

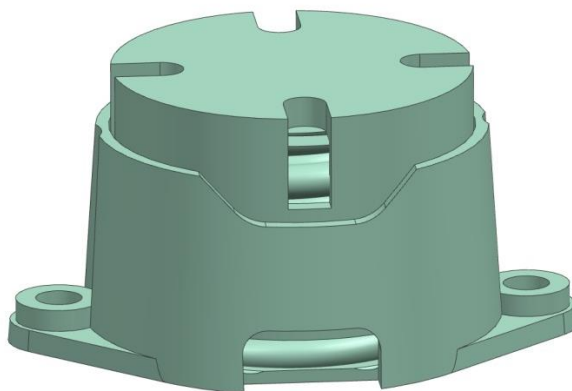
WD-62-MISC-17

TECHNICAL SPECIFICATION

FOR

**CONSTANT CONTACT SIDE BEARERS
FOR
BROAD GAUGE BOGIE WAGONS**

(Amendment No.1 of August-2021)



ISSUED BY

WAGON DIRECTORATE

RESEARCH DESIGNS AND STANDARDS ORGANISATION

MINISTRY OF RAILWAYS

MANAK NAGAR, LUCKNOW-226011

AUGUST-2018

Price:

AMENDMENT SLIP No.-1 of August-2021 to Specification No.WD-62-MISC-2017.

- i) New Clause 12 introduced after Clause 11 as follows:

“All terms and conditions for vendor registration/approval of foreign firms shall be applicable as stipulated in RDSO ISO document QO-D-8.1-5 (latest version) title “Application for registration of vendor”. In case of any contradiction between the clauses of this specification and ISO document QO-D-8.1-5 regarding the vendor registration/approval of foreign firms, the clauses of ISO document shall prevail.”

- ii) Clause 3.7 first paragraph: Minimum physical properties for top and bottom housing of CCSB shall be as per following table.

Properties	Casting	Forging
	ASTM A897/A897M	IS:5517:1993 Gr 35Mn6Mo3 / BS970EN16
Tensile strength	1050MPa	1050MPa
Yield strength	750 MPa	700 MPa
Elongation	7% (Min)	14% (Min)
Charpy V notch	---	55J (min)
Charpy un-notch	80J (min)	---

- iii) Clause 4.1 shall be replaced as under:

RDSO has designed Constant contact side bearers of three variants as per this specification with cast top and bottom housing (common for all variants) to material as per ASTM A897/897M grade 1050-750-7 and metallic spring to specification no. IS:3195 Grade 52Cr4Mo2V. However for housings, forging material IS:5517:1993 Gr.35Mn6Mo3/BS970EN16 with physical properties given in clause 3.7 may be used.

- iv) Clause 5.1 shall be replaced as under:

Indian firm or Indian associate firm of a foreign firm's design having experience in designing of similar items to any Railroads system worldwide, can offer their CCSB design (cylindrical type only) meeting the requirements to this specification.

v) Clause 5.2 shall be replaced as under:

Foreign firms having experience in manufacturing and supplying similar items to Railroads abroad may also apply for the registration. Terms and conditions for registration of the foreign firm shall be as per extant RDSO ISO guidelines.

vi) Clause 5.3 shall be replaced as under:

For own design and Indian associate firm of foreign firm's design, Foundries which have in house manufacturing, heat treatment, laboratory testing facilities for ADI castings/CCSB assembly and have at least two mechanical/metallurgical engineers with degree plus five year experience or diploma with eight year experience in relevant field of manufacturing/quality control may apply for registration of complete CCSB. Applying firm must have all laboratory testing facilities as per requirements to this specification. Firms manufacturing housing may procure metallic/non-metallic spring element(s) used in CCSB from any Indian/foreign source having proven design of Side Bearer/Spring Element, adequate experience in manufacturing and supply of the Side Bearer/Spring Element to any Rail Road globally. A proper written MOU in this regard is to be submitted by the firm applied for registration. In case of firm outsourcing spring element applying firm shall be fully responsible for quality control, physical and functional requirement, warranty requirement etc. given in this specification totality.

vii) New clause 5.4 inserted :

For own design and Indian associate firm of foreign firm's design, Forging firms having in house manufacturing, heat treatment, laboratory testing facilities for ADI castings/CCSB assembly and have at least two mechanical/metallurgical engineers with degree plus five year experience or diploma with eight year experience in relevant field of manufacturing/quality control may apply for registration of complete CCSB. Applying firm must have all laboratory testing facilities as per requirements to this specification. Firms manufacturing housing may procure metallic/non-metallic spring element(s) used in CCSB from any Indian/foreign source having proven design of Side Bearer/Spring Element, adequate experience in manufacturing and supply of the Side Bearer/Spring Element to any Rail Road globally. A proper written MOU in this regard is to be submitted by the firm applied for registration. In case of firm outsourcing spring element applying firm shall be fully responsible for quality control, physical and functional requirement, warranty requirement etc. given in this specification totality

viii) New clause 5.5 added:

