Introduction to Trainset bogies

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Diagram: Two Stage Suspension System



Simple DOF of a Single Body

- □ 3 linear
 - Shuttling
 - Lurching
 - ✤ Bouncing
- 3 rotational
 - Rolling
 - Pitching
 - Nosing or Yaw



EMU / MEMU motor bogie

- 20.32 t axle capacity
- ➤ Spherical roller bearings 22328 C/C3
- Primary suspension Coil springs with dashpot arrgt.
- Secondary 180 kN air springs, vertical & lateral dampers.
- Side bearers with oil.

> 203mm JSL type brake cylinders, brake levers, brake beams, 'K' type high friction composite brake blocks, spring applied PB.

➤ Max speed – 110 kmph



DEMU trailer bogies





 Common for all makes of 1400 hp & 1600 hp DEMUs.
 Air springs -180 kN & control equipment common for all types of DEMUs & EMUs.

Fiat bogie



Fiat bogie with air springs





Salient features of trainset bogies

- Bolster less bogie carbody rests on air spring less components.
- Suitable for 160kmph.
- Max. axle load 17 t.
- CTRB.
- Primary suspension with helical springs & damper.
- Secondary suspension air springs.
- Dampers secondary vertical, lateral & yaw.
- Stabilisers / anti roll bar.
- Wheel mounted disc brakes.
- Common bogie frame (basic) for both MC & TC.
- Traction motors fully suspended less unsprung mass.

Trainset motor bogies – new design

Differences with existing T-18 bogie

- Traction motor with opening for air inlet bellows
- ➤ CP pin
- Primary springs
- Air springs
- CTRB, control arm, bush, covers etc
- Bogie frame changes in spring pot, plate thickness.
- Metal bonded rubber items.
- Dampers.
- ➤ Wheel & axle
- ➤ Wire rope

Common with existing T-18 bogie

Complete carbody interfaces.

All bogie brake items – brake disc, caliper units, brake pad, phonic wheel





Primary spring failures - contd

• Poor drainage on top side of control arm.



Old – 50mm depth, one side drain hole 10mm

New – 15mm depth, both sides open drain 24mm width

Trainset trailer bogies – new design

Additional features compared with existing T-18 bogie

- > TPWS provision.
- > APC receiver provision.
- Basic bogie frame is common with MC.

COMPARISON BETWEEN FIAT, TRAIN 18 & EMU BOGIES

	FIAT Bogie	Trainset Bogie	EMU bogie		
Over all dimension(LxB xH)	3534 x 3030 x 1125	4308 x 2855 x 988	3976x2830x920		
Wheel base (mm)	2560	2700	2896		
Wheel diameter New/ worn (mm)	Ø 915 / Ø 845	Ø 952 / Ø 877	Ø 952 / Ø 877		
Wheels	Solid forged wheels, curved webs	Solid forged wheels, straight webs to provide brake discs.	Solid forged / cast wheels, curved webs		
Axle capacity	16 t	17 t	20.32 t		
Wheel seat dia	195mm	212mm for MC, 190 for TC (222mm old)	193 mm		
Axle body dia	170mm	179mm for MC, 160mm for TC	184mm		
Bearing	CTRB 130 mm - SKF / Timken	CTRB -130mm – SKF/Timken	Self aligning spherical roller bearing – NEI/FAG – 22328 C/C3		
Axle guidance	Axle control arms with pivot bush	Axle control arms with pivot bush	Rigidly guided with welded guides, working in oil filled dashpot.		
Primary suspension	Nested Helical springs with shock absorber and silent bloc in axle control arm.	Nested Helical springs with shock absorber and silent bloc in axle control arm.	Single helical springs resting over rubber pad & oil filled dash pot.		
Secondary suspension	Flexi-coil spring/ Air spring over bogie side frame with 2 vertical dampers and one lateral damper.	Air spring over bogie side frame with 2 vertical and 2 lateral dampers.	Air spring fitted over LS beam (Cradle welded to bogie side frame)		
Brake system	Axle mounted disc brake system.	Wheel mounted disc brake system. (KB / Faiveley)	Clasp type with brake levers, brake beam & pull rod		

