



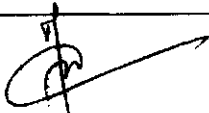


भारत सरकार, रेल मन्त्रालय
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

SPECIFICATION OF TREAD BRAKE UNIT (TBU)
FOR WDG4 / WDG4D LOCOMOTIVES

SPECIFICATION NO. MP- 0.4900.22
(Revision - 00)

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SPECIFICATION OF TREAD BRAKE UNIT (TBU) FOR WDG4 / WDG4D LOCOMOTIVES

1. GENERAL

It is proposed to provide Tread Brake Units (TBU) with and without parking brakes instead of conventional brake rigging on WDG4/WDG4D locomotive bogie. These units being compact in design shall offer the following advantages:

- .1 Easy installation and lighter in weight.
- .2 Compact in construction resulting in significant space saving.
- .3 Less frequent maintenance requirement due to the absence of brake linkages.
- .4 Modular construction, unit exchange methodology can be adopted.
- .5 Built in automatic slack adjuster to maintain the proper gap between brake block and wheel.
- .6 Better efficiency of braking due to better utilisation of braking force.
- .7 No requirement of mechanical hand brake, as spring loaded parking brake shall be the integral feature of the TBU.
- .8 Parking brake operation by driver through solenoid valve shall make parking brake operation smooth. The status of parking brake application can be made visible to driver at driver cab. The equipments along with the circuit diagram shall be in the supplier's scope. However, DLW will coordinate for fitment of the equipment on the locomotive between different firms, if required.

2. SCOPE

- .1 This specification covers the technical, inspection, installation and testing requirements of tread brake unit (TBU) for application on WDG4/WDG4D Diesel locomotives of Indian Railways.
- .2 The TBU shall initially be fitted on a prototype locomotive for Emergency Braking Distance (EBD) trials and field performance evaluation.
- .3 The tenderer shall submit quotation for the TBU, TBU with parking brake and related fittings etc. separately.

3. DEVIATION(s)

- .1 If deviation(s) from technical stipulations of this specification are desired by the supplier, specific proposals with reasons shall be submitted to RDSO. Commencement of manufacture shall not be done till a clear authorization for acceptance of deviation(s) is granted.
- .2 In case of contradiction between this specification and the relevant drawing(s)/ sketches or if any special requirements are given in these drawing(s)/ sketches, the stipulations in the drawing(s)/ sketches shall override this specification.

4. DRAWINGS

- .1 These TBUs shall be fitted on goods locomotive bogie to RDSO drawing no. SK.VL-764. TBU design including hardware shall be such that it will bear the exceptional accelerations encountered during the service of the locomotive. RDSO drawing no. SK.VL-764 along with the TBU mounting bracket detail is attached as **Annexure – I**. However, 3D model file of the bogie has been given to check the space availability for the TBU fitment on the bogie. A drawing for wheel tread profile is attached as **Annexure – II**.
- .2 A solid model of finally accepted design of TBU for WDG4/WDG4D locomotive bogie (compatible with UG NX5) shall be submitted by the successful tenderer before supply of material. This is to

facilitate undertaking necessary design modifications in the bogie design by RDSO to ensure fitment of TBU in prototype locomotive on requirement basis, if required.

5. DEFINITIONS

- .1 'Tenderer' means the firm/ company submitting the offer for the supply of TBU with miscellaneous fittings, piping and consumables for WDG4/WDG4D diesel electric locomotives conforming to this specification.
- .2 'Purchaser' means the President of Republic of India.
- .3 'RDSO' means Research Designs and Standards Organization, Ministry of Railways, Manak Nagar, Lucknow-226011, India.
- .4 'Inspecting Officer' means person, firm, or department nominated by the purchaser to inspect the TBU with miscellaneous fittings and consumables on his behalf or the representative of the Inspecting Officer so nominated.
- .5 'DLW' means Diesel Locomotive Works, Varanasi - 221004 or their successors.
- .6 'Supplier' means any firm or company with whom the order for supply of TBU with miscellaneous fittings and consumables conforming to this specification has been placed or is intended to be placed.

6. CREDENTIALS OF SUPPLIER

- .1 The supplier shall be the OEM or shall have collaboration with the OEM of TBU for locomotives. The OEM shall have a proven technology of TBU for locomotives and must have a valid ISO 9001 certification.
- .2 The OEM of the TBU being supplied shall submit test certificate of suitability for intended application on Indian Railways.
- .3 The supplier or its OEM should have successfully supplied at least 50 loco sets of TBU for locomotives and shall been in service performing satisfactory in the field for at least 5 years.

7. TECHNICAL AND OTHER GENERAL DATA

The tenderer is responsible and is expected to have read and understood the relevant technical and other general data and requirements as well as service conditions for functionality & effective supply of TBU.

