


	 <p>PRODUCT STANDARD TME DIVISION, BHOPAL</p> <p>TME/2023</p>	<p>TM20587</p> <p>Rev 04</p> <p>PAGE 01 OF 14</p>	
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	<p>Revision : 04</p> <p>Date: 04/08/2023</p>	<p>Distribution</p> <p>TME TXM-Plg.</p>	<p>Qty.</p> <p>1 1</p>

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1. GENERAL

This specification governs the requirement for design, manufacturing and supply of gear drive assembly for use with BHEL traction motor for train set application in Indian Railways. The gear drive assembly should be reliable for operational speed of 160 kmph and should also be able to serve at a design speed of 180 kmph. Supplier shall clearly specify compliance of each clause of this specification in their offer. In case of any deviation w.r.t any clause of this specification, supplier should also specify the same in their offer.

2. SCOPE OF SUPPLY


Scope of supply for gear drive assembly kit shall be as given below in table-1. Gear drive kit supplied shall be ready for assembly and in painted condition on un-machined surfaces & temporary rust preventive applied on machined surfaces.

Sl. No.	Component	Qty. per gear drive assy.	Remarks
1	Gear drive assembly consisting of:		
1.1	Main driving gear along with pinions	1 set	
1.2	Input Shaft for pinion & half coupling mounting	1 no.	
1.3	Gear drive housing	1 no.	
1.4	Other gear drive assembly components viz. Bearings, Labyrinths, Seals, Fasteners, Rubber items, 'O' rings etc. required for complete gear drive assembly	1 set	
1.5	Reaction rod along with items (fasteners etc.) required for mounting of reaction rod on gearbox.	1 set	
1.6	Rubber item (elastomer) for mounting of Reaction rod on bogie	1 no.	
1.7	Gear drive half coupling	1 no.	
1.8	Traction motor half coupling	1 no.	


NOTE: Necessary support shall be provided by supplier for the following:


1) Submission of design documents (to BHEL) as mentioned in clause 6.2 of this specification.

2) Clarification to RDSO queries, discussion with RDSO for finalization and approval of design documents of gear drive assembly.


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	a. Supervision & training required for assembly/disassembly, testing & commissioning of gear drive assembly:														
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<b>COPYRIGHT AND CONFIDENTIAL</b> The information on this document is the property of <b>BHARAT HEAVY ELECTRICALS LIMITED</b> It must not be used directly or indirectly in any way detrimental to the interest of the company	<p>vii. The gear drive assembly shall function in accordance with this Specification when subjected continuously to an atmosphere containing dust in concentrations up to 1.6 mg / m<sup>3</sup>.</p> <p>viii. The gear drive assembly shall function in accordance with this Specification when subjected continuously to a humid and salt laden atmosphere with maximum pH value of 8.5, sulphate content of 7 mg per litre, maximum concentration of chlorine 6 mg per litres and maximum conductivity of 130 micro Siemens / cm.</p> <p>ix. The gear drive assembly shall function in accordance with this Specification when subjected to high wind speed in certain areas, with wind pressure reaching 216 kg/m<sup>2</sup>.</p> <p>x. Gear drive assembly shall function in accordance with this Specification when exposed to solar radiation in the range from 0 kW/m<sup>2</sup> to 1 kW/m<sup>2</sup>.</p> <p>xi. Special care shall be taken to ensure no damage to gear drive assembly due to deposition of atmospheric salts and industrial pollutants. Supplier shall enclose the details of specific measures adopted to ensure the satisfactory working of gear drive assembly against the deposition of salts &amp; industrial pollution.</p> <p><b>5. <u>TECHNICAL REQUIREMENTS</u></b></p> <p><b>5.1 Gear Drive Assembly</b></p> <p>i. The gear drive assembly shall be of proven design for same or higher traction/braking transmission.</p> <p>ii. The gear drive assembly shall be free from lubricant leakage.</p> <p>iii. The tractive/braking effort shall be directly transferred from the input pinion to wheel gear. The torque transmission arrangement of gear drive assembly shall be simple and suitable for both traction and braking forces.</p> <p>iv. The gear drive assembly design shall be suitable for climatic and environmental conditions as specified in clause no. 4 of this specification. Special care shall be taken in design with respect to high track vibrations as mentioned in clause 5.2.</p> <p>v. The gear drive assembly design documents as per clause 6.2 shall be furnished and finalized during design approval by RDSO Lucknow. The suitability of gear drive assembly should be proved in a type test.</p> <p>vi. The gear drive shall be compatible with the flexible coupling. Gear drive assembly movements shall be restrained by a torque reaction link between the gear drive and bogie frame. A safety device shall be incorporated to restrain gear drive rotation shall the link fail in service.</p> <p>vii. Gear drive assembly shall have toothed wheel for sensing speed and suitable provision for mounting of speed sensor on gear drive assembly.</p> <p>viii. The external items of gear drive assembly viz. rubber items, paint etc. shall comply with standard EN 45545 HL-2/ HL-3 for fire safety.</p>		


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	<p><b>5.3 Coupling</b></p> <ol style="list-style-type: none"> <li>The coupling shall compensates radial, axial and angular misalignments between motor and gear drive assembly. The coupling design and the motor to gear drive assembly mounting arrangement shall minimize coupling dynamic angular displacement.</li> <li>The coupling should be suitable for operation at speed of 6000 rpm.</li> <li>The coupling should be able to withstand the maximum level of shocks of magnitude as per EN13749:2021.</li> <li>The sealing system should be adequate to prevent dirt/dust and water into couplings.</li> <li>The coupling shall be grease lubricated.</li> <li>Slipping bush shall be installed at the gear box side to protect the gearbox of too high shock torques that can be generated in the motor in case of a converter short circuit.</li> <li>The coupling shall be insulated to ensure that the gearbox bearings are not affected by discharging currents of the rotor.</li> </ol> <p><b>5.4 Gears and Pinion</b></p> <ol style="list-style-type: none"> <li>Gear &amp; pinion should be produced from case hardened alloy steel and complying with national/international standards of gears &amp; pinion being used in traction application.</li> <li>The MTBF for the pinion should at least be 1 million Km and for the gear wheel at least 2 million km.</li> <li>Gear ratio of 5.158 is to be used for gear drive assembly in trainset application.</li> <li>Supplier shall submit proof of stability for gear tooth forming and total design (i.e. design documents mentioned in clause 6.2), description of the gear tooth forming, used materials, manufacturing and hardening procedures with corresponding specifications, Oil types, lubrication process and lubrication intervals.</li> <li>Gear &amp; Pinion used in gear drive assembly shall be guaranteed against any failure for a period of 6 years from the date of supply.</li> </ol>	





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	<div><div>i. Gear drive housing shall be made of proven material and shall have sufficient mechanical strength so as not to get damaged due to hitting by ballast or any other foreign objects at high speed during run. Supplier may use alloys, which have been used for traction application and has been validated and time tested. Aluminium should not be used anywhere in the gear drive housing. The use of heli-inserts in the threaded holes for fastening of bolts shall not be permissible. The gear drive housing shall be totally enclosed and free from lubricant leakage during operation.</div><div>ii. The gear drive housing shall be totally enclosed and free from lubricant leakage during operation.</div><div>iii. The quantity of oil in the housing and its replenishment/replacement period shall be provided in the maintenance manual. It shall not be necessary to change the oil earlier than 300,000 km or once a year whatever comes first. The lubrication points of gear drive housing shall be easily accessible. The oil recommended for use in gear drive housing shall be of Indian make available readily in India.</div><div>iv. Gear drive housing and its sealing arrangement shall be designed in such a way that there should not be any ingress of water inside gear drive assembly upto a height of 203 mm from rail level.</div><div>v. Gear drive assembly shall be suitably painted to prevent any deterioration of surface due to operation in extremely dusty, humid &amp; salty conditions for most part of the year.</div></div>		
	<b>5.6 Bearings</b>		
	<div><div>i. Details of the fits kept in the bearings of gear drive assembly should be furnished during design documents approval by RDSO.</div><div>ii. L10 life calculation report for complete duty cycle shall be submitted.</div></div>		
	<b>5.7 Mounting and suspension arrangement</b>		
<div><div>i. Suitable reaction rod mounting bush (elastomer) shall be provided for suspension of gear drive housing.</div><div>ii. The mounting bolts/nuts shall be accessible for easy mounting and dismounting during maintenance.</div></div>			
<b>5.8 Packing</b>			
<div>Gear drive assembly shall be suitably packed to avoid any damage during transit.</div>			

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	<p><b>6.1</b> The supplier shall submit the following documents <u>along with their techno-commercial offer</u>:</p> <p>i. <b>For gear drive assembly supply experience:</b> Reference of projects executed for similar applications during the last 10 years wherein supplier has designed, manufactured and supplied at least 240 no. of gear drive assembly for Railway stock speed of 130 KPH or more. Firm should submit necessary supporting credentials i.e. document in support of maximum operational speed of gear drive assembly and PO/Invoice/Contractual document/Any other documentary proof in support of supply of 240 sets of gear drive assembly (if required, financial details may be hidden).</p> <p>ii. <b>For flexible coupling supply experience:</b> a. Reference of projects executed for similar applications during the last 10 years wherein supplier/supplier's source of flexible coupling has designed, manufactured and supplied at least 240 no. of flexible coupling (both motor half &amp; gearbox half) for gear drive assembly for Railway stock speed of 130 KPH or more. Firm should submit necessary supporting credentials i.e. document in support of maximum operational speed of gear drive assembly and PO/Invoice/Contractual document/Any other documentary proof in support of supply of 240 nos. of flexible coupling (if required, financial details may be hidden). b. Supplier to confirm that coupling supplied shall be of same make for which experience details are submitted as clause 6.1 {ii (a)} above.</p> <p>iii. OGA drawing of the offered gear drive assembly.</p> <p>iv. Separate offer for tentative price (budgetary quotation) of training &amp; tools required as per clause no. 3.a &amp; 3.b of this specification.</p> <p><b>6.2</b> Supplier shall start submission of design documents of gear drive assembly along with required technical data and calculations to BHEL Bhopal (for further submission to RDSO for approval) <u>within 4 weeks</u> after date of PO placement and shall be completed within 5 months of PO placement. Design documents shall comprises of following:</p> <p>i. Detailed outline drawing indicating weight and centre of gravity.</p> <p><b>Note:</b> Outline drawing shall be submitted to ICF by BHEL for fitment clearance of gear drive assembly on bogie. Based on ICF feedback, modification in fitment dimensions may be required to be done. Supplier to carry out the modifications.</p>		


<div><div><div>भारत भारी विद्युत निगम लिमिटेड</div><div>BHEL</div></div><div>PRODUCT STANDARD TME DIVISION, BHOPAL</div><div>TME/2023</div></div>		<div>TM20587</div> <div>Rev 04</div> <div>PAGE 10 OF 14</div>
<div>COPYRIGHT AND CONFIDENTIAL</div> <div>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED It must not be used directly or indirectly in any way detrimental to the interest of the company</div>	<div><div><div>ii. General assembly/long section drawing with exploded view and complete bill of material.</div><div>iii. 3D model of external envelope of complete gear drive assembly.</div><div>iv. Type of gear and pinion, grade of steel used and particulars of heat treatment.</div><div>v. Outline drawing of gear &amp; pinion with relevant data required from fitment and maintenance point of view and deciding the usability/condemning limit like chord over teeth ('k' value) etc.</div><div>vi. Drawings along with dimensions required from maintenance point of view.</div><div>vii. Material and type of construction of gear drive housing.</div><div>viii. Strength calculation for gear and pinion.</div><div>ix. Calculation report (bearing, gearing, safety nose, reaction rod, connection gear drive-reaction rod, shrink fit of gear axle).</div><div>x. Details of fits used in assembly of different components of gear drive assembly including gear, pinion, bearings etc.</div><div>xi. The supplier shall submit finite element analysis (FEA) report in all 3-axis which includes stress analysis, fatigue analysis, modal analysis and harmonic analysis of complete gear drive assembly including sub-components considering boundary conditions for vibration &amp; shocks as per EN13749:2021. Factor of safety kept by vendor in other proven gear drive assembly (details provided by supplier against clause 6.1) designed &amp; supplied earlier shall be considered for FE analysis.</div><div>Note: Any other additional boundary conditions for FEA desired by RDSO shall be suitably incorporated in the FE analysis.</div><div>xii. Make &amp; type of bearings, L-10 life calculation of bearings for complete duty cycle and life span of bearing while considering the axle deflection.</div><div>xiii. Make &amp; type of lubrication compound of gear drive assembly and bearing grease along with their technical datasheet. Quantity for initial fill of lubricant and refill along with periodicity of refilling shall also be indicated.</div><div>Note: The lubricant recommended for use in gear drive assembly shall be made in India.</div><div>xiv. Quality Assurance Plan of complete gear drive assembly including gear &amp; pinion.</div><div>xv. Reliability prediction calculations (RAMS, LC etc.) complying the requirements of clause 5.4 (ii) of this specification.</div><div>xvi. Source for flexible coupling.</div><div>Note: The flexible coupling selected shall be such that vibration coming on motor from gear drive shall not adversely affect the performance of the complete system (motor &amp; gear drive).</div><div>xvii. For motor shaft, supplier shall suggest length, taper, diameter, fit/advancement for coupling and other relevant dimensions to be kept for mounting of motor half-flexible coupling.</div></div></div>	

