Contact Details for comments on Spec/STR`s

Draft Spec. No. - RDSO/2014/CG-11 (Rev.2).

Title- Specification for Bogie Mounted Brakes Cylinder with built in Double Acting Slack Adjuster for ICF Design BG Main Line Coaches

1) RDSO has revised the above specification/STR in line with 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 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	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:

Executive Director /Carriage
Research Designs and Standards Organization
Manak Nagar, Lucknow – 226011
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INDIAN RAILWAYS

सत्यमेव जयते

SPECIFICATION

FOR

BOGIE MOUNTED BRAKES CYLINDER

WITH

BUILT IN DOUBLE ACTING SLACK ADJUSTER

FOR

ICF DESIGN BG MAIN LINE COACHES

S. No.	Month/Year of Issue	Revision/ Amendment	Page No.	Reason for Amendment
1.	January, 2015	-	-	First issue
2.	September,2016	Amendment-1		To include the ISO Doc.No.QO-D-7.1-11, New sub clause No.1.2 added under clause no. 1 of foreword.
3.	March,2017	Rev.1	-	Regular fitment of Double Acting Bogie mounted Brake Cylinder
4.	July, 2020	Rev.2	3-7, 11, 15 & 16	To make the specification more enabling with focus on functional requirements

Issued By:
RESEARCH DESIGNS AND STANDARDS ORGANISATION
MINISTRY OF RAILWAYS
MANAK NAGAR, LUCKNOW- 226011

Signature			
Name & Designation	Prepared by: JE/Carriage	Checked by: SSE/Carriage	Approved by: Jt.Director/Carriage

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SECTION-A

SPECIFICATION FOR DOUBLE ACTING BOGIE MOUNTED BRAKE CYLINDER FOR ICF DESIGN BG MAINLINE COACHES

1 FOREWORD

1.1 To overcome the problem of Brake binding due to overloading, it has been decided in CME conference to use double acting BMBC in GS and SLR Coaches which have capability to provide both pay out as well as pay in arrangement. The similar system is already successfully working in wagons.

1.2 Where vendor approval is done by RDSO, 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.

2 SCOPE

2.1 This Specification covers the technical requirements related to manufacture, supply, inspection, performance and testing of Double Acting Bogie Mounted Brake Cylinder for ICF design BG Mainline coaches.

3 PARTICULAR REQUIREMENTS

3.1 The firm willing to supply Double Acting Bogie Mounted Brake Cylinder for the use of Indian Railways shall register themselves with vendor approving authority ~~RDSO~~. ~~Vendor approval process guidelines are available at RDSO website.~~

3.2 The firms willing to supply must have adequate experience in the field of brake system/brake cylinder for locomotives, coaches or wagons.

3.3 The firm along with their principals shall have adequate infrastructures for manufacturing, testing and quality control requirements for Double Acting Bogie Mounted Brake Cylinder. This will be verified by vendor approving authority /~~RDSO~~ at the time of registration of the firm.

~~3.4 Rubber items except imported rubber components shall be procured from RDSO approved sources only. However, the manufacturers shall be fully responsible for satisfactory performance of the rubber items.~~

4 EQUIPMENT DESIGN

4.1 The brake cylinder bore size shall have of 8" (203.2 mm).

4.2 The brake cylinder shall have an in-built double acting slack adjuster and it should have automatic pay in and pay out feature. No manual resetting is required.

4.3 The brake cylinder shall maintain a constant gap of 5-6 mm between the wheel and brake shoes. Whenever there is change i.e. increase or decrease in the gap between the wheel and brake shoes is occurred, it shall be automatically adjusted by the brake cylinder to constant gap of 5-6 mm.

4.4 The take-up stroke for brake cylinder shall be 32+10mm. This is to be measured on test bench.

4.5 Double acting brake cylinder for SLR coaches shall have provisions for connection of hand brake arrangement.

4.6 Double acting Bogie Mounted Brake cylinder should generate a brake force of min 1106 kg at cross head at 3.8 Kg/cm^2 pressure.

4.7 The minimum take-up capacity of the in-built slack adjuster shall be 305mm.

4.8 Mounting dimensions of the brake cylinder shall be as per the RDSO's drawing No.SK-81057 (latest alteration).

4.9 The double acting Brake cylinders shall not consume excessive air during functioning. The manufacturer shall provide the air consumption data with valid calculations in comparison to existing single acting BMBC used in ICF coaches.