COMPARISON BETWEEN FIAT, TRAIN 18 & EMU BOGIES - contd

	FIAT Bogie	Trainset Bogie	EMU bogie			
Brake unit	Calipers provided inside the frame	Brake calipers provided at ends of bogie frame.	8" single acting BMBC – 4 Nos. per bogie			
Parking brake / Hand brake	Hand brake in LWRRM / SLRD only.	50% of wheels in all coaches are with spring applied parking brake. PB is an integral unit of brake caliper.	Diagonally opposite wheels with spring applied PB.			
Bogie rotation stops	Provided	Not available	Not provided.			
Longitudinal bump stops	Trovided					
Other features	Yaw damper, Anti-roll bar,	Secondary vertical damper, lateral damper, lateral rubber stop.				
Bogie suitable for max speed	160 kmph	160 kmph	110 kmph			
Provision of traction motors	Not feasible	Provided with fully suspended traction motors.	Provided with axle hung nose suspended traction motors.			
Bogie type	Bogie with bolster	Bolsterless bogie	Bogie with bolster, side bearer loaded.			
Provision of axle end equipments	WSP sensor, axle earthing	WSP sensor, axle earthing, speed sensor	Speed sensor for speed indication.			
Bogie weight	6.635 t	10.50 t for MC, 7.21 t for TC	10.793 t for MC, 6.68 t for TC			
Unsprung mass	3.10 t	3.945t for MC, 3.765t for TC (4.910 for MC, 3.910 for TC)	6.220 t for MC, 3.54 t for TC			
Motor rating	NA	210 kW, 3574 rpm, Gear ratio – 5.158	268 kW, 1398 rpm, Gear ratio – 4.478 (Medha / TSA make)			

Wheel & axle



Wheels with straight webs to fix brake disc.

New wheel dia 952, wornout dia 877 – common for all bogies.

Supplier – M/s Bonatrans / M/s KLW.







Wheel – straight webs





Wheel for other coaches

CTRB



Axle end equipments



Bearing arrgt. – cross section



Phonic wheel along with security disc screwed to axle end using M20x80 hex screw.
 M8 screws in Fiat.

Bogie frame





Top flange – 12, webs 12, 10, 32 Bottom flange -16, stiffeners - 8

All plates – EN 10025 S355J2W+N Castings – EN 10293 G24Mn6+QT1 Forgings – EN 10250-2 S355J2G3 <u>Seamless tubes – EN 10210 S355J2H</u>

Primary suspension



- Inner & outer springs M/s Axtone / M/s Gruber.
- Rubber metal bonded items Bump stop, primary spring pad M/s GMT.
- Bogie frame lowered on wheel sets with springs.

Primary suspension - contd



Primary vertical damper – M/s ZF
 / M/s Koni.

- Control arm locked with frame.
- Lift stop & pins.
- Damper top side fitted to the cavity in bogie frame.



Primary bump stop clearance



Primary suspension – completed



Secondary suspension components



Secondary suspension components - contd





Lateral bump stop.
Shims to adjust lateral clearance





Adaptor plate screwed to bogie. Bump stop fixed to adaptor plate.

Secondary suspension components - contd





Stabiliser assembly



Traction centre, traction bar assembly



Secondary suspension components - contd



- ➢ Air springs M/s GMT, M/s Contitech
- ➤ Fixed on bogie side frame.
- Rod extends inside side frame.





Components fixed to car body



- ≻CP pin.
- Stabiliser link.
- ➤ Wire rope.

Body Bogie Interface







NO. ASSEMBLIES REQUIRED P	ER COACH
THRE OF COACH	1
O ALL COADIES OF TRAN18, DAU-US & MEMU-US.	2

TABLE-1. SHIW THICKNESS (SEE NOTE-2)

AMERAGE WHEEL TREAD OUR DETWEEN THE WHEELS ON SAME BOOK.	DRM THEOREES
ABONE 932 10 952	-
ABOVE \$12 UPTO \$32	10
ABOVE 892 UPTO 912	29
BETOM 885	30

LE PLATE	
ME-2.3	THIS CRAW
	RALWAYS P

100	
NO1	10.0

1. FS ALL STEEL LOCK MUT

DETAIL - A

1.1 DIMENSIONS OF NUT SHALL BE AS PER DIN 6925/DIN 990M.

Construction Construction Construction Construction Construction Constructions Constructions

- 1.2 NUT SHALL BE OF WAKE M/S FLAIG+HOMMEL GHOH, GERMANY.
- 2. ADJUSTMENT FOR WHEEL WEAR
 - 2.1. TO COMPENSATE WHEEL WEAR, PROVIDE SHIMS (TEM-1) SUETABLY BELOW AIR SPRING, SHIM THEORNESS SHALL NOT BE MORE THAN 30mm.
 - LENGTH OF HEXAGON SOCKET COUNTER SUNK HEAD SCREW (ITEM-2) SHALL BE SELECTED TO SUIT SHIM THEORNESS.

SEE NOTE-2.1, INILE-1

- 2.3. ADJUSTER PLATE SHALL BE PROVIDED BY SHIFTING HOLE POSITIONS TO SUIT INSTALLATION LEVER OF LEVELING VALVE.
- 2.4. FOR ADJUTMENT OF STABILZER LINK, INSTRUCTIONS OF M/S GMT SHALL BE FOLLOWED.
- FOR OTHER ITEMS, FORMS ARRANGEMENT, TIGHTNING TOROUES ETC. REFER DRG NO. 72705001,72705004, 78005001 & 78005002.
- 4. SCREW SHALL BE OF MAKE TVS OR UNBRAKD OR LPS ONLY.
- 5. ZINC ELECTROPLATED TO GRADE ASL OF ANNEXURE-E OF IS:1367 (PART-ELEVEN).
- 6. TIGHTENING TORQUE M12-8.8 65Nm.
- DURING ASSEMILY MATING THREADS AND BEARING SURFACES OF SCREW & MJT (ITEM-2&4) SHALL BE SUITABLY APPLIED WITH ANTI-SELZE COMPOUND (MOLYKOTE 100 OR ANABOND NEVERSELZE C-975).