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<b>COPYRIGHT AND CONFIDENTIAL</b> The information on this document is the property of <b>BHARAT HEAVY ELECTRICALS LIMITED</b> It must not be used directly or indirectly in any way detrimental to the interest of the company	<p><b>B. At BHEL Bhopal:</b></p> <p>i. Supplier shall provide assembly procedure of half coupling on traction motor.</p> <p><b>C. At ICF/RCF/MCF (Mounting of assembled gear drive with axle on bogie):</b></p> <p>i. The supplier shall submit detailed instructions for adjustment / levelling of gear drive w.r.t motor / alignment of coupling halves, assembly of reaction rod and any checking to ensure proper alignment of coupling halves.</p> <p>ii. Special tools, fixtures, gauges &amp; shims required for adjustment / levelling of gear drive w.r.t motor / alignment of coupling halves and assembly of reaction rod on bogie shall be provided by supplier. BHEL will issue separate enquiry for the same.</p> <p>iii. For initial 4 bogies (consisting of 8 gear drive assy. sets), during alignment of coupling halves, supplier shall depute its experts to supervise, train/ guide at ICF/RCF/MCF.</p> <p><b>6.4 Maintenance:</b></p> <p>i. The supplier shall submit maintenance manual for the gear drive assembly containing following details:</p> <ol style="list-style-type: none"> <li>Write up on the working of gear drive assembly.</li> <li>The dimensional drawing of complete gear drive assembly (including flexible coupling) with technical data.</li> <li>The detail functioning of each item and its sub-assembly.</li> <li>Part list of components used in gear drive assembly.</li> <li>Assembly &amp; disassembly procedure of gear drive assembly along with drawings indicating usage of special tools.</li> <li>Fitment procedure of half couplings on traction motor &amp; half coupling.</li> <li>Testing procedure of gear drive assembly.</li> <li>Maintenance instructions for inspection, troubleshooting and recommended maintenance schedule.</li> <li>List of special tools &amp; instruments required for assembly, disassembly &amp; maintenance.</li> <li>List of spares, must change items during scheduled maintenance and consumables.</li> </ol> <p>ii. The supplier shall be responsible for carrying out improvements and modifications on the gear drive assembly supplied, in case any repetitive issues are observed during service (provided such modifications/ improvements are necessary for meeting the requirements of reliability, performance and safety etc., jointly with Indian Railways/RDSO Lucknow).</p>		

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<div>COPYRIGHT AND CONFIDENTIAL</div> <div>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED It must not be used directly or indirectly in any way detrimental to the interest of the company</div>	<div>7. TYPE TEST</div> <div>The type test (dimensional, material and other necessary tests) of individual items of gear drive assembly (gear, pinion, housing etc.) and complete gear drive assembly shall be in the scope of supplier. The supplier shall have in-house testing facility for the same. During testing, designed load and working conditions shall be simulated. The product shall conform to the designed parameters with respect to its application, efficacy and effectiveness. Axle &amp; other test equipments for type testing by supplier, shall be in the scope of supplier.</div> <div>Following tests shall be done as a part of type test of gear drive assembly:</div> <div><div>i. Dimensional, material &amp; other necessary inspection of gear drive assembly items viz. gear, pinion, housing etc.</div><div>ii. Name plate verification</div><div>iii. Weight measurement of complete gear drive assembly including coupling half and without axle, traction motor &amp; oil in gear drive housing.</div><div>iv. Dimensional inspection of gear drive assembly including axial &amp; radial clearances of bearings, backlash, push on length gear coupling half gear drive side and other dimensions.</div><div>v. Oil level inspection</div><div>vi. Oil leakage verification from gear drive housing.</div><div>vii.Oil splashing verification</div><div>viii. Vibration, sound level measurement and temperature rise test in load condition (at starting torque, both clockwise &amp; counter clockwise directions).</div><div>ix. Vibration, sound level measurement and temperature rise test in load condition (at continuous rating, both clockwise &amp; counter clockwise directions) and vibration measurement.</div><div>x. Vibration, sound level measurement and temperature rise test in load condition (at one hour rating, both clockwise &amp; counter clockwise directions) and vibration measurement.</div><div>xi. Vibration, sound level measurement and temperature rise test in load condition (at maximum operating motor speed, both clockwise &amp; counter clockwise directions).</div><div>xii.Water tightness test.</div><div>xiii. Gear drive oil analysis.</div><div>xiv. Visual inspection of gear &amp; pinion contact pattern and condition of bearings and other components.</div><div>xv. Inspection of interference fit details of components of gear drive system.</div></div>
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	 <p><b>PRODUCT STANDARD</b> <b>TME DIVISION, BHOPAL</b></p> <p>TME/2023</p>	<p><b>TM20587</b></p> <p><b>Rev 04</b></p> <p><b>PAGE 14 OF 14</b></p>
<p><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of <b>BHARAT HEAVY ELECTRICALS LIMITED</b> It must not be used directly or indirectly in any way detrimental to the interest of the company</p>	<p><b>8. <u>ENCLOSURES</u></b></p> <ul style="list-style-type: none"> <li>i. Annexure-1 as input datasheet required for design of gear drive assembly.</li> <li>ii. Annexure-2 as preliminary motor shaft view for coupling fitment.</li> <li>iii. Annexure-3 as preliminary BHEL drawing no.14450005052 rev.02 of gear drive assembly.</li> <li>iv. Annexure-4 as ICF drawing no. TS/MC-0-0-001 of bogie general arrangement.</li> <li>v. Annexure-5 as ICF drawing no. 8900003 of Reaction rod fixing arrangement.</li> <li>vi. Annexure-6 as drawing no. 89002002 of axle.</li> <li>vii. Annexure-7 as drawing no. MT18Br2 001480-4 of axle wheelset.</li> <li>viii. Annexure-8 as revision sheet.</li> <li>ix. Annexure-9 as duty cycle for bearing life calculation.</li> </ul>	

## Annexure-1

Input datasheet for design of Gear drive assembly		
<b>General Data:</b>		
1	End Customer	Indian Railways
2	Application	Electric Train set
3	Location	Chennai / Kapurthala / Rae Bareilly, India
<b>Vehicle:</b>		
1	Type of rail vehicle	Train set
2	Electrical drive type	IGBT based 3 phase drive
3	Bogie configuration (eg. Fully, partly etc.)	BO-BO
4	Axle or Wheel drive	Axle drive
5	Allowable sound power level [dB(A)]	120 dB(A)
6	Vehicle life (year)	25 years
7	Environment temperature (°C)	-10°C (Minimum)
8	Environment temperature (°C)	50°C (Maximum)
9	Service speed (worn wheels) (km/h)	160 Km/h (Maximum)
10	Design speed (new wheels) (km/h)	180 Km/h (Maximum)
11	Number of bogies	32
12	Number of motor bogies	16
13	Axle load (kg)	17000 kg (Maximum)
14	Wheel diameter new (mm)	952 mm
15	Wheel diameter worn (mm)	877 mm
16	Track gauge (mm)	1676 mm (Broad gauge)
17	Truck wheel base (mm)	2700 mm
18	Daily running (km)	2000
<b>Drive gear assembly:</b>		
1	Drive concept	Traction motor fully suspended in bogie frame
2	Final drive gear type	Preferably helical
3	Number of Gear drive assembly per Bogie	2
4	Number of Gear drive assembly per Motor	1
5	Overall gear ratio	5.158
6	First stage gear ratio	5.158
7	Efficiency	98%
8	Weight (kg)	420±7% kg
9	Rail clearance at fully worn wheel	91 mm (Minimum)
10	Gear drive suspension type (fully or partially)	Partially
11	Axle diameter (between wheels)	179 mm (Refer annexure-6)
12	Axle diameter for Gearwheel sitting (mm)	217.5 mm (Refer annexure-6)
13	Axle diameter for bearings sitting (mm)	216.5 mm (Refer annexure-6)
14	Range of centre distance between axle C/L & motor shaft C/L	372 - 376 mm (Refer annexure-3)
15	Pinion offset (Position of motor shaft C/L above axle C/L)	20 mm above axle C/L (Refer annexure-3)
16	Distance between C/L of gear drive & bogie (mm)	513 mm (Refer annexure-6)
17	Distance to bottom of gear drive from axle C/L (mm)	347.5 (Maximum) (Refer annexure-3)

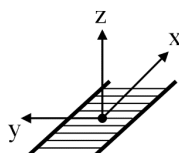


18	Distance to top of gear drive from axle C/L (mm)	350 mm (Maximum) (Refer annexure-3)
19	Distance between end of flexible coupling (face towards motor side) and gear drive assembly pinion side (including all possible movements) (mm)	580 mm (Maximum) (Refer annexure-3)
20	Width of Gear drive assembly sitting on axle	350 mm (Maximum) (Refer annexure-3)
21	Length of Gear drive assembly upto safety catch from axle C/L (mm)	600 mm (Refer annexure-3)
22	Horizontal distance of bogie connection point of reaction rod (in relation to wheel axle centre) (mm)	545 mm (Refer annexure-5)

#### Traction motor:

1	Motor manufacturer	BHEL
2	Motor type	AC
3	Motor weight (kg)	950±5% kg
4	Motor shaft end	Enclosed as annexure-2
5	Motor maximum power (motoring) (kW)	297
6	Motor maximum power (braking) (kW)	373
7	Motor continuous power (kW)	240
8	Motor continuous torque (Nm)	905
9	Motor continuous speed ( $\text{min}^{-1}$ )	3136
10	Motor maximum speed ( $\text{min}^{-1}$ )	5616
11	Maximum starting torque (Nm)	2298
12	Maximum braking torque (Nm)	2250
13	Root mean square torque (Nm)	1340
14	Motor short circuit torque (Nm)	12000

#### Bogie primary suspension movement

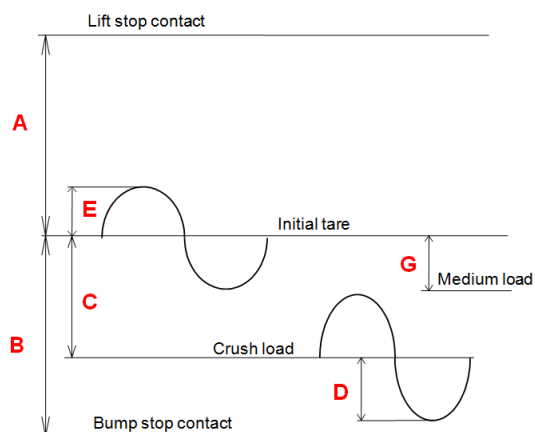


X (longitudinal) to mechanical stop + tolerances [mm]

Y (lateral) to mechanical stop + tolerances [mm]