.1 TECHNICAL DATA

Basic relevant technical data regarding locomotive in which TBU is supposed to operate is as follows:

Capacity of locomotive compressor:

Compressor capacity (FAD) at 10 kg/cm² pressure:

- i. At 200 rpm (Idle speed) : 990 LPM
- ii. At 950 rpm (Max. speed) : 5677 LPM

Note: The above compressor also caters to requirements of locomotive auxiliaries in addition to the brake system.

7.1.1 Nominal bore diameters of major pneumatic pipes used on air brake locomotive are as follows:

Brake pipe	:	32 mm
Feed pipe	:	32 mm
Brake cylinder pipe	:	20 mm
Brake cylinder equalising pipe	:	19 mm

Main reservoir E.Q. pipe : 25 mm

7.1.2 The brake system pressures being maintained are:

MR Pressure : $8.0 \pm 0.1 \text{ Kg/cm}^2 - 10.0 \pm 0.1 \text{ Kg/cm}^2$

Brake Cylinder Pressure

Automatic Braking : $1.8 \pm 0.1 \text{ Kg/cm}^2$

Independent Braking : $5.1 \pm 0.1 \text{ Kg/cm}^2$

Brake Pipe Pressure : $5.0 \pm 0.1 \text{ Kg/cm}^2$

Feed Pipe Pressure : $6.0 \pm 0.1 \text{ Kg/cm}^2$

7.2 OTHER GENERAL DATA

	Parameter	Requirements
1.	Speed Potential	The TBU shall be suitable for speed potentials as follows on straight tangent track with new / fully worn wheels of 1092 / 1016 mm diameter: Operating Speed : 105 km/h (Maximum) Test Speed : 115 km/h However, the design of TBU shall be capable to work properly up to the speed of 120 kmph.
2.	Axle Load	20.5 tonnes (Up gradation upto 22.3 tonnes)
3.	Locomotive weight	123 tonnes (Up gradation upto 133.8 tonnes)
4.	Wheel diameter	1092 mm (New) 1016 mm (Fully Worn)
5.	No. of Axles / Loco	06
6.	No. of TBU per wheel disc	01
7.	No. of TBUs / Loco	04 (With Parking Brake) 08 (With Service Brake)
8.	Total TBUs / Loco	12
9.	Total Brake Power	Gross total locomotive brake power of WDG4/WDG4D locomotive at 5.1 kg/cm^2 is 59709 kgf. Total Effective Loco Brake Power : 50753 kgf (Min.) at brake cylinder pressure of 5.1 kg/cm^2 .
10.	Type of brake system	Type of brake system may be as per any of the following specifications: (i) Computer Controlled Brake System CCB 1.5 to RDSO Spec. No. MP.0.01.00.20. (ii) Indigenous CCB Brake System to RDSO Spec. No. MP.0.01.00.23. (iii) Computer Controlled Brake System CCB 1.5 to RDSO Spec. No. MP.0.01.00.24.

7.3 SERVICE CONDITIONS

The TBU shall be capable of working satisfactorily under the service conditions indicated below:

7.4 Climatic and Environmental Conditions

	Parameter	Requirement
. 1	Maximum temperature (Atmospheric)	Under Sun : 70° C In shade : 50° C
. 2	Humidity	100% saturation during rainy season.
. 3	Reference site conditions	Ambient temp. : 47° C Humidity : 60 % Altitude : 160 m above mean sea level.
. 4	Rainfall	Very heavy in certain areas.
. 5	Atmosphere during hot weather	Extremely dusty and desert terrains in certain areas.
. 6	Coastal area	The TBU shall be designed to permit locomotive operation in coastal areas in humid and salt laden atmosphere.
. 7	Vibrations and shocks	As encountered on the locomotive during service.

7.4.1 Relevant Track Parameters

	Parameters	Requirements
. 1	Gauge	Broad Gauge (BG) 1676 mm (nominal).
. 2	Sharpest curve & turn out to be negotiated	174 m radius.
. 3	Maximum down gradient	1 in 37

The track parameters and environment details given here are indicative only and for easy appreciation of operating conditions.

8. TECHNICAL REQUIREMENTS

- .1 TBU offered should be such that it shall be compatible with composition brake blocks to RDSO Drawing No. SK.DP-3630 (Alt.-2). Drawing attached as Annexure – III.
- .2 The tenderer shall submit brake power particulars and EBD at maximum test speed for the offered TBU at the time of submission of his offer.
- .3 The successful bidder shall submit detailed brake power calculations indicating the assumptions considered for calculations along with brake power diagram for the offered TBU to operate at maximum test speed.
- .4 The output brake shoe force shall meet the requirements specified on the drawing with a tolerance of +5% / -7%.
- .5 TBUs shall be simple, robust and lighter in weight. Weight of each TBU with or without parking brake shall be indicated.
- .6 TBUs shall have built in automatic slack adjuster to take up the slackness due to wearing of brake blocks. It shall be simple and compact in design. Maximum slack adjusting capacity should not be less than 125mm.
- .7 The design shall be such that it is easy to replace the worn out brake blocks by new ones in position.
- .8 Handling of TBU in diesel loco shed / workshop shall not require any special arrangements.

