

IN THIS AREA MAX

NOTE:-

1. THIS DRG. IS TO BE WORKED IN CONJUNCTION WITH  
SPECIFICATION No. CLWMS/3/009 FOR WAG-9 & WAG-9H LOCO 2 4.
2. TOLERANCE ON THE DAMPING FORCE (COMPRESSION & TENSION)  
SHALL BE AS SPECIFIED BELOW AT DAMPER TEMPERATURES OF  
16° TO 22°C 5.  
 6.  
 7.
- a) NEW OR RECONDITIONED DAMPERS :  $\pm 15\%$
- b) WORN DAMPERS :  $\pm 25\%$
3. THIS DRAWING TO BE WORKED IN CONJUNCTION WITH SPECIFICATION  
NO. CLWMS/SPEC/ELDO - BOGIE /002. NOVEMBER 2013 FOR WAP-7 LOCOMOTIVES.

4. ALL DIMENSIONS ARE IN mm
5. NEXT LEVEL ASSEMBLY DRG. NO. 1209-01.115-001 REF-11,12,13,14
6. USED FOR LOCO-WAG-9,WAG-9HC&WAP-7
7. UNSPECIFIED TOLERANCE IN THE DIMENSIONS MENTIONED AT DRAWINGS TO BE FOLLOWED AS PER IS:2102(PART 1):1993-TOLERANCE CLASS-MEDIUM.



1



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Location: New Delhi

SHEET 1 OF 7	SPECIFICATION NO. CLW/MS/3/009	ALT. '3'
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**SPECIFICATION FOR  
DAMPERS (SHOCK ABSORBERS) FOR USE ON WAG-9  
3-PHASE ELECTRIC LOCOMOTIVES  
FOR INDIAN RAILWAY**

**ENCLOSURES:**

**1. ANNEXURE: NIL**

**2. DRG. NO. 1209-01.215-014 ALT. '1'**

**SPECIFICATION NO. : CLW/MS/3/009 ALT. '3'**  
**ISSUE DATE : 24.01.1997**

**ISSUED BY:  
DY. CHIEF ELECTRICAL ENGINEER/D-I  
CHITTARANJAN LOCOMOTIVE WORKS  
P.O. CHITTARANJAN-713331  
DIST. BARDHAMAN (WEST),  
WEST BENGAL(INDIA)**

<p style="text-align: center;"><b>PREPARED BY</b> <b>DEBABRATA DHAR</b> Digitally signed by DEBABRATA DHAR Date: 2023.04.04 16:26:08 +05'30' Adobe Reader version: 11.0.10</p> <p style="text-align: center;"><b>SSE/Drg. (MECH.)</b></p>	<p style="text-align: center;"><b>CHECKED BY</b> <b>GURUDAS MANDAL</b> Digitally signed by GURUDAS MANDAL Date: 2023.04.04 17:16:50 +05'30' Adobe Reader version: 11.0.10</p> <p style="text-align: center;"><b>SSE/Drg. (MECH.)</b></p>	<p style="text-align: center;"><b>APPROVED BY</b> <b>RAVI YADAV</b> Digitally signed by RAVI YADAV Date: 2023.04.06 10:42:47 +05'30' Adobe Reader version: 11.0.10</p> <p style="text-align: center;"><b>DY. CEE/D-I</b></p>
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Location: New Delhi

3048315/2026/O/o Dy.CEE/LOCO/GRC/SER

SHEET 2 OF 7	SPECIFICATION NO. CLW/MS/3/009	ALT. '3'
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**DETAILS OF ALTERATIONS**

Sl. No.	Date of Amendment	Alt. No.	Description	Remarks	Authority
1.	13.05.2002	1	Clause 12 added.	As suggested by Railway Board vide their letter no. 2002/M/L/466/1505, dtd: 10.04.02	AME/D&D Sd/- Dtd: 13.05.2002
2.	18.06.2003	2	Alt.1 added to drg. no.	Tolerance specified on damping forces on the drawing vide alt.1	Sd/- Dtd: 20.06.2003
3.	28.07.2005	3	Clause 12 deleted.	Some indigenous firms are also there hence this clause is not required. Further QAP of the firm is to be checked before placement of order during assessment itself.	Sd/- Dtd: 28.07.2005

**Specification has been digitized and all alterations have been incorporated.**

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SHEET 3 OF 7	SPECIFICATION NO. CLW/MS/3/009	ALT. '3'
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SHEET 4 OF 7	SPECIFICATION NO. CLW/MS/3/009	ALT. '3'
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**TECHNICAL SPECIFICATION FOR DAMPERS (SHOCK ABSORBERS) FOR USE ON WAG-9 ELECTRIC LOCOMOTIVES.**

**1. SCOPE:**

This specification covers the design, manufacture, supply and delivery of dampers for use on WAG-9 electric locomotives.