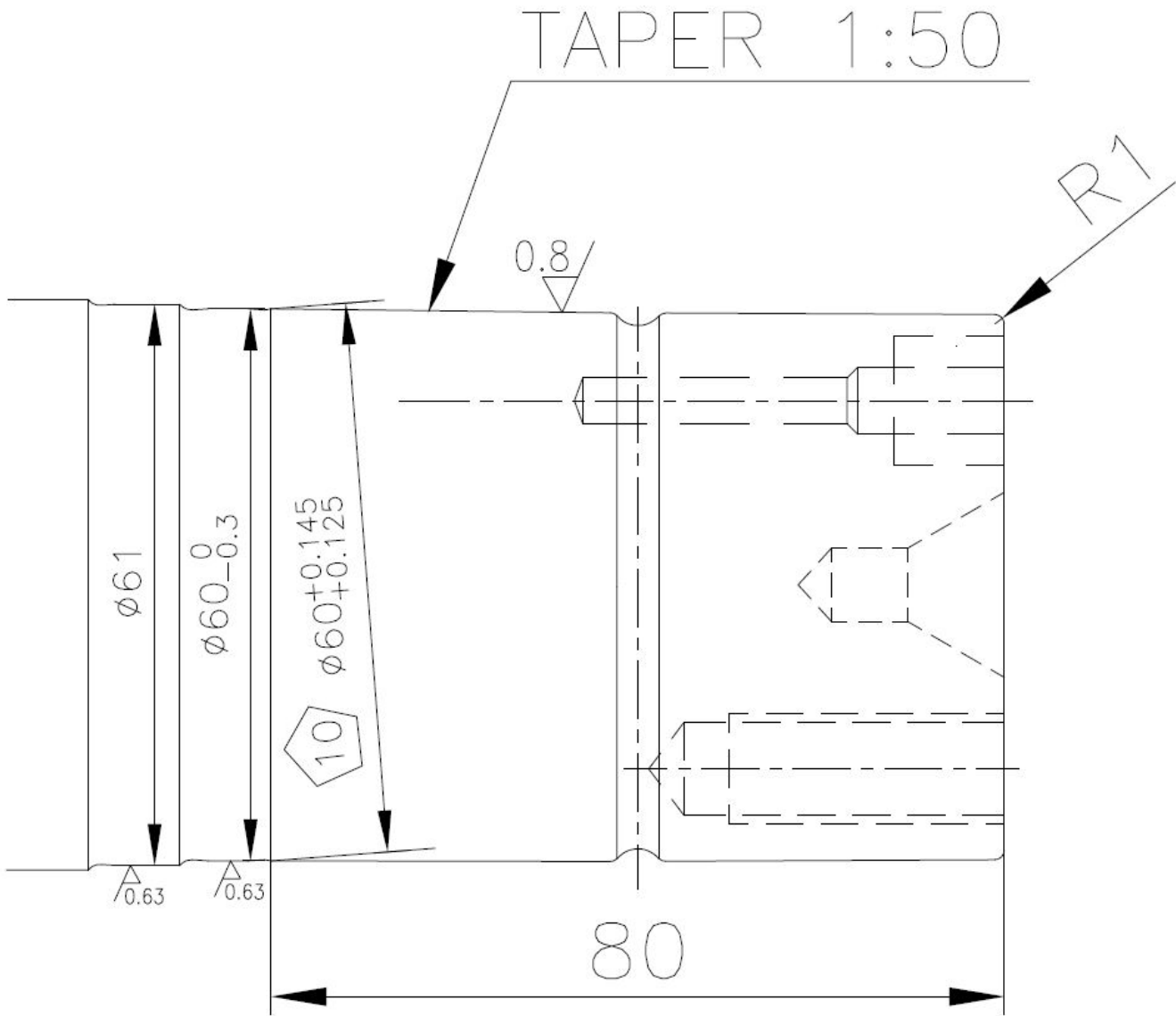
Maximum dynamic and continuous dynamic movement values for X and Y directions.

Z (vertical) [mm] – distances A, B to mechanical stops + tolerance of stop position along with E, C and D.

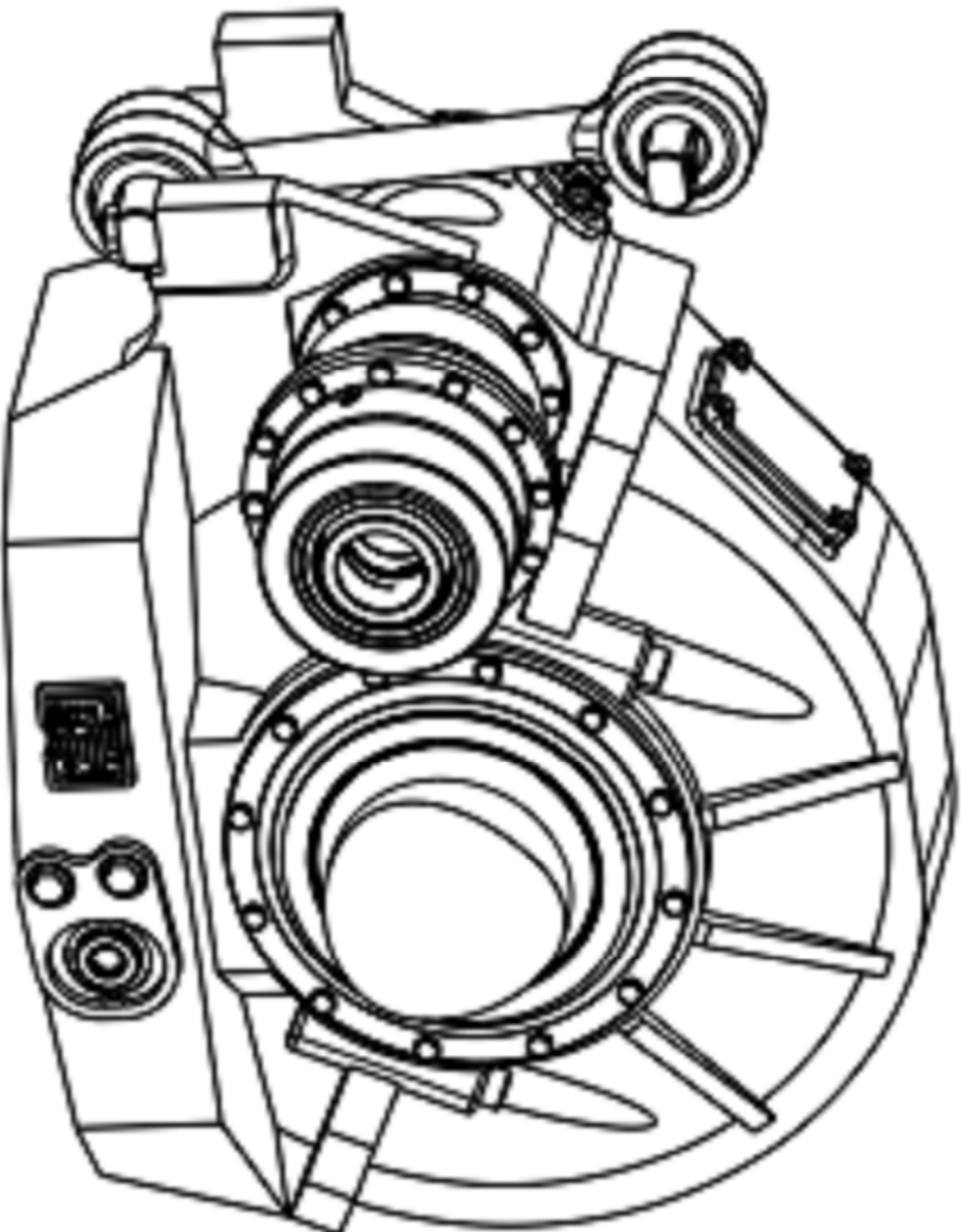

**Primary suspension** (bogie tolerances  $\pm 2$  mm in all directions)

Drives shown in position		$Z = \text{tare}$	
Prehold		4 mm at $Z = 0$	
X	Max.	$\pm 10$ mm	
Y	Max.	$\pm 8$ mm	
Z (bump stop)	Max.	- 45 mm	
Z (lift stop)	Max.	+ 25 mm	
Tare AWO	10%	$Z = 0$ mm	Dyn.: $X \pm 5$ ; $Y \pm 4$ ; $Z \pm 13$
Nominal AW3	80%	$Z = -12.5$ mm	Dyn.: $X \pm 9$ ; $Y \pm 4.5$ ; $Z \pm 14$
Full load AW4	10%	$Z = -15$ mm	Dyn.: $X \pm 9.5$ ; $Y \pm 5$ ; $Z \pm 14$

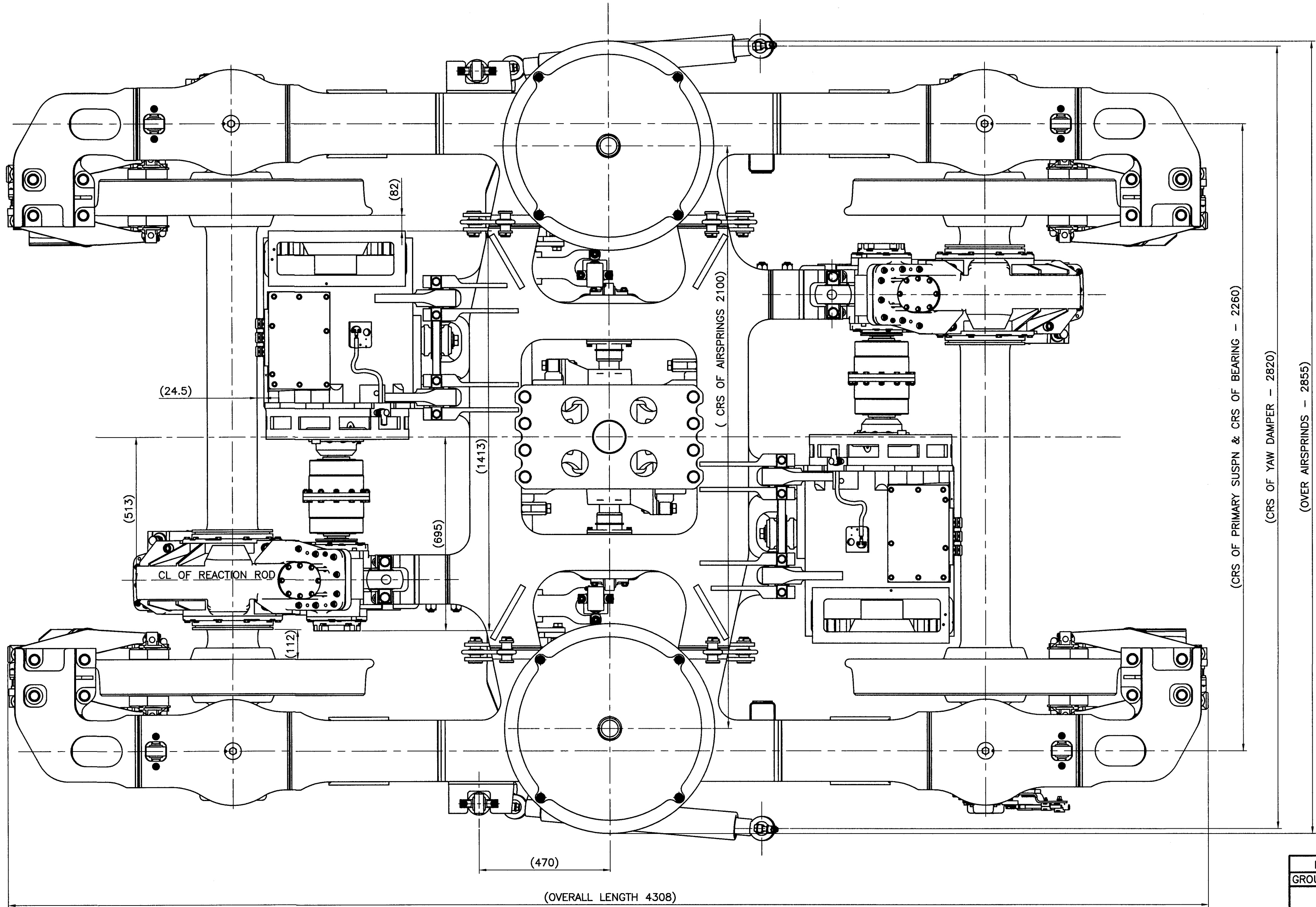
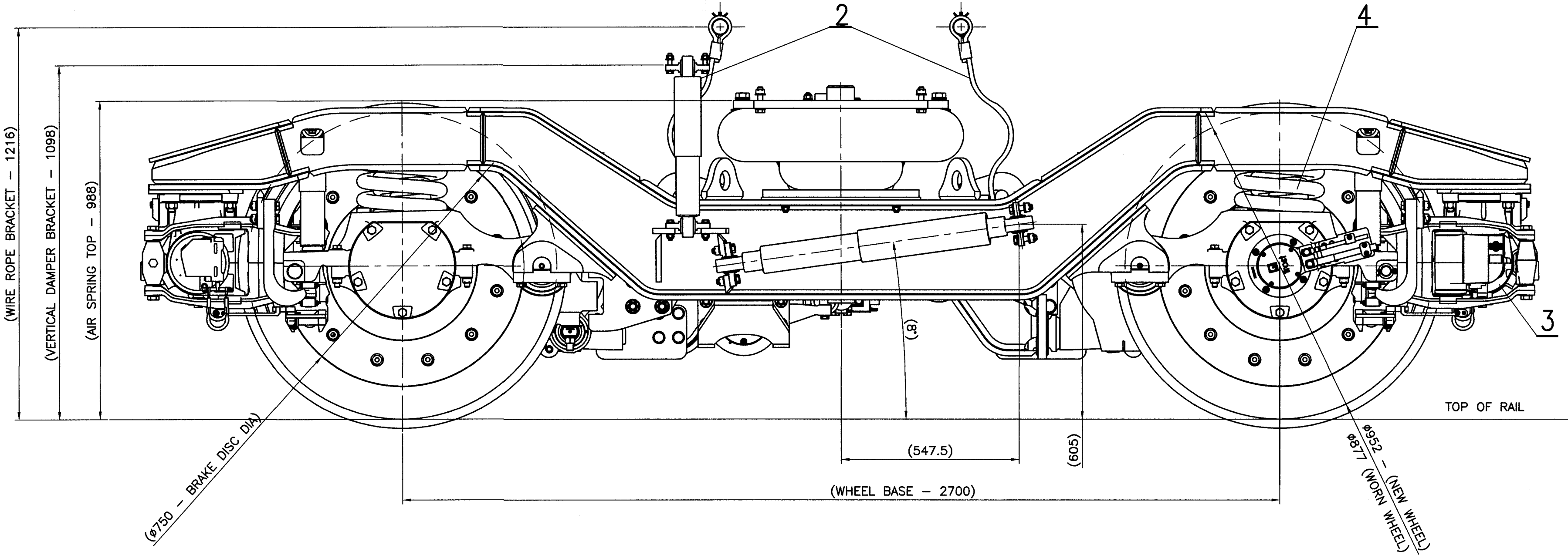
Annexure-2



3D VIEW FOR REF.