Indian/foreign source having proven design of Non-Metallic Spring Element, adequate experience in manufacturing and supply of the Non-Metallic Spring Element to any Rail Road globally can also be permitted for complete CCSB as per this specification and can procure housings outside with own quality control. RDSO shall inspect/test of housing parameters at firm's premise applying for registration.

ix) Clause 5.4 renumbered as 5.6.

x) Clause 5.5 renumbered as 5.7.

xi) In sub-clause Clause 7.5.1 of Clause 7.5 : Constant contact side bearer to be tested for dual axis simulated service test on appropriate capacity dual axis machine. Hysteresis energy shall be calculated before and after the dual axis simulated service test. CCSB must meet the hysteresis ratio criteria.

xii) In sub-clause 7.5.5.3 of Clause 7.5.5 : 7.5.5.3 Actual Hysteresis area is to be calculated using data taken in a typical cycle after third cycle.

xiii) In sub-clause 7.5.5.4 of Clause 7.5.5 : 7.5.5.4 Hysteresis ratio (R_h) is to be calculated as $\text{hysteresis area final (after fatigue)} / \text{hysteresis area initial (before fatigue)}$.

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SPECIFICATION NO. WD-62-MISC-17 FOR CCSB

1. General

- 1.1. Indian Railways (Railway Board) has decided to use constant contact side bearers on the fleet of Broad Gauge air brake four-axle bogie wagons as per requirements of AAR specification M-948.
- 1.2. This specification specifies the technical requirements, laboratory test requirements, product evaluation and their performance criteria and purchase inspection of the side bearers. These requirements are indicative and not exhaustive.
- 1.3. The design of offered CCSB shall conform to the requirements of this specification. The firm shall submit a para-wise compliance of this specification along with their offered design.
- 1.4. The firm must have adequate facilities for manufacturing and testing of constant contact side bearers conforming to requirements of this specification.
- 1.5. Documents referred in this specification to be used (i.e. IS, ISO, ASTM, UIC, AAR etc.) shall be of latest versions.
- 1.6. Specific provisions in this specification will override those in AAR/ASTM/IS/UIC specification where these are not in conformity with one another.
- 1.7. Any special requirements mentioned in drawings will override this specification.

2. Side Bearer Requirements and Related Terms

- 2.1. Side bearers are fitted between bogie bolster and wagon body bolster primarily for stability of wagon body. The Constant contact designs of side bearer also reduce the hunting tendency and thus improve riding behavior of the wagon.
- 2.2. Constant contact side bearers are generally designed to share up to 85% of empty wagon body weight for optimum level of rolling resistance to negotiate while on curve.
- 2.3. Metallic or non-metallic spring/s housed in between the cylindrical type top and bottom housing is required to suit the space requirements with standard fitment by high tensile castle nut/bolt fasteners of $\Phi 21.5\text{mm}$ with spacing 216 mm for Indian Railway BG wagons.
- 2.4. The design shall be such that it should not make any hindrance to any other components of wagon in normal straight track to 11 degree curved railway track in either direction.
- 2.5. Following are the technical terms related to constant contact side bearers-
 - 2.5.1. **Set up height**
Set up height is the nominal installed height of side bearer in the wagon on leveled track. The designed set up height for all the variants is 128.5mm.
 - 2.5.2. **Pre load**
Pre load is the vertical load taken by the side bearer at set up height.
 - 2.5.3. **Side bearer travel**
Side bearer travel is the compression of side bearer from nominal set up height to solid height. The specified travel for long travel side bearers is 16mm.

2.5.4. **Solid Height**

Solid height is compressed height of CCSB at non yielding arrangement. It is nominal set up height minus travel of the CCSB.

3. **Technical Parameter Requirements of Constant Contact Side Bearers.**

3.1. This specification specifies following three variants of constant contact side bearers to suit all the BG wagon fleet of Indian Railways.

3.1.1. **Variant 'A'** – Pre load (Kg) - $1750 \pm {}^0_{200}$

(Generally applicable for wagons having empty body weight up to 9.4t)

3.1.2. **Variant 'B'** – Pre load (Kg) - $2000 \pm {}^0_{250}$

(Generally applicable for wagons having empty body weight between 9.4t to 12.7t)

3.1.3. **Variant 'C'** – Pre load (Kg) - $2700 \pm {}^0_{300}$

(Generally applicable for wagons having empty body weight over 12.7t)

3.2. All the three variants of CCSB shall have following parametric requirements:

3.2.1. **Free height:** Unloaded height of CCSB (to be included in the drawing)

3.2.2. **Setup height:** 128.5 mm

3.2.3. **Solid height:** 112.5 mm

3.3. A non-yielding arrangement is to be provided to restrict compression of CCSB beyond solid height.

3.4. Preload of CCSB with non-metallic springs shall be taken after 24 hours of compression at set height. However, pre load of CCSB with metallic springs, 24 hours compression is not mandatory.

