



भारत सरकार रेल मन्त्रालय
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

**TECHNICAL SPECIFICATION FOR HYDRAULIC DAMPERS
OF
HIGH HORSE POWER & WDM3D (WITH EQUALISER-LESS BOGIE)
LOCOMOTIVES**

**No. MP.0.40.99.03
(Revision - 05)**

March' 2021

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TECHNICAL REQUIREMENTS FOR HYDRAULIC DAMPERS OF HIGH HORSE POWER & WDM3D (WITH EQUALISER-LESS BOGIE) LOCOMOTIVES

1. SCOPE

This document covers the technical requirements for hydraulic dampers to RDSO Drawing No.SK.VL-484 (Revision Latest) on for High Horse Power locomotives, and RDSO Drawing No.SK.VL-387 (Revision Latest) for WDM3D (with equalizer less bogie) locomotives.

2. DEVIATION(s)

If deviations from original design, dimensions, etc. are desired by the tenderer, specific proposals with reasons shall be submitted to the purchaser. Commencement of manufacture shall not be done till the purchaser grants clear authorization for acceptance of the deviation(s).

3. MINIMUM GENERAL REQUIREMENTS OF THE FIRM

The firm shall be met minimum testing & manufacturing infrastructure to RDSO STR No. MP.STR.VL-01.01.16 (Revision- 02 or Latest).

4. TECHNICAL REQUIREMENTS

4.1 Dimensions & Damping Capacities

The Hydraulic Damper shall conform to the latest version of the concerned RDSO Drawing including dimensions, damping capacities at room temperature condition. The damper shall be easy to overhaul and adjustable as per requirements.

4.2 Operating environmental conditions:

4.2.1 The damper shall be resistant to the following operating environmental conditions to which it may be exposed during service:

- Projection of ballast
- Exposure to oil or petroleum
- Exposure to organic waste
- Wind, rain, snow, coal dust, sand storms
- Sand, brake and ferric oxide dust (abrasion of wheels, brake blocks and tracks)
- Saline spray
- Washing plant agent (both acids and alkalis)
- 100% humidity

4.2.2 The damper shall be required to function safely at operating temperature in the range from -10°C to 70°C. After operating in these extremes, the damper shall be required to fully recover its functionality. Furthermore, the damper shall not display any fluid leaks or any sign of failure or cracking in the damper components.

Salt spray test (Saline spray) to be done as per ISO-9227/ASTM B-117 and remaining environmental conditions shall be monitored in the field.

4.3 Surface protection

All the parts of the damper in contact with the ambient air shall be protected from corrosion. The protection shall be ensured either by the nature of materials used or by suitable painting / surface treatments.

Damper material shall be compatible with following paints:

Primer: High solid epoxy primers, High solid alkyd primers

Paint: Aliphatic polyurethane enamels or two part epoxy paint.

4.4 Strength test

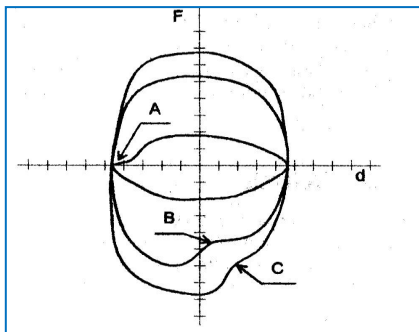
The construction of Hydraulic Damper shall be such as to withstand the static compressive axial load of 3 tonnes (when fully closed) and a tensile load of 3 tonnes (when fully extended) without any failure, damage or permanent change in damping characteristic at nominal velocity and Stroke shall be between

12 to 15 mm or reduction in service interval. All welded joints of the Hydraulic Damper shall be free from welding defects and shall be sufficiently strong to withstand the loads intended.

4.5 Reliability

Reliability of the component shall meet the following locomotive reliability goals. Failure per locomotive year needing warranty replacement shall also not exceed 0.010. Failure per locomotive year causing line failure and unscheduled replacement shall not exceed 0.007. Failure means leakage of oil, deterioration in damper performance by 30% or more, breakage of any part of damper.

4.6 Force - Displacement Characteristic



The shape of the Force - Displacement curve or Hysteresis Cycle (see above figure), shall be regular and symmetrical, and in particular shall be free from:

- flex as shown in above figure with letter A, B and C
- Local vibration phenomena
- Jumps and sudden change in the shape of the curve

4.7 Overall Damping Characteristics

The overall damping forces on the compression and extension strokes of the damper, taken separately, shall be as specified in the drawing(s).

The Hydraulic Damper shall be assembled in such a manner that the damping shall be uniform throughout the stroke i.e. the damping characteristics shall not have any sudden deviation or changes throughout the stroke. Damper forces during the extension and compression stroke shall be symmetrical.