[illegible]

TS/MC-0-0-001



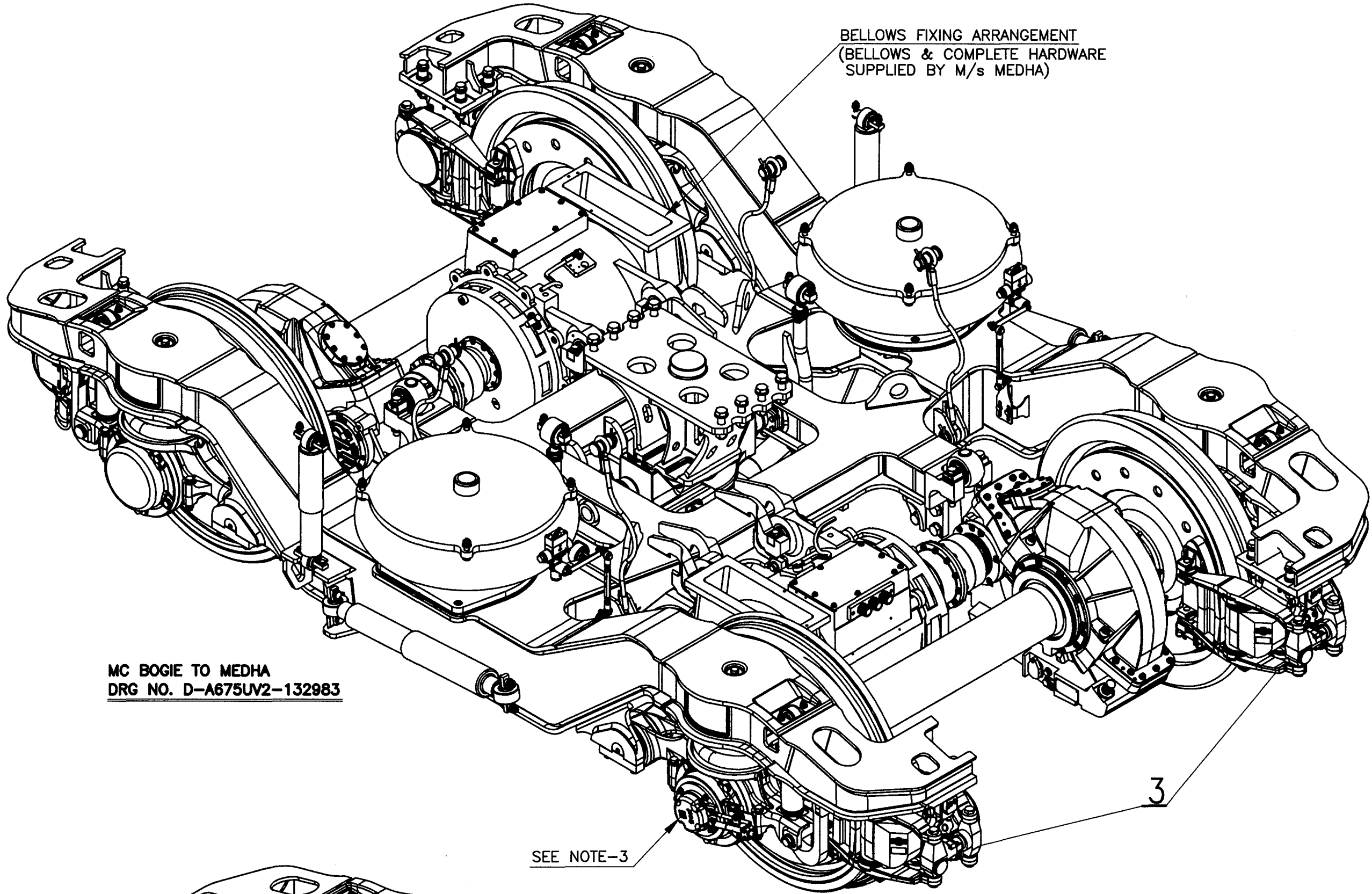
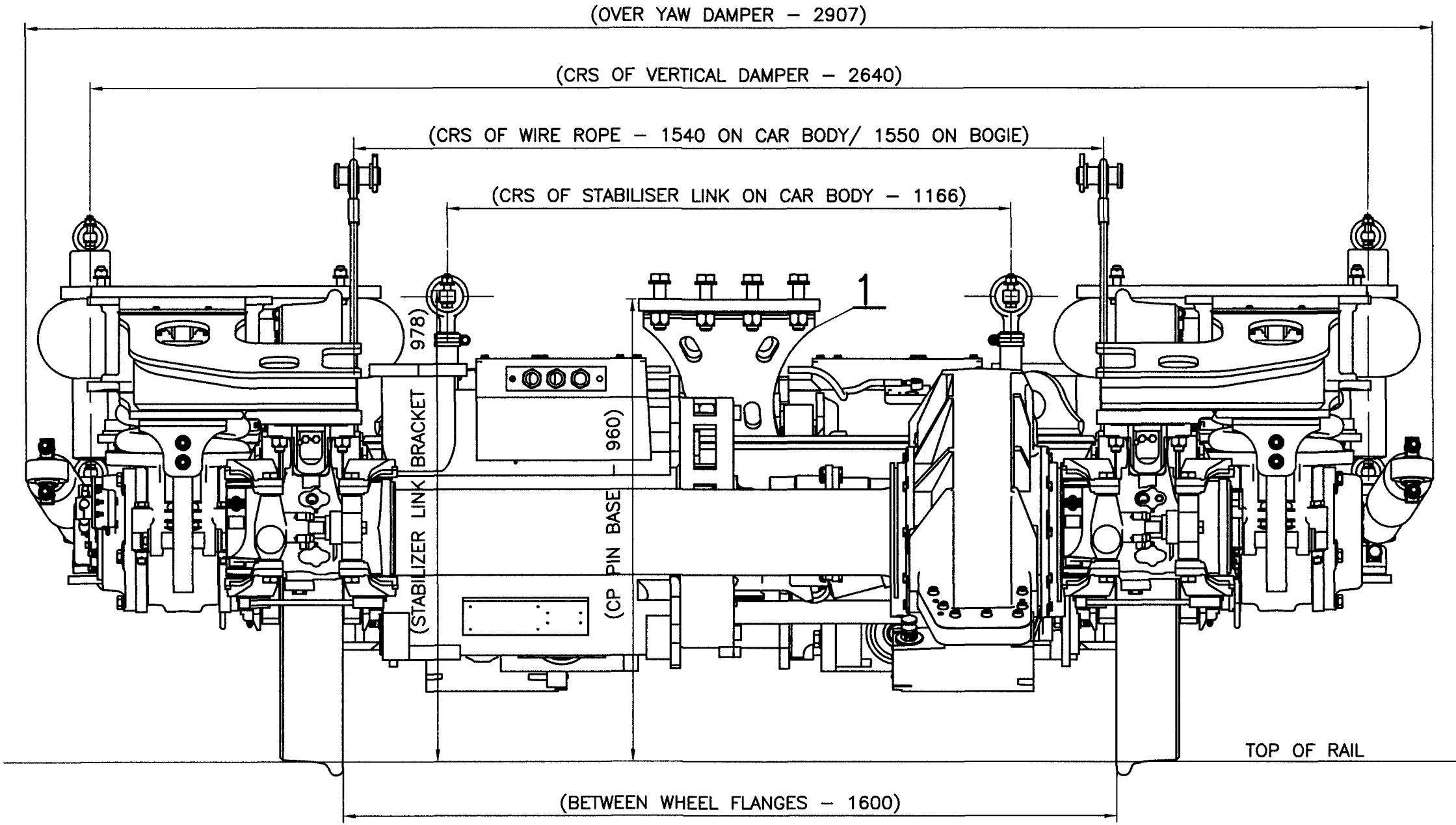
ASSEMBLY DRAWINGS			
		15-9-2021	15/9/21
0	Num. Alt.	DATE OF LATEST ALT	DATE OF FIRST ISSUE
			AME/SME

DESCRIPTION & DIMENSION		ITEM	REF.DRGS	MAT.SPEC	WEIGHT/UNIT	REMARKS	
GROUP: 0-0					SUPERSEDED BY:		
BOGIE GENERAL ARRGT. FOR TRAINSET BOGIES					SUPERSEDES:		
					SCALE	SSE/D	SABAPATHY NATHAN M
						CHD	
						ALTD	
						DRN	S.N.Karthikeyan
					Alpha Alt: -		
DATA CODE NO.	INDIAN RAILWAY STANDARDS	SHEET	INTEGRAL COACH FACTORY CHENNAI-38				
			TS/MC-0-0-001				

