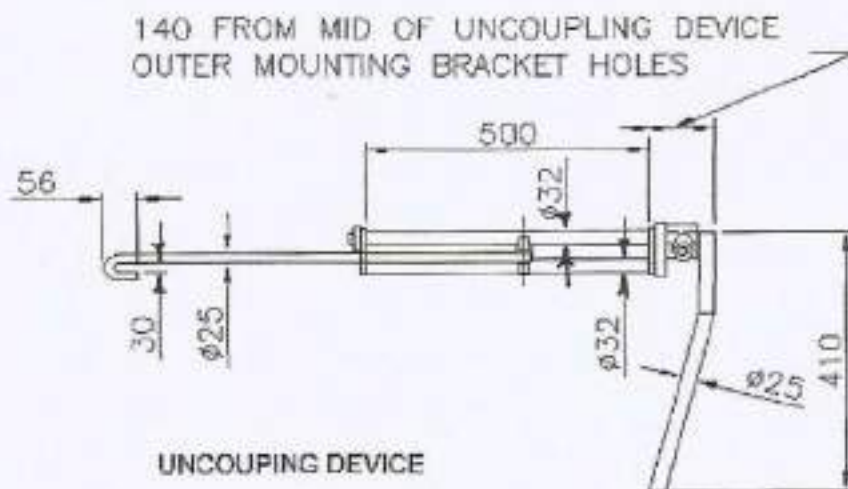
Fig. - 1



SPRING DETAILS:-
WIRE DIA -----11mm (Min.)
INTERNAL DIA-----71.5mm (Min.)
NUMBER OF SPRING-----4

SUPPORTING DEVICE SPRING

Fig. - 2



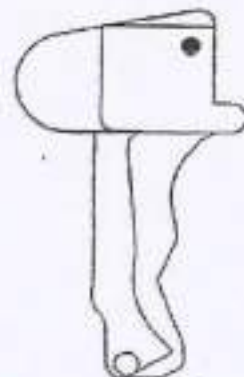
UNCOUPLING DEVICE

Fig. - 3

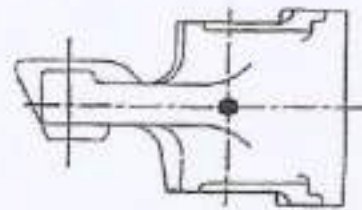
Signature	23/04/30.04.2019	Checked By:- S.P. Awasthi/SSE (D)	Approved By:- S.S. Chauhan /Director/CD
Name & Designation	Prepared By:- Subhash Oraon/SSE(D)		

Ref: CG-WI-4.2.1-1 (Ver.1)	Page 23 of 27	Date/Month of Issue APRIL-2019	Specification No. RDSO/2011/CG-03 (Rev-3)
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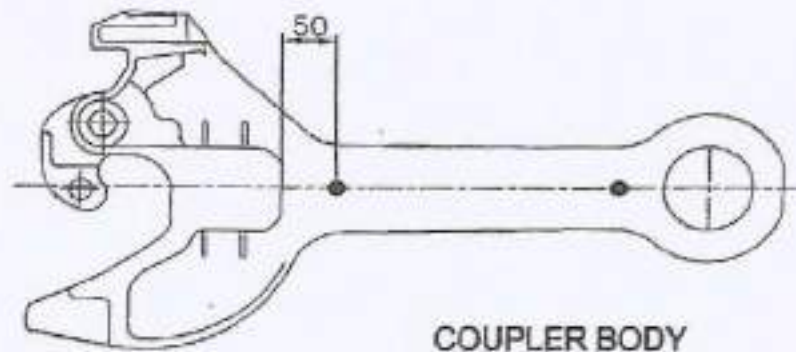
Annexure - F



