

REVISION OF SPECIFICATION / STR

Ref: Current Specification No. C- 9509 (Rev -2)

1. RDSO is reviewing the specification/STR to cater to the latest technological developments in the field, modify clauses not relevant in the present context and making them more enabling with focus on functional requirements.
2. It is requested that your comments / suggestions with regard to improvements / modifications in specification / STR of this item may be submitted in the following format alongwith the justification for the changes required.

Part A: Basic Information

SN	Particulars	Information
1	Name	
2	Designation	
3	Professional Qualification	
4	Organization / Firm's Name	
5	Address for Correspondence	
6	Contact No.	
7	Email ID	
8	In case of Firm / Individual: Manufacturing experience of item (or similar Item) on which comments are offered	
9	Where relevant: Whether any technical document to support suggested changes is available / enclosed for better appreciation	

Part B: Comments / suggestions on the specification

SN	Clause No. of RDSO STR / Spec	Clause, as exists in RDSO STR / Spec	Clause, as it should read after incorporation of comments / suggestions in the RDSO Spec / STR	Justification for changes

Comments may be sent to:

Director Carriage
Research Designs and Standards Organization
Manak Nagar, Lucknow – 226011

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INDIAN RAILWAYS



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 Controlling Officer. *Mohammad Saquib*
 Signature.....
 Designation.....

**SCHEDULE OF TECHNICAL REQUIREMENTS
FOR ENHANCED CAPACITY (ALLOY STEEL)
DRAW HOOK ASSEMBLY USED ON
RAILWAY COACHES**

S. No.	Month/Year of Issue	Revision/Amendment	Page No.	Reason for Amendment
1.	May - 2003	1	-	-
2.	Feb, 2007	2	7	Added Magnaflux test as recommended by ED/QA (Mech) vide letter no. MW/IL/Regn/Emson/D Dt. 31/02/2007
6.	October, 2016	Amendment-1	3	To include the ISO Doc. No. QO-D-7.1-11, New sub clause No.1.2 added under clause no. 1 of Scope.

**Issued By:
Research Designs and Standards Organization
Manak Nagar, Lucknow-226 011**

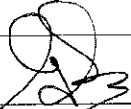

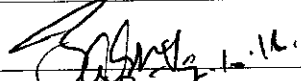
Signature	<i>S.P. Awasthi</i>	<i>Subhash Singh</i>	<i>Mohammad Saquib</i>
Name & Designation	Prepared By:- S.P. Awasthi SSE/Carriage	Checked By:- Subhash Singh SSE/Carriage	Approved By:- Mohammad Saquib Director/VDG/CD

Ref: CG-WI-4.2.1.1 (Ver -1)	Page 1 of 14	Date of Issue: October - 2016	Spec. No. C-9509 (Rev.-2)
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Amendments slip No. 1 of October, 2016 to Spec No. C-9509 (Rev.2) for SCHEDULE OF TECHNICAL REQUIREMENTS FOR ENHANCED CAPACITY (ALLOY STEEL) DRAW HOOK ASSEMBLY USED ON RAILWAY COACHES.

New sub Clause 1.2 added as under:

1.2 All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-7.1-11 dated 19.07.2016 (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.

Signature			
Name & Designation	Prepared By:- S.P. Awasthi SSE/Carriage	Checked By:- Subhash Singh SSE/Carriage	Approved By:- Mohammad Saquib Director/VDG/CD

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Controlling Officer

Signature :

Designation

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SCHEDULE OF TECHNICAL REQUIREMENTS

FOR

ENHANCED CAPACITY (ALLOY STEEL)

DRAW HOOK ASSEMBLY USED ON

RAILWAY COACHES

(Supersedes C-9509, November, 1996)

Sn. No.	Issued Date/Month	Revision/ Amendment	Page No.	Reason of Amendment
1	May- 2003	1	-	
2	Feb. - 2007	2	7	Added Magnaflex test as recommended by ED/QA(Mech) vide letter no. MW/IL reyn/Emsan/D Dt. 31/02 02-2007