The stipulated tolerances and requirements shall apply at all points within the required working stroke of the Hydraulic Damper.

4.8 Twisting and Cardanic angles and Bushing Radial stiffness of Spheri bloc:

The twisting and cardanic angles of damper shall be as per specified in the drawings. Bushing radial stiffness shall be more than 20 KN/mm.

The test is to be carried out as per procedure given in Annexure-I

4.9 Damper Oil

The details of damper oil including type, viscosity and amount of the damper oil shall be provided by the supplier.

4.10 Performance characteristics & Maintainability

The dampers shall be of robust construction and shall be re-buildable type. It shall be possible to recondition and recalibrate it to "as new" conditions. It shall have degressive or blow off feature to limit the maximum forces created by severe track conditions, where piston speed may reach 0.30 m/sec. The force rate shall be linear only up to a certain limit. Maximum force even at higher speeds shall not be more than 25% of the force specified as given in relevant drawing at 0.10m/sec.

4.11 Dust Cover and Casing Tube

The joint shall be proven strong enough between piston eye and dust cover shall be done to prevent breakage at the joint. Casing tubes shall be made of steel by accurate and precision welding process or

of seamless tube and similarly protection cover also be sufficiently strong and similarly protection cover shall also be strong to increase the life of dampers.

4.12 Positive Locking of Piston and Piston Rod

Due to higher forces encountered at higher operating speeds, there is a possibility that piston can rotate and free itself from piston rod. Therefore, proper locking of piston with piston rod shall be ensured by appropriate method.

4.13 Sealing Arrangement

The damper shall be protected against ingress of dust along with piston rod by using low friction multiple sealing arrangement with better wiping properties, provision of additional dust lip etc.

4.14 Internal Design

It shall have all the constructional features to reduce friction, provide protection against dust and ensure long life. The internal mechanism shall have provision so that in any odd situation, the force of oil goes beyond a prescribed limit; the system shall take action automatically to prevent the failure of the damping system. The valve system shall be noise free and there shall also be arrangement to ensure absence of metal to metal contact in the piston & guide.

4.15 Surface finish of cylinder & piston rod:

A high degree of surface finish of the order of 0.1 to 0.3 μm Ra for piston rod shall be maintained during manufacture.

4.16 Vibrational characteristic

The dampers shall be able to withstand the vibration levels of the intended application in primary / secondary suspension stages of locomotive bogie. Particularly yaw damper shall be specially designed to control small amplitude sinusoidal bogie rotational movements.

Damper shall function under exceptional accelerations for 5 hrs as per IEC: 61373):

Locations	Primary vertical	Secondary Lateral/yaw
Vertical	+/- 50 g	+/- 6 g
Lateral	+/- 5g	+/- 3g
Longitudinal	+/- 5g	+/- 5g

Vibrational Test of Hydraulic Damper shall be done during the prototype inspection or when a new design is introduced or when there are any significant design alteration/quality issues.

4.17 Leakage

The damper shall operate without excessive loss of oil throughout its operating life. Oil loss shall be considered excessive when there is visible evidence of accumulation of oil in the form of drip on the body of the damper.

4.18 Salt spray test

Surface treatment must have durability against minimum 240 hours salt spray test as per ISO 9227/ASTM B-117. The result of test for degree of rusting shall be conforming to Ri 1 as per ISO 4628-3 and adhesion of paint shall be conforming to 0 until 1 (any squares may not come off) as per ISO 2409.

Salt spray test shall be done during the prototype inspection or when a new design is introduced or when there are any significant design alteration/quality issues.

5. ENDURANCE TESTING OF HYDRAULIC DAMPERS

Endurance Testing of Hydraulic Damper shall be done during the initial approval of a supplier as approved source for supply of Hydraulic Dampers to Railways/ PUs, or when a new design is introduced or when there is any significant design alteration.

Endurance Testing of Hydraulic Dampers shall be undertaken as per the “Endurance Testing Procedure” enclosed in the **Annexure II**.

6. GUARANTEE / WARRANTY:

The manufacturer shall guarantee for service life of dampers i.e. 10, 00,000km or 4 years from the date of commissioning, whichever is earlier, even in the severest track and running condition as prevalent on Indian Railway system. Guarantee/Warranty shall be given as per Annexure-Annexure III.

7. SAMPLING

Dimensional check as per drawing – 10 Nos. from every Batch of 100 no. or 5 no. per batch if less than 100 Nos.

Physical testing – 5 nos. from every Batch of 100 no. or 3 no. per batch if less than 100 Nos.