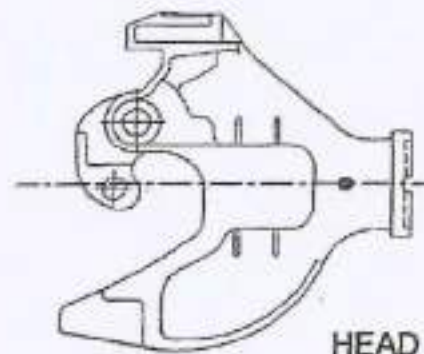
LOCK



KNUCKLE



COUPLER BODY



HEAD



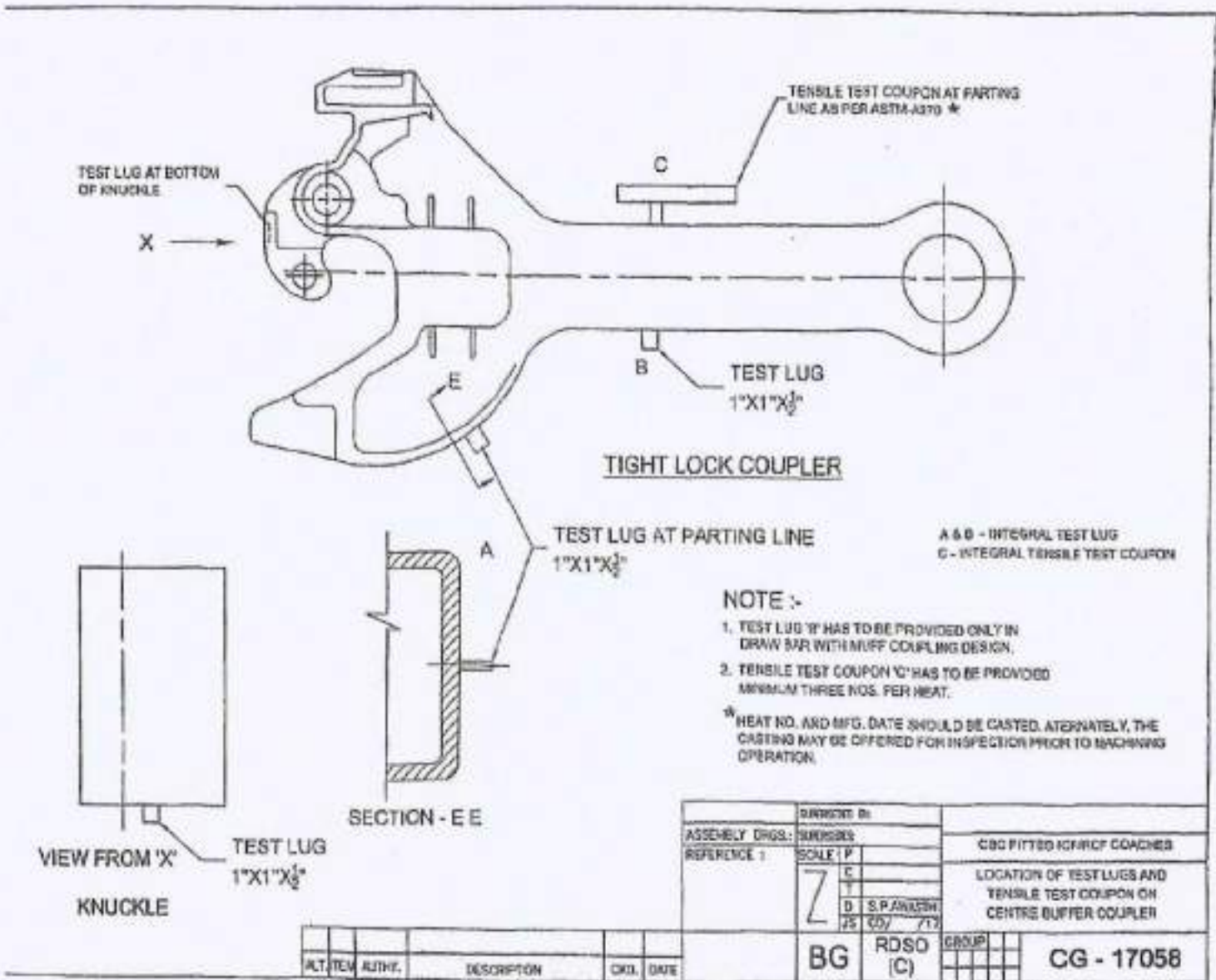
DRAFT GEAR

MUFF COUPLING TYPE COUPLER HEAD

LOCATION FOR BRINELL HARDNESS TESTING