3.5. Load at solid height of CCSB should not be more than FOUR times of nominal preload.

3.6. Common housing for all variants of CCSB shall be preferred.

3.7. Minimum physical properties requirements of top and bottom housings of CCSB (cast or forging) shall be as under-

Ultimate tensile strength	: 1050MPa
Yield strength	: 750MPa
Elongation	: 7%
Impact strength	: 80J for Un-Notched Sample for ADI / 52J for notched sample for steel material..

Samples shall be tested from finished product. In case, preparation of sample from finished product is not feasible, integral cast/ representative forging test coupons may be accepted. Other quality parameters (like chemical composition, micrographic examination etc) shall be checked as per national/ international standards of casting /material used in forging.

4. RDSO Designed CCSBs and Requirements for vendors

- 4.1. RDSO has designed spring loaded constant contact side bearers of three variants as per this specification with cast top and bottom housing (common for all variants) to material as per ASTM M897 Grade 1050-750-7 and metallic springs to specification no. IS: 3195 Grade 52Cr4Mo2V. However forging material option with above physical properties for top and bottom housings is also open. Drawing numbers for these variants of CCSB are-

Variant 'A'	: Drawing No. – WD-17025-S/1
Variant 'B'	: Drawing No. – WD-12008-S/1
Variant 'C'	: Drawing No. – WD-12007-S/1

- 4.2. These CCSBs have been tested at manufacturer/RDSO Laboratory as per requirements to this specification and also evaluated during field performance.
- 4.3. Foundries which have in house manufacturing, heat treatment, laboratory testing facilities for ADI castings/CCSB assembly and have at least two mechanical/metallurgical engineers with degree plus five year experience or diploma with eight year experience in relevant field of manufacturing/quality control may apply for registration of housing set /complete CCSB. For complete assembly, springs are to be procured from RDSO approved sources duly inspected by RDSO.
- 4.4. Forging firms having in house manufacturing, heat treatment, laboratory testing facilities for CCSB assembly/forged housings as per this specification and have at least two mechanical/metallurgical engineers with degree plus five year experience or diploma with eight year experience in relevant field of manufacturing/quality control may also apply for registration of complete CCSB/ housing set. For CCSB assembly, springs are to be procured from RDSO approved sources duly inspected by RDSO.
- 4.5. RDSO approved spring manufacturer as per WD-01-HLS-94 can also be permitted for complete CCSB as per this specification but they have to procure housings from RDSO approved sources duly inspected by RDSO.

5. Other than RDSO Design Constant Contact Side Bearers and Requirements

- 5.1. Indian, Indian associate firm of foreign firm's design having experience in designing of similar items to any Railroads system worldwide, can offer their CCSB design (cylindrical type only) meeting the requirements to this specification.
- 5.2. Foreign firms having experience in similar items to Railroads abroad must have technical collaboration with Indian firms to manufacture CCSB in India. Such technical collaboration must guarantee (by the principal manufacturer) for quality control and regular production in India.
- 5.3. For own design and Indian associate firm of foreign firm's design, applying firm must have all in-house manufacturing and laboratory testing facilities required for at least metallic/ non-metallic spring element(s) used in CCSB designs offered as per requirements to this specification.
- 5.4. Top and bottom housings of own design CCSB can be manufactured in-house by casting/forging as per minimum technical requirements to this specification or may be out sourced with strict quality control of the firm.
- 5.5. Adequate testing infrastructure for evaluation of constant contact side bearer design as per Para 7 to this specification shall be available in-house with the firm.

6. Registration/Approval/Acceptance procedure for Constant Contact Side Bearers

Firms fulfilling the requirements of Para 4 or 5 to this specification shall apply to RDSO Lucknow for registration/ approval/acceptance to manufacture and supply of CCSBs as per this specification.