**1.1 Scope of Supply:**

Qty. one (1) set shall comprise Qty./Loco as indicated below:

<u>Description</u>	<u>Drg. No.</u>	<u>Qty./ Loco</u>
a) Axle Damper	1209-01.215-014/1 (Alt. 1)	8
b) Vertical Damper	1209-01.215-014/2 (Alt. 1)	4
c) Horizontal Damper	1209-01.215-014/3 (Alt. 1)	4
d) Yaw Damper	1209-01.215-014/4 (Alt. 1)	4

**2. GENERAL:**

In WAG-9 locomotive, isolation and absorption of shock loads and vibration is performed by the primary and secondary suspension. Amount and rate of lateral movement between bogie and body is limited by the horizontal dampers. Vertical dampers limit the amount and rate of the vertical rebound of the locomotive body and springs. Yaw dampers control the body yaw & pitch rate.

**3. CLIMATIC AND ENVIRONMENTAL CONDITIONS:**

**3.1 Maximum atmospheric temperature:**

- a) Under Sun : 70°C  
b) In Shade : 50°C

**3.2 Humidity : 100% saturation during rainy season.**

**3.3 Reference site conditions:**

- a) Ambient temp. : 0°C Min., 47°C Max.  
b) The contractor will indicate the expected temperature rise under reference site conditions.  
c) Humidity : 60%  
d) Altitude : 160m above mean sea level.

**3.4 Rainfall : Very heavy in certain areas.**

**3.5 Atmosphere during hot weather: Extremely dusty and desert terrain in certain areas.**

**3.6 Coastal area :**  
Dampers will be designed to work in coastal areas in humid and salt laden atmosphere.

**3.7 Vibration :**  
The dampers, sub system and their mounting arrangement will be designed to withstand vibrations and shocks encountered in service as specified in corresponding IEC publications unless otherwise prescribed.

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SHEET 5 OF 7	SPECIFICATION NO. CLW/MS/3/009	ALT. '3'
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#### 4. TECHNICAL REQUIREMENT:

- 4.1 The Dampers shall be designed by the manufacturer to suit the following features of WAG-9 locomotives.
- |  |              |
|--|--------------|
| a) Spring weight of the loco body              | 78200 Kg.    |
| b) Possible upgrade of the loco body           | 90200 Kg.    |
| c) Sprung weight of the bogie (without motors) | 7700 Kg.     |
| d) Un sprung mass of one axle                  | 3900 Kg.     |
| e) Weight of the axle including the motors     | 4900 Kg.     |
| f) Wheel set mass (without motors)             | 2750 Kg.     |
| g) Expected annual activity                    | 6570 hours   |
| h) Gauge (Broad gauge)                         | 1676 mm      |
| i) Maximum service speed                       | 100 Km/h     |
| j) Maximum test speed                          | 110 Km/h     |
| k) Type of Suspension                          | Coil springs |
| l) Type of damping                             | Hydraulic    |
- 4.2 The nominal points of the force-velocity characteristics specified on the relevant drawing shall not be considered as maximum forces the dampers may be subjected to. The dampers shall be designed and manufactured by the manufacturer to withstand heavy instantaneous shock loads experienced on the railway vehicles operating on inferior tracks.
- 4.3 The manufacturer shall provide uniform dampening characteristic and nominate the changes of the dampening characteristic in the region of 0° C to 70° C.
- 4.4 The load testing of the dampers shall not be conducted using a rotating test stand as rotating test stand is not able to generate the necessary acceleration of the dampers will be subjected to.
- 4.5 The dampers shall be continuously operating at high ambient temperatures. As such sufficient attention should be given to heat dissipation during the entire life of the dampers including the expected surface deterioration and contamination.
- 4.6 Correct rubber attachment shall be ensured. This attachment shall consider the occurring shock absorber forces and angular rotation. The rubber compound selected shall have sufficient chemical and atmospheric resistance to provide a life comparable with that of the damper.
- 4.7 The dampers shall be suitable for being delivered, stored and operated under tropical conditions of high temperature, high humidity, heavy rainfall and fungus-conductive environment.
- 4.8 The manufacture and supply of the dampers shall be strictly in conformance with the relevant drawings.
- 4.9 Test parameters and procedures to be followed by the manufacturer shall be put up to purchaser and prior approval to be obtained.

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SHEET 6 OF 7	SPECIFICATION NO. CLW/MS/3/009	ALT. '3'
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5. **Colouring:**

Colour by which dampers to be painted shall be nominated by the manufacturer with the prior approval of purchaser.