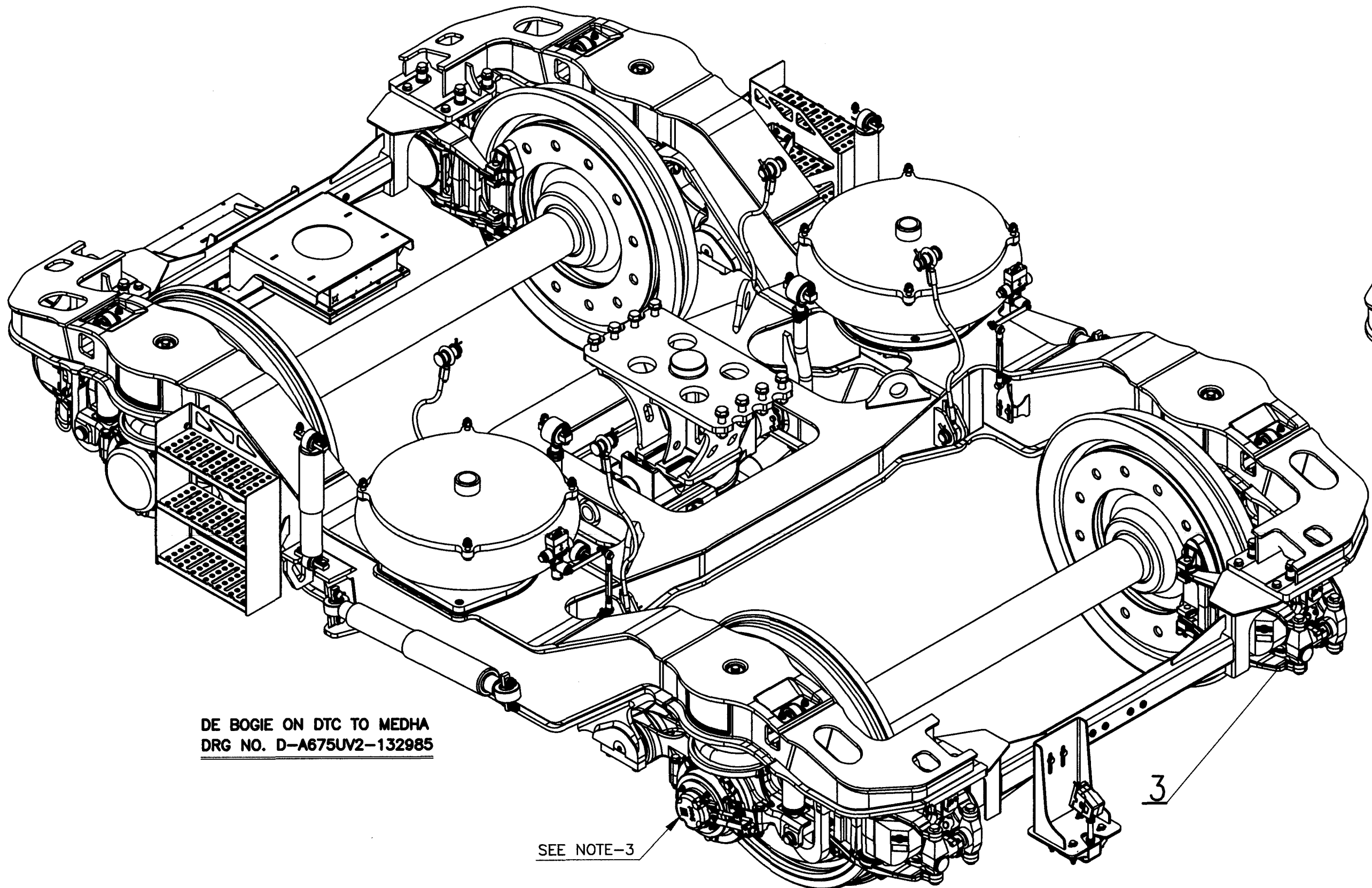


TS/MC-0-0-001

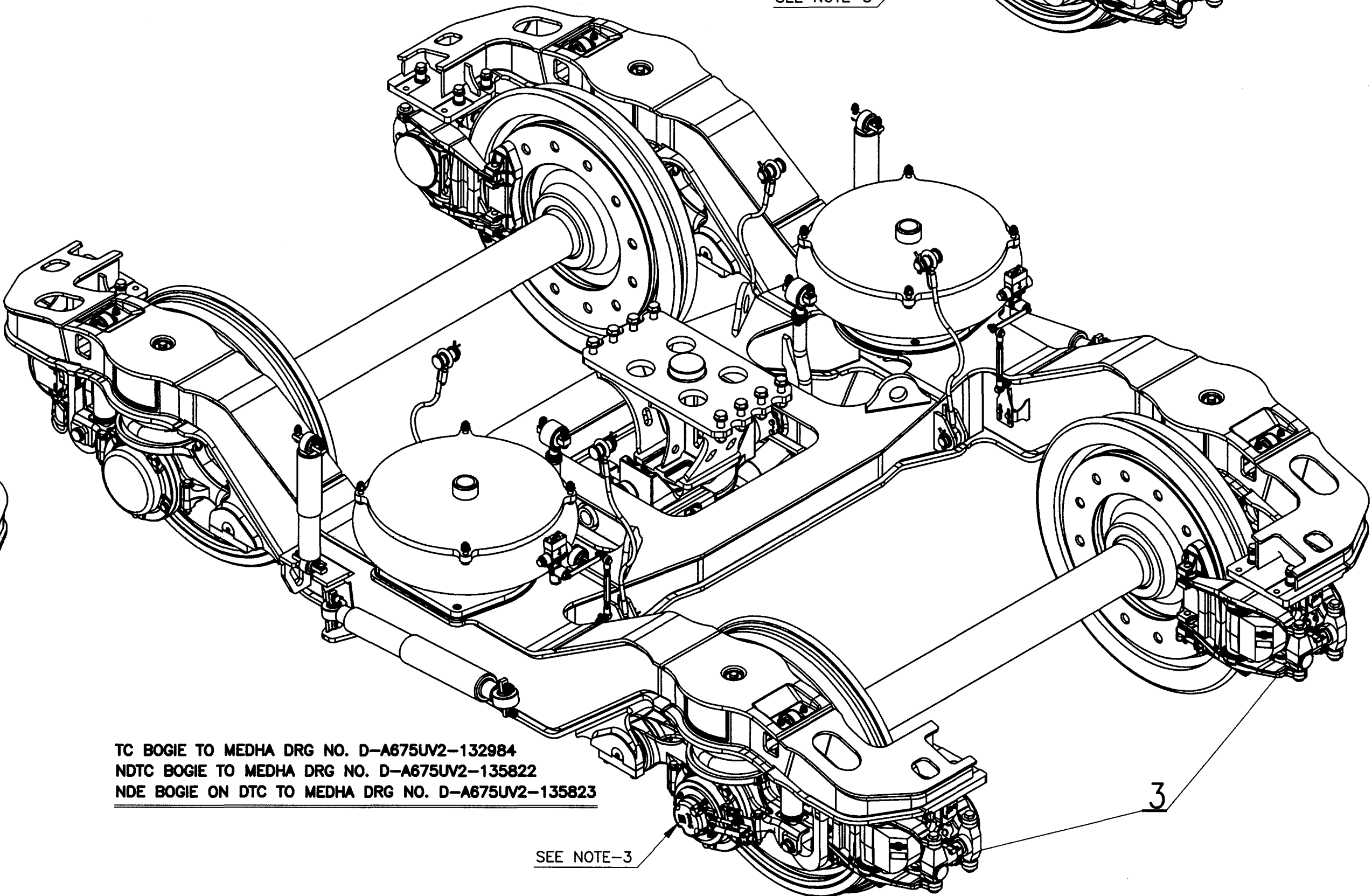
▽ ROUGH MACHINED	① ROUGH CLEANED	ALTERATIONS
▽▽ FINISH MACHINED	② CHAMFERED	
▽▽▽ FINE FINISH MACHINED	③ BURRS REMOVED	



MC BOGIE TO MEDHA  
DRG NO. D-A675UV2-132983



DE BOGIE ON DTC TO MEDHA  
DRG NO. D-A675UV2-132985



TC BOGIE TO MEDHA DRG NO. D-A675UV2-132984  
NDTC BOGIE TO MEDHA DRG NO. D-A675UV2-135822  
NDE BOGIE ON DTC TO MEDHA DRG NO. D-A675UV2-135823

NOTE:

- FOR OPEN TOLERANCES REFER NO: ICF/STD-9-0-001.
- COL-1 PERTAINS TO SHELL ITEMS.  
COL-2 PERTAINS TO FUR ITEMS.
- LOCATION/KEY DIAGRAM OF AXLE END EQUIPMENTS AS PER DRG NO. 89002001 SHALL BE FOLLOWED.
- BOGIE ASSEMBLY
  - BOGIE COMPLETE SUPPLIED BY M/s MEDHA.
  - THIS DRG IS APPLICABLE FOR FITMENT OF LOOSE ITEMS (OF BOGIE) ON CAR BODY AND BRAKE ITEMS ON BOGIE.

ISO VIEWS

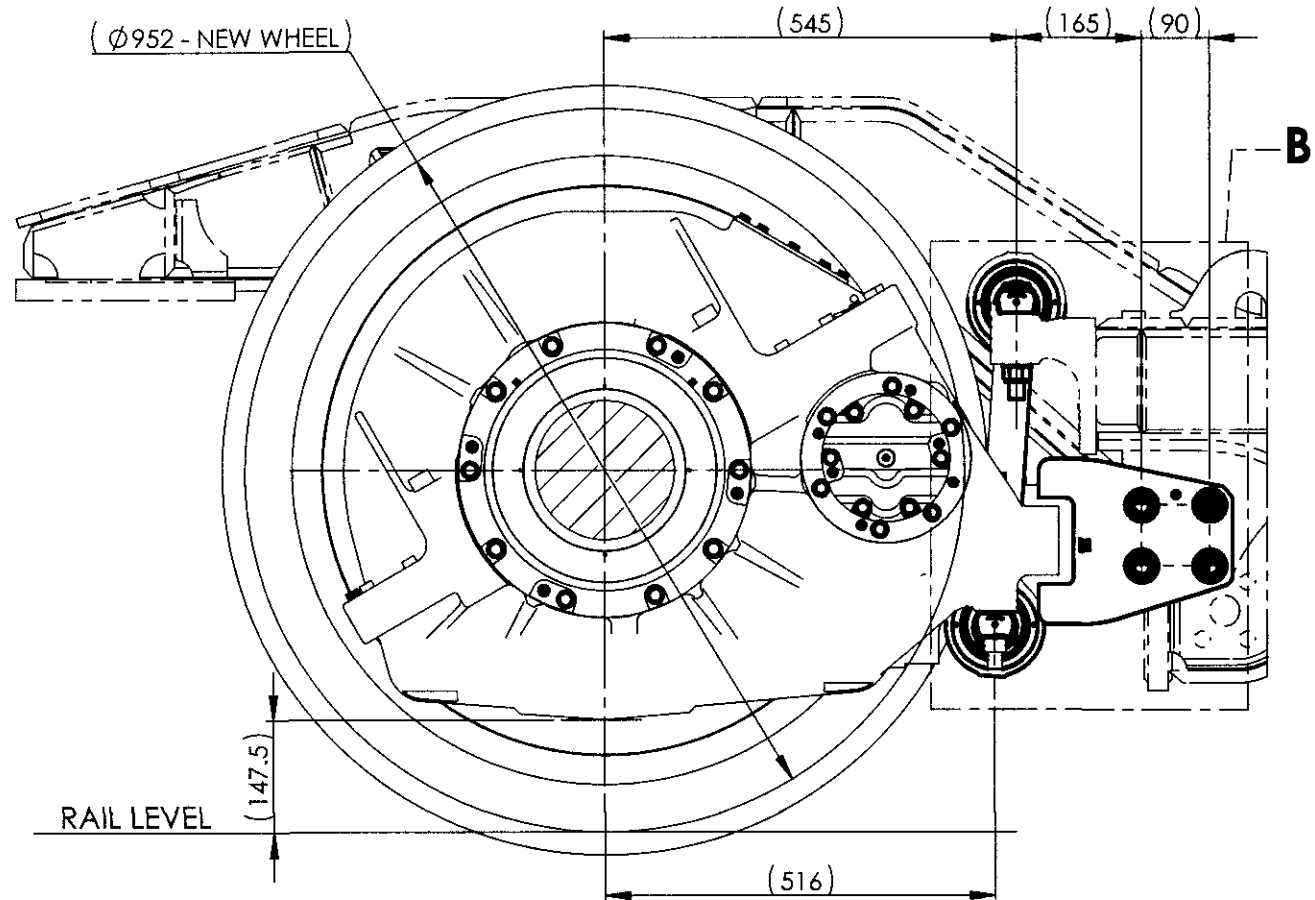
NO. OF ASSY. REQD. PER COACH			
TYPE OF COACH	COLS.	1	2
① TS/MC, TS/TC, TS/DTC, TS/MC2 TS/NDTC/EC, TS/NDTC/EC2		2	2

TS/NDTC/EC2-9-0-002
TS/NDTC/EC-9-0-002
TS/MC2-9-0-002
TS/TC-9-0-002
TS/MC-9-0-002
TS/DTC-9-0-002
ASSEMBLY DRAWINGS

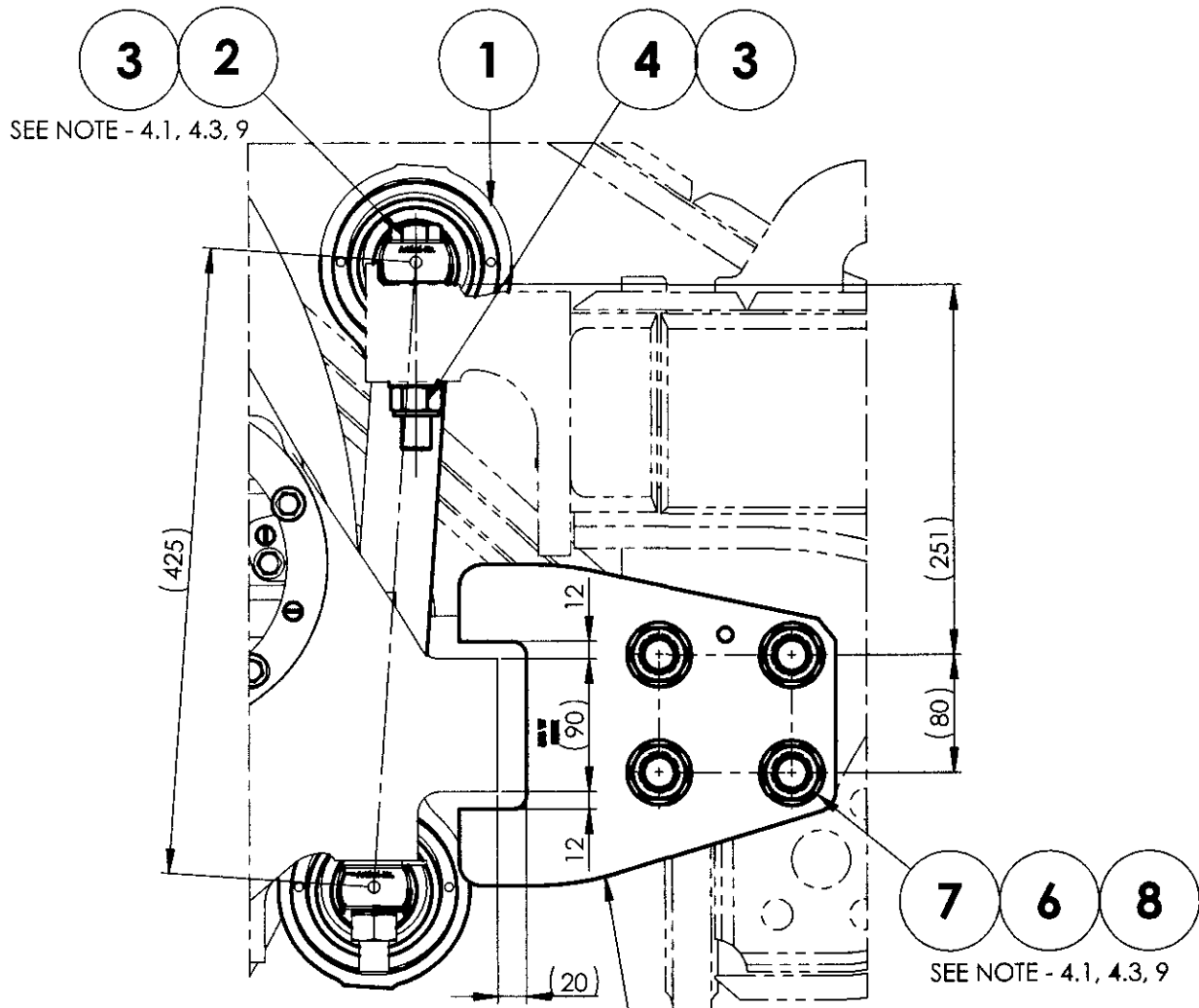
15-9-2021
AME/SME

✓	SUSPENSION DIAGRAMMATIC ARRANGEMENT	4	TS/MC 9-0-004			
1	DISC BRAKE FIXING ARRANGEMENT	3	TRAIN18/MC/MC 3-2-001			
1	SECONDARY SUSPENSION ARRANGEMENT (STAGE-2)	2	89005001			
-	1 CP PIN FIXING ARRGT.	1	89006001			
QTY	DESCRIPTION & DIMENSION	ITEM	REF.DRGS	MAT.SPEC	WEIGHT/UNIT	REMARKS
2	1 GROUP: 0-0					
BOGIE GENERAL ARRGT. FOR TRAINSET BOGIES						SUPERSEDED BY:
						SUPERSEDES:
						SCALE   SSE/D   SABAPATHY NATHAN M.
						1:10   CHD
						ALTD
						DRN   S.N.Karthikeyan
						Alpha Alt:-
						INTEGRAL COACH FACTORY CHENNAI-38
						TS/MC-0-0-001

