

## REVISION OF SPECIFICATION / STR

**Item Name: Bogie Mounted Brake System for Freight Stock Fitted with Casnub Type Bogie.**

**Specification No.: WD-23-BMBS-2008 Rev 1**

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 the abovementioned item may be submitted in the following format along with 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.	Whether firm is registered with RDSO for the subject item. If yes, details like date of registration, current status etc. If no, firm's experience in manufacturing of subject item or similar item	
8.	Whether any technical document/Report/Study 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 it 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 following address within one month from the date of publication on [rdso.indianrailways.gov.in](http://rdso.indianrailways.gov.in)**

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

Email: [dswcdrdso@rdso.railnet.gov.in](mailto:dswcdrdso@rdso.railnet.gov.in)



**Government of India**  
Ministry of Railways

**SPECIFICATION**  
FOR  
**BOGIE MOUNTED BRAKE SYSTEM**  
FOR FREIGHT STOCK  
FITTED WITH  
**CASNUB TYPE BOGIE**  
Amendment No.1 of Sept.-2016

**WAGON DIRECTORATE**  
**RESEARCH DESIGN & STANDARDS ORGANISATION**  
**MANAK NAGAR, LUCKNOW-226 011**

September 2015

Price:-

**Amendment No.1 of September 2016, to specification WD-23-BMBS-2008 Rev.1 for Bogie Mounted Brake System Fitted with Casnub Bogie**

Add the following paragraph after clause 1 “**Scope**”

“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 version/ 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”

DRAFT

## Preamble

Indian Railway's quest for development of Bogie mounted Brake systems (BMBS) for Freight Stock of Indian Railways has been continuing since the year 1991. The first attempts at indigenous BMBS systems were made by M/s Sundaram Clayton and M/s Escorts and thereafter by RDSO. However, limitations of non-automatic slack adjusting system as also unsafe conditions arising out of Slack adjuster being below the lower spring plank of Bogies were noted in such trials. Thereafter in June, 2001, Railway Board placed developmental orders on 2 sources for BMBS based on RDSO Specification No WD-15-BMBS-2000. Further, to gain more experience and based on RDSO's recommendations, Railway Board, in December 2006, placed further developmental orders on 4 Sources on RDSO Specifications WD-15-BMBS-2000(Rev II). In December, 2008, Railway Board, following recommendations of a committee for adoption of BMBS in IR Freight stock, decided the standardization of BMBS on basis of which RDSO issued Specifications WD-23-BMBS-2008. RDSO was instructed to consider approval of other designs subject to meeting requirements and submitting final report for Board's approval. Based on progress made on the alternate designs of the BMBS under the Railway Board's Developmental orders, after deliberations on the report submitted by RDSO, it has been decided to bring about revised specifications WD-23-BMBS-2008. This shall enable IR to consider other alternate designs of BMBS, including those under field trials and development if and when they are successful, with a broader multisourcing perspective.

The intent of this revision is to ensure that the private incentive for technology providers dovetails with the overall perspective of public good. This revision has been cast with an overall objective that the BMBS technologies adopted by IR meet the functional requirements of braking on the Indian Railway freight stock, and yet open up avenues for healthy cost competition amongst alternates. At the same time, keeping in view the safety aspects of the application, rigorous regimen for indigenous capability in terms design, manufacturing, testing and evaluation, at par with those on established international freight Railroads, has been retained. In addition, elements, identified over a period of time with experience, that may have restricted the broader perspective of multisourcing in future, have been removed and/ or suitably modified.

Till now, the process of development of BMBS for Freight stock has followed a process of adoption of proposer's technologies. A slew of designs have been evaluated in the process and shall be adopted for use on IR, if found successful in development and trials. The next step would be to bring about an element of interchangeability to the order established on other Rolling stock of Indian Railways. RDSO, in future, shall endeavour to achieve this objective, apart from other efforts to ensure good technology Brake products with minimum public cost implications.

## 1. SCOPE

This specification covers the technical requirements of bogie mounted air brake system (BMBS) for wagons fitted with Casnub Bogies. This specification is applicable for fitment of BMBS during manufacturing of new wagons as well as for retrofitment of BMBS on existing in-service wagons (with minimum axle load of 20.32 T and maximum axle load of 22.9 T).