ISSUED BY:

Research Designs and Standards Organisation:
Manak Nagar, Luck now – 226 011

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SCHEDULE OF TECHNICAL REQUIREMENTS FOR ENHANCED CAPACITY (ALLOY STEEL) DRAW HOOK ASSEMBLY USED ON RAILWAY COACHES

SECTION-A

1. SCOPE

This schedule covers the technical requirements of enhanced capacity (alloy steel) draw hook assembly used on BG coaches in respect of manufacture, material, testing etc. in Section 'A' and Infrastructure requirements for manufacturing, testing facilities, inspection and quality control requirements in Section 'B'.

2. MATERIAL

2.1 The material of draw hook and other components of draw hook assembly like draft-key, draw bars and draw gear pin etc. shall conform to grade 35Mn6Mo3 of IS: 5517-93 with additional requirements as mentioned in clause Nos.2.1.1.2 and 2.1.1.3. The draft yoke shall be manufactured out of steel to Gr.Fe540 of IS: 8500-91 and as per ICF drg. No. T-2-1-012 with latest alteration.

2.1.1 Manufacture

2.1.1.1 The steel shall be melted in Electric Arc furnace followed by secondary refining. The molten metal shall be degassed through vacuum degassing arrangements to ensure freedom from harmful gaseous content.

2.1.1.2 The hydrogen content in the liquid steel shall be 2 ppm max.

2.1.1.3 The sulphur and phosphorus content during ladle analysis shall be 0.025% (Max.) each.

2.1.1.4 The size of ingots or concast billets for the given size of the finished steel product shall be such that a minimum reduction ratio of 8:1 from the minimum cross-section area of the ingot or concast billets to the maximum cross-section area of the product is ensured.

2.1.1.5 Elements not mentioned in IS: 5517-93 shall not be, intentionally or otherwise, added to the steel.

2.2 Chemical Composition

2.2.1 The ladle analysis of steel, when analysed in accordance with IS: 228 shall be to IS: 5517-93 Table-2 read in conjunction with requirements detailed in clause Nos.2.1.1.2 and 2.1.1.3 above.

2.3 Freedom From Defects

2.3.1 The draw hook assembly and/or spare parts shall be free from harmful surface and sub - surface defects, which may impair the end use of the product. When ingot practice is adopted, the internal defects of steel, as evaluated by macro etching test as per IS: 11371-85 shall not be worse than S-2 (Sub- surface), R-2 (Random condition) and C-2 (Centre segregation) as per ASTM E-381. When continuously cast billets/blooms are used, the internal defects of steel shall not be worse than SB-2 (Sub-surface blow-holes), SC1 (Sub-surface cracks), CS-2 (Centre segregation) and CL-2 (Centre looseness) as per IS: 13352-92 (Stock for forgings produced from continuously cast blooms, billets and slabs-Spec.)

2.3.2 During processing the billets, blooms or slabs shall be conditioned to remove injurious surface defect, provided the depth of conditioning does not exceed 1 mm for every 15 mm of concerned dimension, upto a maximum depth of 20 mm, and provided that the width of the conditioning is at least four times its greatest depth; except that in case of slabs, the depth of conditioning on the wide surface may exceed this allowance by 50%, upto a maximum depth of 20 mm. The maximum depth of conditioning on two parallel sides at opposite locations shall not exceed one and half times the maximum allowed for one side. The transition between conditioned and non-conditioned areas shall be gradual. All heavy swarf and/ or slag shall be removed. After removal of surface defects from the billets, magnetic particle testing and ultrasonic examination may be carried out on all billets to ensure freedom from surface defects and internal defects respectively. Standard for testing method and acceptance criteria may be prepared and RDSO's approval obtained.

2.3.3 In special cases, particularly where it is necessary on large material and is not injurious, greater depth of conditioning may be permitted by agreement between the Purchaser/Inspecting Authority and the Manufacturer. The method of conditioning employed for removal of surface defects shall be such that it does not impair the properties of the billet material.