8. DELIVERABLES

Manufacturer shall supply maintenance/instruction manuals, indicating dimension of critical items and its permissible wear, specification, quantity of oil, sectional features etc. to the user Railways.

9. MARKING

Marking identification plate shall be of ‘Aluminum’ and shall be fixed by ‘Aluminum’ rivets. The Hydraulic Dampers shall be marked in 10 mm height letters by punch mark /engraving and minimum depth of 0.25 mm on outer surface at bottom side of the dust cover on the damper with Manufacturer’s name or code, Serial No., Type of Damper, Rated Capacity, Month & Year of manufacture, “IR” & RDSO / EMD Drawing No.

10. PACKING

The manufacturer shall ensure that Hydraulic Dampers are suitably packed in wooden box/ Cartons with separators for each damper to prevent ingress of foreign matter and damage during handling and storage.

11. OVERHAULING INTERVAL

The dampers shall be overhauled after 4 years.

12. FIELD TRIAL

12.1 Qualifying Quantity and Qualifying period for approval as a ‘Developmental vendor’ shall be ‘03 loco sets’ and ‘One Year’ respectively.

12.2 Two numbers of prototype dampers fitted on trial shall be collected from the field after one year of service and examined for physical deterioration. These dampers shall be tested in the firm premises for conformance to the performance characteristics. The deterioration in the performance shall not be more than 25 % of the nominal value.

12.3 Field performance shall be monitored as per format at Annexure-IV.

12.4 After successful completion of field trial approval may be considered.

13. STORAGE

The hydraulic damper shall be stored in a cool and dry place.

14. INSPECTION

Inspection shall be carried out by the Inspecting Agency specified in the purchase order.

Test plan for the inspection of the dampers is attached as **Annexure-V**.

15. PREFERENCE TO MAKE IN INDIA

The government of India policy on ‘Make in India’ shall apply.

16. DATE OF ENFORCEMENT

For all the firms, the time frame for implementation of revised requirement/ facilities in the STR shall be with effect from 01.05.2021.

Annexure I

TESTING PROCEDURE OF CARDANIC, TWISTING ANGLE AND BUSHING RADIAL STIFFNESS OF HYDRAULIC DAMPERS FOR HIGH HORSE POWER & WDM3D (WITH EQUALISER-LESS BOGIE) LOCOMOTIVES

This test shall be conducted as per test set up is to be arranged as per figure 1 & 2. Clamp the attachment trunnion by bolting through the holes in trunnion. Alternatively clamp the outer shell of silent block and rotate the trunnion. Rotate the inner part with reference to the outer shell, or rotate the outer shell with respect to inner trunnion, starting at no preload up to required angle as per drawing. The process shall be done three times. During fourth cycle, rotate the silent block up to required angle & release the force. The silent block should not exhibit any physical damage or loss of functionality. There should be no drop of radial stiffness beyond 20kN. The similar process shall be followed for the Radial stiffness.

Test Set Up

Torsional/Twisting angle

Hold Trunnion and rotate outershell according to Torsional/Twisting angle of the drawing. Alternativley rotate trunnion and hold outershell.

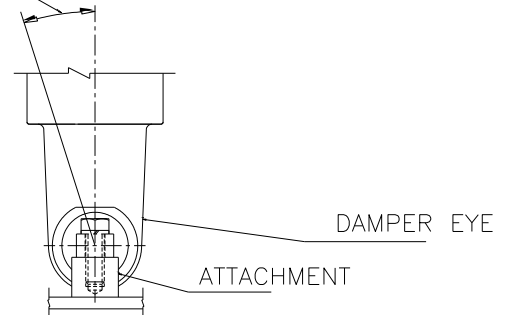


FIGURE-1

Conical/Cardanic angle

Hold Trunnion and rotate outershell according to Conical/Cardanic angle of the drawing. Alternativley rotate trunnion and hold outershell.

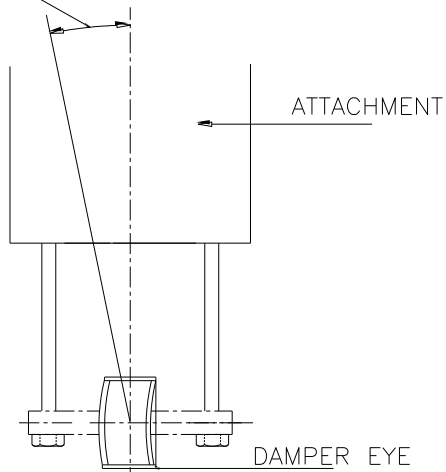


FIGURE-2

ENDURANCE TESTING PROCEDURE FOR HYDRAULIC DAMPERS OF HIGH HORSE POWER & WDM3D (WITH EQUALISER-LESS BOGIE) LOCOMOTIVES

After ascertaining the damping characteristics and strength test, the hydraulic damper samples to be tested shall be subjected to endurance testing as follows:

.1 Procedures

Two of the samples that have passed the tests under Para 4.1 to 4.17 shall be randomly selected for endurance testing.