5 PERFORMANCE REQUIREMENT

5.1 The double acting brake cylinder is to be so designed that it provides faultless operation under the Indian Railway environmental conditions for a period of at least 6 years from the date of commissioning subject to recommended maintenance practices are followed as per OEM's maintenance manual.

5.2 The double acting brake cylinder should be designed in such a way that it has minimum wear and tear and maintenance possibility.

5.3 The double acting brake cylinder should be able to eliminate the cases of brake binding due to overloading in coaches.

6 MATERIAL& WORKMANSHIP

6.1 The material of brake cylinder with in-built slack adjuster shall conform to the latest revision of vendor approving authority /~~RDSO~~ approved drawing.

6.2 All the components shall be manufactured/ procured to the material specification indicated against each component in the drawings.

6.3 The castings shall be sound, clean and sharp without defects or blemishes of any kind and conform to the requirement of the specification.

6.4 The rubber items shall be smooth, free from pin holes, blisters, porosities and other visual flaws& should be fit for at least 30/24 months.

6.5 The fabrication and welding of fabricated cylinder body shall conform to the requirements of Section-II of IS:2825 (code for unfired pressure vessel). Casted design may also be used, it shall confirms to IS:1865 SG 450/10. Equivalent international standards may also be allowed.

7 DIMENSIONS AND TOLERANCES

7.1 The dimensions and tolerances of brake cylinder shall be as indicated in the latest revision of vendor approving authority ~~ICF/RCF~~ approved installation drawings.

7.2 All dimensions identified in the drawing shall be gauged. The manufacturers shall have the necessary instruments/gauge available with them. If gauges used, Gauge drawings shall be got approved from vendor approving authority /~~RDSO~~ prior to the manufacture.

7.3 Discrepancies in dimensions, if noticed shall be brought to the notice of vendor approving authority /~~RDSO~~ at the developmental stage and sorted out

8 DEVELOPMENTAL INSPECTION

8.1 Developmental inspection shall be carried out at the manufacturer's premises at the time of registration of the firm with vendor approving authority /~~RDSO~~.

The following procedure shall be followed for the developmental inspection:- The inspecting authority shall verify and ensure that the manufacturer is having and strictly following a well-documented system of the 'Internal Quality Assurance Plan'. After having done the same, the following procedure shall be followed:-

8.1.1.1 The manufacturer shall offer five brake cylinders complete in all respects and two brake cylinder bodies with test plates in accordance with the layout corresponding to fig. 8.2 of IS:2825 Section III.

8.1.1.2 The inspecting authority shall carryout the following test/check on the five complete brake cylinders as per details given below:-

a) Checking of dimensions of assembled brake cylinders and interchangeability of components and general workmanship.

b) Testing of the two nos. brake cylinders as per the test plan stated in Appendix -A.

c) Hydraulic Pressure testing of one nos. cylinder body as per details given at Para 13.1.1.2.

d) Testing of two nos. brake cylinders for type testing as per Appendix-B.

8.2 In case samples offered fails in any of the test/ check indicated at para 8.1.1.2 the complete lot of developmental order placed on the firm shall be rejected. Then the firm has to re-offer the request for prototype inspection.

9 Prototype fitment and functional test

9.1 The firm shall offer 2 nos. double acting bogie mounted brake cylinders for GS coach and 2 nos. double acting brake cylinder with hand brake attachment for SLR coach. These brake cylinders shall be fitted on ICF bogies and functional testing shall be carried out before giving approval for field trial.

10 FIELD TRIAL

10.1 The firm supplying material for first time shall subject to field trial as per following scheme.

10.2 Double Acting Bogie Mounted Brake Cylinder shall be subjected to field trials on minimum 30 coaches (20 GS &10 SLR) for a period of minimum 12 months or 2,00,000 Kilometer, whichever is later and their performance shall be monitored by Railways as per Appendix–C and periodically reported to vendor approving authority ~~/RDSO~~. Any modifications found necessary as a result of these tests/trial or further service trials for at least 12 months shall be carried out by the manufacturer at their own cost in the coaches in a manner approved by the purchaser/ vendor approving authority ~~/RDSO~~.