2.3.4 The Manufacturer shall be at liberty to choose the method of conditioning, subject to prior approval of the Purchaser.

2.4 The raw material shall be procured from RDSO approved sources only. Complete details of chemical composition and other tests shall be obtained from steel maker and shall be produced to the inspector on demand.

2.5 The draw gear arrangement shall conform to RDSO/Sk-99003 with latest alteration.

3. QUALITY OF DRAW HOOKS

3.1 The draw hooks shall be forged, smoothly and accurately finished in accordance with the drawings, true to template and gauges. All draw hooks of the same type must be interchangeable. The inside surface of each draw hook shall be left full, and shall be filed or machined smooth to finished size and carefully examined to prevent the possibility of flaws existing in the finished draw hook. Pinholes in the draw hooks shall be drilled and slots for draft key shall be machined from the forged draw hooks.

4. HEAT TREATMENT (Hardening and Tempering)

4.1 Draw hook, draft key, draw bar, castle nut, draw gear pin shall be heat treated separately in a batch as per following procedure to meet the requirements stipulated in clause 6. The threads of the draw bar and castle nut should be given suitable protective masking to avoid any damage of the thread during heat treatment

- i) Put the draw hook / components in the furnace at a temperature lower than 500°C.
- ii) Heat it progressively upto 860°C in minimum 2 hours.
- iii) Soak at 860°C. Soaking time should be as per the thickness of the component.
- iv) Quench in circulating oil.
- iv) Temper at 550-600°C followed by normal cooling. Soaking time should be as per the thickness of the component.

5. SAMPLING

5.1 Complete draw hook assembly or spare parts shall be offered for inspection in separate lots. Lot size for complete draw hook assembly will, however, not to exceed 100. One No. of Draw hook assembly shall be drawn from the lot for conducting test as per clause 6.1 to 6.2.2 and remaining draw hook shall be subjected to proof load testing as per clause 6.3.2. For spare parts, lot size shall be of a maximum of 300 No. or part thereof from one heat treatment batch.

6. TESTS

6.1 Chemical Tests

6.1.1 Chemical Composition

Chemical composition shall be checked on the finished products. The variation of these chemical analysis when compared to limits specified in IS: 5517-93 table 2 read in conjunction with key requirements detailed in clause No.2.1.1.2 and 2.1.1.3 shall conform to clause 6.2 of IS: 5517-93.

6.2 Metallographic Examination

6.2.1 Inclusion Rating

The inclusion rating level of steel when determined as per IS: 4163-82 (Method for determination of inclusion content in steel by microscopic method) shall not be worse than 2.0 A, B, C, D in thin and 1.0, A, B, C and D in thick series.

6.2.2 Microstructure

Microstructure should be tempered martensite.

6.3 Mechanical Tests

6.3.1 Destruction Test

One draw hook assembly per batch shall be tested to destruction by a direct pull. The draw hook assembly when tested must withstand a load of not less than 130 tonnes. The test must be conducted on a hydraulically operated machine having minimum capacity of 150 tonnes. The sample after testing shall be destroyed by oxy cutting in the presence of the purchaser/ Inspecting Authority. For spare parts, refer to clause 7.

6.3.2 Proof Load Test

Each remaining draw hook assembly of the batch which has complied with the requirements of clause 6.3.1 shall withstand a direct pull of 75 tonnes and must not show any signs of permanent set. Any draw hook assembly showing permanent set shall be rejected. The test must be conducted on a hydraulically operated machine having used for destruction test.

6.3.3 Periodical Test

In addition to the above test, at random sample shall be sent to NTH once in six months for conducting the Destruction & Proof load test as enumerated in clause 6.3.1 & 6.3.2.

6.3.4 Magnaflux Test

Non-destructive magnetic particle test should be carried out on 100% of the lot quantity.