The hydraulic dampers shall be tested in their normal plane of operation.

The hydraulic damper shall be connected to the testing machine with its flexible end mountings in the same manner as it is done on the locomotives. No additional flexible elements shall be used for this purpose.

The damper shall undergo a life/wear test with at least 10, 00,000 cycles at maximum velocity of 30 cm/sec and stroke between 12 to 15 mm. In addition, a side load shall be applied which shall be equivalent to 50% of torsion angle or conical angle, whichever is greater.

The damper oil temperature shall not exceed 70°C temperature during the endurance test.

After completion of 2 lakh, 4 lakh, 6 lakh and 8 lakh cycles each, the hydraulic damper shall be removed from endurance testing machine and re-tested for overall damping characteristics as mentioned above after it cools to room temperature so that the damping characteristics test is carried out with the hydraulic damper at a temperature between 27° C to 33° C inclusive. Necessary data shall be recorded as per the Proforma enclosed at **Annexure – II A**. A continuous record of endurance testing shall be maintained in the log sheet as per the Proforma placed at **Annexure – II B**.

The cyclic working on endurance testing machine shall preferably be continuous except for short intervals when hydraulic damper is removed for checking their capacity or when circumstances are beyond the control of testing agency e.g. power failures etc.

.2 Criteria for Acceptance

After completion of recommended endurance cycles as above, the sample hydraulic dampers shall be considered to have passed this endurance test if:

- a. No damage or distortion to damper components or oil leakage occurs.
- b. The damping characteristics do not deteriorate beyond $\pm 25\%$ of rated damping capacity upto 6 lakh cycles and $\pm 30\%$ beyond that.

.....

Annexure IIA

DAMPER PERFORMANCE DURING / AFTER ENDURANCE TEST

Product: Vertical hydraulic damper / Lateral damper		Capacity (Kg):
Application: Primary / Secondary		RDSO Drawing No:
Sample No:		
Test Dates:	Start:	
	Completion:	

S.No.	Endurance Test Stage	At Constant Stroke of 12 mm to 15mm			
		At Piston Velocities of			
		10 (cm/sec)		30 (cm/sec)	
		Comp	Expn	Comp	Expn
1.	Initial				
2.	After 2 Lakh Cycles				
3.	After 4 Lakh Cycles				
4.	After 6 Lakh Cycles				
5.	After 8 Lakh Cycles				
6.	After 10 Lakh Cycles				

LOG SHEET FOR ENDURANCE TESTING DATA OF HYDRAULIC DAMPERS

Product: Vertical hydraulic damper / Lateral damper		Capacity (Kg):	
Application: Primary / Secondary		RDSO Drawing No:	
Sample No:			
Test Dates:	Start:		
	Completion:		
Stroke (mm):		Frequency (Hz):	Velocity (cm/sec):

Sl. No.	Date	Started time	Stopped time	Total hours	No. of cycles	Cumulative no. of cycles completed	Temperature of damper (°C)	Remarks

Annexure III

QUALITY ASSURANCE & GUARANTEE CERTIFICATE

(Reference – Clause 6 of Specification No. MP.0.40.99.03)

No. Dated:.....
Railway :
P.O. No. : Dated:.....
Quantity : Consignee:.....
Hydraulic Damper Description:
.....

- i. THIS IS TO CERTIFY THAT THE HYDRAULIC DAMPERS INDICATED IN THIS PURCHASE ORDER HAVE BEEN SUBJECTED TO OUR INSPECTION AND TEST PROCEDURES AND ARE FOUND TO CONFORM TO THE ORDER/DRAWING/SPECIFICATION REQUIREMENTS.
- ii. THE QUALITY CONTROL PROCEDURES IN RESPECT OF THIS SUPPLY ARE IN ACCORDANCE WITH OUR QUALITY MANUAL AND AS PER APPROVED QUALITY ASSURANCE PLAN.
- iii. THIS IS TO CERTIFY THAT EACH HYDRAULIC DAMPER SUPPLIED AGAINST THIS PURCHASE ORDER SHALL FUNCTION SATISFACTORILY FOR THE INTENDED APPLICATION & PERIOD SPECIFIED IN THE RELEVANT SPECIFICATION.