6. **Marking:**

Each damper shall have clear readable marking on its body. The marking shall be as follows:

- Manufacturer's name/ Trade mark.
- Designation and type of damper with unique model number.
- Year & month of manufacture.
- Capacity.

7. **Documents to be supplied:**

7.1 Following to be supplied along with offer:

- Endurance testing for one million cycles for prototype samples test plan to be submitted by the firm.
- Force velocity characteristics curve – to be indicated by the firm and its testing method and equipment.
- Maximum force/moment (capacity)
  - Compression
  - Tension
  - Bending moment
  - Torsional moment – method of testing and equipment to be indicated.
- Dimensional checking:  
Maximum force and bending moment, which may be absorbed by the damper without showing any sign of failure.

7.2 Minimum ten (10) copies of the maintenance manual shall be supplied incorporating the following information along with the supply of materials:

- Repairing procedure of the dampers.
- List of spare parts which may be required for its repair.
- Parameters of removed parts to be checked.
- Condemnation and permitted dimensions of the loose parts.
- Drg./design of special tooling, if any required for maintenance purpose including testing equipment for examining fitness of repaired/overhauled dampers.

8. **Inspection & Acceptance:**

8.1 Prototype inspection shall consist of endurance test for one million cycles apart from all routine examinations.

8.2 Routine examination:-

- Visual examination.
- Dimensional checking.
- Maximum force (capacity) test.
- Maximum bending and torsional moments tests.
- Force velocity characteristics test.

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SHEET 7 OF 7	SPECIFICATION NO. CLW/MS/3/009	ALT. '3'
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- 8.3 Firms should indicate prototype and routine test plans and equipments available at their end for this purpose along with their offer.
- 8.4 The inspecting authority of the purchaser shall have free access to the works of the manufacturer at all times during the manufacture of dampers. He shall be free to inspect the manufacture at any stage, to reject any material or items which do not conform to the terms of this specification.
- 8.5 Dampers @10% or part of it from the lot shall be selected for carrying out test/inspection approved for test parameters. Any deviation other than the specified values shall not be accepted.
- 8.6 Overall dimensions shall conform to the dimensions of the relevant drawing.
- 8.7 The inspector shall affix his stamp/seal on each assembled damper after inspection as a token of the material passed by him.

**9. GUARANTEE:**

- 9.1 The manufacturer/ supplier shall have guarantee for dampers and its satisfactory performance for the period of five (5) years from putting into service or six (6) years from the installation whichever is earlier. All aspects of workmanship and material will be covered with this guarantee. The dampers which fail during the guarantee period shall be replaced by the supplier free of cost.
- 9.2 The manufacturer shall nominate expected minimum reliability in terms of operating hours or distance travelled between failures. The reduction or increase of the damping force by more than 30% will be considered as a failure.
- 9.3 'Reliability' is defined as the mean kilometers between serious engineering faults. Such as engineering fault occurs when a defect of an engineering nature develops which is of sufficient importance to require the locomotive to be repaired before return to revenue service.