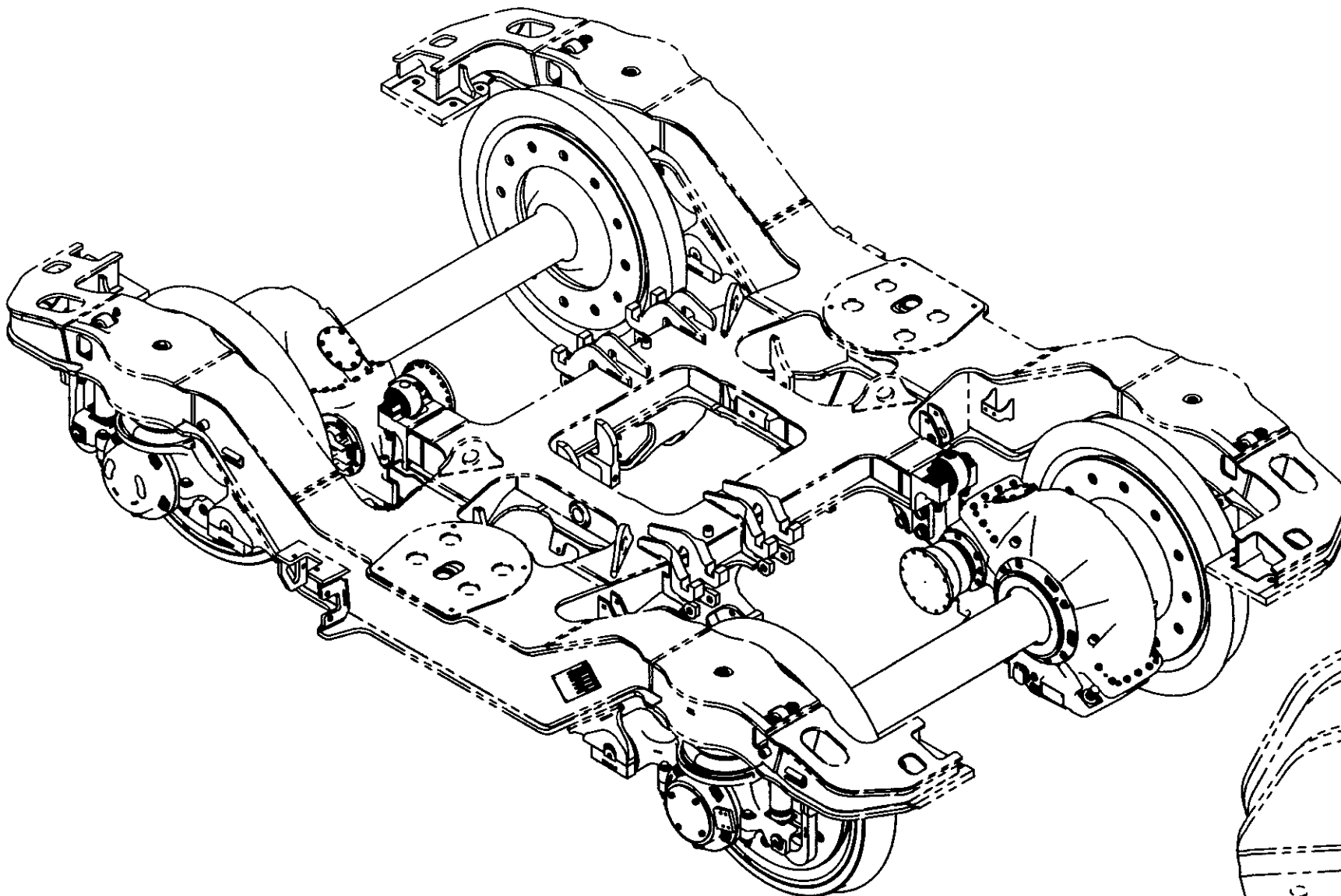
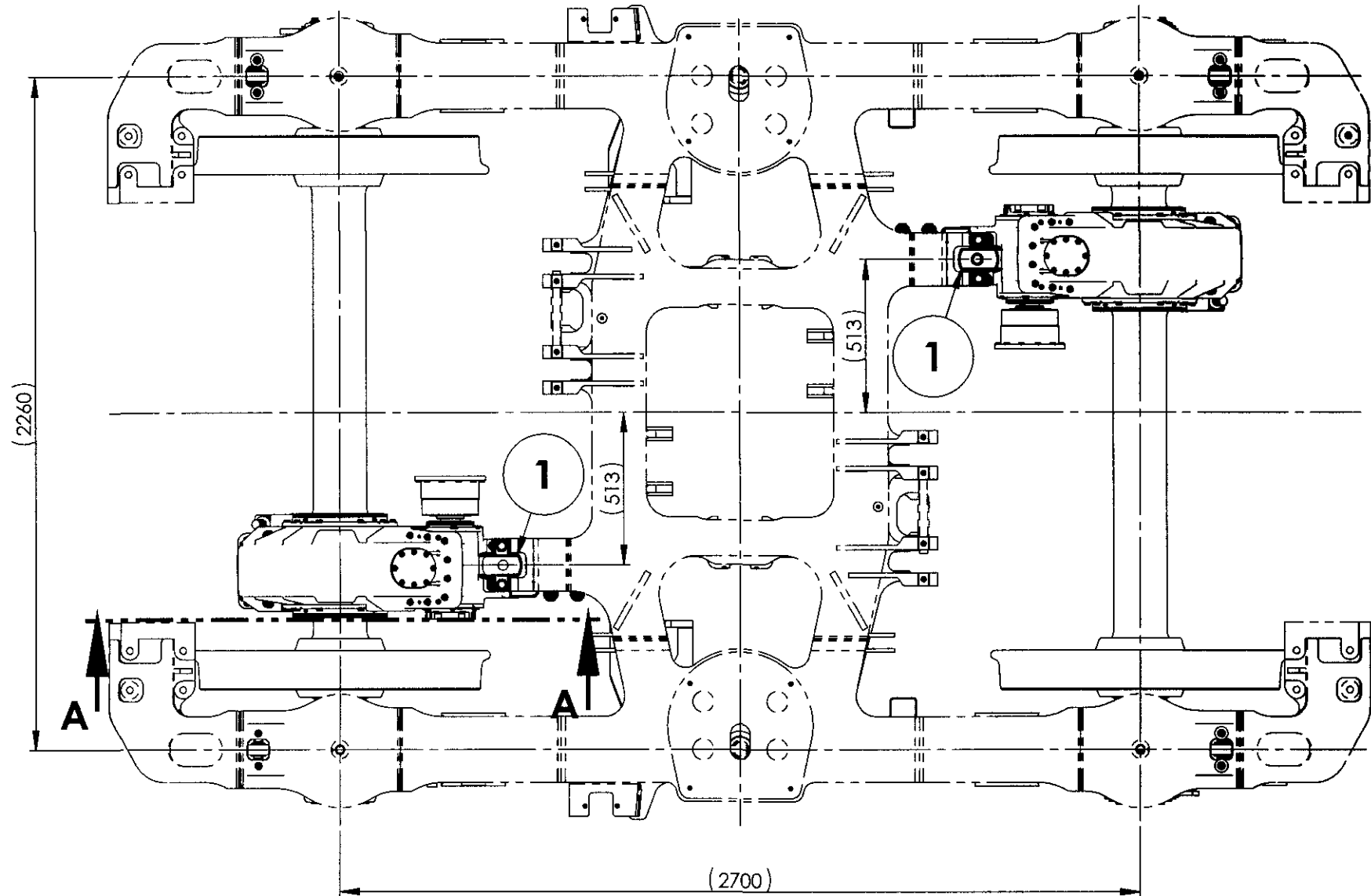
▽ ROUGH MACHINED	01	ROUGH CLEANED	REVISIONS			
▽▽ FINISH MACHINED	01b	BURRS REMOVED	ALT.	ZONE	DESCRIPTION	APPROVED & DATE
▽▽▽ FINE FINISH MACHINED	01c	CHAMFERED				



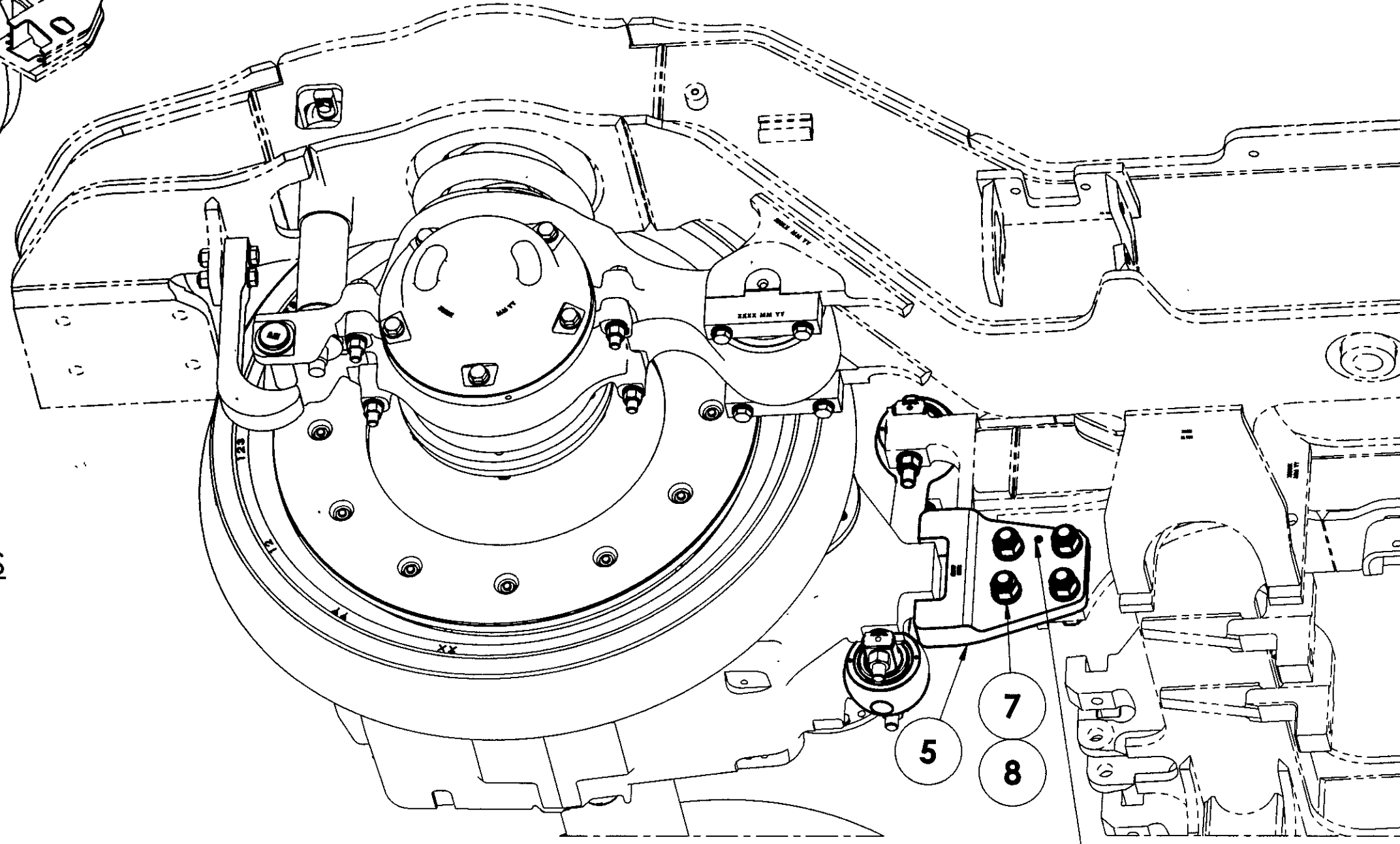
SECTION A-A  
SCALE 1 : 10



DETAIL B  
SCALE 1 : 5  
(SEE NOTE - 3)




ISO VIEWS

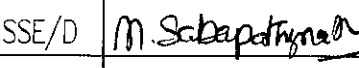


FOR ITEM-5, ENSURE ORIENTATION  
& HOLE POSITION AS SHOWN.