6.4 **Additional Tests**

6.4.1 If the sample draw hook assembly of any heat treatment batch fails to withstand the destruction test, the Manufacturer with the concurrence of the Purchaser or the Inspecting Authority may reheat-treat all the draw hook assemblies of the same batch from which the Purchaser or the Inspecting Authority shall select two draw hook assemblies for destruction tests. Should the results of these repeat tests carried out on two draw hook assemblies satisfy the requirements of the schedule, the lot represented shall be accepted for proof tests as per clause 6.3.2. Should either of the samples fail in destruction test, the product shall be taken as not complying with the schedule and the whole batch represented by the samples shall be rejected.

7. **SPARES**

7.1 Only those vendors approved for the supply of complete draw hook assembly are eligible for the supply of spare parts of the draw hook assembly. When spares i.e., draw hook, draw bars, castle nut, draft key and draw gear pins are ordered, one sample from each heat treatment batch shall be tested as per clause 6.1.1 to 6.3.1. For destruction testing of the spare a special test draw hook assembly having load capacity in excess of 130 tonnes is to be developed by the vendor and these spare parts shall be fitted in the test draw hook assembly and tested as per clause 6.3.1. The spare parts after testing shall be destroyed by oxy cutting. When testing the spare, if the test draw hook breaks before required loading is attained, the test shall be terminated. After successful compliance of the above requirement the remaining spare parts shall be subjected to proof load test. To test these spare parts they shall be fitted in a standard draw hook assembly and complete assembly subjected to test enumerated in clause 6.3.2.

8. **TESTING AND INSPECTION FACILITIES**

8.1 The Manufacturer shall supply free of charge the material required for testing and shall at his own expense, furnish and prepare the necessary test pieces, and provide labour and appliances for such testing as may be carried out in his

premises in accordance with this schedule. Failing to provide facilities for carrying out the prescribed test, at his own works, the Manufacturer shall bear the cost of conducting the tests elsewhere.

9. REJECTION

9.1 The draw hooks assembly and/ or spare such as Draw Hook, Draw bar, Castle Nut, Draft key, Draw gear pin, etc. found defective due to improper workmanship or not complying with the provision of this schedule shall be rejected. The manufacturer should ensure that the rejected materials are not to re offered for inspection / testing. Procedure for disposal of the rejected materials should be clearly spelt in the QAP of the manufacturer.

10. MARKING

10.1 Each draw hook assembly and/or spare parts shall be stamped with such marks of identification as shown in the drawings and in the absence of which as mutually agreed between the Purchaser and the Manufacturer. "IS: 5517-93" should be stamped for the material.

11. PROTECTION

11.1 All draw hooks assembly and / or spare, after acceptance, shall be painted with one coat of boiled linseed oil to IS:77 and packed securely in rigid cases ensuring that each case does not weigh more than 750 kg. Alternatively, to be packed securely in double gunny bag. The thread of the draw bar shall be given additional rigid protection.

SECTION-B

1. REQUIREMENTS

The vendors seeking approval shall comply all the below mentioned requirements:

1.1 General & Manufacturing Facilities

Covered area with adequate space underneath for storage of raw materials e.g. billets, round corner squares, rounds etc. The covered area should have display board showing different colour shades nominated to different grades of steel to avoid mix up of materials. Arrangement of painting the billets, RCS rounds etc with particular paint shade previously nominated according to the grade of steel should be available.

1.2 At least 1 No. Fork-lift and/or 1 No. Over-head crane of 2t capacity shall be available for material handling.

1.3 Minimum 1 No. of band saw / billet shearing machine should be available.

1.4 At least 2 Nos. of drop hammer with minimum capacity of 3t or double acting pneumatic hammer / forging press of equivalent capacity along with at least 2 Nos. of trimming press of minimum capacity of 300t for removal of flash etc. shall be available.

1.5 Minimum 2 Nos. of compressors of 75 cfm minimum capacity each are to be installed. In addition, blower of minimum 5 HP should be available.

1.6 Minimum 2 Nos. of batch type oil fired or gas-fired or induction furnace of adequate capacity for heating cut pieces of billets/RCS/rounds etc. shall be available. The temperature range of these furnaces should be up to 1200°C and should be provided with automatic temperature controllers. The controller should be calibrated once in six month. The desired temperature shall be achieved within an accuracy of $\pm 10^{\circ}\text{C}$.