Dated:

Q.C. INCHARGE
(SIGNATURE & SEAL OF THE MANUFACTURER)

Annexure- IV

PROFORMA FOR REPORTING DAMPER PERFORMANCE OF LOCOMOTIVES

Shed Railway Date

S.No.	Loco No. / Type	Damper Details						Life Obtained	Remarks (like Reused after Repairs)	
		Fitment Details			Damper Make	Whether Still in Service (Y/N)	Removal Details			
		Primary / Sec / Yaw	Location (L1-L6 or R1-R6)	Fitment Date			Removal Date			Cause
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										

**TEST PLAN FOR HYDRAULIC DAMPERS
FOR HHP & WDM3D (WITH EQUALISER-LESS BOGIE) LOCOMOTIVES**

1. SCOPE

This inspection plan covers the checks to be carried out by the Authorized Inspecting Agency during inspection of Hydraulic Dampers to RDSO drawing No. SK.VL-484 (Revision Latest) and SK.VL-387(Revision Latest). The finished dimensions shall be subjected to inspection by the Authorized Inspecting Agency as detailed in this Inspection Plan to ascertain the quality of Hydraulic Dampers.

2. CONTRACT DOCUMENTS

Sl.	Description
1.	Purchase order in reference
2.	Drawing(s) referred in purchase order
3.	RDSO's specification No. MP.0.40.99.03 (Rev. 05 or latest)
4.	Approved Quality Assurance Plan of the firm for Hydraulic Dampers

3. GENERAL CHECKS BY THE INSPECTOR

Before commencing the inspection, the Inspector shall ensure that:

- i. Inspection of Dampers shall be carried out by the Inspecting Agency specified in the purchase order.
- ii. The delivery period of the Purchase Order is valid.
- iii. Inspection call is well in advance before D.P. and address of works is same as given in the Vendor directory.
- iv. Valid copies of QAP and relevant drawings as per the P.O are available.
- v. Check the internal inspection record carried out at various stages of manufacture of the product by the firm's quality control department for the product being offered and confirms that the results of the internal inspection records are in order.
- vi. The measuring instruments, gauges, testing facilities, etc are in working order and they are properly calibrated.
- vii. The observations on general checks carried out by inspecting agency shall be recorded in Proforma A.

4. INSPECTION PROCEDURE

4.1 Sample Size

Samples for various tests shall be drawn from each lot of 100 nos. offered for inspection by the representative of Authorized Inspecting Agency. The following tests shall be carried out:

Srl.	Test	Sample Size
1.	Visual Inspection	10 Nos.
2.	Dimensional check	10 Nos.
3.	Physical test: i) Strength test ii) Force – displacement / overall damping characteristic test Cardanic, twisting angle and Radial Stiffness	05 Nos.

If the quantity offered for inspection is less than 100 nos. the sample sizes will be for visual inspection & dimensional check will be done of a sample of 5 nos. and physical test will be done on 3 nos.

Additional Tests for Prototype Approval:

In addition to the tests mentioned above, the following tests shall be carried out at the time of prototype approval, or if there is any quality issues, arising from failures in field or design review or change, as the case may be.

Sl.	Test	Sample Size
1.	Vibration test	01 No.
2.	Endurance test	02 Nos.
3.	Salt Spray test	01 Nos.

The supplier shall be responsible for carrying out all the tests. Check sheet as per enclosed **Proforma-C** shall be prepared. The firm shall have a vibration testing machine with suitable fixtures for vibration testing of dampers. In case, the firm is not having Endurance Testing Machine & Vibration Testing Machine as per requirements of the STR No. MP.STR. VL-01.01.16(Revision Latest), the firm shall take prior approval to carry out the test from 'International Centre for Automotive Technology (ICAT), Manesar' or 'Automotive Research Association of India (ARAI), Pune' or any other government accredited testing laboratory having capability to get the test done as per the requirement of specification(s).

5. Visual, Dimensional Checks & Physical Tests

5.1 Visual Checks & Marking

Samples picked up at random per lot of Hydraulic Dampers offered for inspection shall be subjected to the following visual checks:

- 5.1.1 Hydraulic Dampers shall be checked visually for general workmanship, free from welding defects and surface finish and should be found satisfactory.
- 5.1.2 Marking identification plate shall be of 'Aluminum' and shall be fixed by 'Aluminum' rivets. The Hydraulic Dampers shall be marked in 10 mm height letters by punch mark/engraving and minimum depth of 0.25 mm on outer surface at bottom side of the dust cover on the damper with Manufacturer's name or code, Serial No., Type of Damper, Rated Capacity, Month & Year of manufacture, "IR" & RDSO / EMD Drawing No.

The results of visual check shall be recorded in the check sheet provided with this Inspection Plan.