## 2.0 SYSTEM REQUIREMENTS

2.1 The bogie mounted brake system shall be suitable for existing wagons fitted with all variants of Casnub bogies. These bogies are provided with spring plank. Other parameters of the casnub bogies are as follows: -

1. Wheel diameter
  - a) New 1000mm
  - b) Condemning 906mm
2. Type of brake block 'K' type non-asbestos composition brake block with 58mm thickness & condemning size 10 mm
3. Brake Block Force (per wheel) 2110 Kg ( $\pm 50$  Kg)

2.2 General arrangement of Bogie mounted brake system shall be as per RDSO's drawing number WD- 08093-S/2. There will be one brake cylinder with one double-acting slack adjuster per bogie.

2.2.1 The brake system shall be suitable for working with single/twin pipe graduated release air brake system conforming to RDSO specification No. 02-ABR-02(latest) except for Brake Cylinder and Automatic Brake Cylinder Pressure Modification device (hereinafter called APM). Brake cylinder can be of manufacturer's design, the details (drawings, etc.) of which will be furnished by the manufacturer. In case BMBS system or any of its subcomponents are patented items, the supplier will furnish the patent details along with current status and validity date etc.

2.2.2 Brake system shall be provided with brake cylinder and double acting automatic slack adjuster. The minimum slack take up capacity shall be adequate to take up the complete slack arising out of a wheel wear of 47 mm and Brake Block wear of 48 mm.

2.2.3 The brake head and other accessories for fitment of 'K' type composition brake blocks shall be in accordance with RDSO specification No. WD-22-Brake head-97 (rev.1) or latest amendment and brake block as per WD-14-ABR-2007 or latest amendments.

2.3 The bogie mounted brake system shall be compatible with air brake equipment as per RDSO Specification No. 02-ABR-02(latest). Any changes to be made in the air brake equipment shall be specifically indicated by the supplier.

- 2.4 Air Brake Pipe layout and fitment of Air Brake Equipment shall be as per respective drawings of individual wagons, which will be issued by RDSO, Lucknow.
- 2.5 All air brake pipes and fittings shall be of stainless steel as per specification no. 04-ABR-2002(latest).
- 2.6 A major objective in the development of BMBS in freight stock being interchangeability across vendors at core component level, the proposer may be asked by IR/RDSO to share technical details of their design with RDSO for multi sourcing on freight rolling stock of Indian Railways.

### **3.0 BOGIE DETAILS**

- 3.1 Wagons on which bogie-mounted air brake system shall be provided are fitted with Casnub type bogies. Details of these bogies i.e. drawings etc. can be obtained on payment basis from RDSO, Lucknow.
- 3.2 The complete weight particulars per wagon of offered bogie mounted brake system shall be furnished by the supplier.

### **4.0 TECHNICAL REQUIREMENTS**

- 4.1 One number of Brake beam mounted brake cylinder (two numbers per wagon) shall be used on each bogie. These brake cylinders shall be provided along with double acting slack adjusters. Mounting of the brake cylinders shall be done on one of the two brake beams fitted in each bogie. Each brake cylinder shall control the braking on two wheel sets of a bogie.
- 4.2 One brake cylinder shall have provision for hand brake cables and the other shall be without hand brake.
- 4.3 Design of the brake cylinders shall be as per firm's own design.
- 4.4 The BMBS system of the proposer should have adequate minimum clearances as defined in RDSO Drawing no WD-08093-S/2. The proposer shall detail these clearances in their design proposal through suitable 3D/2D Drawings pertaining to their product. These shall be ratified by physical measurements in the developmental inspection of the product. Notwithstanding the above mentioned clearances, the system shall be designed such that no infringements shall take place with any other member of the system or Bogie, in the worst condition, during the entire range of operation of the BMBS system
- 4.5 Minimum brake cylinder piston travel of the bogie mounted brake cylinders must be sufficient to provide proper brake shoe clearance when brakes are released. The piston stroke, as specified by the proposer, in both empty and loaded condition shall be within a tolerance range of +/- 10 mm.
- 4.6 The brake cylinder must generally meet the requirements of Leakage test, Environmental test, Cycle test and Vibration test as per the test scheme given in **Annexure-II.**