**10. PACKING AND DELIVERY:**

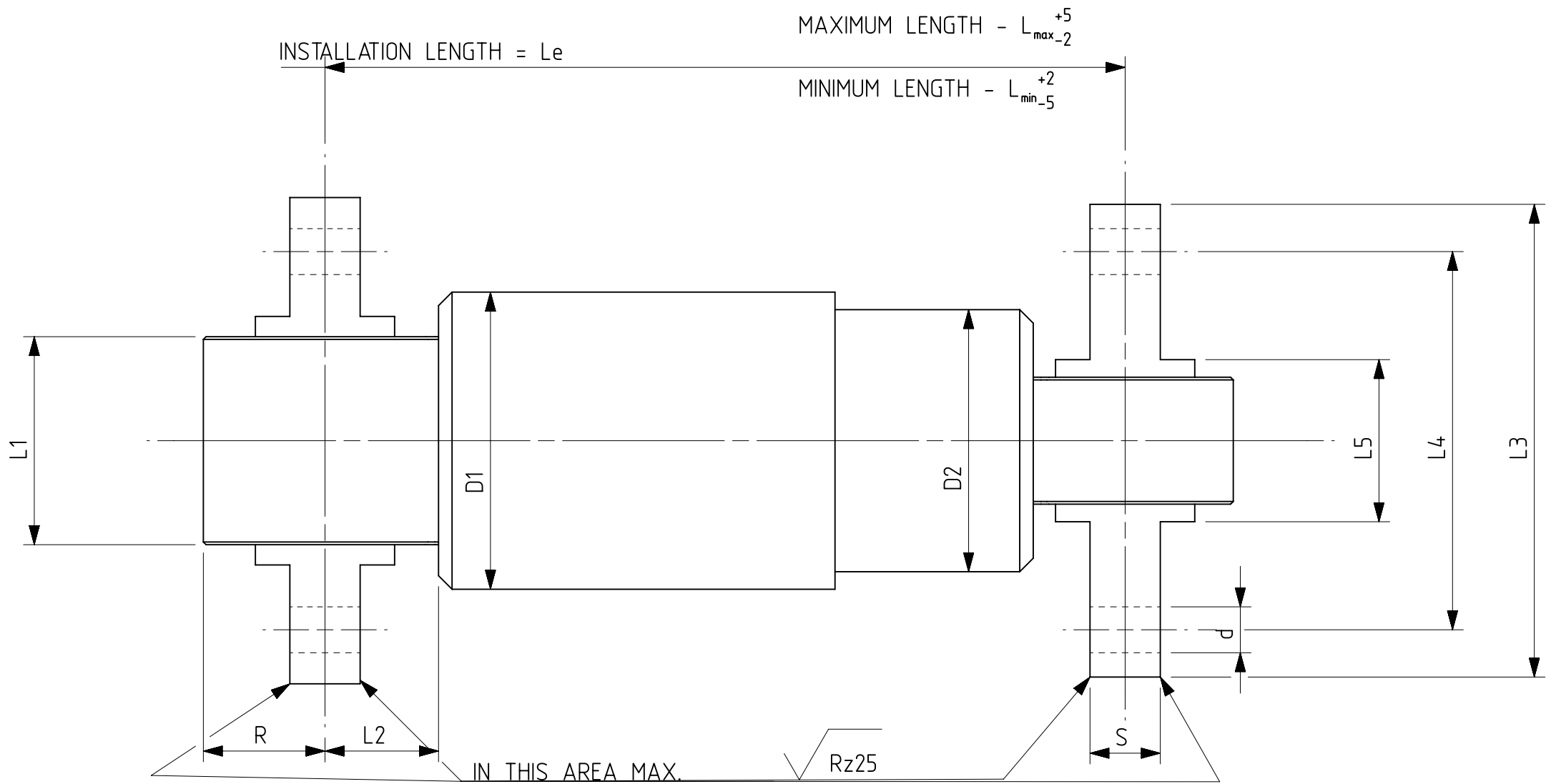
The dampers shall be prepared and pack in such a manner as will properly protect them from damage or deterioration during transit and storage prior to installation. The storage period of at least 24 months shall be considered.

**11. REFERENCE:**

- 11.1 The Dampers used by M/s ABB transportation for WAG-9 class (Co-Co) electric locomotives is supplied by  
M/s Koni BV  
P.O Box 1014 3260AA  
Langeweg Holland QUD – Beyerland
- 11.2 Type – ABB Drg. No. IB016-00372

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<b>SSE/Drg. (MECH.)</b>	<b>SSE/Drg. (MECH.)</b>	<b>DY. CEE/D-I</b>





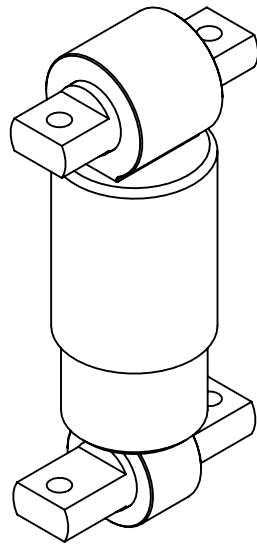
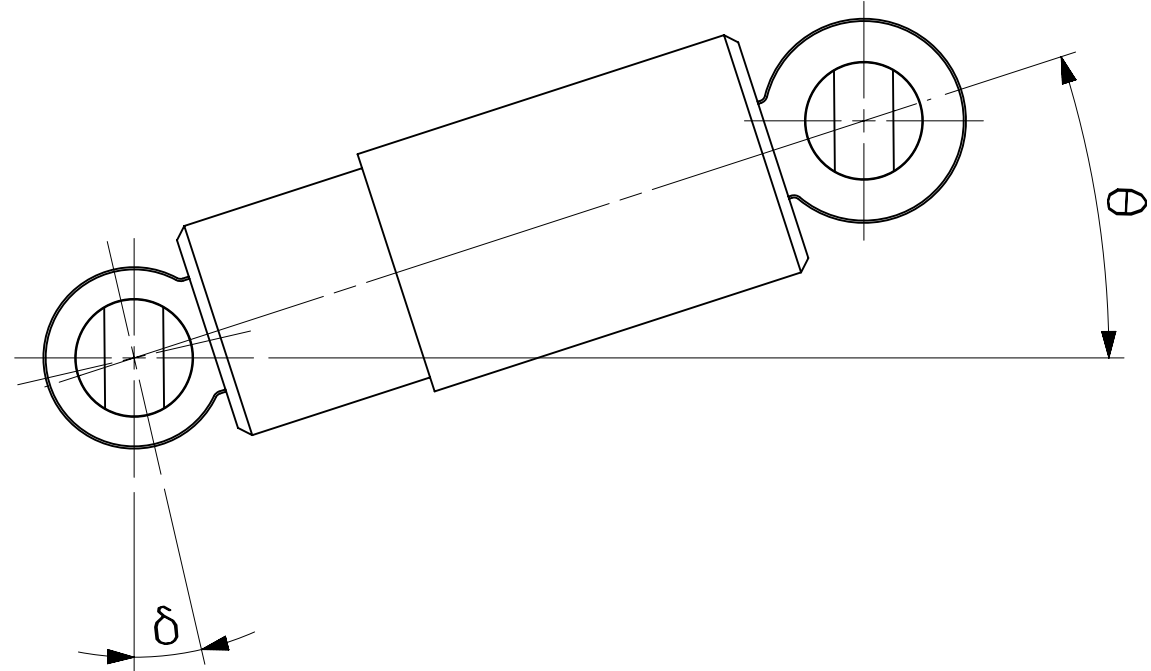
- $\alpha/2$