OR

Minimum one number of pusher type oil fired/gas-fired/ induction furnace shall be available. The pusher type arrangement should be hydraulic / mechanical operated. The furnace should have adequate capacity to heat cut pieces of billets/RCS/rounds upto 1200°C temperature. The furnace should be provided with automatic temperature controllers. The controller should be calibrated once in six month. The desired temperature shall be achieved within an accuracy of $\pm 10^{\circ}\text{C}$.

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- 1.7 2 Nos. batch type electrically heated or oil fired furnaces each having a capacity of 500 kg for heating of components upto 1000°C. The furnaces should be provided with automatic temperature controllers and recorders and temperature-time graph recording facilities. Hardening temperature to be maintained shall be controllable within $\pm 10^{\circ}\text{C}$. The furnace shall have facility for controlling the internal atmosphere to avoid undesirable scaling and decarburisation.
- 1.8 One number of oil quenching tank of approx. 6,000-liter capacity with necessary heat exchanger and continuous circulation of oil facilities should be available. The quenching tank should be provided with automatic temperature recorder.
- 1.9 2 Nos. of forced air circulation, pit type electric or equivalent tempering furnace of adequate capacity having automatic temperature controllers and recorders.
- 1.10 One shot blasting machine with table dia. of at least 3ft shall be available. The shot blasting machine shall have in-built facility of sieving undersize shots.
- 1.11 The firm should be equipped with CAD facility for designing its own forging and trimming dies.
- 1.12 A die shop having adequate die sinking facilities comprising of spark erosion machines etc. capable of accommodating die blocks upto 1t weight and 400mm height.
- 1.13 Adequate machining facilities comprising of vertical milling machine/radial drilling machines/horizontal lathes with tapping arrangements etc. of suitable capacities and standard makes are required for preparation of die blocks and machining of forged components.
- 1.14 Adequate Nos. of hand grinders is required for removal of fins & burrs.
- 1.15 Minimum 1 No. semi -automatic/automatic thread cutting lathe for formation of threads on drawbars is required.
- 1.16 Prior to release of dies for production, it should be ensured that the dies are checked dimensionally in all respects including it's mounting on the forging hammer/press. The firm must list out the method of checking the dies i.e. either on plaster of Paris blocks or on auto-cad arrangement. Proper records of die inspection/checking showing the date of checking; important dimensions and contours must be maintained. Any ill effect of dies on forged components or their mismatching with forging hammers/press must be recorded. The remedial measures taken should also be documented.

1.17 Ensure that critical inspection of the first forging and last forging of a production run is essentially carried out to ascertain behavior of the dies in operation and product quality.

2. TESTING FACILITIES

2.1 Chemical Lab

2.1.1 The firm must possess a fully equipped chemical lab with following facilities:

- i) Arrangement to carry out the analysis of C & S by Strohlein's apparatus and those of Si, P, Cr, Ni, Mo, V by conventional method shall be available.
- ii) Metallurgical microscope of standard make having 1000 magnification and with photographic attachment to check inclusion content, grain size, microstructure, decarb etc.
- iii) The firm should have permanent arrangement with NABL certified Lab or a reputed steel making company for arranging the spectro analysis of the material.
- iv) The lab should possess facilities of making sulphur prints, hot etching for macro examination of materials.
- v) Muffle furnace with temp. range upto 1000°C.

2.2 Physical Testing Lab:

2.2.1 The firm must possess a well equipped physical lab with following facilities:

- a) Universal Testing machine of 40t capacity with load/ deflection plotting arrangement to conduct UTS, Yield strength and bending tests etc.
- b) Impact testing machine of 30-kgm minimum capacity to conduct Izod/Charpy tests.
- c) BHN testing machine with necessary standard test pieces. The hardness testing machine shall have capacity to apply 3000 kgs load on one test specimen.
- d) One number Portable hardness tester with standard calibration blocks.