5.2 Dimensional Checks

Samples picked up at random per lot of Hydraulic Dampers offered for inspection shall be subjected to the dimensional checks. The Hydraulic Dampers shall conform to the dimensions and tolerances as given in relevant drawings.

5.3 Physical test

5.3.1 Damping Force Capacity:

Damping capacity shall be conformed to relevant RDSO drawing no. SK.VL-484 and SK.VL-387.

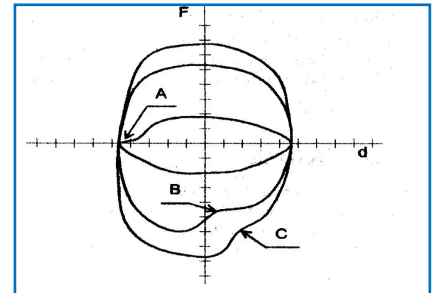
5.3.2 Strength test:

The construction of Hydraulic Damper shall be such as to withstand the static compressive axial load of 3 tonnes (when fully closed) and a tensile load of 3 tonnes (when fully extended) without any failure, damage or permanent change in damping characteristic at nominal velocity and Stroke shall be between 12 to 15 mm or reduction in service interval. All welded joints of the Hydraulic Damper shall be free from welding defects and shall be sufficiently strong to withstand the loads intended.

5.3.3 Forces - Displacement / Overall Damping Characteristics:

The overall damping forces on the compression and extension strokes of the damper shall be within as specified in the drawing(s).

The Hydraulic Damper shall be assembled in such a manner that the damping shall be uniform throughout the stroke i.e. the damping characteristics shall not have any sudden deviation or changes throughout the stroke likes A, B & C shown in the figure.



5.3.4 Cardanic, Twisting angle & Bushing Radial Stiffness Test

Cardanic, Twisting angle & Radial stiffness is to be carried out as per procedure laid down in the annexure-I of specification.

5.3.5 Salt Spray Test:

Salt Spray test shall be done as procedure laid down in ISO 9227/ASTM B-117 for minimum 240 hrs.

5.3.6 Endurance Testing

Endurance testing shall be done as per procedure laid down in the annexure-II of specification.

5.3.7 Vibration Characteristics Test: This test shall be done as per IEC: 61373:

.1 For Primary Vertical damper:

- a. **Test run in vertical axis of primary vertical damper:** The damper is to be mounted on the armature of the vibration machine for testing in vertical axis. The test is to be run at a vibration level of $\pm 50g$ in vertical orientation for 5 hrs.
- b. **Test run in longitudinal axis of primary vertical damper:** Tested Damper in vertical axis is removed from test set up to change the test configuration from vertical to horizontal direction. After the shaker is reconfigured for horizontal test direction, the test object is mounted on the horizontal slip table for testing in longitudinal direction. The test is to be run at a vibration level of $\pm 5g$ in vertical orientation for 5 hrs.
- c. **Test run in longitudinal axis of primary vertical damper:** To change the test configuration for lateral direction, only the test object has to be disconnected from the slip table, rotated by 90° and fixed again the testing in lateral direction and the test is to be run at a vibration level of $\pm 5g$ in vertical orientation for 5 hrs.

.2 For Secondary lateral/Yaw damper:

- a. **Test run in vertical axis of Secondary lateral damper:** The damper is to be mounted on the armature of the vibration machine for testing in vertical axis. The test is to be run at a vibration level of $\pm 6g$ in vertical orientation for 5 hrs.
- b. **Test run in longitudinal axis of Secondary lateral damper:** Tested Damper in vertical axis is removed from test set up to change the test configuration from vertical to horizontal direction. After the shaker is reconfigured for horizontal test direction, the test object is mounted on the horizontal slip table for testing in longitudinal direction. The test is to be run at a vibration level of $\pm 5g$ in vertical orientation for 5 hrs.

- c. **Test run in longitudinal axis of Secondary lateral damper:** To change the test configuration for lateral direction, only the test object has to be disconnected from the slip table, rotated by 90° and fixed again the testing in lateral direction and the test is to be run at a vibration level of $\pm 3g$ in vertical orientation for 5 hrs.

6. ACCEPTANCE CRITERIA

- i. The firm shall not withdraw the material offered for inspection during the course of inspection. Any move by the firm in any way to withdraw the material / interfere / hinder with the inspection, shall render rejection of the entire quantity of material offered for inspection.
- ii. If any sample fails in one or more criteria given in **Para 5** of this Inspection Plan, double the sample size shall be drawn and tested against the criteria in which the failure had occurred. If all the samples of double sampling pass the criteria, the entire quantity shall be accepted except the failed ones.
- iii. Failure of any sample of the double samples will, however, result in rejection of the entire offered quantity.
- iv. In the event of rejection, the entire quantity offered for inspection shall be made un-suitable for Railway application in presence of the inspecting agency.