6.1. For RDSO Designs-

- 6.1.1. The firms having the adequate infrastructure as per requirements of para 4 to this specification and willing for registration to RDSO design CCSBs may apply for registration. Firm shall apply to QA (Mech) directorate, RDSO, Lucknow with required infrastructures for manufacturing, in-house testing facilities along with commercial documents as per prevailing procedure of RDSO.
- 6.1.2. As the design validations of these CCSBs have been done by RDSO as per Para 3 and Para 7 to this specification at firm/RDSO laboratory and monitored for performance under field trials. Hence for RDSO designed variants of CCSB, infrastructure and testing facilities mentioned in para 7.3 and 7.5 are not mandatory for registration/acceptance.
- 6.1.3. Firm shall submit quality assurance programme (QAP) in latest ISO format for the product from purchase of raw material to finished product determining and controlling each critical stages in the process. QAP should clearly specify critical stages with their control parameters and system of their measurements.
- 6.1.4. Firm shall also submit internal test results of components and CCSB assembly for all the variants which shall include all required tests mentioned in para 3 and para 7 to this specification except tests in para 7.3 and 7.5.
- 6.1.5. RDSO will scrutinize the documents and internal test results submitted by the firm and if found in order, nominated team shall visit the firm for infrastructure verification and capability assessment. In case of inappropriate/incomplete information during scrutiny, firm shall be informed accordingly for necessary compliance.
- 6.1.6. After satisfactory compliance of all the infrastructural requirements and capability assessment, testing of samples shall be undertaken at firm's premises as per requirements to this specification.
- 6.1.7. After satisfactory testing of components and CCSB assembly, firm may be registered as 'RDSO Vendor for Developmental Orders', for manufacturing and supply of CCSB assemblies as per this specification.
- 6.1.8. Supply of minimum quantity of CCSB assemblies as per latest version of RDSO ISO document no. WD-P-7.1-2 and satisfactory field performance are required for upgradation of vendors. The provisions of ISO document No. QO-D-8.1-11 (titled "Vendor-Changes in approved status") for upgradation of vendors as 'Approved vendor' shall be applicable except in criteria (i) of clause 4.1.1(b) 'to be in service for a minimum period of one year' to be read as 'to be in service for a minimum period of two years' and in criteria (ii) '12N' shall be read as '24N'.
- 6.1.9. All other provisions contained in RDSO's ISO procedures laid down in document No. QO-D-8.1-11 (titled "Vendor-Changes in approved status") and subsequent versions/amendments thereof, shall be binding on all approved firms.

6.2. For Other than RDSO Design

- 6.2.1. For firm's own designs or Indian associate firm with foreign collaborator's designs, firm willing to apply for registration must fulfill the requirements given in para 5 to this specification.
- 6.2.2. Firm out sourcing housings of CCSBs shall submit MOU with out-sourcing firm for supply of housings and an undertaking regarding adequate infrastructure for producing housings as per requirements to this specification. Applying firm shall be responsible for quality checks for all physical and technical property requirements as per this specification.
- 6.2.3. Indian associate firm with foreign firm's design must have technical collaboration/ MOU with principals for sharing technical knowhow and quality control of CCSB design. Indian associate firm shall have at least two mechanical/ metallurgical engineers with degree plus five year experience or diploma with eight year experience in relevant field of manufacturing/ quality control.
- 6.2.4. Firm shall apply to Wagon directorate, RDSO, Lucknow with required manufacturing infrastructures, in-house testing facilities along with commercial documents as per prevailing procedure of RDSO.
- 6.2.5. Firm shall submit CCSB assembly/component drawings alongwith functional properties and test criteria. CCSB assembly and component drawings submitted shall be at least with dimensions for all functional parameters alongwith any other relevant information of CCSB. Firm shall also submit any patent cover of offered design of CCSB.
- 6.2.6. Quality assurance programme (QAP) in latest ISO format for the product from purchase of raw material to finished product determining and controlling each critical stages in the process shall be submitted. QAP should clearly specify critical stages with their control parameters and system of their measurements. Firm shall also submit internal test results of components and CCSB assembly for all the variants which shall include all required tests mentioned in per para 3 and para 7 to this specification. Procedures for field inspection and maintenance requirements in workshop are also to be furnished.
- 6.2.7. RDSO will scrutinize the documents and internal test results submitted by the firm and if found in order, a team shall be nominated for infrastructure verification and capability assessment of the firm. In case of inappropriate/incomplete information during scrutiny, firm shall be informed for necessary compliance. Further action shall be taken accordingly.
- 6.2.8. During team's visit the infrastructural verification, capability assessment and testing of samples shall be undertaken at firm's premises as per requirements to this specification. Confirmatory testing at RDSO laboratory and/ or oscillation trial may be undertaken, if required.
- 6.2.9. After satisfactory report from above, firm may be permitted to take developmental order from Railways/ Wagon manufacturers for manufacturing and supply of CCSB assemblies for field performance monitoring. Minimum three rakes fitted with any of the variant of CCSB assembly (for which first purchase order is obtained) shall be monitored for two years (one ROH period). During this period, failure due to any components of CCSB shall not be more than 2% of CCSB fitted.

- 6.2.10. After two years (one ROH period) from the fitment, 05 samples each from three rakes shall be picked randomly, examined for components and tested for load deflection characteristics. The condition of all components should be good and vertical load of CCSB assembly must not be less than 65% of nominal pre load of that variant.
- 6.2.11. If firm's CCSB under field performance monitoring not qualify para 6.2.10, further inspection and supply shall not be recommended. Firm will have to come up with complete investigation report of reason/s and their remedial action for consideration of RDSO. If investigation report is accepted by competent authority, firm may be given one more opportunity for performance monitoring as per para 6.2.9 and 6.2.10 for further action accordingly.
- 6.2.12. After successful field performance of the offered design, firm may be registered as 'RDSO Vendor for Developmental Orders', for manufacturing and supply of CCSB assemblies as per this specification.
- 6.2.13. Supply of minimum quantity of CCSB assemblies as per latest version of RDSO ISO document no. WD-P-7.1-2 and satisfactory field performance are required for upgradation of vendors. The provisions of ISO document No. QO-D-8.1-11 (titled "Vendor-Changes in approved status") for upgradation of vendors as 'Approved vendor' shall be applicable.
- 6.2.14. All others provisions contained in RDSO's ISO procedures laid down in document no. QO-D-8.1-11 (titled "Vendor-Changes in approved status") and subsequent versions/amendments thereof, shall be binding on all approved firms.