- 4.7 The brake cylinder shall give trouble free service without any attention for a period of six years. The vendor shall submit detailed maintenance instructions of the brake cylinder. These maintenance instructions shall be followed at the time of overhauling of the brake cylinders.
- 4.8 Brake beams (outline) shall be as per RDSO's drawing number WD-08093-S/2. The brake beam manufactured by the firm shall be subjected to load-deflection and fatigue testing as per test scheme given in **Annexure-I**.
- 4.9 High friction composition brake blocks of "K" type to RDSO's specification WD-14-ABR-2007(latest) has been used in the BMBS.
- 4.10 Two stage **Automatic Brake Cylinder Pressure Modification Device** (APM) whose functioning based on the gap between underframe and bogie side frame of the wagon shall be as per firm's own design. APM should sense the gap only at the time of air brake application. During remaining time it should not be in contact with the bogie side frame. APM shall be a proven design and must meet the space envelope shown in RDSO's drawing number WD-08096-S-01. One number of APM shall be used per wagon. No human intervention shall be required for operation of APM.
- 4.11 APM shall ensure brake cylinder pressure of  $3.8 \pm 0.1$  Kg/cm<sup>2</sup> when the gap between wagon underframe and bogie side frame is as prescribed in applicable Wagon drawings. After the gap between underframe and bogie side frame becomes more than as prescribed in the applicable drawings, the brake cylinder pressure shall be reduced to  $2.2 \pm 0.25$  Kg/cm<sup>2</sup>. The tolerance of operation of changeover point in the APM from empty to loaded condition shall be +/- 1 mm.
- 4.12 Performance testing of APM shall generally conform to AAR standard S-4002 (Latest). Specific procedure and parameters for testing shall be prescribed by the contractor/manufacturer and will be approved by RDSO.
- 4.13 Complete arrangement of hand brake shall also be part of BMBS. Hand brake shall be provided on one of the two bogies. The hand brake shall be operated as shown in the general arrangement drawing of the wagon fitted with BMBS.
- 4.14 Complete BMBS shall be generally tested as per AAR standard S-4005 [Latest revision]. Specific procedure and parameters for testing shall be as per the scheme given in **Annexure-II**. This testing shall be carried out after installing the entire BMBS in a suitable bogie or in a suitable test fixture that duplicates the dimensions and geometry of the bogie.
- 4.15 Air Brake Pipe layout arrangement and fitment of air brake equipment which are fitted on the underframe may vary from one type of wagon to another. Such drawings of different type of wagons shall be issued by RDSO separately.
- 4.16 All pins connecting to brake cylinder, bell crank levers, push rods and brake beams shall be secured by a suitable anti pilferage device (APD). A proper APD

for Automatic Brake Cylinder Pressure Modification Device (APM) is also to be provided.

## **5.0 PROCEDURE FOR TECHNICAL CLEARANCE**

- 5.1 The manufacturer willing to supply the BMBS system shall have in-house Infrastructure facilities for design, manufacture and testing of Bogie mounted Brake system in line with STR G-104 or latest for Bogie mounted Brake systems for Freight Rolling Stock. The firm shall submit a compliance of the same at the time of proposing their system to RDSO.
- 5.2 Such manufactures, who will be called “Principle manufacturers”, should agree to provide technology to at least two or more manufacturers, who will be called “Licensee manufacturers” .The vendor approval for all manufacturers will be as per Vendor Approval Procedure of RDSO.
- 5.3 The licensee manufacturer shall have the certificate of approval from the principle manufacturer and the same shall be submitted to RDSO. The principle manufacturer will also give a certificate certifying that the licensee manufacturer has the same testing/manufacturing facilities (machine and plant) as those with the principal manufacturer. The purpose of having licensees is to broaden the vendor base by induction and subsequent graduation of licensees into independent sources. With these view, the prospective sources desirous for registration under this specification shall be required to submit a copy of the detailed licensee agreement entered into by them with their principal.
- 5.4 The manufacturers (principal as well as licensee manufacturers) shall have to enter into Running Maintenance Contract of the equipment with the Railways. Such contract will be for overhauling of equipment's, out of course repair and testing of equipment.
- 5.5 If the applicant satisfies the Qualifying Requirements as laid down in Para 5.1 to 5.4 as also the technical provisions of BMBS system advised in this specification to the satisfaction of RDSO, development Inspection as mentioned below shall be carried out.

## **6.1 DEVELOPMENTAL INSPECTION**

Developmental inspection shall be carried out at the manufacturer's premises at the time of registration of the firm with RDSO. The following procedure shall be followed for the developmental Inspection:

- 6.1.1 The inspecting authority shall verify and ensure that the manufacturer has Infrastructure as per the relevant STR for BMBS system for Freight Rolling Stock of Indian Railways, strictly following a well documented system of the Internal Quality Assurance Plan.