- .9 The design shall have a suitable arrangement to prevent sliding off of brake shoe blocks from wheel tread, even on relatively small rail running radii, as mentioned under Para 7.4.1.2. .
- .10 The supplier shall supply installation drawings of TBUs and TBUs with parking brakes based on the availability of the space in fabricated bogie frames and get them approved by RDSO before supplying equipment.
- .11 Supplier is responsible to inform RDSO any proposed design changes after the first order is placed. Design change cannot be implemented until approval is received from RDSO. Supplier is responsible to provide revised drawings to RDSO for each revision.
- .12 Both air and manual release features should be provided for the parking brake. The air pressure required to release the parking brake should be as specified on the drawing.
- .13 Parking brake manual release device should be accessible from the outside of the locomotive.
- .14 In case of TBU with parking brakes, it shall be possible to isolate the function of parking brakes in that TBU without isolating the service brake portion side.
- .15 The TBU shall be designed and constructed in such a way that in normal operating conditions, the functional efficiency of the brake system should not be adversely affected.
- .16 The tread brake unit shall function under these exceptional accelerations: Vertical : $\pm 6g$, Lateral : $\pm 3g$ & Longitudinal : $\pm 5g$
- .17 The TBU units for end axles and middle axles should be working properly with a wheel lateral displacement of ± 7.85 mm & ± 12.7 mm respectively.
- .18 The brake unit shall work properly within a primary suspension deflection range of ± 55 mm. During lifting (brakes not operating) the displacement can be 75 mm.
- .19 The brake unit with parking brake shall function with a wheel longitudinal displacement range of 6mm. The longitudinal stiffness per wheel is at least 25kN/mm. The brake unit without parking brake shall function with a wheel longitudinal displacement range of 11mm.
- .20 The tread brake unit shall not be damaged by exposure to oil, grease, degreaser, fuel etc.
- .21 The material of the components including rubber parts shall be such that it is not affected by the prevailing temperature and presence of oil fumes in compressed air.
- .22 Design of the TBU shall be such that the performance of the system is not adversely affected under extreme positions of wheel and suspension movement under maximum wear conditions.
- .23 The tenderer shall offer the latest design for TBU and ensure the mounting of TBU has enough safety margins to hold the TBU while working and TBU will not fall during service.
- .24 The mounting and operating details of TBU shall be advised by the Vendor.
- .25 The fitment of TBU should not warrant change in CCB.
- .26 Brake circuit diagram for interfacing with LCC shall be in the supplier's scope of supply. However DLW / RDSO will coordinate between different firms for interfacing with LCC, if required.
- .27 Installation of the tread brake arrangement on the first two bogies for locomotive shall be the responsibility of the supplier. Supplier's expert engineer(s) will remain present for guidance to DLW staff during prototype installation. Its mechanical & functional integrity is to be ensured by the supplier.

- .28 The brake unit can be stored under normal warehouse conditions for up to 3 years including rubber parts. However if unit will be stored for more than 1.5 years, functional test will be performed before putting in service and beyond 3 years overhauling will be done to replace rubber parts to ensure reliable working of TBU during service.
- .29 Standard hardware of minimum class 8.8 shall be used for tread brake arrangement.

9. INSPECTION AND TESTING

- .1 Pre-despatch inspection by RDSO or its authorised representative shall be done.
- .2 The supplier shall provide without any extra charges, material, equipment, tools and any other assistance which the purchaser or his nominee may consider necessary for any tests and / or examination.
- .3 The supplier shall submit all the inspection and maintenance related drawings before inspection and shall arrange all the manufacturing drawings and material specification during inspection. However, general arrangement drawing showing the functional features shall be submitted to RDSO for approval.
- .4 Supplier shall submit the test criteria for testing of TBUs with and without parking brakes. The test scheme should clearly indicate the type as well as routine tests to be carried out.
- .5 At the time of inspection, the supplier shall carry out all tests necessary to prove that the equipment fulfils the technical requirements covered in this specification as well as the standard test specification laid down for these units.
- .6 The inspecting authority of the purchaser shall have free access to the works of the manufacturer at all times during manufacture. He shall be free to inspect the manufacture at any stage, to reject any materials which do not conform to the terms of this specification.
- .7 **Type Test:** The brake unit shall undergo a life test with at least 1,00,000 cycles air brake application with brake cylinder pressure of 450kPa and 10,000 cycles of parking brake application with full parking brake capacity. These cycles should consist of 10,000 cycles blocks, which includes 9 apply / release cycles of air brake, plus one cycle of air brake apply, parking brake apply, air brake release, and parking brake release.
- .8 **Routine Tests:** 20% TBU shall be subjected for the following tests:
 - a) Pressure test.
 - b) Leakage test of service brake cylinder.
 - c) Leakage test of spring actuator.
 - d) Slack adjustment stroke test.
 - e) Slack adjustment capacity test.
 - f) Force test of service brake cylinder.
 - g) Force test of spring actuator.
 - h) Manual release test of spring actuator.
- .9 The tenderer shall indicate the acceptance criteria for type tests and routine tests for purchaser's acceptance.
- .10 Inspection certificates for all the tests carried out duly signed by the purchaser's authorised representative.
- .11 The acceptance of TBU with miscellaneous fittings, piping and consumables shall be done against the WTC of the OEM.