TWISTING ANGLE
- $\beta/2$

CARDARIC ANGLE
- $\theta$

ORIENTATION ANGLE TOWARDS HORIZONTAL LINE
- $\delta$

MOUNTING ANGLE BOLT



	C&D NO.	QTY./LOCO	REF. NO.	MEASURES (mm)														ANGULAR MOVEMENT (°)			MOUNTING ANGLE (°)		ARTICLE No	REMARKS
				Le	Lmax.	Lmin.	Lstroke	Lfix	D1	D2	L1	L2	R	L3	L4	L5	S	d	/2	$\alpha$	$\beta$ /2	$\theta$		
AXLE DAMPER	T222/012	8	1	338	386	296	90	195 206	110 102	97 89	77 47	34 42	40 45	175 180	140	92 60	26	17	10	1	72	13	1209-01.215-014-001	IR CO'CO' AND IR BO' BO' AXLE DAMPER ARE IDENTICAL. PULLING STOP FORCE MAX. 50 KN.
VERTICAL DAMPER (SECONDARY)	T222/014	4	2	430	520	370	150	197 203	110 120	97 108	50 47	40	43.5 45	175 180	140	92 60	20 26	17	15	9	90	0	1209-01.215-014-002	
HORIZONTAL DAMPER (SECONDARY)	T222/013	4	3	574	690	465	225	190 201	110 120	97 108	77 47	34 61.5	40 45	175 180	140	92 60	20 26	17	7	8	5	5	1209-01.215-014-003	
YAW DAMPER	T222/015	4	4	700	820	605	215	370	120	110	65 76	60 133	55 60	172	130	80	28	21	7	11	5	5	1209-01.215-014-004	

NOTE:-

- 1

THIS DRG. IS TO BE WORKED WITH IN CONJUNCTION WITH SPECIFICATION No. CLWMS/3/009 FOR WAG-9 & WAG-9H LOCO
- 2

TOLERANCE ON THE DAMPING FORCE (COMPRESSION & TENSION) SHALL BE AS SPECIFIED BELOW AT DAMPER TEMPERATURES OF 16° TO 22°C
- 2

a) NEW OR RECONDITIONED DAMPERS : ±15%
- 2

b) WORN DAMPERS : ±25%
- 2

THIS DRAWING TO BE WORKED IN CONJUNCTION WITH SPECIFICATION NO. CLWMS/SPEC/ELDO - BOGIE /002. NOVEMBER 2013 FOR WAP-7 LOCOMOTIVES.

4. ALL DIMENSIONS ARE IN mm
5. NEXT LEVEL ASSEMBLY DRG. NO. 1209-01.115-001 REF-11,12,13,14
6. USED FOR LOCO-WAG-9,WAG-9HC&WAP-7
7. UNSPECIFIED TOLERANCE IN THE DIMENSIONS MENTIONED AT DRAWINGS TO BE FOLLOWED AS PER IS:2102(PART 1):1993-TOLERANCE CLASS-MEDIUM.