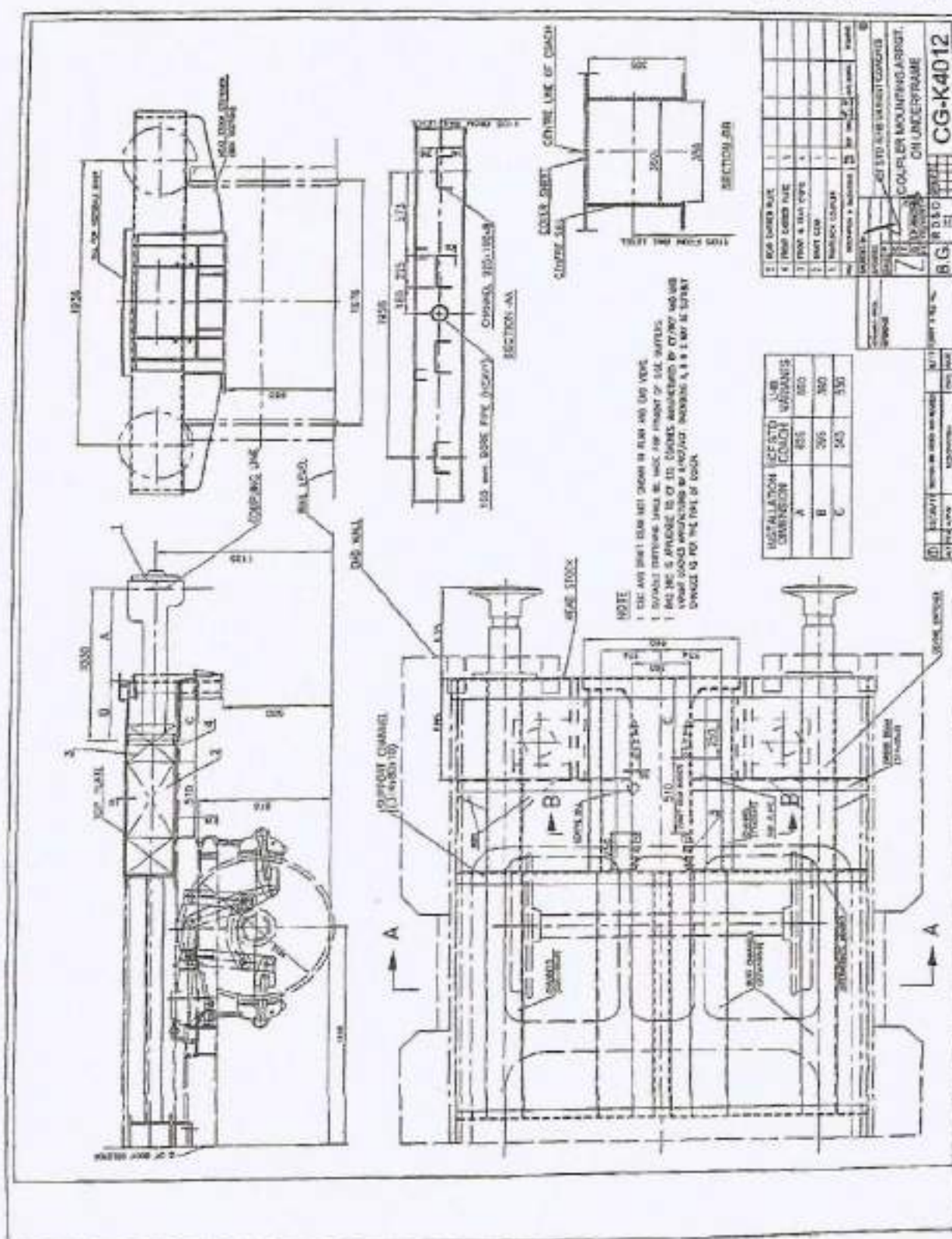
Signature	23/04/30-04-2019		
Name & Designation	Prepared By:- Subhash Oraon/SSE(D)	Checked By:- S.P. Awasthi/SSE (D)	Approved By:- S.S. Chauhan /Director/CD