7. Product Evaluation for Functional Requirements for Vendor Approval of Constant Contact Side Bearers

Following tests shall be carried out on test samples of each variant produced by the firm for CCSB validation during vendor registration for developmental orders for which internal test results have been submitted:

- 7.1. Ten (10 nos) assembled CCSB to be tested for free height, Preload and solid height. Load observed at solid height shall be less than four times of nominal pre load. For preload test of CCSB with non-metallic springs, minimum three (03 Nos) samples shall be tested for 24 hours. Balance may be tested for shorter period (30 minutes & 08 hours) and pre load values shall be compared with 24 hours tests. Appropriate capacity universal testing machine with recording facility shall be available with firm.
- 7.2. Five (05 Nos) assembled CCSB shall be tested for a vertical load of 94.8t for structural integrity. For this test, load shall be retained for about 2-3 minutes. Adequate capacity hydraulic press should be available.
- 7.3. Three (03 Nos) assembled CCSB shall be tested for friction saturation test at set up height. Distance travelled in friction saturation shall not be more than 03mm. Appropriate capacity dual axis machine should be available with the firm.
- 7.4. One CCSB assembly with springs has to be fatigue tested as per table given below. One vertical fatigue test machine with minimum capacity of 10t sinusoidal load and minimum 50mm peak to peak stroke is required. Fatigue test machine should have recording features in graphical mode in load verses time and displacement verses time. For fatigue test, any frequency or more than one frequency may be chosen as per capacity of fatigue test machine and displacement of CCSB and are to be recorded. A value of 2Hz or more is preferred. One assembled CCSB to be fatigue

tested in displacement mode about setup height for 14,92,500 cycles as per following table.

S.No.	Amplitude (mm)	Peak to Peak (mm)	Cycles
1.	3.2	6.4	12,00,000
2.	6.4	12.8	2,40,000
3.	9.5	19.0	40,000
4.	12.7	25.4	10,000
5.	Travel	2 x Travel	2,500
Total			14,92,500
Criteria: Preload of CCSB after fatigue test must be more than 65% of pre load before fatigue test.			

7.5. Dual Axis Simulated Service Test

7.5.1. Spring loaded side bearer to be tested for dual axis simulated service test on appropriate capacity dual axis machine. Hysteresis energy shall be calculated before and after the dual axis simulated service test. CCSB must meet the hysteresis ratio criteria.

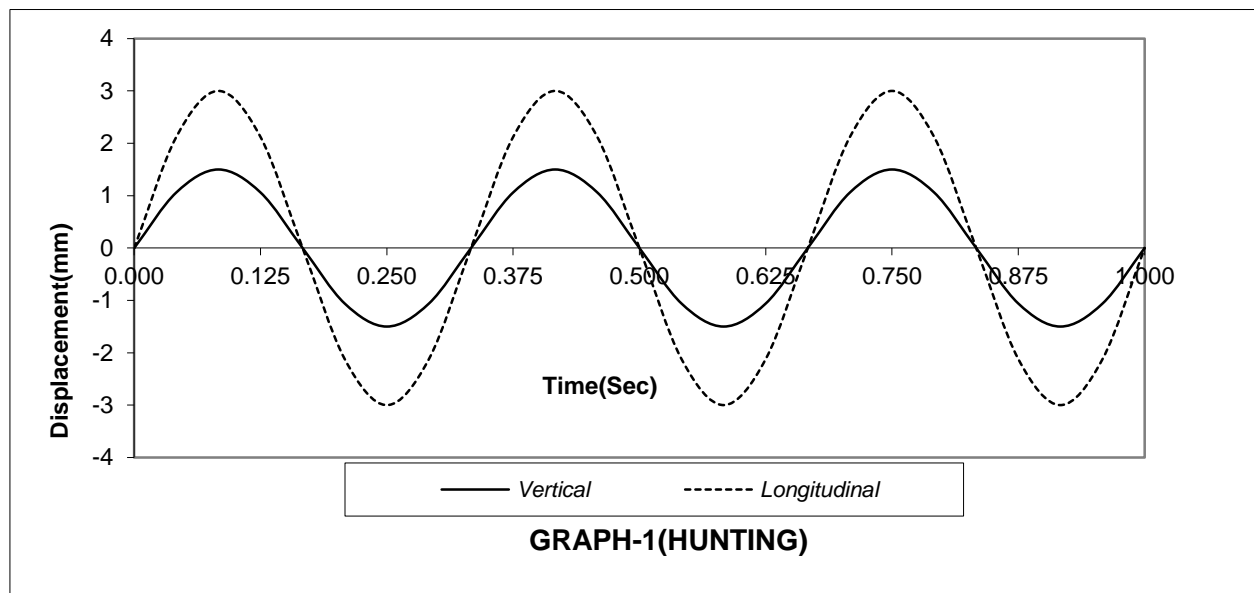
7.5.2. Assembled CCSB is to be subjected to a dual axis simulated service test for 69 hours 20 minutes for Hunting simulation and curving simulation as per following details. Detail of hunting and curving simulation is given in table.