NOTE:

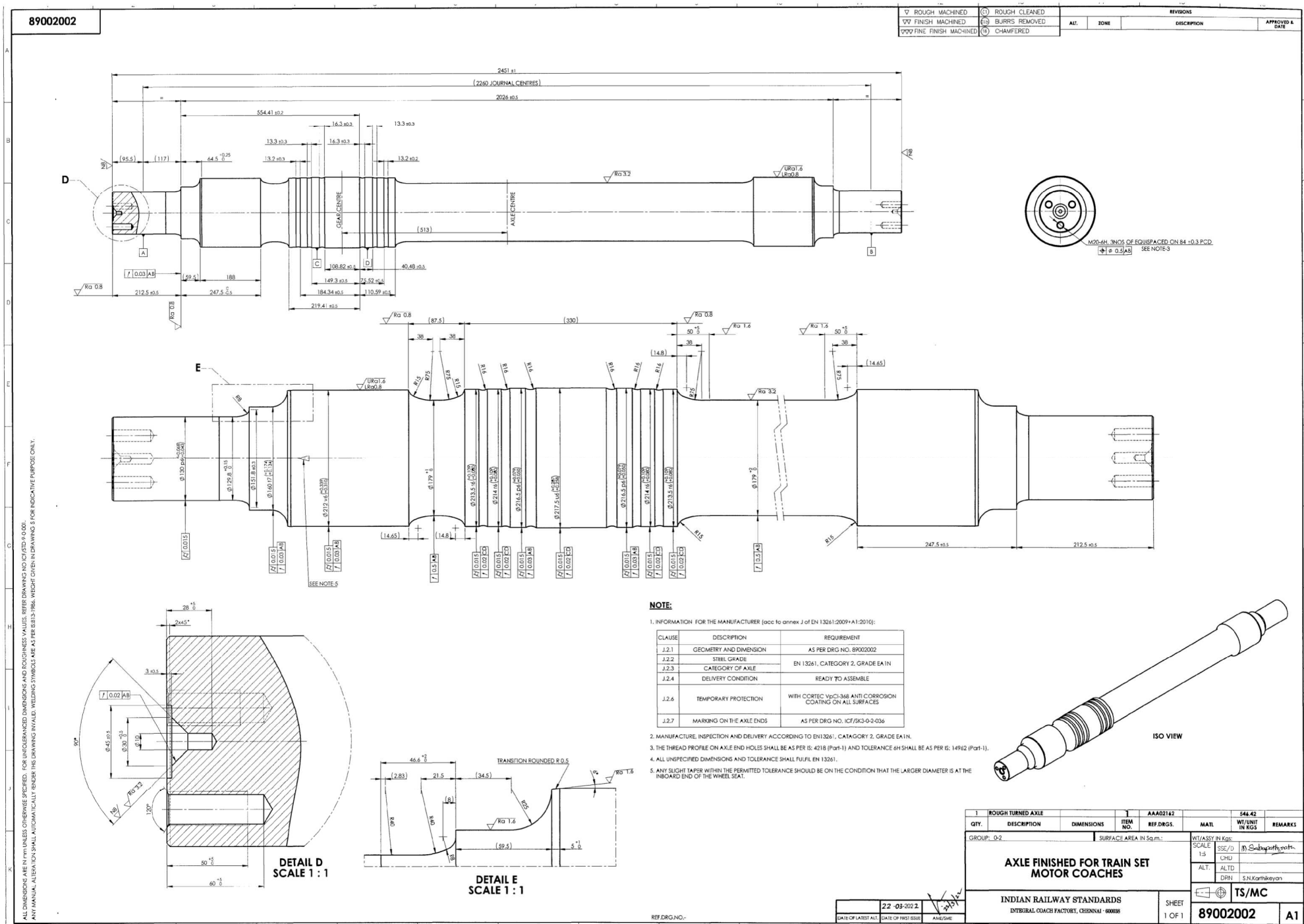
- REACTION ROD COMPLETE (REF. M/S TSA DRG. NO. TSA024288) SUPPLIED BY PROPULSION SYSTEM SUPPLIER ALONG WITH MOTOR / GEAR BOX AND COVERED IN ELECTRICAL SCOPE.
  - FOR GEAR BOX SIDE, ALL FASTENERS - BOLT, NUT, WASHER, ADJUSTMENT SHIMS ARE SUPPLIED BY PROPULSION SYSTEM SUPPLIER ALONG WITH MOTOR / GEAR BOX AND COVERED IN ELECTRICAL SCOPE.
  - ZINC ELECTROPLATED TO GRADE A3L OF ANNEX-E OF IS:1367 (PART-ELEVEN).
  - DIMENSIONS SHOWN ARE WITH NEW WHEEL IN TARE LOAD.
  - TIGHTENING TORQUE:  
4.1) M20-10.9 - 530 ± 5% Nm (REACTION ROD TOP SIDE)  
4.2) M24-10.9 - 900 ± 5% Nm (SAFETY CATCH)  
4.3) AFTER TIGHTENING TORQUE APPLICATION, SUITABLY MARK WITH PERMANENT MARKER OR PAINT ON BOLT/SCREW, NUT FACE, WASHER AND PART. THIS IS NECESSARY FOR INSPECTION / VERIFICATION / CHECKING IN SERVICE.
- EXAMPLE:
- 
- FOR ASSEMBLY OF REACTION ROD, INSTRUCTIONS OF PROPULSION SYSTEM SUPPLIER SHALL BE FOLLOWED.
  - BOLTS / SCREWS (ITEMS-2 & 6) SHALL BE OF MAKE - TVS OR UNBRAKO ONLY.
  - AFTER ASSEMBLY, UNPAINTED EXPOSED MATING SURFACES ON BOGIE FRAME SHALL BE SUITABLY COATED WITHRUST PREVENTATIVE.
  - FS ALL STEEL LOCK NUT:  
8.1) DIMENSIONS OF NUT SHALL BE AS PER DIN 6925/ DIN 980M.  
8.2) NUT SHALL BE OF MAKE M/S FLAIG + HOMMEL GmbH, GERMANY.
  - DURING ASSEMBLY, THREADS & BEARING SURFACES OF BOLTS & NUTS SHALL BE SUITABLY APPLIED WITH ANTI-SEIZE COMPOUND (MOLYKOTE 1000 or ANABOND NEVESEIZ C-975 or SIMILAR).
  - FASTNERS & SAFETY CATCH (ITEMS - 2 TO 8) AND SHALL BE IN BOGIE SUPPLIER'S SCOPE.

8	FS ALL STEEL LOCK NUT	M24- PROPERTY CLASS - 10	8				ZINC ELECTROPLATED SEE NOTE-3, 8, 10
16	WASHER ISO 7089 - 24 - 300 HV		7	ISO 7089			ZINC ELECTROPLATED SEE NOTE-3, 10
8	HEXAGON HEAD BOLT	ISO 4014-M24 x 90-10.9	6	IS:1364 PART-1			ZINC ELECTROPLATED SEE NOTE-3, 6, 10
2	SAFETY CATCH		5	AAA00005	10.25		SEE NOTE - 10
4	FS ALL STEEL LOCK NUT	M20- PROPERTY CLASS - 10	4				ZINC ELECTROPLATED SEE NOTE-3, 8, 10
8	WASHER ISO 7089 - 20 - 300 HV		3	ISO 7089			ZINC ELECTROPLATED SEE NOTE-3, 10
4	HEXAGON HEAD BOLT	ISO 4014-M20 x 140-10.9	2	IS:1344 PART-1			ZINC ELECTROPLATED SEE NOTE-3, 6, 10
2	REACTION ROD		1		2.43		SEE NOTE-1, 2, 5
QTY.	DESCRIPTION	DIMENSIONS	ITEM NO.	REF.DRGS.	MATL	WT/UNIT IN KGS	REMARKS

GROUP: 0-0		SURFACE AREA IN Sq.m.:		WT/ASSY IN Kgs:	
REACTION ROD FIXING ARRGT. FOR TRAIN SET MOTOR BOGIES		SCALE	SSE/D		
		1:20	CHD		
		ALT.	ALTD		
		DRN	DRN		
INDIAN RAILWAY STANDARDS		SHEET		TS/MC	
INTEGRAL COACH FACTORY, CHENNAI - 600038		1 OF 1		89000003	
				A1	

06-04-2022		
DATE OF LATEST ALT.	DATE OF FIRST ISSUE	AM/SM/ME







A

B

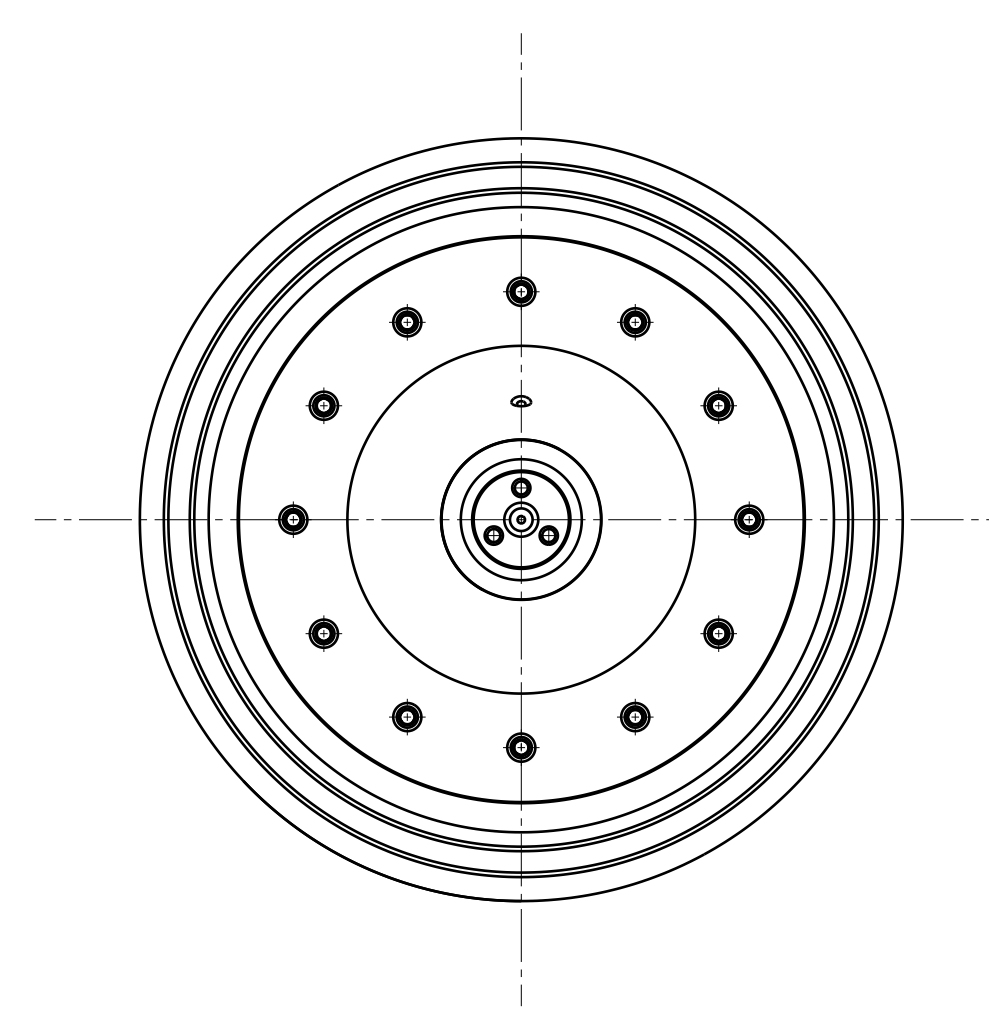
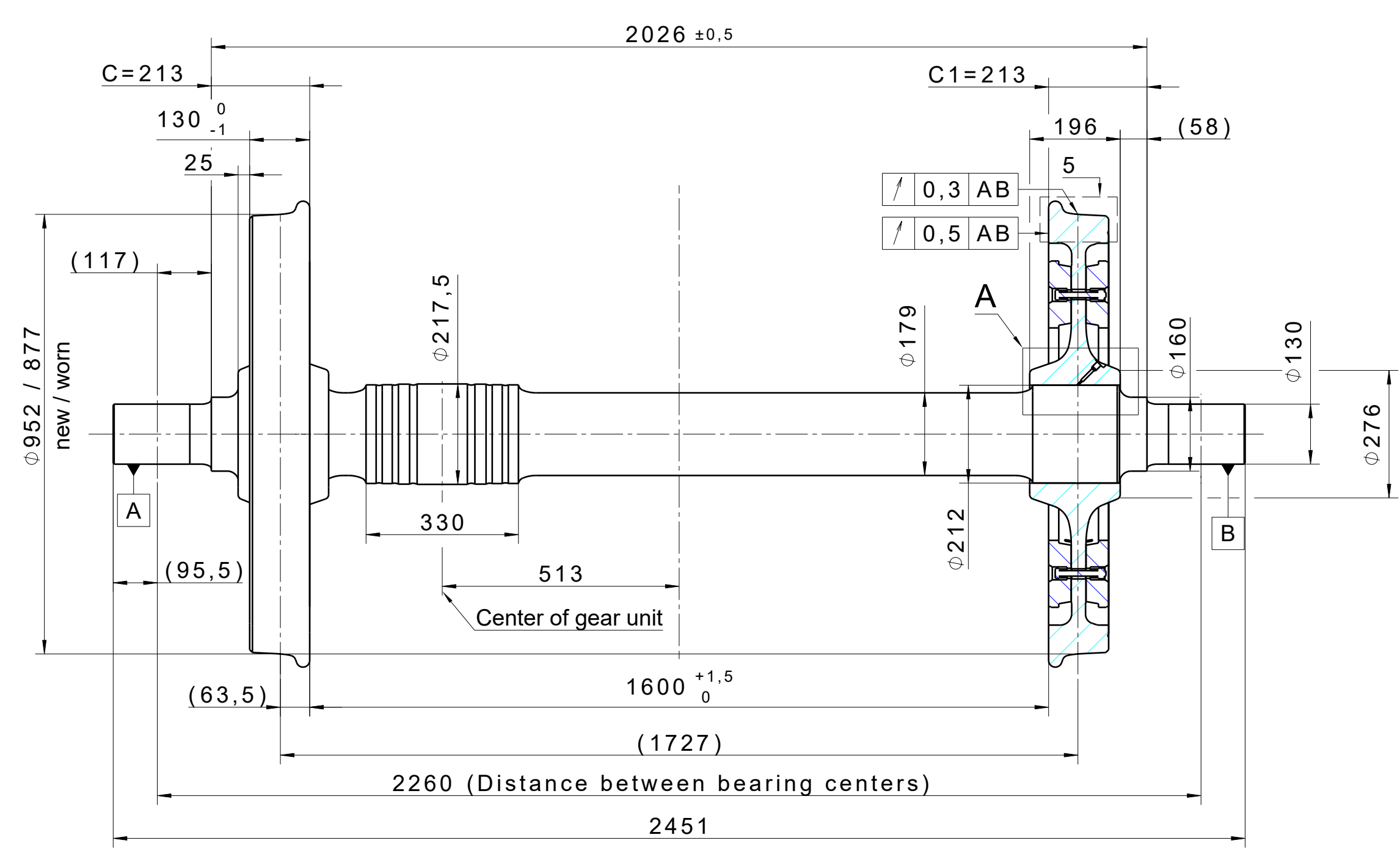
C