Annexure - G



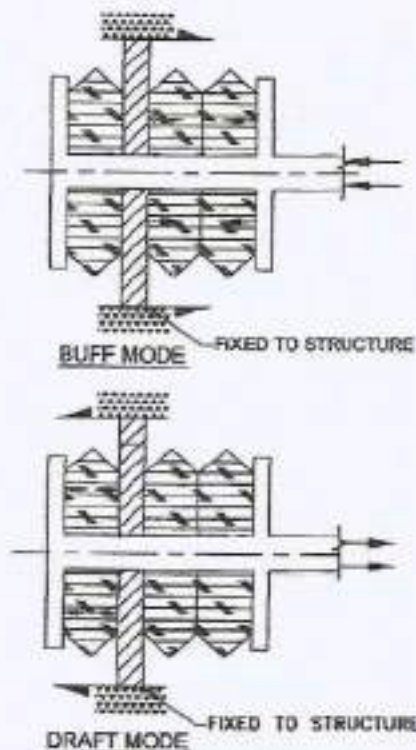
Signature	28/04/2019	Checked By:-	Approved By:-
Name & Designation	Subhash Oraon/SSE(D)	S.P. Awasthi/SSE (D)	S.S. Chauhan/Director/CD

Annexure – H



Signature	20/11/30.04.2019		
Name & Designation	Prepared By:- Subhash Oraon/SSE(D)	Checked By:- S.P. Awasthi/SSE (D)	Approved By:- S.S. Chauhan /Director/CD