10. DOCUMENTATION

- .1 The supplier shall supply along with offer, two copies of the lay-out drawings, brake ratio calculation details, descriptive literature covering functions, operation, maintenance, trouble shooting and testing instructions and spare part catalogue in English language.
- .2 Supplier to supply functional, inspection and maintenance manuals of the tread brake system and its components.

11. MARKING

Each TBU shall have clear readable marking at appropriate place on body of the brake cylinder. The marking shall be as follows:

- a) Supplier's name / Trade mark.
- b) Part No. / Drg. No. of the individual items.
- c) Designation and type of TBU.
- d) Year and month of manufacture.

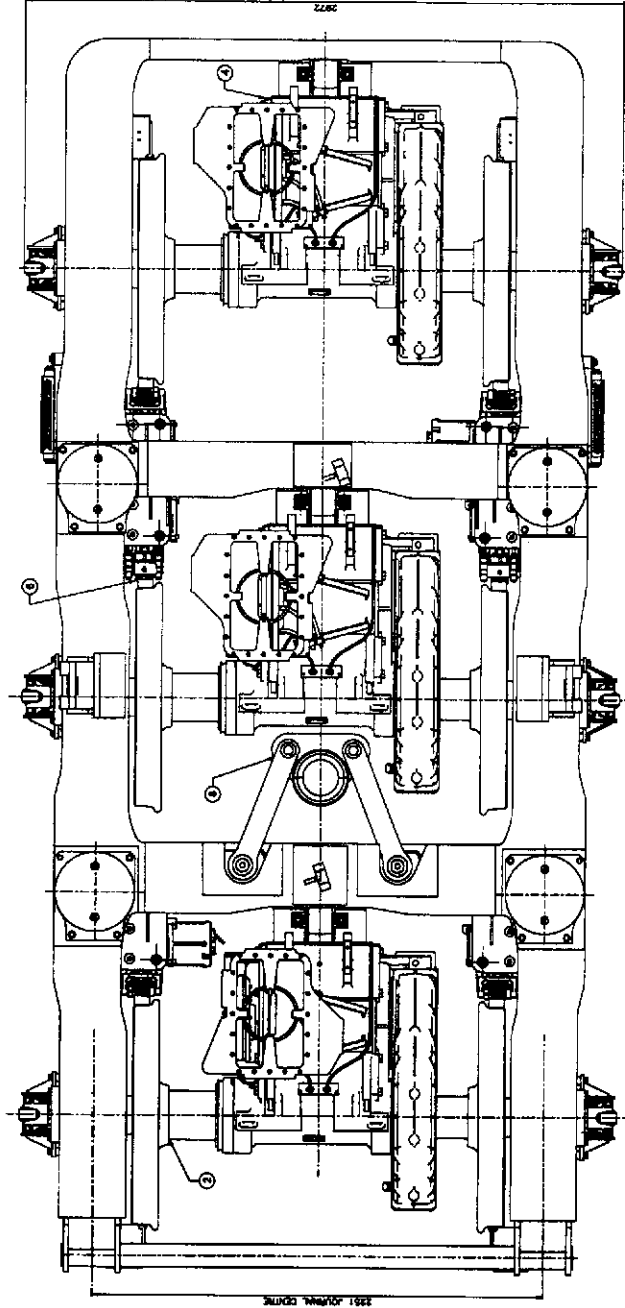
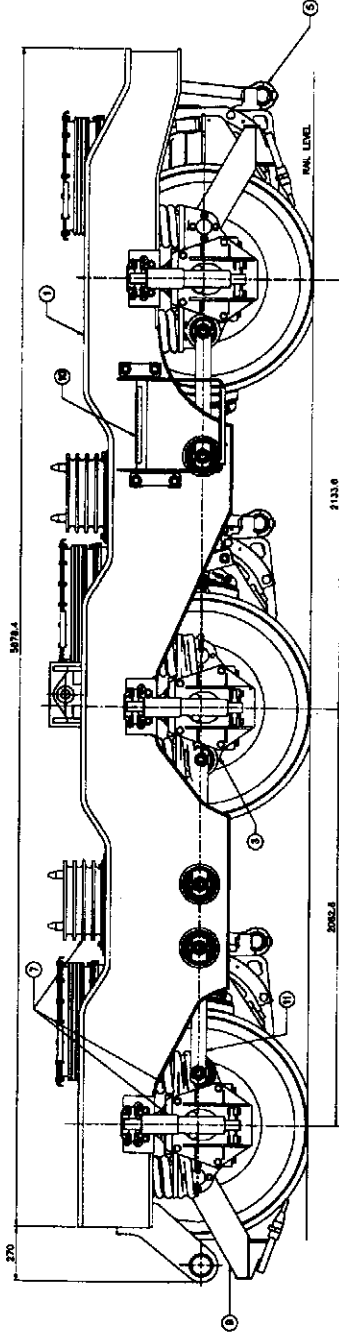
12. WARRANTY