10.3 Firm shall associate with Indian Railways during the trials with double acting brake cylinder. ~~He~~ Firm shall also undertake to modify the equipment supplied, if required as a result of trials.

10.4 After the satisfactory performance of the field trials, the firm may be considered for approval.

11 APPROVAL OF DRAWING

11.1 The design/drawing of the double acting brake cylinder shall be developed based on the design and performance requirements given in this specification and sound engineering practice.

11.2 The mounting and general assembly drawing (with and without hand brake attachment) shall be submitted by the firm with technical data and calculations to vendor approving authority ~~RDSO~~ for approval.

11.3 The drawing shall be developed in SI units.

11.4 Approval of the design means the approval of the general design features. Notwithstanding the approval, the contractor will be wholly responsible for the performance of the brake cylinder.

12 PURCHASE INSPECTION

12.1 Purchase inspection shall be carried out at the premise of the manufacturer who is cleared for the regular manufacture of brake cylinder. The following procedure shall be followed for the purchase inspection:-

12.1.1 The inspecting authority shall make audit checks of the manufacturing procedure / internal quality assurance system to ensure that the brake cylinder 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 brake cylinder offered are strictly to the specification. During such audit checks, the inspecting authority shall also see from the records of internal quality assurance that the raw material used for the manufacture of brake cylinder is as per the laid down specification.

12.1.2 The inspecting authority shall conduct the following checks from the offered lot:

12.1.2.1 Two percent or minimum 2 nos. brake cylinder picked up at random shall be checked for assembly dimensions with respect to manufacturer's vendor approving authority /~~RDSO~~ Approved drawings.

12.1.2.2 Five percent or minimum five brake cylinder picked up at random shall be subjected to tests as given in Appendix A of this specification.

12.2 In case the samples picked up fails in any of the tests/ checks indicated in Para 12.1.2.1 to 12.1.2.2, 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 brake cylinders shall be rejected. In case the failures are on account of reasons other than non-implementation of internal quality assurance system, the manufacturers may reoffer the lot after rectifying the defects. However, in such cases, double the quantity of the samples shall be picked up and tests/ checks conducted as per Para 12.1.2.1 to 12.1.2.2. In case the samples again fail in any of the tests/ checks, the entire lot shall be rejected.

12.3 Type test as per Appendix-B of Brake Cylinder shall be conducted at the firm's premises under the supervision of inspecting authority during fresh registration and subsequently only on need basis as decided by ~~directorate head~~ competent authority based on major changes in specification or any other serious reason warranting fresh type testing. Records of last tests conducted shall be given by the manufacturer to the inspecting authority during purchase inspection.

13 TESTS

13.1 Type Test

13.1.1 The following test shall constitute type test and shall be carried out in accordance to Appendix - B at the time of Product approval and at the time of Quality Audit by vendor approving authority ~~RDSO~~:

13.1.1.1 Performance and Endurance Test.

13.1.1.2 Hydraulic Test- This test shall be conducted on cylinder body. The cylinder body shall be subjected to hydraulic pressure of 7 Kg/cm^2 for 5 minutes. There should be no leakage.

13.2 Routine Test

13.2.1 Leakage & Function Test for Brake Cylinder Complete

The leakage and function test of the brake cylinders should be conducted in accordance with Appendix-A.

14 WARRANTY

The firm shall, at his cost, replace the double acting brake cylinder failing prematurely or proving unsatisfactory in service for reasons attributed to defective/faulty design, defective material or poor workmanship within a period of 30 months from the date of delivery or 24months from the date of fitment, whichever is earlier. This warranty shall survive, not withstanding the fact that the double

acting brake cylinder may have been inspected, accepted and payment thereof made by the purchaser.

15 AFTER SALES SERVICE

15.1 Firm may be required to send his technical expert during the installation and commissioning of their equipment on coach/coaches. The charges for this service shall be quoted separately.

15.2 Firm shall also depute his technical expert on request by the Purchaser/ vendor approving authority /~~RDSO~~ to investigate and attend to specific problems that may come up during actual operation of double acting brake cylinder.