6.1.2 The manufacturer shall offer FIVE BMBS sets complete in all respects. The procedure for all the tests for testing of BMBS has been listed in **Annexure I&II**.

6.1.3 In case samples offered fail in any of the test/check, the firm shall be advised accordingly.

## **6.2 FIELD TRIAL**

6.2.1 Once the developmental tests have been cleared, prototype fitment of BMBS shall be done by the supplier on a single bogie in their premises. After demonstrating satisfactory working of the system, the supplier shall make arrangements for the fitment of the above equipment on a complete wagon

6.2.2 Field Trial shall be conducted for a period of 18 months. Field trial shall be conducted to assess the system reliability of proposed BMBS design.

6.2.3 Field Trials are not required in following cases:

- I. Principle manufacturers who have supplied BMBS (of same/similar design as laid down in RDSO's drawing number WD- 08093-S/2 for wagons) to Indian Railways as per RDSO spec WD-15 –BMBS-2000(Rev-II) and have already undergone successful field trials in the past.
- II. Licensee manufacturers.

6.2.4 Only on successful completion of all the above steps the firm will be accorded technical clearance for becoming a vendor for BMBS. The vendor approval will be done after this as per Vendor Approval Procedure of RDSO in vogue.

## **6.3 PURCHASE INSPECTION**

Purchase inspection shall be carried out at the premises of manufacturer who are cleared for the regular manufacture of BMBS. For each type of wagon prototype fitment of BMBS shall be done and cleared by RDSO during purchase inspection. If the prototype for that type of wagon has been earlier cleared by RDSO for that firm, then the same will not be required to be done again. The following procedure shall be followed for the purchase inspection:

6.3.1 The inspecting authority shall make audit checks of the manufacturing procedure / Internal Quality Assurance system to ensure that the BMBS offered for inspection is manufactured strictly as per internal quality assurance system and the manufacturer has carried out all tests / inspection during manufacturing stage to ensure that BMBS offered are strictly to the specification. During such audit checks, the inspecting authority shall also check the records of internal quality assurance.

6.3.2 The inspecting authority shall conduct the checks/tests as given below from the offered lot.

- 6.3.3 Components of 2% of the offered lot of BMBS subject to minimum two BMBS randomly picked up shall be checked for dimensions with respect to assembly drawing.
- 6.3.4 1% of brake cylinder of the offered lot subject to minimum one brake cylinder shall be dismantled and dimensions and general workmanships of each component shall be checked as per the component drawings.
- 6.3.5 The manufacturer shall ensure that all the brake beams are subjected to Static Tests of para 1.1 & 1.2 as laid down in test scheme (**Annexure-I**). During the purchase inspection 1% brake beams (picked up randomly) of the offered lot subject to minimum two number will be subjected to these tests under the supervision of the inspecting authority.
- 6.3.6 Safety factor test (para 1.3 of **Annexure –I**), Bend tests (para 2 of **Annexure-I**), Dynamic test (para 3 of **Annexure –I**) on brake beams shall be conducted under the supervision of inspecting authority at periodic interval of one year. Same brake beam may be used for para 1.3 and 2. Separate brake beam shall be used for dynamic test. The brake beams tested under 6.3.6 shall not be allowed to use on IR and shall be scraped. Record of last test conducted shall be given by the manufacturer to the inspecting authority during purchase inspection.
- 6.3.7 The manufacturer as a part of its internal testing scheme shall conduct Leakage Test at room temperature for all the brake cylinders on routine basis as given in **Annexure-II**. During the purchase inspection one brake cylinder out of every 2000 brake cylinders being manufactured will be subjected to Leakage Test (for the complete temperature range as given in **Annexure-II**) under the supervision of the inspecting authority. If a manufacturer manufactures less than 2000 brake cylinders in a year than the test is to be conducted at least once (for the complete temperature range as given in **Annexure-II**) in that year.
- 6.3.8 Environmental Test, Endurance Test, Vibration Test of brake cylinder and Function test of BMBS shall be conducted under the supervision of inspecting authority at periodic interval of one year. Record of last tests conducted shall be given by the manufacturer to the inspecting authority during purchase inspection.
- 6.3.9 Manufacturer shall ensure that all APM's shall be subjected to RDSO approved tests as laid down in Para 4.11. During the purchase inspection 2 % APM's (picked up randomly) of the offered lot subject to minimum two number will be subjected to this test under the supervision of the inspecting authority.
- 6.3.10 In case the component samples picked up fail in any of the tests / checks indicated in para 6.3.3 to 6.3.9 the reasons for such failure shall be Identified. The inspecting authority shall verify the reasons by conducting audit check on internal quality assurance system. If it is found that such failures are due to non implementation of internal quality assurance system, the entire lot of BMBS shall be rejected. In case the failures are on account of reasons other than non implementation of internal quality assurance system, the manufacturers may re-offer the lot after rectifying the defects. However, in such cases, double