- .1 The TBU shall have a life expectancy consistent with the bogie overhaul interval of 1 million km or 6 years (including shelf life), whatever comes first. Because the actual railroad conditions vary, the actual overhaul interval needs to be established for a particular type of service.
- .2 Any equipment which fails during the warranty period, shall have to be replaced free of cost by the supplier. The replaced components shall be under further warranty for a period of two years from the date of their fitment. Should these components also prove to be unsatisfactory in service, they shall be replaced by modified and improved components by the supplier free of cost.
- .3 Reliability of each components shall meet the following goals:
 - a) Failures per locomotive year causing road failures not to exceed 0.002 (1 failure in 500 locomotive years).
 - b) Failures per locomotive year needing replacement not to exceed 0.01 (1 failure in 100 locomotive years).
- .4 Whenever it becomes necessary to modify the design, all existing units will have to be modified by the supplier free of cost.

13. SPARES

- .1 The supplier shall submit list of spares for two years for every 10 sets of locomotive equipments and indicate the cost of each component separately.
- .2 The expected service life of replaceable components should be indicated.

Annexure - I (Page 1 of 2)



NOTE:-
1. FOR OTHER ITEMS WHICH ARE NOT SHOWN, REFER TO
OF BOGE ASB DRAWING NO. 40070076.

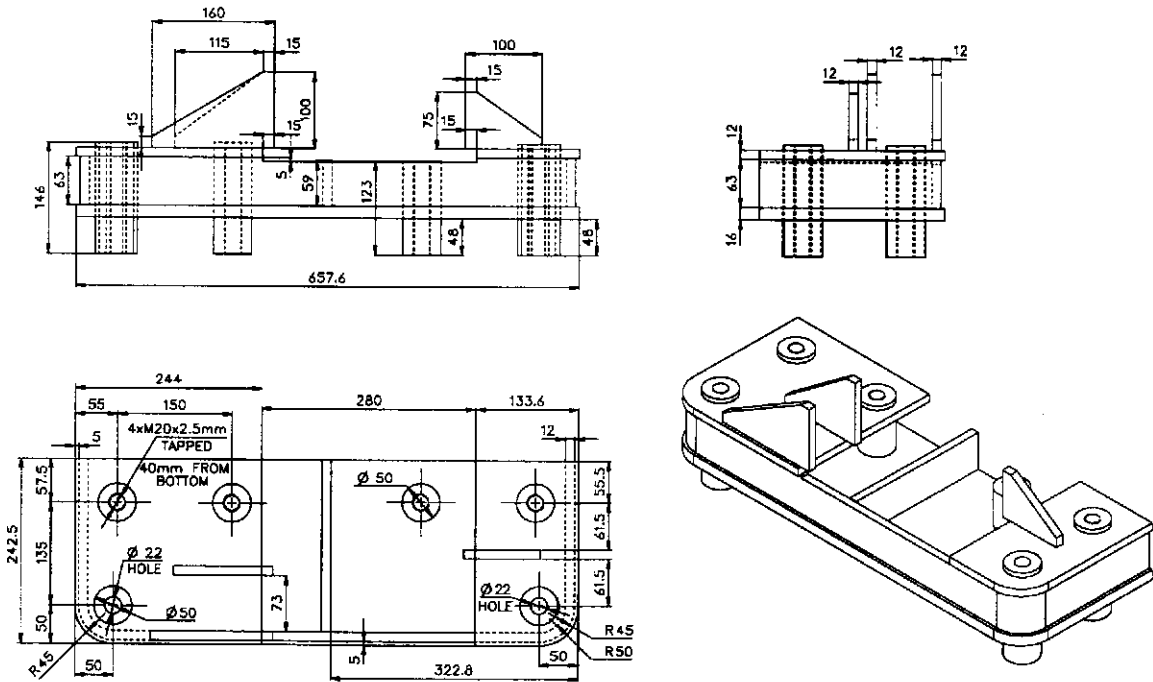
NO.	DESCRIPTION	QTY	UNIT	REF. NO.
11	TRACTION ROD-PRIMARY	12	NO.	
10	STEP PIN	2	NO.	
9	WHEEL SPINDER PIN	2	NO.	
8	FRONT ASB	2	NO.	
7	ROCK SUSPENSION ARRANGEMENT	2	NO.	
6	TRACTIVE GEAR ARRANGEMENT	2	NO.	
5	TRACTIVE MOTOR	6	NO.	
4	TRACTIVE MOTOR	6	NO.	
3	WHEEL ADAPTOR ASB	12	NO.	
2	WHEEL AXLE ASB	8	NO.	
1	ROCK FRONT ARRANGEMENT	2	NO.	