15.3 Firm shall ensure that sufficient copies (Soft & hard both) of the Operation & Maintenance Manuals and Servicing Instructions are made available to the Zonal Railways. These should normally include:

15.3.1 Brief Details of functioning of equipment.

15.3.2 Details of attention to be given during IOH/POH or any other schedule examination.

15.3.3 Test procedure and standards for various brake equipments on test bench.

15.3.4 Details of gauges, jigs & fixtures, tools, machinery and plant for maintenance of brake equipment.

15.3.5 Typical defects and their remedial measures.

15.3.6 List of spares for day to day maintenance and at the time of IOH/POH in the form of periodic overhaul kit.

16 PAINTING

16.1 Brake cylinder shall be given suitable anti-corrosive treatments.

16.2 The exterior of the brake cylinder shall be painted with black enamel paint.

17 PACKING

17.1 The manufacturer shall ensure that all external ports of brake cylinders are suitably covered with protection caps to prevent ingress of foreign particles during handling and storage.

17.2 The manufacturer shall also ensure that brake cylinders in assembled condition are adequately packed before dispatch to prevent damage in handling and storage.

18 TRAINING

18.1 Maintenance staff in coaching depots / workshops, wherever the coaches fitted with brake cylinders are required to be maintained, will be trained in functional & maintenance aspects of brake cylinder.

APPENDIX - A

TESTING PROCEDURE OF BOGIE MOUNTED BRAKE CYLINDER WITH BUILT IN DOUBLE ACTING SLACK ADJUSTER

S. No.	Description of Tests	Specified Values
1	**Leakage Test (Room Temperature)**	
a	Check brake cylinder leakage at 0.8 Kg/cm^2 air pressure	Leakage should not exceed 0.1 Kg/cm^2 in 10 min.
b	Check brake cylinder leakage at 3.8 Kg/cm^2 air pressure	Leakage should not exceed 0.1 Kg/cm^2 in 10 min.
2	**Maximum Slack Adjustment Take-up**	
a	Apply 0.8kg/cm^2 air pressure and allow the ram/piston rod to extend out completely.	305 mm (Minimum)
3	**Constant Piston stroke Test at 0.8 kg/cm^2 (Stopper plate at 100 mm from initial position)**	
a	**Forward slack adjuster take-up.** Increase the gap between the brake cylinder front end and the stopper plate.	After application and release of BC pressure, the gap between the brake cylinder front end and the stopper plate should remain constant.
b	**Backward slack adjuster take-up**. Decrease the gap between the brake cylinder front end and the stopper plate.	After application and release of BC pressure, the gap between the brake cylinder front end and the stopper plate should remain constant.
4	**Constant Piston stroke Test at 3.8 kg/cm^2 (Stopper plate at 100 mm from initial position)**	
a	**Forward slack adjuster take-up.** Increase the gap between the brake cylinder front end and the stopper plate.	After application and release of BC pressure, the gap between the brake cylinder front end and the stopper plate should remain constant.
b	**Backward slack adjuster take-up**. Decrease the gap between the brake cylinder front end and the stopper plate.	After application and release of BC pressure, the gap between the brake cylinder front end and the stopper plate should remain constant.
5	**Constant Piston stroke Test at 0.8 kg/cm^2 (Stopper plate at 225 mm from initialposition)**	
A	**Forward slack adjuster take-up.** Increase the gap between the brake cylinder front end and the stopper plate.	After application and release of BC pressure, the gap between the brake cylinder front end and the stopper plate should remain constant.
B	**Backward slack adjuster take-up**. Decrease the gap between the brake cylinder front end and the stopper plate.	After application and release of BC pressure, the gap between the brake cylinder front end and the stopper plate should remain constant.

6	**Constant Piston stroke Test at 3.8 kg/cm^2 (Stopper plate at 225 mm from initial position)**	
a	**Forward slack adjuster take-up.** Increase the gap between the brake cylinder front end and the stopper plate.	After application and release of BC pressure, the gap between the brake cylinder front end and the stopper plate should remain constant.
b	**Backward slack adjuster take-up**. Decrease the gap between the brake cylinder front end and the stopper plate.	After application and release of BC pressure, the gap between the brake cylinder front end and the stopper plate should remain constant.