	DAMPER ADJUSTMENT									
	AXLE DAMPER		VERTICAL DAMPER (SECONDARY)		HORIZONTAL DAMPER (SECONDARY)		YAW DAMPER			
TEST SPEED (m/s)	0.10	0.30	0.10	0.30	0.10	0.30	0.01	0.02	0.05	0.10
TEST STRAKE (mm)	50	50	50	50	50	50				
TEST FREQUENCY (Hz)										
DAMPING FORCE (N) (+/-)	5000	9000	11000	20000	7000	14000	3000			

धातु-वेल्डन चिन्ह		अनिर्दिष्ट सद्य - सीमा मा. मा. : 2102 / अ. मा. सं. : 2768												TOL. CLS.	
मा. मा. : 813 / अ. मा. सं. :2553		UNSPECIFIED TOLERANCE TO IS : 2102 / ISO : 2768													
WELDING SYMBOLS TO IS:813 / ISO:2553		पदांक	सं1	सं2	सं3	सं4	सं5	सं6	सं7	सं8	सं9	सं10	सं11	सं12	
		GRADE NO.	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	
		Rz	0.16-6.3	0.5-6.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250	
		Ra	μm	0.075	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
		चिन्ह	XXXX		XXXX		XXXX		XXXX		XXXX		XXXX		
		SYMBOL													

2	DY CEE / D-II	NOTE 3 ADDED FOR WAP-7. NOTE 1 MODIFIED. WAG-9H & WAP-7MENTIONED IN USED FOR LOCO COLUMN.	12-12-13
1	DY.CME/D&D	NOTE 2 ADDED	17-06-03
परिवर्तन संख्या	प्राधिकार	वर्णन	DESCRIPTION
ALT. NO.	AUTHY		

संदर्भ / REF.	IB016-00372	ALT- 2
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अधिकृत DGN		चिततरंजन रेलइंजन कारखाना CHITTARANJAN LOCOMOTIVE WORKS, INDIA	
जोधा व.अ.अ. CHD SSE	DEBAB RATA DHAR	पदार्थ MAIL	प्रति भार कि. घा. WT. EACH IN KG
समीक्षित स.वि.अ. / व.वि.अ. REVIEWED AEE / SEE		विशिष्ट SPECN	
अनुमोदित चक्रवि.अ. APPROVED DYCEE	RAVI YADA V	वर्णन	
दिनांक DATE	12-01-2023	DESCRIPTION	
दृष्टिक अनुपात SCALE	1:1	आरेखण संख्या	1209-01.215-014
परिवर्तन संख्या ALTERATION NO.	2	पर्ण SHEET	1 OF 1
परिवर्तन संख्या ALTERATION NO.	2	पर्ण SHEET	1 OF 1
परिवर्तन संख्या ALTERATION NO.	2	पर्ण SHEET	1 OF 1

3048315/2026/O/o Dy CEE/LOCO/GRC/SER

1 of 8

JUNE 2021)

एस.टी.आर.सं./STR No.  
CLW/2020/ELDO/M/STR/061

पुनरावृत्ति/Rev 0

**SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURING AND SUPPLY OF  
"DAMPERS FOR 3-PHASE ELECTRIC LOCOMOTIVES"**

जारी कर्ता

ISSUED BY

विद्युत इंजन अभिकल्प कार्यालय

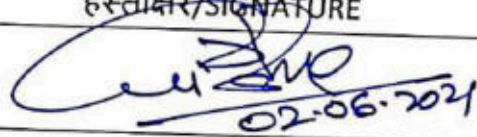
चिरेका/चित्तरंजन

ELECTRIC LOCO DESIGN OFFICE




CHITTARANJAN LOCOMOTIVE WORKS

CHITTARANJAN-713331

WEST BENGAL

अनुमोदन कर्ता/APPROVED BY	हस्ताक्षर/SIGNATURE
प्रधान.मु.वि.अभि./PCEE	 02-06-2021

सिफारिश कर्ता/RECOMMENDED BY	हस्ताक्षर/SIGNATURE
मु. वि. अभि. / डी एंड डी/ CEE/D&D	अभिजित

बनाया गया (के द्वारा)/Prepared By	जांचा गया (के द्वारा)/Checked By	जारी किया गया /ISSUED BY
JE/DRG. 	SEE/Design 	 DY.CEE/D-I

Signature Not Verified

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GURUDAS MANDAL  
Date: 2022.10.10  
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Location: New Delhi

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**SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURE AND SUPPLY OF DAMPERS FOR THREE PHASE ELECTRIC LOCOMOTIVES:-**

**1.0 NAME OF THE ITEM:**

DAMPERS for 3-Phase Electric Locomotives.

**2.0 APPLICATION:**

Used in 3-Phase Electric Locomotives in Indian Railways. The items are to be manufactured as per relevant drawings and specifications.

**3.0 SCOPE:**

The Schedule of Technical Requirements (STR) is issued to serve as a guide to manufactures (called the "firm" hereafter) and should be read in conjunction with the relevant drawings and specifications with latest Revisions / Alterations. The technical requirements are meant to serve as guidelines only and are not exhaustive. The firm should satisfy themselves having complied with the requirements of drawings and STR. List of relevant Drawings / Specifications is listed as per Annexure –I.