7. STAMPING

The Hydraulic Dampers, which has been inspected and passed, shall be double stamped by the Inspecting Agency. The entire quantity of Hydraulic Dampers from which the sampling has been taken shall be stamped (single stamp mark) by the Inspecting Agency. Double stamping mark is to identify the samples, which were drawn for inspection for future reference in the event of any dispute.

8. PACKING

The manufacturer shall ensure that Hydraulic Dampers are suitably packed in wooden box/ Cartons with separators for each damper to prevent ingress of foreign matter and damage during handling and storage.

PROFORMA -A

GENERAL CHECK SHEET

Srl.	Description	Observations
1.	Name of Component	
2.	Firm's Name & address	
3.	Date (Period) of Inspection	
4.	Contract Details as per P.O.	
	a) Purchase Order No. & Date	
	b) Order placing Authority	
	c) Specification No.	
	d) Drawing No.	
5.	Quantity on Purchase Order	
6.	Quantity offered for Inspection	
7.	Consignee	
8.	Validity of D.P. of P.O.	
9.	Remarks on internal checks carried out by the firm	
10.	Remarks on calibration of Measuring Instruments & Testing Facilities	

Quality Control Manager of Firm	Authorised Representative of Inspecting Agency

CHECK SHEET FOR TESTING FOR HYDRAULIC DAMPERS

1. Visual Check:

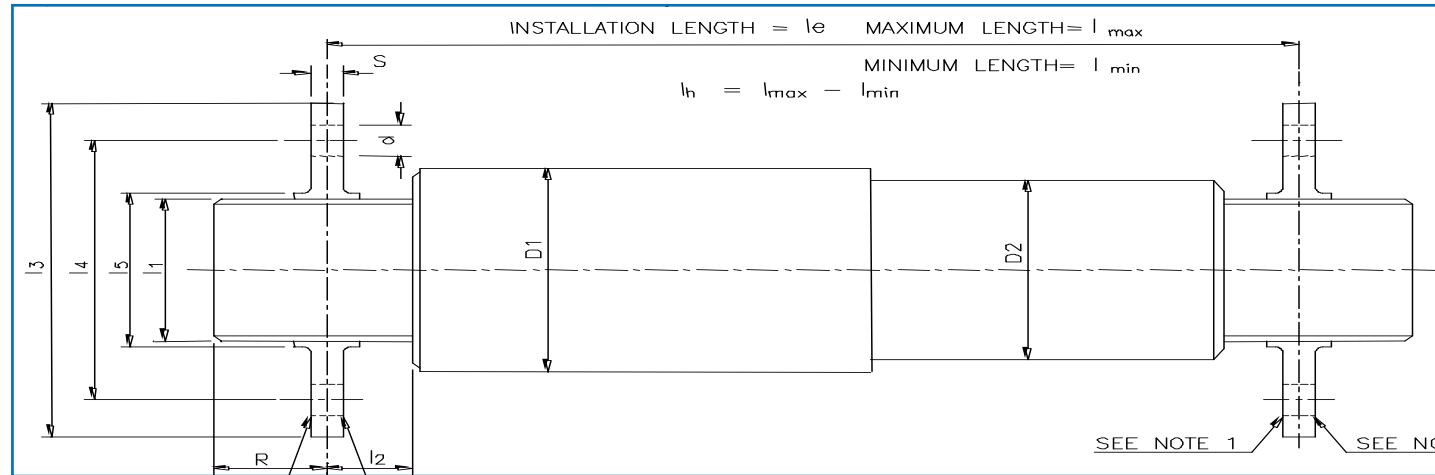
Drawing No.

Lot Size

Sl.	Description	Checks	Sample No.										Remarks	
			1	2	3	4	5	6	7	8	9	10		
1.	Visual Check	General workmanship												
2.	Free from welding defect	General workmanship												
3.	Damper Oil	Damper oil type, viscosity and amount of the damper oil												
4.	Surface finish of Piston Rod *	0.1 to 0.3 µm												
5.	Positive locking of Piston and piston Rod *	Proper locking of piston with piston ring to be ensured												
6.	Sealing Arrangement *	Using low friction multiple sealing arrangement with better wiping properties , provision of additional dust lip etc.												
7.	Surface protection:													
	i,	Quality of primer	High solid epoxy primers/ High solid alkyd primers (Firm to submit details).											
	ii.	Thickness & Quality paint	Aliphatic polyurethane enamels or two part epoxy paint (Firm to submit details).											
8.	Identification Marking	Manufacturer's name /code, Serial No., Type of Damper, Rated Capacity, Month & Year of manufacture, Drawing No												

* S.No. 4, 5 & 6 shall be checked during prototype inspection & quality issues.