SCALE: 1:10 (WITH TBU)
INDIAN RVS DNG SK.VL-764
RDSO(VDG) NO. _____
PARTS LISTED IN SUPPLEMENTARY SHEET

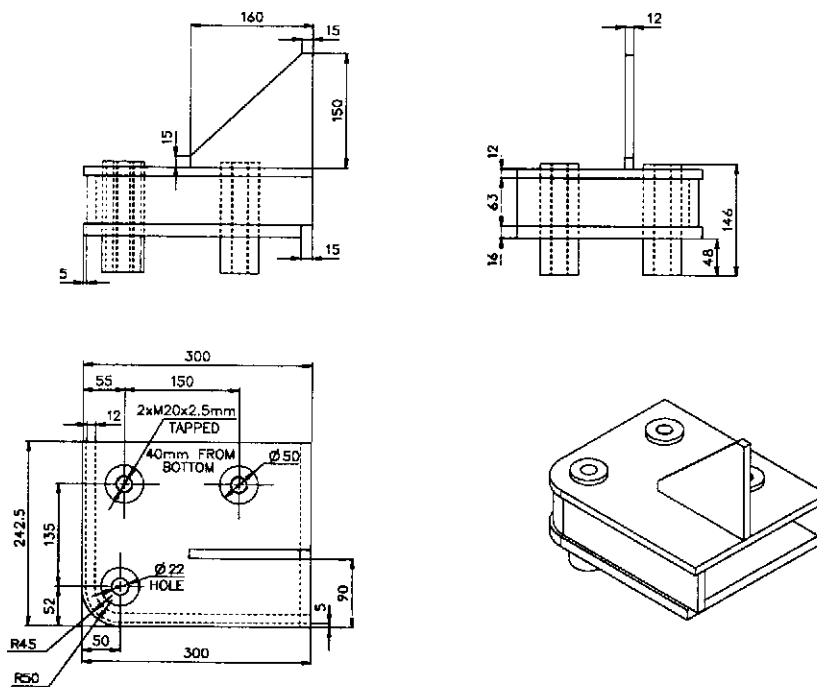
NO.	DESCRIPTION	QTY	UNIT	REF. NO.
1	TRACTIVE MOTOR	6	NO.	
2	WHEEL AXLE ASB	8	NO.	
3	WHEEL ADAPTOR ASB	12	NO.	
4	TRACTIVE MOTOR	6	NO.	
5	TRACTIVE MOTOR	6	NO.	
6	TRACTIVE GEAR ARRANGEMENT	2	NO.	
7	ROCK SUSPENSION ARRANGEMENT	2	NO.	
8	FRONT ASB	2	NO.	
9	WHEEL SPINDER PIN	2	NO.	
10	STEP PIN	2	NO.	
11	TRACTION ROD-PRIMARY	12	NO.	

ALL DIMENSIONS ARE IN MM.
DRAWING NO. 40070076
DATE: 15-11-2014

Annexure - I (Page 2 of 2)