Wherever lacking, existing CLW approved sources must also upgrade their facilities to fulfill the requirements of this STR within a period of one year from date of issue of this STR.

**4.0 GENERAL REQUIREMENTS:**

- 4.1 The firm should have currently valid ISO-9000 certification issued by an approved agency of the International Accreditation Forum (IAF) with the activity desired clearly mentioned in the scope of certification.
- 4.2 A system of regular submission of rejection details of material giving rejection rate, cause of rejection, corrective action taken etc. on quarterly basis should be followed by firm.
- 4.3 The firm must have system of documentation in respect of rejection at customer end, warranty replacement and failure of item supplied by them during service.
- 4.4 The firm shall have all latest relevant Standards like IS, DIN, BS etc. pertaining to product specification.
- 4.5 The firm shall have system of recording the plant, machinery and control equipments remaining out of service, nature of repairs done etc.
- 4.6 The testing & measuring equipments shall be duly calibrated and the validity of calibration should be current and verified by physically checking the calibration certificate issued by Calibration Agency from whom it was calibrated. Calibration shall be done by NABL accredited labs whose accreditation is valid on the date of calibration.

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- 4.7 Firm should have adequately trained personnel and service after sales network.
- 4.8 QAP to be made as per the online format of CLW. The format can be obtained from [http://clw.ggn.rcil.gov.in/help\\_vendor.htm](http://clw.ggn.rcil.gov.in/help_vendor.htm).
- 4.9 Whenever there is any change with respect to approved QAP, the same shall be promptly submitted to CLW for approval.

#### 5.0 INCOMING MATERIAL:

- 5.0.1 A complete bill of material indicating all input material items required for manufacturing of the products, governing specification and their sources of supplies as approved by the firm should be furnished.
- 5.0.2 Raw material shall be procured from CLW/RDSO approved sources wherever applicable or from reputed suppliers if no CLW/RDSO source is specified. Documentary proof of purchase and test certificate of each component shall be maintained and produced.
- 5.0.3 Record of each sub-supplier clearly showing the quantity purchased and rejected as well as cases of late delivery, if any shall be kept.
- 5.0.4 Incoming raw material shall be 100% inspected by Quality Control Department of the firm for any defect and deviation. The test results of incoming raw material with references to test certificate issued by the supplier and the results of internal tests carried out by the firm for verification may be submitted as part of QAP.

#### 5.1 PROCESS OF MANUFACTURING:

- 5.1.1 Complete process flow chart covering all steps of process of manufacture for an individual product (or for a family of product if the process is same), including the process flow of outsourced activities along with its integration with main process, shall be clearly enlisted as part of QAP.
- 5.1.2 The following details of machine used for all the steps of machining operations should be included.
- Make, model and commissioning date of the machine.
  - Accuracy.
  - Details of machining operations.
- 5.1.3 Machining process should be such that all critical dimensions are final. Vague language like available or will install is not acceptable.

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5.1.4 Details of jigs and fixtures used during manufacture should be furnished along with the manufacturing process wherever used.

5.1.5 List of typical Machinery & Plant, testing and measuring instruments required for manufacture is mentioned in Annexure – II. The list is for general guidance only and manufacturing operation shall be submitted and got approved by the firm as a part of QAP.

## 5.2 INSPECTION AND TESTING PLAN:

5.2.1 Testing setup should be available in the firm's own premises capable of testing the equipments as specified in the relevant technical specification.

5.2.2 Complete Inspection and Testing Chart covering all steps of process of manufacture for an individual product including final inspection should be clearly enlisted as part of QAP.

5.2.3 The following details of Testing/measuring instruments/equipments/tools/jigs/fixtures used for all the steps of measurement and testing operations should be included:

- Make and Model of the equipment
- Name of the manufacturer
- Accuracy
- Capacity or Range
- Date of Calibration
- Due date of calibration
- Agency of Calibration

Vague language like available or will install is not acceptable.

5.2.4 The accuracy and capacity of the testing and measuring equipments shall be adequate to meet the requirements of the specification and drawing.

5.2.5 Stage inspection detailing inspection procedure, inspection parameters and method of testing / test procedure including sample sizes for destructive and non-destructive testing. Record of test results of stage inspection should be available and furnished.

5.2.6 List of typical Testing and measuring instruments required for manufacture is mentioned in Annexure – III. The list is for general guidance only. However, the specific Testing & measuring instruments, gauges used by the firm will also form part of QAP and shall be submitted.