2. Dimensional Checks:



Drawing no. & Capacity:															Remarks
Specified Value as per Drawing															
Sl.	Firm's sl.No.	l-max	l-min	D1	D2	l1	l2	l3	l4	l5	l6	d	R	S	
1.															
2.															
3.															
4.															
5.															
6.															
7.															
8.															
9.															
10.															

3. Strength Test & Damping Characteristics Test:

Test procedure shall be followed as per procedure Para 5.3.2 of inspection plan and following data shall be recorded as followed:

Sr. No.	Firm's sl. No. on dampers	Condition of damper before/after strength test	Specified damping force as per drawing	Observed Damping Force at Piston Velocities of 10 cm/sec				Remarks on Damper characteristics (Attach graph)	Oil leakage/physical damage (Yes/No)	Remarks
				Compression	%age change	Expansion	%age change			
1.		Before								
		After								
2.	Before									
	After									
3.	Before									
	After									
4.	Before									
	After									
5.	Before									
	After									

4. Cardanic, Twisting angle & Bushing Radial Stiffness Test Check

Testing of twisting, Cardanic angle and bushing radial Stiffness shall be done as per procedure mentioned in Para 5.3.4 of Inspection Plan and shall be recorded as under

S.No.	Specified Value as per Drawing and Para 4.8 of specification			Remarks
	Firm's Sl.No.	Spheri Bloc Test		
		Twisting angle	Cardanic angle	
1.				
2.				
3.				
4.				
5.				

* Bushing Radial Stiffness shall be checked during prototype inspection & quality issues.

ADDITIONAL TESTS FOR PROTOTYPE APPROVAL/QUALITY ISSUES

PROFORMA -C

1. **Vibrational Characteristic Test:** Before testing of Vibrational characteristic test, a performance test run is carried out on Damper as per clause 5.3.1 & 5.3.2 of inspection plan. Vibrational characteristic test shall be carried out as per Para 5.3.7 of inspection plan, after completing the vibration test, the dampers shall be retested as per specified value in the relevant drawing and stroke shall be between 12 mm to 15 mm and checked for oil leakage or physical damage.

Type of Dampers:

S.No.	Firm's Sl.No.	Condition of damper before/after vibration test	Specified damping force as per drawing	Damping Force at Piston Velocities of 10 cm/sec.				Remarks on Damper characteristics (Attach graph) / performance
				Comp	%age Change	Expn.	%age change	
		Before						
		After						

2. **Salt Spray test:**

Salt Spray test shall be done as procedure laid down in ISO 9227/ASTM B-117 for minimum 240 hrs and following observation shall be recorded:

Sl.	Firm's Sl.No.	Test Method/Standard	Checks	Observation	Remarks
1.		ISO: 4628-3	Degree of Rusting shall be Ri1.		
		ISO: 2409	Adhesion of paint shall be 0 until 1 (any squares may not come off)		

3. **Endurance testing**

Endurance testing shall be done as per procedure laid down in Annexure –II of specification and results/ observation shall be recorded as under:

- i. **LOG SHEET FOR ENDURANCE TESTING DATA OF HYDRAULIC DAMPERS(Annexure- IB)**

Product: Vertical hydraulic damper / Secondary Yaw	Capacity (Kg):
Application: Primary / Secondary	RDSO Drawing No:
Sample No:	

Test Dates:				Start:				
				Completion:				
Stroke (mm):				Frequency (Hz):			Velocity (cm/sec):	
Sl. No.	Date	Started time	Stopped time	Total hours	No. of Cycles	Cumulative no. of cycles completed	Temperature of damper (°C)	Remarks

ii. DAMPER PERFORMANCE DURING / AFTER ENDURANCE TEST(Annexure- IIA)

Product: Vertical hydraulic damper / Secondary Yaw						Capacity (Kg):		
Application: Primary / Secondary						RDSO Drawing No:		
Sample No:								
Test Dates:				Start:				
				Completion:				
Sl.	Endurance Test Stage	At Constant Stroke between 12 mm to 15mm				Checked the damage or distortion to damper components or oil leakage (Yes/No)	Checked the percentage deterioration of damping capacity (±25% up to 6 lakh cycles and ±30% beyond)	Remarks
		At Piston Velocities of						
		10 (cm/sec)		30 (cm/sec)				
		Comp	Expn	Comp	Expn			
1.	Initial							
2.	After 2 Lakh Cycles							
3.	After 4 Lakh Cycles							
4.	After 6 Lakh Cycles							
5.	After 8 Lakh Cycles							
6.	After 10 Lakh Cycles							