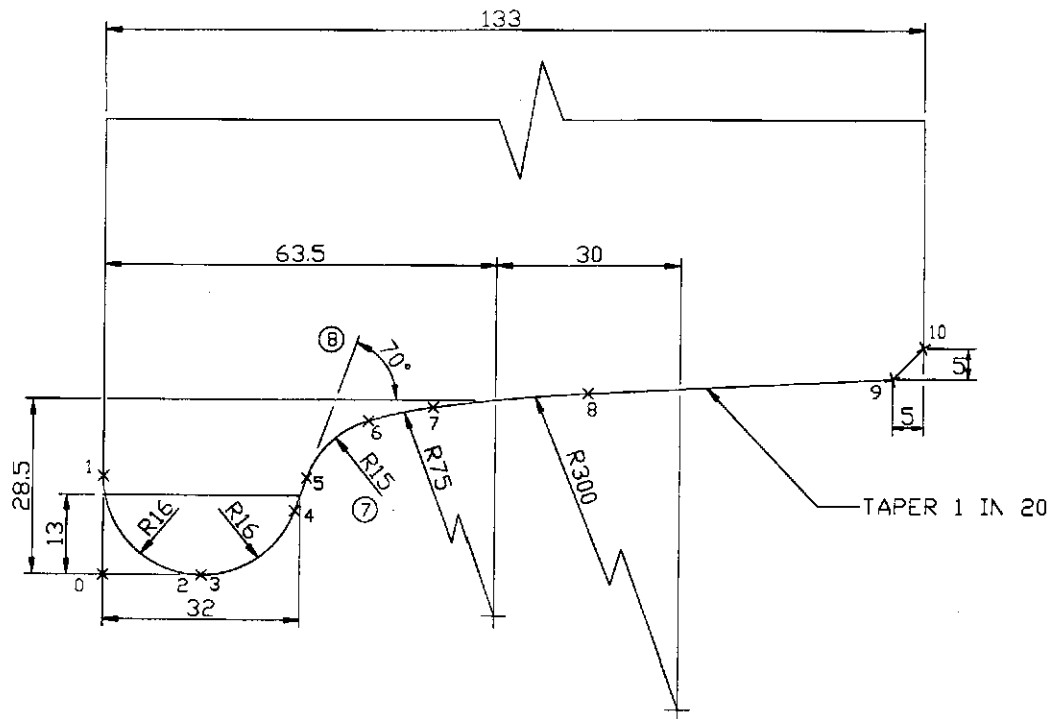


BRACKET FOR AXLE-2 & 3 TBU ON MIDDLE TRANSOM TO RDSO DRG. NO. SK.VL-764 (ALT.-NIL)



BRACKET FOR AXLE-2 & 3 TBU ON MIDDLE TRANSOM TO RDSO DRG. NO. SK.VL-764 (ALT.-NIL)

INDIAN RLYS. RDSO(MP) APPLICABLE FOR B.G LOCOS. WEAR ADAPTED WHEEL PROFILE FOR DIESEL & ELECTRIC LOCOMOTIVES



⑥
CO-ORDINATES ARE GIVEN BELOW:-

Pt.	X	Y
0	0.0000	0.0000
1	0.0000	16.0000
2	16.0000	0.0000
3	16.0651	0.0000
4	31.1001	10.5277
5	33.0371	15.8495
6	43.0407	25.1503
7	53.5000	27.3251
8	78.5187	29.6295
9	128.0000	32.1035
10	133.0000	37.1035

⑥
NOTE: GIVEN POINTS CO-ORDINATES ARE ROUNDED OFF UPTO FOUR DECIMAL PLACE.

ALL DIMENSION ARE IN mm.

⑧	-	FLANGE ANGLE 70° INDICATED.	L2-980		17.10.06
⑦	-	ROOT RADIUS CHANGED FROM R17 TO R15. CO-ORDINATES OF THE POINTS 5&6 REVISED ACCORDINGLY.	L2-977	Sd/-	07.9.06

⑥	-	DRG. REVISED & NOTE ADDED.	DV/L2/924	Sd/-	23.8.05	SCALE 1:1	REF: SK.DL-2561 ALT.3
⑤	-	DRG. REVISED	DV/L2/XXX	Sd/-	-12.93		
④	-	DRG. REDRAWN	DV/L2/452	Sd/-	5.7.89		DRG NO. SK.DL-2561 SUPERSEDED BY ALT. 6
ALT.NO.	REF.NO.	DESCRIPTION	ALT.NO.	SIGN	DATE		