APPENDIX -B

TESTING PROCEDURE OF BOGIE MOUNTED BRAKE CYLINDER WITH BUILT IN DOUBLE ACTING SLACK ADJUSTER

Leakage Test for Brake Cylinder complete

Apply 0.7 Kg/cm^2 & 3.8 Kg/cm^2 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^2	-10 ^{o}C	0.07 Kg/Cm^2 in 10 minutes
	21 ^{o}C	0.03 Kg/Cm^2 in10 minutes
	55^o C	0.03 Kg/Cm^2 in10 minutes
3.8 Kg/cm^2	-10^o C	0.1Kg/Cm^2 in10 minutes
	21^o C	0.1 Kg/Cm^2 in10 minutes
	55^o C	0.1 Kg/Cm^2 in10 minutes

Cycle Test/ Endurance Test

After successfully completion of Leakage test of brake cylinder, check the brake cylinder force at room temperature at 3.8 Kg/cm^2. Brake force should not be less than 1106 kg. Cycle the brake cylinder at a pressure of 6.2 Kg/cm^2 for 200,000 cycles at room temperature.

Efficiency at the completion of cycle test / endurance test must not decrease more than 2% when subjected to leakage and brake cylinder force test at room temperature.

APPENDIX -C

1. **INITATION OF TRIAL:**

At the commencement of the trial following action shall be taken:-

a) Brake cylinder Leakage, Leakage rate of coach, brake application and release timing of trial coaches should be checked after fitment of double acting 203mm bogie mounted brake cylinder.

b) Train No., Coach No., Brake cylinder No, Date of Fitment, Date of Test, to be recorded in Performa-I& II

c) In case a coach is withdrawn from the trial rake during the trial period for 'C' or quarterly schedule, Performa-I & II to be filled.

d) In case a coach is withdrawn in trial period for IOH/POH, the brake cylinder is to be removed from the coach & is to be fitted in newly inducted coach. Detailed documentation for this exercise should be filled in Performa-I & II.

2. MONITORING OF TRIAL

i) Weekly examinations.

Trial coaches shall be examined every round trip for the following. In case of any deviation/abnormalities record shall be maintained in Performa – I.

a) Visually inspect for any kind of damage in brake cylinder.
b) Visually inspect the wheel/ brake block for any sign of brake binding or any other defect.
c) Check the gap between wheel and brake blocks which should be between 5 to 6mm.
d) Check the brake cylinder for any leakage.
e) Check the piston stroke of the brake cylinder which should be between 32 to 42 mm.

iii) Monthly examination

a) All items mentioned in weekly examination and record shall be maintained in Performa– I.
b) Detailed inspection as per Performa-II shall be done and record shall be maintained

iv) Three monthly examination

a) All the items of weekly & monthly examination to be carried out jointly with Railway, and Firm's representative.
b) Record shall be maintained in Performa–I & II.

3. CLOSURE OF TRIAL

~~After 12 month or whenever, it is decided by CME of respective Railway whichever is the earliest to close the trial~~ The trial is to be conducted & cleared as detailed in para 10.2 of this specification. The date of closure of trial & total round trips covered is to be recorded in Performa-III. All the Performa to be sent to ~~Carriage/RDSO~~ vendor approving authority for further action.

PROFORMA-I

TO BE FILLED WEEKLY

Train No: Coach No: Brake cylinder No:
Rake No: Fitted on: Inspected On:

S.No.	Item to be checked	Specified value	Observation	Remarks
1	Whether any kind of damage/defect observed in brake cylinder.	-		
2	Whether any sign of brake binding or any other defect.	-		
3	Whether gap between wheel and brake blocks within specified limit	5 to 6 mm		
4	Whether any leakage observed in brake cylinder.	No leakage		
5	Record the piston stroke of the brake cylinder which should be between 32 to 42 mm.	32 – 42 mm		
6	Any other abnormality	-		

PROFORMA-II

TO BE FILLED MONTHLY

Train No: Coach No: Brake cylinder No:
Rake No: Fitted on: Inspected On:

S. No.	Description of Tests	Specified Values	Observation	Remarks
1	**Forward slack adjuster take up (Pay out)**			
	Remove 2 adjacent brake blocks of a brake beam and apply brakes 2-3 times. Check the gap between the brake block & wheel.	The slack adjuster should pay out and maintains a constant gap of 5-6mm between the brake block and wheel.		
2	**Backward slack adjuster take up (Pay in)**			
	Apply pry bar between wheel and brake head to push back the brake beam. The slack adjuster will pay-in creating space for the brake block. Fit 1 brake block on each axle and apply brakes 2-3 times. Check the gap between the brake block & wheel.	The slack adjuster should pay in and maintains a constant gap of 5-6mm between the brake block and wheel.		