7.5.3. Hunting Simulation (Block 'A')

Vertical cycle : Set up height ± 1.6 mm at 3 Hz for 43200 cycles.

Longitudinal cycle : Centered ± 3.2 mm at 3 Hz for 43200 cycles.

Both axes must be cycled simultaneously and remain in phase as shown in graph -1.



7.5.4. Curving Simulation (Block 'B')

Vertical cycle : Set up height ± 5 mm at 2.15 Hz for 36120 cycles.

Longitudinal cycle : Centered ± 12.7 mm at 0.43 Hz for 7224 cycles

Both axes must be cycled simultaneously and remain in phase as shown in graph-2.

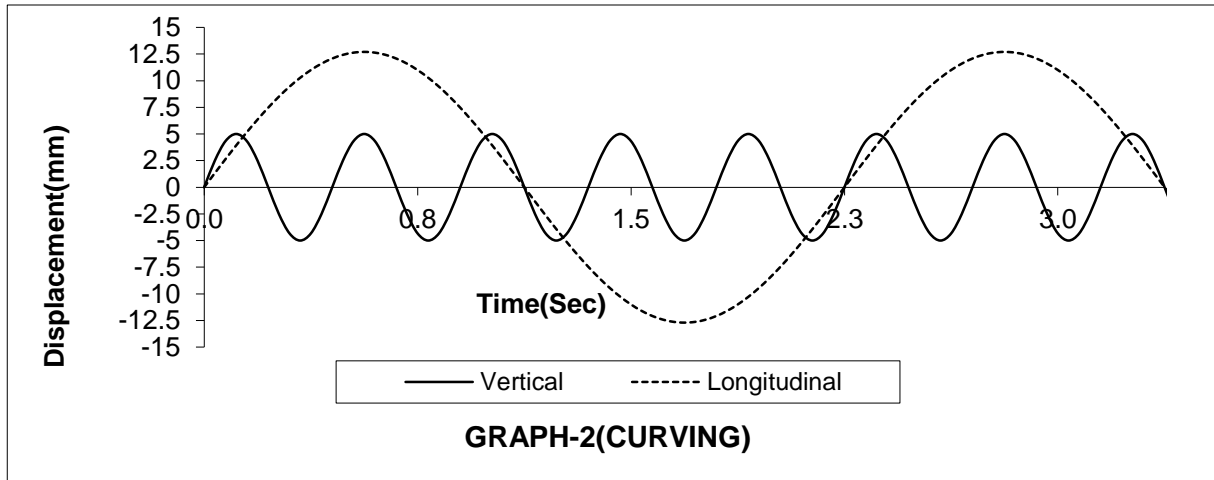


Table for dual axis simulated service test

S.No.	Description	Duration	Cumulative duration	Cumulative Vertical	Cumulative Longitudinal
Initial measurements					
1.	Block 'A'	4 Hours	4 Hours	43200	43200
2.	Block 'B'	4Hrs. 40 Minutes	8Hrs. 40 Minutes	79320	50424
Input Reset not to exceed 5 minutes.					
3.	Block 'A'	4 Hours	12Hrs. 40 Minutes	122550	93624
4.	Block 'B'	4Hrs. 40 Minutes	17Hrs. 20 Minutes	158640	100848
Input Reset not to exceed 5 minutes.					
5.	Block 'A'	4 Hours	21Hrs. 20 Minutes	201840	144048
6.	Block 'B'	4Hrs. 40 Minutes	26Hrs.	237960	151272
Input Reset not to exceed 5 minutes					
7.	Block 'A'	4 Hours	30Hrs.	281160	194472
8.	Block 'B'	4Hrs. 40 Minutes	34Hrs. 40 Minutes	317280	201696
Input Reset not to exceed 5 minutes.					
9.	Block 'A'	4 Hours	38Hrs. 40 Minutes	360480	244896
10.	Block 'B'	4Hrs. 40 Minutes	43Hrs. 20 Minutes	396600	252120
Input Reset not to exceed 5 minutes.					
11.	Block 'A'	4 Hours	47Hrs. 20 Minutes	439800	295320
12.	Block 'B'	4Hrs. 40 Minutes	52Hrs.	475920	302544
Input Reset not to exceed 5 minutes.					
13.	Block 'A'	4 Hours	56Hrs.	519120	345744
14.	Block 'B'	4Hrs. 40 Minutes	60Hrs. 40 Minutes	555240	352968
Input Reset not to exceed 5 minutes.					
15.	Block 'A'	4 Hours	64Hrs. 40 Minutes	598440	396168
16.	Block 'B'	4Hrs. 40 Minutes	69Hrs. 20 Minutes	634560	403392

7.5.5. Procedure for Longitudinal Hysteresis Test: -

Before and after dual axis simulated service test, longitudinal hysteresis energy test shall be done as per following procedure for calculation of hysteresis energy.