the quantity of samples shall be picked up and tests/checks shall be conducted. In case the samples again fail in any of the tests/checks, the entire lot shall be rejected.

6.3.11 The manufacturer will maintain a list of all internal acceptance tests being carried out at various stages of manufacturing of the product. Proper record of such internal acceptance tests shall be maintained and also included in the QAP. At the time of inspection of the product, these records shall be put to the inspecting authority for scrutiny and countersign.

## **7.0 TRAINING**

Maintenance staff in wagon depots/workshops, wherever the wagons fitted with BMBS are required to be maintained, will be trained in maintenance aspects of BMBS. Manufacturer in association with Wagon directorate, RDSO, Lucknow and Zonal Railways shall arrange this training.

## **8.0 MARKING AND PACKING**

8.1 Each major component of the bogie mounted brake system should have prominent and durable marking as follows: -

- Manufacturer's name (initials/trade mark can also be marked)
- Month and the year of manufacture.
- Country of origin (in case of imported components)
- Serial No.

8.2 The components shall be suitably packed to make them fit for transit by Rail/Road/Sea/Air without any damage and also for storage.

## **9.0 AFTER SALES**

9.1 The manufacturer/contractor shall arrange for adequate service engineers at his own cost to ensure that the equipment supplied performs satisfactorily. Manufacturer/Contractor shall also depute his staff on request by the Purchaser / RDSO, to investigate and attend to specific problems that may come up during actual operation of Air Brake Equipment.

9.2 The manufacturer/contractor shall arrange to supply along with the equipment maintenance manuals, wall charts and cut models for proper maintenance of his own proprietary equipment. Two numbers of manuals and wall charts per 100 number of BMBS or part thereof and cut model one each per 2000 number of BMBS or part thereof shall be supplied against every contract free of cost. The consignee for these shall be nominated by RDSO. Manuals shall be illustrated, containing information pertaining to the principle of operation, maintenance schedule of all the proprietary items of equipment being supplied. The Manual shall also contain information on the following: -

- a) Details of attention during various schedules of Examination.
- b) Test equipments.

- c) Special tools
- d) Trouble shooting
- e) List of spares required during various schedules of Examination.
- f) Updated position of modifications carried out.

9.3 The manufacturer/contractor shall supply revised Maintenance Manuals and Wall Charts incorporating necessary changes in the Manuals and Wall Charts already supplied by them for earlier contracts. The copies of maintenance manuals and wall charts are meant for wider circulation on Railway and fresh copies shall be furnished as stipulated even if there are no changes in the manuals & wall charts furnished against earlier contract.

## 10. **GUARANTEE/WARRANTY**

The firm shall stand guarantee, unless otherwise specified in the specification of individual component/sub assembly, for a period of 36 (thirty six) months from the date of fitment of the system.

In case of any premature failure of any components due to design/manufacturing deficiency, firm will be liable to make free replacement within reasonable time to the depot where failure has been reported. Whenever repeated failures are reported, firm shall investigate and come up with satisfactory reasons for failure and take remedial action. The failed component/sub assembly (within the warranty period) shall be taken back by the supplier for repair and re-supply to the Railways after RDSO Inspection along with an extended warranty period as applicable to the new supply.

This will not exclude satisfactory performance of brake cylinders for a time period of six years in Indian environmental and working conditions.

.....

**TEST SCHEME FOR BRAKE BEAM OF BMBS FOR WAGONS**

The following tests are to be carried out on both the brake beams (Primary and Secondary) for BMBS application on Indian Railways.