Annexure - I

FORCE FLOW DIAGRAM OF DOUBLE
ACTING BALANCED DRAFT GEAR

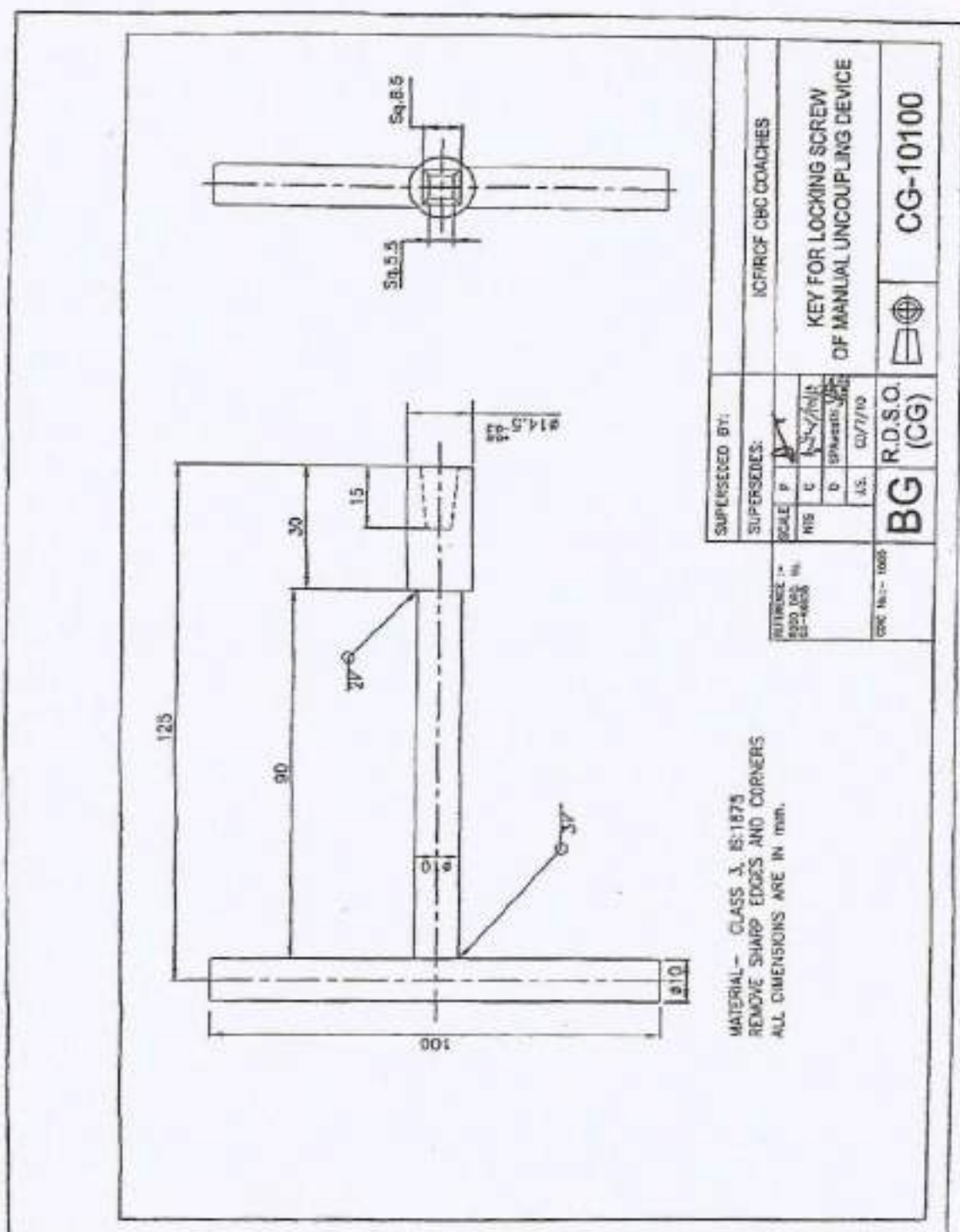
NOTE

1. NO.OF PAD SHOWN IN THE SKETCH IS SYMBOLIC ONLY.
2. DRAFT GEAR ARRANGEMENT SHALL HAVE EFFECTIVE ZERO PRELOAD IN BUFF AS WELL AS DRAFT MODE. IT MEANS THAT FORCE Vs DISPLACEMENT CURVE OF DRAFT GEAR CHARACTERISTICS DRAWN FOR QUASISTATIC CONDITION SHALL PASS THROUGH ZERO FORCE AND SHALL HAVE REGULAR CURVE (NOT SEPARATED BY VERTICAL LINE) IN LOAD REVERSAL IN BOTH THE DIRECTIONS i.e.
(a) BUFF TO NEUTRAL TO DRAW AND
(b) DRAW TO NEUTRAL TO BUFF.

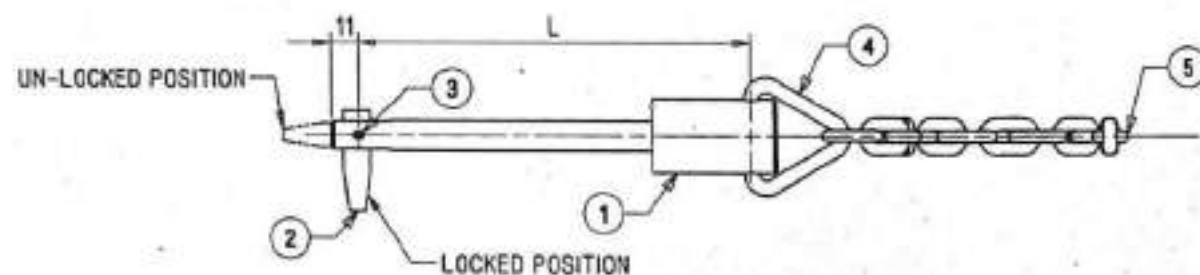
(1)	CD/48/11	NOTE ADDED.	08/11
ALT.	AJ017	DESCRIPTION	DATE
SUPERSEDED BY			
SUPERSEDED BY		ALT. NIL	
REFERENCE:-	SCALE P		
	NTS		
	C		
	D		
FILE No.:-	BG	RDSO (CARRIAGE)	CG- K8207