- 7.5.5.1. In a test set up a sinusoidal longitudinal (car wise) translation with a peak-to-peak displacement of 12.7 mm at 3.0 Hz has been applied between side bearer and body wear plate while under nominal set up height load. Either the wear plate or the side bearer can be translated.
- 7.5.5.2. Longitudinal displacement, longitudinal force and vertical force measured and recorded using at least 100 scans per second per channel. After simulated service test these measurements has to be taken within 10 minutes.
- 7.5.5.3. Actual (H_a) and theoretical (H_{max}) hysteresis energy has been calculated using the values taken in a typical cycle after third cycle.
- 7.5.5.4. Hysteresis ratio (R_h) to be calculated as follows;

$$\text{Hysteresis ratio (Rh)} = \frac{\text{Actual hysteresis energy (Ha)}}{\text{theoretical (Hmax) hysteresis energy}}$$
- 7.5.5.5. Due to variability of friction in lab conditions, the data obtained shall be normalized using in-cycle measured forces to a coefficient of friction of 0.6. Hysteresis ratio calculated shall not be less than 0.5.

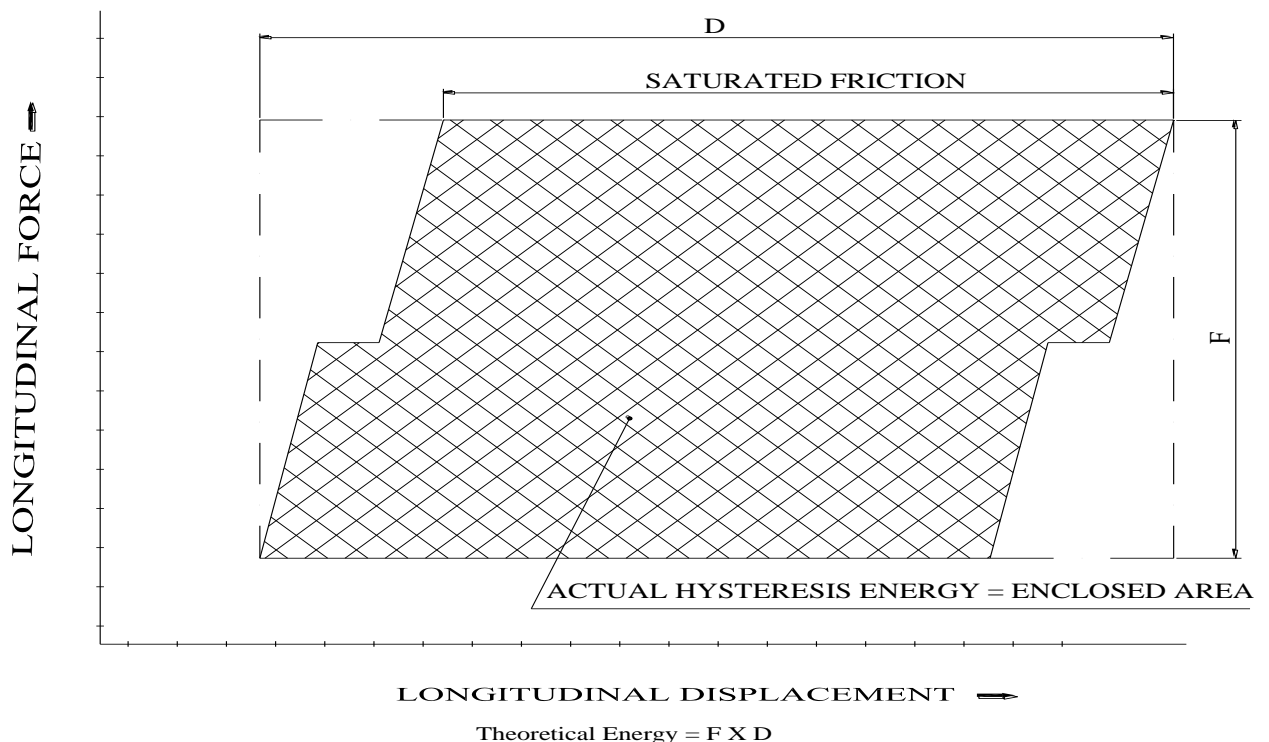


Figure - Hysteresis Energy

8. Expected Service Life and Guarantee Period

- 8.1. The offered design of constant contact side bearer assembly including housings and spring element/s is expected to work satisfactorily for a period of 72 months on Indian Railway's working conditions. Hence offered CCSB shall be guaranteed for a period of 05 years (Sixty months) from the month and year of manufacturing. The guarantee shall cover design, material and workmanship. The firm shall replace complete CCSB or component/s failed during guarantee period to the depot raised claim at his own expense within reasonable time normally within three months. Conditional offers regarding guarantee period of CCSB linked to bogie maintenance practices and Indian Railway's working conditions etc shall not be acceptable.
- 8.2. Following shall be treated as failures of any of the housing(s) or suspension element/ spring (s) for replacement under warranty period:
 - a) Crack/ breakage in top/bottom housing.
 - b) Wear of 3mm or more in top face of top housing and increase/decrease more than 03mm in diameter of bottom/top housing measured from nominal values.
 - c) Crushing, tears, breakage or crack in any suspension element. However minor surface crack which do not affect properties may be ignored.
 - d) A permanent set in spring elements observed equal or more than half of the difference between nominal free height of CCSB and nominal set up height for the wagon. For example, if nominal free height of CCSB is 163.0mm, then half of deflection $(163.0-128.5)/2 = 17.25\text{mm}$

9. Purchase Inspection

- 9.1. Purchase inspection shall be carried out only at the premises of registered vendor of RDSO. Lot size for purchase inspection shall be 1000 Nos. or part thereof. All components including bolts etc. as per drawing shall be in scope of supply.
- 9.2. Inspection shall be carried out for parameters as per relevant RDSO/approved drawing and firm's approved Quality Assurance Programme (QAP) for the product. All the test facilities with proper recording system required for purchase inspection must be available with the firm in house.
- 9.3. Metallic springs shall be inspected as per latest RDSO specification WD-01-HLS-94 with additional tests on the drawing. Spring material other than metallic spring shall be inspected as per firm's approved drawing and strictly as per approved QAP.