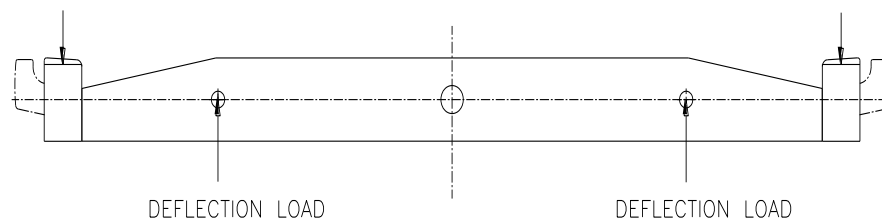
1. STATIC TESTS.
2. BEND TESTS OF BRAKE BEAM ENDS
3. DYNAMIC TEST.

**1. STATIC TESTS**

The test fixture shall have suitable supports to represent the back of brake shoe, so that the brake beam can be mounted in the fixture, supported on brake heads.

**Deflection measurement test**

The brake beam is to be loaded for a load of 10.8t at load application points of the brake beam for three consecutive load cycles. At the end of third cycle the load is to be reduced to 500kg to set the deflection reading to zero. Then the deflection load of 10.8t is to be re-applied and deflection reading at center is to be taken which should not be more than 1.8 mm.



**Set test**

After deflection test, the beam shall be loaded for a set load of 16.2t and then released to 500 kg. The brake beam shall not show a set more than 0.25mm.

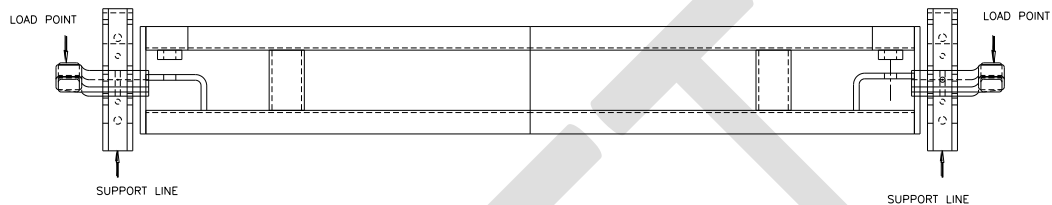
**Safety factor test**

The brake beam is to be subjected to a safety factor test to withstand a load of 24.2t with deflection not more than 50 mm and without failure of any of the parts.

## 2. BEND TESTS OF BRAKE BEAM ENDS

### Proof load test

The brake beam shall be supported in a fixture with the brake heads against dummy brake shoes and a deflection load of 10.8t is to be applied on it to hold the brake beam in position. Then by means of a clamp fixture attached to the brake beam end, a load of 2t at each end is to be applied through a distance of 110mm from brake head centre.



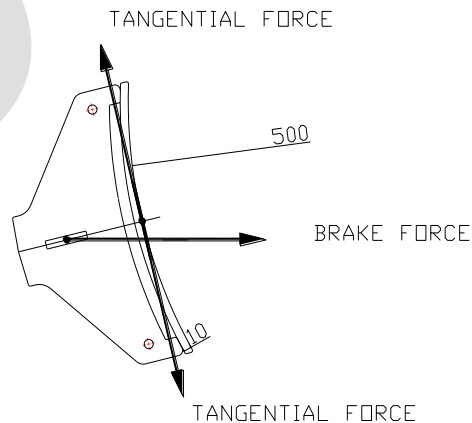
After this the load of 2t is to be reduced to 200 kg and measure the set as zero. Then apply a load of 3t at each the ends and measure the set by reducing the load to 200kg, which shall not be more than 0.18mm.

### Safety factor test

After successful set test, a load of 4.5t is to be applied for safety factor test. There shall not be any type of failure of brake beam ends.

## 3. DYNAMIC TEST

The beam shall be loaded for one million cycles at a frequency range between 1Hz to 3 Hz



- 3.1 The beam shall be mounted in a suitable cycle machine capable for 10.8t deflection load at push rod connections on brake beam.
- 3.2 A tangential load of 2t must be applied at each brake head simultaneously with deflection load and this load must be reacted at brake beam ends. The reaction load shall be applied through suitable brake beam guide of dimensions described in item 9 of drg. No. SK 69597.
- 3.3 The tangential load must alternate in direction with each normal load cycle.
- 3.5 Failure is defined as complete breakage of any component, part of the beam or when such weakness has been developed that the beam can no longer sustain the test load.