D

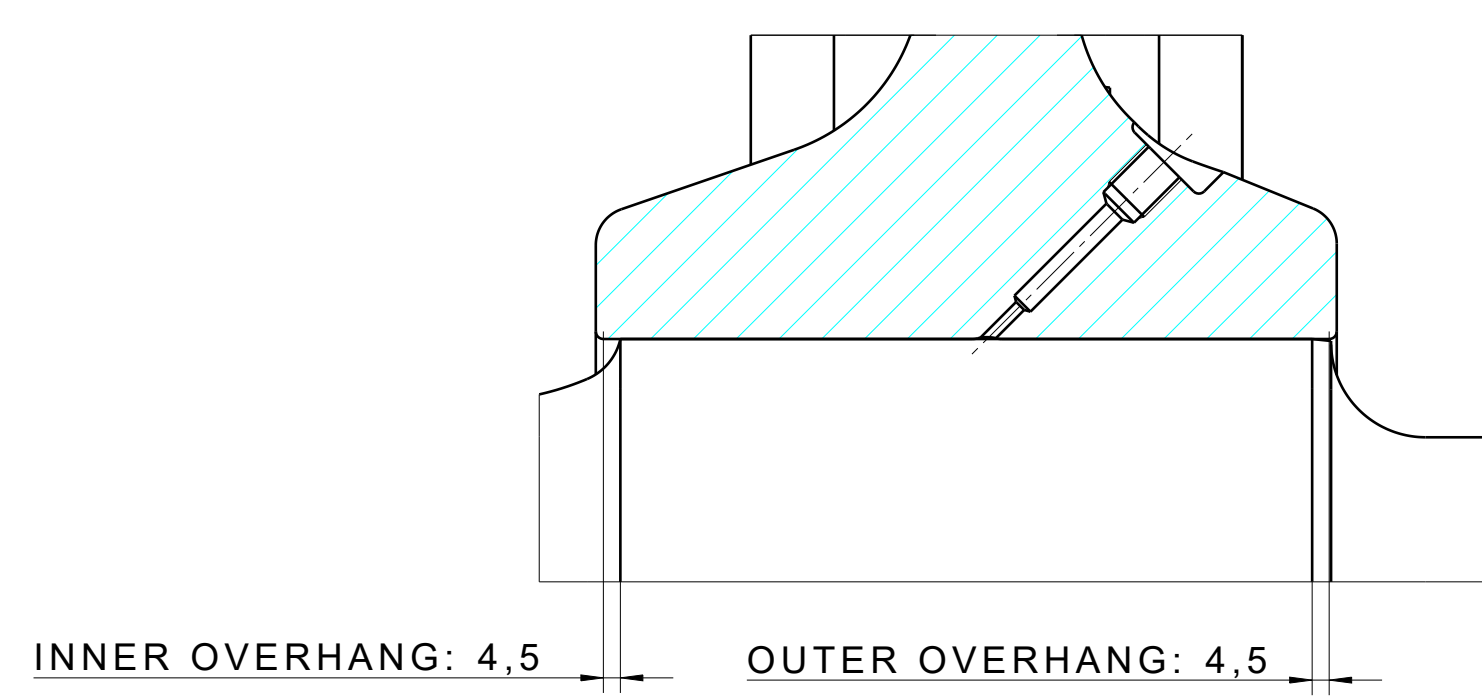
E

F

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RELEASED FOR  
PROTOTYPE



A  
1:2

- 1. DIFFERENCE BETWEEN C AND C1 DIMMENSION ≤1mm
- 2. DIFFERENCE IN TREAD CIRCLE DIAMETER ≤0,3mm
- 3. MAXIMUM DYNAMIC IMBALANCE ACCORDING TO EN 13260: 75 gm
- 4. MAXIMUM AXLE LOAD: 17 TONNES
- 5. WHEEL PROFILE AS PER RDSO SKETCH SK-91146
- 6. MAXIMUM OPERATING SPEED: 160 KM/H
- 7. WHEEL OVERHANG:  
NOMINAL: 4,5mm (INNER AND OUTER)  
MAXIMUM: 6,2mm (INNER)  
MINIMUM: 2,05mm (INNER)  
MAXIMUM: 7,45mm (OUTER)  
MINIMUM: 3,3mm (OUTER)
- 8. MANUFACTURE, MARKING AND DELIVERY ACCORDING TO EN13260, CATEGORY 2b

4	RELEASE	10.2021	M. Wróblewski	Weight [kg]	-	General Tolerances: ISO 2768-mK ISO 8015	Material:	
3	GEOMETRY UPDATE	10.2021	M. Wróblewski	Size	A2			
2	GEARBOX INTERFACE CHANGE	06.2021	M. Wróblewski					
1	DIMENSIONS CHANGE	04.2021	M. Wróblewski					
Rev.	Description	Date	Name					
Scale:	1:5	Prepared	03.2021	M. Wróblewski	Driven Wheelset Specification			
		Checked	03.2021	R. Grzesiak				
		Approved						
		Date	Name					
		en						
		Drawing number: MT18Br2 001480-4					Revision: -	Sheet number: 01/01

**REVISION SHEET OF BHEL TECHNICAL SPECIFICATION NO. OF TM20587  
FOR GEAR DRIVE ASSEMBLY FOR TRAIN SET APPLICATION**

<b>Sl. No.</b>	<b>Page No.</b>	<b>Details of revision in SPEC. No. TM20587 REV.02 DT 27.03.2023 with respect to REV 01 DT. 02/02/2023</b>
1	6	Sl. no. vii added in clause no. 5.1.
2	7	Sl. no. v to vii added in clause no. 5.3.
3	-	Annexure-1: In sl. no. 11 to 21 (Drive gear assembly), reference of relevant annexures mentioned.
4	-	Annexure-1: In sl. no. 8 (Drive gear assembly), gear drive assembly weight updated from 400 kg to 420 kg (max.).
5	-	Annexure-1: In sl. no. 14 (Drive gear assembly), range of center distance (372-376) mm added in place of center distance 372 mm.
6	-	Annexure-1: In sl. no. 19 (Drive gear assembly), distance between end of flexible coupling & gear drive assy. pinion side updated from 500 to 515 mm (max.).
7	-	Annexure-1: In sl. no. 20 (Drive gear assembly), width of gear drive assembly sitting on axle updated from 320 to 350 mm (max.).
8	-	Annexure-1: In sl. no. 3 (Traction motor), motor weight updated from 1000 to 1100 kg.
9	-	Annexure-1: Details of bogie primary suspension movement updated.
10	-	Annexure-3: Revision of drawing no. 14450005052 changed from 0 to 1.

<b>Sl. No.</b>	<b>Page No.</b>	<b>Details of revision in SPEC. No. TM20587 REV.03 DT 12.05.2023 with respect to REV 02 DT. 27/03/2023</b>
1	4	Information submission time changed to “within 3 weeks from PO date” in place of “with techno-commercial offer”.
2	4	In sl. no. b of clause 3, quantity of tools added.
3	9	In clause no. 6.1, sl. no. ‘iii’ added.
4	9	In clause no. 6.2, document submission time after PO placement changed from 2 months to 4 weeks.
5	12	Sl. no. 6.5 added.
6	-	Annexure-1: In sl. no. 8 (Drive gear assembly), tolerance of $\pm 7\%$ added in weight.

1637561/2023/HEP-12/05/2023	Sl. No.	Page No.	Details of revision in SPEC. No. TM20587 REV.04 DT 04.08.2023 with respect to REV 03 DT. 12/05/2023
	1	3	In clause 2, requirement of painting & temporary rust preventive added.
	2	3	In clause 2, sl. no. 1.6 added.
	3	4	In clause 3 (b), sl. no. 4 deleted.
	4	6	In sl. no. ii of clause 5.1, "totally enclosed" deleted.
	5	6	In clause 5.1, sl. no. 'viii' added.
	6	8	In sl. no. 'v' of clause 5.5, "light grey colour" deleted.
	7	9	In clause 6.1, description of sl. no. 'i' updated.
	8	9	In clause 6.1, sl. no. 'ii' & 'iii' added and sl. no. 'ii' of rev.03 deleted.
	9	9	Description of clause 6.2 updated.
	10	10	In sl. no. 'iii' of clause 6.2, "external envelope" added.
	11	10	In clause 6.2, description of sl. no. 'v' & 'vi' updated.
	12	10	In sl. no. 'xv' of clause 6.2, "RAMS, LC" added.
	13	11	In clause 6.2, sl. no. 'xxiv' added.
	14	12	Clause 6.5 deleted.
	15	13	In clause 7, type testing details of individual items of gear drive assembly added.
	16	13	In clause 7, sl. no. 'viii' to 'xii' deleted and vibration & noise measurement added in sl. no. 'xiii' to 'xvi'.
	17	14	In clause 8, annexure-9 added.
	18	14	In sl. no. iii of clause 8, "preliminary" added and revision no. of drawing no. 14450005052 changed from 1 to 2.
	Annexure-1		In sl. no. 18 (Drive gear assembly), dimension 515 changed to 580 mm.
	Annexure-1		In sl. no. 3 (Traction motor), weight 1100 changed to 950 kg.

Annexure-8			
Load cycle and speed time relation for L10 life calculation			
EMU Speed [km/h]	Motor Speed (RPM)	Motor Torque [Nm]	Time (%)
0-50	730	2249.71	13
50-120	2772	1235.0855	26
120-140	4074	827.44	12
140-160	4910	472.73	49