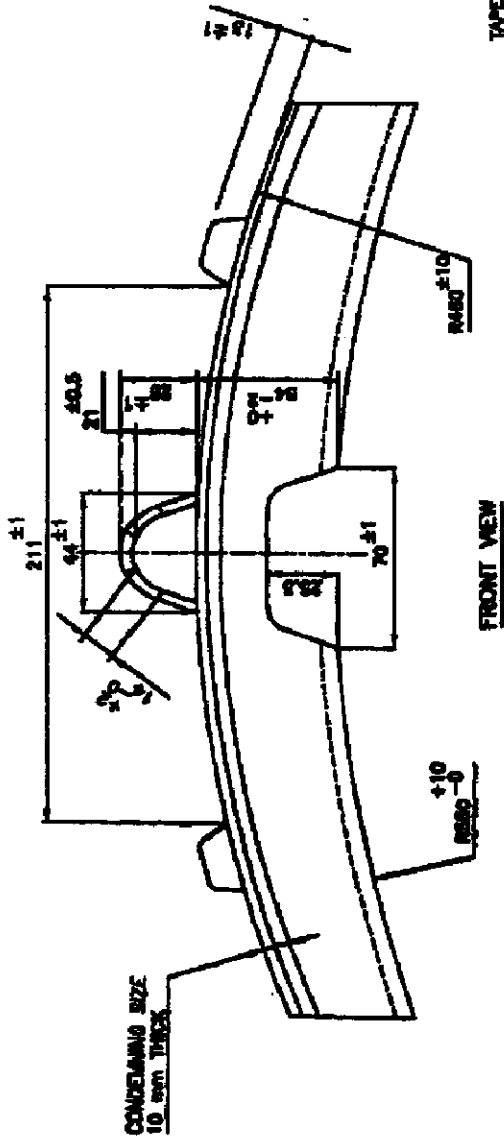
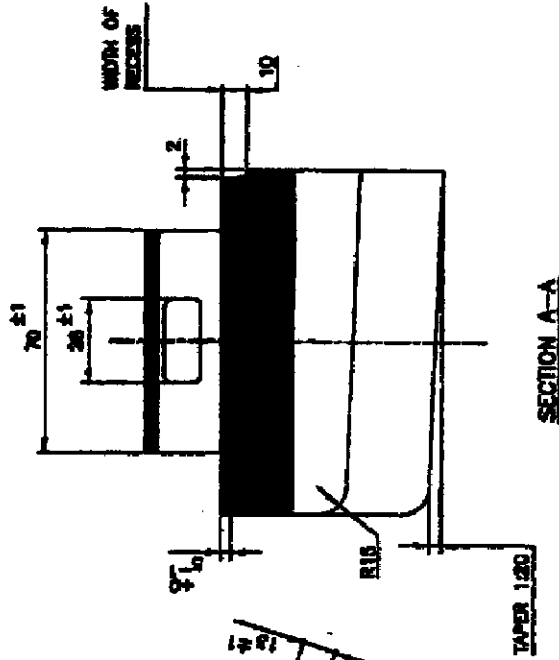
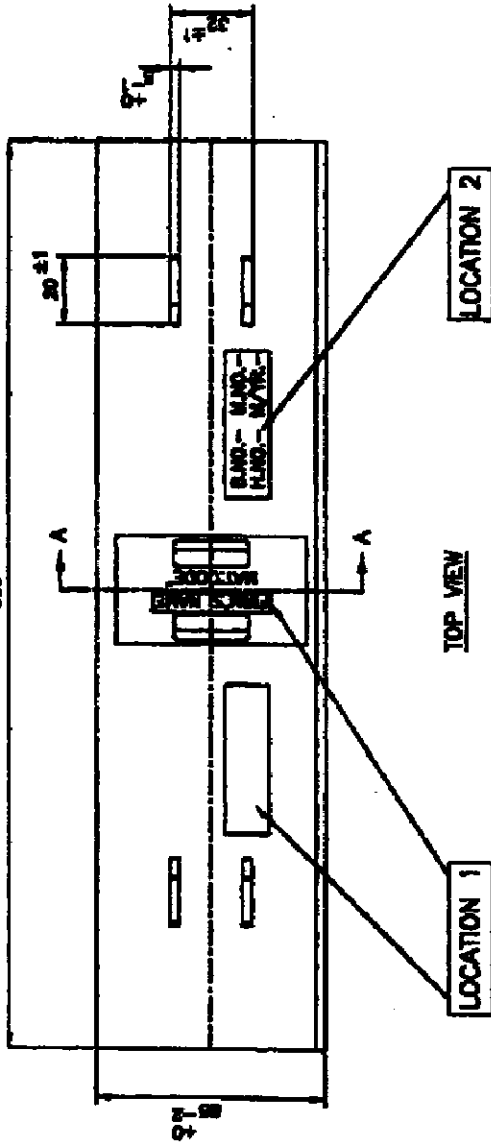
D
C
APPD.
Dt

ANNEXURE - IV

COLOR CODE	HIGH FRICTION
WDM/WDM4	RED

ABBREVIATIONS USED IN FORMAT:

- B.A.N.D. - BATCH NUMBER
- B.A.N.D. - BOX NUMBER
- B.A.N.D. - HEAT NUMBER
- M/YR - MONTH/YEAR OF MANUFACTURE



- NOTES:-
- 1) PAINT CONCERNING RECESSES AS PER COLOUR CODE INDICATED.
 - 2) PUNCH MANUFACTURERS NAME & MATERIAL CODE 'Y' ON CLAMP AS WELL AS ON BACK PLATE SHOWN BY LOCATION 1.
 - 3) PUNCH FORMAT INDICATED IN LOCATION 2 BEFORE MOLDING. FULL RELEVANT INFORMATION BY PUNCHING AND APPLY WHITE PAINT ON THE PUNCH IMPRESSIONS.
 - 4) ENSURE PUNCHED INFORMATIONS GIVEN IN THE LOCATIONS 1 & 2 ARE LEGIBLE.
 - 5) ENSURE PROPER FITMENT OF BRAKE BLOCK WITH EXISTING BRAKE HEAD OF LOCOMOTIVE.

ALL DIMENSIONS ARE IN mm.

APPLICABLE FOR	HIGH FRICTION
WDM4 & WDM4	COMPOSITION BRAKE BLOCK
SCALE	1:1
UNIT	MM
DRG. NO.	SKDP-3630
REV.	

2	-	ISSUED REVISION AND REVISIONS	
1	-	ISSUED FOR APPROVAL	
0	-	ISSUED FOR DESIGN	

DESIGNED	
CHECKED	
APPROVED	
DATE	