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## ANNEXURE – I

LIST OF DRAWINGS, SPECIFICATIONS AND STANDARDS

Sl. No.	Item	Drawing/Specification No.
1.	DAMPERS for WAP-7	CLW spec No. CLW/MS/3/SPEC/ELDO-Bogie/002 Drawing No. 1209-01.215-014
2.	DAMPERS for WAG-9	CLW spec No. CLW/MS/3/009 Drawing No. 1209-01.215-014
3.	DAMPERS for WAP-5	CLW spec No. CLW/MS/10/005 Drawing No. 1210-01.215-014

- All Specification of Raw Materials and Testing should be as per latest version.

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## ANNEXURE – II

LIST OF MACHINERY AND PLANT

Sl. No.	Name of Machinery & Plant	Capacity/ Rating	Purpose	Essential/ Optional
1.	Forging Machine	Standard	For manufacture of spindle etc.	Optional **
2.	Grinding Machine	Standard	For grinding of spindle.	Essential
3.	CNC Horizontal Machining Center	Standard	For machining bore of spindle, valves etc.	Essential
4.	Hardening Unit	Standard	For Hardening of spindle	Optional **
5.	Zn Plating unit	Standard	For Zn plating several parts	Optional **
6.	Welding machine	Standard	For welding of easing parts.	Essential
7.	Hydraulic/ Mechanical Press Machine	6 to 10 ton	For bearing press.	Essential
8.	Pneumatic press Moulding machine	Standard	For all sealing and rubber items.	Optional **
9.	Modern fitting table with Torqueing unit	Standard	For fitment of all parts.	Essential
10.	Vertical Machining center	Standard	For Spindle Boring	Essential
11.	Lapping Machine	Standard	For lapping the spindle bore.	Essential
12.	Turning Center	Standard	For turning pin, spindle, cylinder.	Essential
13.	Drilling and Tapping Machine	Standard	For Drilling and tapping of different parts.	Essential
14.	Milling Machine	Standard	For Milling and Slotting of different parts.	Essential
15.	Thread Milling Machine	Standard	For threading spindle and cover.	Optional **
16.	Power saw machine	Standard	For cutting of shaft, pipe etc.	Essential
17.	Painting unit with measuring instruments	Standard	For painting of damper	Essential
18.	Material handling arrangement	2-ton EOT crane /Trolley	For assembly of Damper	Essential
19.	Vulcanizing unit for non-metallic parts /Outsourcing	Standard	For manufacturing 'O' rings, seal spheribloc etc.	Optional **
20.	Spring manufacturing unit	Standard	For production of spring	Optional **

\*\* Optional activity or Machinery & Plant facility may be outsourced. However, the sub-vendor is also to be assessed.

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LIST OF TESTING EQUIPMENTS

ANNEXURE – III

Sl. No.	Name of Measuring & Testing	Capacity / Rating	Purpose	Essential/ Optional
1.	Computerized Damping testing Machine	120mm stroke (Max) 50KN load (Max)	For testing of force-velocity curve & sudden shock	Essential
2.	Rockwell hardness tester	Standard	Hardness testing of different parts of Damper	Essential
3.	Spring testing Machine	Standard	Testing of Spring	Essential
4.	Coating Thick gauge (DFT meter)	Standard	Measuring Coating thickness of paint	Essential
5.	Tensile testing machine	Standard	Checking of Tensile Strength of Damper	Essential
6.	Leakage testing arrangement of Pipe	Standard	For leakage of Tube before manufacturing	Essential
7.	Endurance testing Machine	Standard	For Endurance of minimum 1 Million Cycles	Essential
8.	Salt Spray testing arrangement	Standard	To check surface durability against Rusting	Optional **
9.	Hydraulic Test Arrangement	Standard	To check stroke length of Damper at different velocities	Essential
10.	Stiffness Test	Standard	To check Torsional and Cardanic Stiffness	Essential
11.	Vibration Testing Arrangement	Standard	To check the amplitude of bogie movements	Optional **

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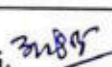

**LIST OF MEASURING EQUIPMENTS**

Sl. No.	Name of Measuring & Testing	Capacity / Rating	Purpose	Essential/ Optional *
1.	Vernier	1 to 2 feet	For measuring different dimensions	Essential
2.	Bore gauge	Standard	For measuring different bore.	Essential
3.	Angular Measuring Device	Standard	Testing of Spring	Essential
4.	Micrometer	Standard	Measuring Coating thickness of paint	Essential
5.	Surface Roughness Tester	Standard	For Checking Surface Roughness	Essential
6.	Profile Projector	Standard	For Checking Rubber Seals	Essential

\* Optional measuring & testing facility may be outsourced but outsourced firm should be Govt. Approved / RDSO Approved Lab.

**QUALITY REQUIREMENTS**

1. Input Raw Material-Chemical/Metallurgical test is to be done & Source of raw material to be specified.
2. Stage -Wise inspection are to be done & Check List for the same is to be made.
3. Final Inspection is to be done and Check List for the same is to be made.

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