PROFORMA- III

TO BE FILLED AT THE END OF TRIAL

S. No.	Coach No.	Brake Cylinder No.	Date of Starting of trial	Trip No.	Date of end of trial	Total Round Trips covered in Trial	Km Earned	Any Defect noticed in trial	Remarks

Signature			
Name & Designation	Prepared by: JE/Carriage	Checked by: SSE/Carriage	Approved by: Jt.Director/Carriage

SECTION-B

INFRASTRUCTURE - MANUFACTURING AND TESTING FACILITIES

19. SCOPE

The schedule of technical requirements covers the norms for manufacturing of Air Brake cylinder 203mm with built in double acting slack adjuster for coaching stock.

20. REQUIREMENTS

The vendors seeking approval shall comply with all the below mentioned requirements.

GENERAL &MANUFACTURING FACILITIES:

20.1 Covered area with adequate space for machine shop, Assembly Sections, performance test benches, welding section, standard room laboratory, storage of raw material and finished product should be available.

20.2 The vendor/their supplier should have adequate machining facilities such as turning, facing, boring, milling, drilling, tapping, grinding, honing and threading or have CNC machine for carrying out the required machining operations on the components. The operations involved for each component should be specified machine wise or process wise in case of CNC machine in the process flow chart with accuracy of the machine.

20.3 The firm or their supplier should have a honing machine for honing of cylinder body or have a turning machine for maintaining specified roughness in cylinder body.

20.4 The firm should have adequate supply of compressed air at 8 kg/cm^2 minimum on the shop Door for performance testing of the equipment.

20.5 It is to be ensured that all the hardware items are of reputed make and adhere to the required specifications.

20.6 There should be a painting booth for painting the components.

21. TESTING FACILITIES

21.1 The firm should have facilities of testing the Brake cylinders to meet the requirements mentioned in Section-A of this specification.

21.2 The firm should have a test stand for conducting endurance testing of brake cylinders.

21.3 A hydraulic pressure testing arrangement of capacity 15 kg/ cm^2 to conduct hydraulic test of brake cylinder should be available.

21.4 Firm should have a shadow graph for checking profile of the rubber packing ring.

21.5 Firm should have a surface finish tester for measuring the surface finish of cylinder bore.

21.6 Spring load testing machine for testing stiffness of various springs.

21.7 Hardness testing machine for measuring hardness of various parts as per drawing.

21.8 Shore hardness tester for checking hardness of rubber items.

21.9 In addition to above machine the standard room should also have following instruments:

a. Surface plate.

b. Three point bore gauge of 250mm.
c. Vernier depth gauge of 300mm.
d. Bevel protector for measuring angle.
e. Minimum one Vernier height gauge of 300mm.
f. Minimum two sets of outside micrometer up to 75mm.
g. Plug, Go - No-Go and thread gauges as per requirement of the components.

22.0 QUALITY CONTROL REQUIREMENTS

22.1 It is to be ensured that head of the Quality control is a graduate engineer with 5 years' experience or a diploma holder in relevant field with 10 years' experience. He should have full knowledge of the product and should be involved in day to day activities of quality control, stage inspection and also compliance of QAP.

22.2 The firm should have a ISO-9000 series certification and the product for which the approval is sought should be broadly covered in the scope of the certification for manufacturing and supply.

22.3 The quality manual of the firm should clearly indicate control over manufacturing process, system of measuring and testing.

22.4 The firm should have Quality Assurance Plan as per vendor approving authority /~~RDSO~~ guidelines available on vendor approving authority /~~RDSO~~ website.

22.5 There should be a methodical approach for calibration and record keeping of Ganges, Instruments, Jig and fixtures.

22.6 There should be an established and working system for assessing the quality of the sublet vendors.

~~22.7 Rubber packing ring should be procured from RDSO approved sources only.~~

22.8 Despite obtaining test certificates from sublet vendors for non-ferrous and malleable casting items, a system should exist to get samples tested periodically and records should be maintained.