2.3 Non-destructive testing:

2.3.1 The firm must possess the following NDT facilities:

- i) 1 No. Magnetic particle testing machine (wet method) with ultra violet light facilities. The bed of the machine should be of adequate length to accommodate the full length of test pieces. The machine shall have arrangement for both longitudinal and circular magnetization. Magnetizing

current capacity shall be appropriate to the work piece (1500 amps minimum).

- ii) One number dye penetrant kit for detection of surface cracks.
- iii) One number surface comparator to compare the surface finish of machined surfaces.
- iv) One number shadowgraph equipment for verification of part profiles under 10X magnification.
- v) One number optical pyrometer to measure temp. ranging from 800°C to 1600°C.

2.4 **Destructive Test:**

2.4.1 Firm must possess in house one number hydraulically operated destruction-testing machine with minimum capacity of 150 tonnes.

2.5 **Other Testing Facilities:**

2.5.1 The firm shall possess the following:

- a) The firm shall have adequate facilities for preparation of sample. Facilities like machining, grinding, polishing etc. should be available in house.
- b) Adequate number of fine punches for stamping marking particulars on finished components.
- c) Adequate numbers measuring instruments such as:
 - i) Vernier Calipers - 150.0 mm to 1000 mm
 - ii) Measuring scales – 1 meter to 2 meter
 - iii) Micrometers - Ranging from 50 to 100 mm
 - iv) GO & NO-GO gauges

3. **QUALITY CONTROL REQUIREMENTS**

3.1 There should be a system to ensure the traceability of the product from raw material stage to finished product stage. This system should also facilitate to identify the raw material composition from the finish product stage.

3.2 Ensure that there is a QAP for the product detailing various aspects: -

- QA Organisational Chart
- Flow Process Chart
- Stage inspection details
- Various parameters and to ensure control over them

3.3 There should be at least one full time technologist having a minimum bachelor's degree in relevant field & 5 years experience or a person with diploma in relevant field with 12 years experience. He should be free from day-to-day

production, testing and quality control responsibilities. He should be mainly responsible for development of a product, analysis of products, control over raw material, and corrective action in case of difficulties in achieving the parameters.

- 3.4 The firm should have acquired ISO: 9000 series certification and the product for which an approval is sought should be broadly covered in the scope of the certification for manufacture and supply.
- 3.5 The Quality manual of the firm for ISO: 9000 should clearly indicate at any stage the control over manufacturing and testing of the said railway product.
- 3.6 Ensure that proper analysis is being done on monthly basis to study the rejection at various internal stages and it is documented.
- 3.7 Ensure that all the relevant specifications, IS standards are available with the firm.

4.0 INSPECTION

4.1 Purchasing / Inspecting Authority

- 4.1.1 The manufacturer shall furnish the Purchasing / Inspecting authority the details of internal inspection and test records and other relevant records as required under the quality control system in force. The records & reports shall be open to examination by the Purchasing / Inspecting authorities at all reasonable times.
- 4.1.2 The Purchasing / Inspecting authority at their discretion may draw samples at any stage of production for conformity tests either at the works of the manufacturer or in an approved laboratory. In case the samples do not conform to the requirements of the specifications, double the number of samples from the same lot / batch shall be drawn for re-testing. Should any of the re-test samples do not conform to the requirements, the entire lot / batch shall be rejected.
- 4.1.3 The Purchasing / Inspecting authority shall in his presence destroy the samples after the impact & destruction test in such a way that the same cannot be usable. These samples are to be preserved for at least three month in a designated area. The Purchasing / Inspecting authority shall verify the accountal of these samples visa-a-vis quantity supplied during the period.

4.2 Consignee Railway

- 4.2.1 The consignee Railway, on receipt of the consignment, shall verify:
 - a) The condition of the packing.

- b) Facsimile of the inspector's stamp on each Draw hook assembly and/or spare parts
- c) Quantity received as per the inspection certificate.
- d) At random checking of the markings on the Draw hook assembly and/or spare parts as per the drawing.