- 9.4. Minimum ten CCSB samples shall be measured for dimensional accuracy as per RDSO/ Approved drawing. Free height, load deflection characteristics from free to set up height, solid height and load at solid height of side bearer assembly shall be measured on all 10 samples. For non-metallic suspension element CCSBs, minimum three samples shall be tested for 24 hrs. Remaining samples may be tested for shorter time period (30min. & 8 hrs.) to correlate the load deflection characteristics.
- 9.5. Five CCSB samples shall be tested for a vertical load of 94.8t for structural integrity test and there shall not be any catastrophic failure. (Para 7.2)
- 9.6. Chemical composition, micro examination and physical testing of housings must be checked by the firm in-house as per approved QAP/drawing and record to be presented to the inspecting official. Inspecting official shall counter check one sample per lot for chemical composition, micrographic examination and physical

properties as per approved QAP/drawings to ensure the material properties to be as per specification. Physical properties shall be in line with para 3.7 to this specification.

- 9.7. One side bearer assembly shall be fatigue tested in vertical mode as per procedure given in para 7.4 to this specification. The fatigue test shall be done per ten thousand supplies or one year period from previous supply, whichever is earlier.
- 9.8. Material shall be offered for inspection within three months of manufacturing i.e. any component of the CCSB manufactured in January of a year, CCSB assembly must be offered for inspection by March of that year.
- 9.9. If any sample fails in any one or more criteria, double sample method prevailing in RDSO shall be applied for accepting or rejecting the entire lot offered. If double sample fails, entire lot shall be rejected. Inspection shall not be recommenced till further advice from RDSO. Firm shall investigate the cause and come up with remedial action for the failure and implement the same.
- 9.10. Material once offered for inspection shall not be withdrawn during the course of inspection. Any move to withdraw the material or interference in the inspection in any way shall render the entire lot being rejected.

10. Marking and Painting

- 10.1. Marking on Top, Bottom housing and spring element of Constant Contact Side Bearers must be embossed/depressed letters size of at least 5mm on non- wearing surfaces during manufacturing processes as per RDSO/ firm's approved drawing. Stamping/punching and marking by any other method after manufacturing shall not be permitted.
- 10.2. All variants of CCSB (springs and CCSB assembly) are to be painted as under-
 - Variant 'A' : Synthetic Enamel Salmon Pink ISC 443 to IS: 8662
 - Variant 'B' : Synthetic Enamel Middle Brunswick Green ISC 226 to IS: 8662
 - Variant 'C' : Synthetic Enamel Sky Blue ISC 101 to IS: 8662.
 Mating surface of CCSB assembly shall not be painted.

11. Packing and Storage

The constant contact side bearer assemblies shall be suitably packed in wooden/corrugated boxes in two sets/one set with the aim of easy handling and to protect them against damage during transit. The supplier should ensure proper securing of loose items (bolts, washer etc) during packing. CCSB assemblies are to be stored under cover and dry places.