Signature	23/04/2019	Checked By:-	Approved By:-
Name & Designation	Subhash Oraon/SSE(D)	S.P. Awasthi/SSE (D)	S.S. Chauhan /Director/CD

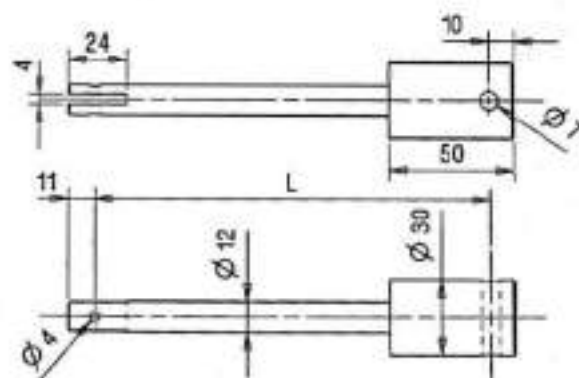
Annexure – J



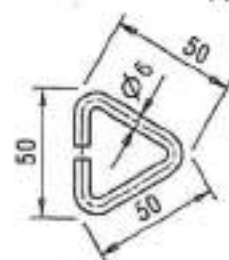
Signature	28/04/30.04.2019		
Name & Designation	Prepared By:- Subhash Oraon/SSE(D)	Checked By:- S.P. Awasthi/SSE (D)	Approved By:- S.S. Chauhan /Director/CD



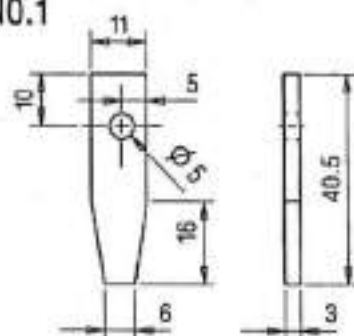
ISO VIEW



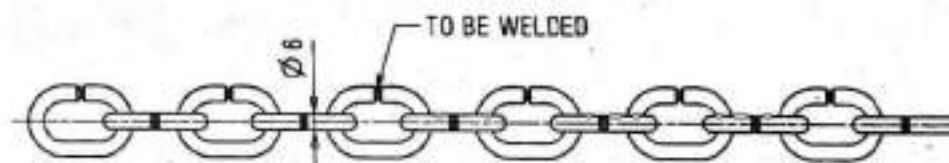
ITEM NO.1



ITEM NO.4



ITEM NO.2




ITEM NO.5

5	CHAIN	1			Fe40WA TO IS:2062	IS:2760
4	CLIP	1			Fe40WA TO IS:2062	
3	SPRING DOWEL PIN	1			ISO 8752 / DIN1481	ISO 8752-4 x 9-51
2	PLATE	1			SS-304	
1	LOCKING PIN	1			816M49 T9 SS-639 (EN-24)	HARDENED & TEMPERED SS-48 HRC
ITEM	DESCRIPTION & DIMENSIONS	NO. QTY	REF.	DRG.	M. & M. OF MATERIAL	REMARKS

NOTE:-

1. ALL SHARP EDGES AND BURRS SHALL BE REMOVED.
2. UNSPECIFIED TOLERANCE AS PER IS-2102-VC.
3. SURFACE TREATMENT: BLACK PAINTING.

	SUPERSEDED BY:-		INDIAN RAILWAYS	
ASSEMBLY DTS.	SUPERSEDES:-		ICF/LHB TYPE COACHES	
REFERENCE:-	SCALE	P	LOCKING PIN ASSEMBLY	
		C		
	1:2	O		
	J.S.	CD/01/24		
COIC NO.1:-	B.G.	R.D.S.O. I.C.G.		RDSO/CG/DRG/24003

ALT.	ITEM	AUTH.	DESCRIPTION	CHD.	DATE
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