\*\*\*\*\*

### **BMBS System Function Tests**

- a) Install the system in the suitable test fixture that duplicates the complete set of system and make sure all the adjustments are correct.
- b) For the minimum slack clearance use max. thicknesses of brake block and keep the brake cylinder between the mounting holes/pins. Retract the system back until max. show clearance is obtained.
- c) Apply 0.7 Kg/Cm<sup>2</sup> air pressure to the brake cylinder and note that all the brake blocks are touching the wheel.
- d) Apply 3.8 Kg/Cm<sup>2</sup> air pressure to the brake cylinder and record the brake block force at each brake head with-out rapping the rigging. Then rap each friction point of the system and again record the brake block force at each brake head. These reading will be used to compute the efficiency of the bogie mounted brake system in the static and simulated dynamic conditions.
- e) Removing a brake block, apply and release 0.7 Kg/Cm<sup>2</sup> air pressure to the brake cylinder until the brake heads touch the wheel with correct piston stroke. Repeat the procedure until all brake blocks have been removed.
- f) Install a brake block, apply and release 0.7 Kg/Cm<sup>2</sup> air pressure to the brake cylinder until the brake heads are brought up against the wheel with correct piston stroke. Repeat the procedure until all brake blocks have been installed.

### **Brake Cylinder (with Built in Slack Adjuster) Testing**

#### **Leakage Test for Brake Cylinder complete**

Apply 0.7 Kg/Cm<sup>2</sup> & 3.8 Kg/Cm<sup>2</sup> air pressure and wait 5 minutes after application and observe that the leakage is not more than as given in table below.

Brake Cylinder Pressure	Temp*	Maximum leakage rate
0.7 Kg/Cm <sup>2</sup>	-10° C	0.07 Kg/Cm <sup>2</sup> in 10 minutes
	21° C	0.03 Kg/Cm <sup>2</sup> in 10 minutes
	55° C	0.03 Kg/Cm <sup>2</sup> in 10 minutes
3.8 Kg/Cm <sup>2</sup>	-10° C	0.03 Kg/Cm <sup>2</sup> in 10 minutes
	21° C	No. leakage in 10 minutes
	55° C	No. leakage in 10 minutes

*\* During routine test (internal test to be done by the manufacturer) the leakage test will be conducted for all the brake cylinders at room temperature of 21° C.*

#### **Environmental Test**

Measure brake cylinder force output and efficiency at 3.8 Kg/Cm<sup>2</sup> in room temperature (21° C), 55° C and -10° C or below. Efficiency shall be measured by comparing the air pressure force on the piston to the total brake block force. If efficiency is measured in a test fixture the air pressure force on the piston will be



compared to the piston push rod force. All readings will be made after the friction points of the system have been rapped. Under no circumstance should the brake rigging be rapped in a manner that might artificially increase or reduce the brake block forces.

### **Cycle Test/ Endurance Test**

- a) Leakage test for brake cylinder complete and Environmental test at room temperature must be completed successfully both prior to and after completion of Cycle test/ Endurance test. Efficiency at the completion of Cycle test/ Endurance test must not decrease more than 2% if forces are measured at the pushrod, or 5% if forces are measured at the brake block heads, for the efficiency measured prior to the cycle test.
- b) Cycle the brake cylinder with in built slack adjuster at a brake cylinder pressure of at 6.2 Kg/Cm<sup>2</sup> for 200,000 cycles.
- c) Remove one brake block every 25,000 cycles until 125,000 cycles is reached and then add one brake block every 25,000 cycles for remainder of the test.
- d) Repeat the leakage test and Environmental test at room temperature (21°C).
- e) Install the brake cylinder with built in slack adjuster in the test fixture with all associated components and perform a function test as described in System functional test.

### **Vibration Test**

- a) Leakage test for brake cylinder complete and Environmental test at room temperature must be completed successfully both prior to and after completion of the Vibration tests.
- b) Brake Cylinder with built in slack adjuster must be subjected to a vibration test at no less than 30 or more than 60 cycles per second at  $\pm 3g$  for Five million cycles.
- c) Repeat the leakage test and Environmental test at room temperature (21°C). Efficiency at the completion of Vibration test must not decrease more than 2% at push rod from the efficiency measured prior to the Vibration test.
- d) Install the brake cylinder with built in slack adjuster in the test fixture with all associated components and perform a function test as described in System functional test.