H	1		-		WIT CORE	HARDEN A BOT	SEL NOT-2.1, SEL 1
	6	SHM	1	ANN05152	TABUE KAN	100W5	
Г	8	IESUS SOOT CENTER SIN HER SORT ISO 10642-M12x100-8.8	2	6 4741			SEE NOTE-2.2.
	8	WASHER ISO 7089-12-300 HV	3	150 7099			SEX NOTE-5
Γ	8	FS ALL STIEL LOOK NUT M12 - PROPERTY CLASS- 10	4				SEE NOTE-1.5





THIS	CPA	NINO	15	APPL	JCA	3.8	FOR	USER
PALM	AYS	FOR	PR	OVIDE	NO	PAC	KNG	TO
COMP	20	ATE I	enc)	а, ж	i (Al	L		



Wheel balancing for Trainset bogies

Clarifications to Charbagh Workshop/NR for letter No. 516-M/DMU/Trainset/Material/ML-3 Dt. 18-01-2022

M/s Bonatrans wheel drawing



- Max static imbalance = 75 gm.
- > This is defined in specification EN 13262 clause 4.8 also.
- Balancing is achieved by machining on inner rim's ID of wheel.
- Position of residual imbalance is marked (punched) on all wheels as per drawing No. D11-4-01686.

Marking of position of imbalance



For purpose of traceability, each wheel shall be identified, as a minimum, with the following marks:

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prEN 13262:2017 (E)

- manufacturer's mark;
- cast number;
- steel grade;
- month and two last figures of the year of production;
- position of residual imbalance and its symbol (see 4.8);
- serial number after heat treatment.

These may be applied according Figure 9 or as defined in the technical specification. These marks shall be stamped, except for imbalance marks which may be made by other means. Stamps with sharp edges are not allowed.



Activa Go to S

Figure 9 — Manufacturer's marking possible places

- Position of imbalance marked by E2 (E3 as per drawing) on wheel's inner hub face.
- > This is defined in specification EN 13262 clause 4.10 also.
- > This marking is important for assembly of wheel sets.

Wheel specification - EN 13262

4.8 Static imbalance

The maximum static imbalance of a finished wheel in the delivery condition is defined in Table 11.

The means and methods of measurement shall be defined in the technical specification.

Γable 11 — Maximum static imbalance of the finished wheels in the delivery or ready for	
assembly state	

	For vehicles running at speed v km/h	Static imbalance g·m	Symbol
	<i>v</i> ≤ 120	≤ 125	E3
	120 < v ≤ 200	≤ 75	E2
1	200 < v ≤ 250	≤ 50	E1
	v > 250	≤ 25	E0

- Max speed is 160 kmph for trainset.
- Hence, as per clause 4.8, max static imbalance = 75 gm.
- As per table E.1, 100% of the finished wheels shall be tested for static imbalance.
- Hence, it is suggested that, wheels (even rough turned wheels) shall be procured in pre balanced condition, duly marked (punched) as E2 in all wheels.

prEN 13262:2017 (E)

Table E.1 — Type and number of controls to be carried out

Characteristics to be verified	Number of	Subclause reference		
	Qualification (see D.4.5)	Deli (see	very E.4)	
Maximum size of the batch	≤ 100	≤ 250	> 250	-
- Chemical composition	1	1	1	4.1
- Hydrogen content	а	а	а	ь
- Tensile characteristics				
in the rim	1	1	2	4.2.1
in the web	1	1	2	4.2.1
- Hardness on rim parts	1	1	2	4.2.2
- Hardness on rim (homogeneity)	100 %	100 %	100 %	E.5.2
- Impact tests	1	1	2	4.2.3
- Toughness ^c	1	1	1	4.2.5
- Heat treatment homogeneity	10 % ^d	1	2	4.3
- Inclusion cleanliness	1	1	2	4.4.1
- Internal integrity				
Rim	100 %	100 %	100 %	4.4.2
hub	100 %	-	-	4.4.2
web	20 %e	-	-	4.4.2
- Residual stresses trends	1	1	2	f
- State of surface	100 %	100 %	100 %	4.6.1
- Surface integrity	100 %	100 %8	100 %8	4.6.3
- Geometry and dimensions	100% ^h	100% ^h	100 % ^h	4.7
- Static imbalance	100 %	100 %	100 %	4.8

^a One analysis by cast. Sampling shall make it possible to ensure that the content measured is representative of the maximum hydrogen content of the cast.

^b The hydrogen content is determined according to the methods described in Annex P (normative). It has to be ≤ 2 ppm for wheels of category 1 and ≤ 2,5 ppm for wheels of category 2.

Only tread braked wheels. The results of the fracture toughness test of samples from a small batch of wheels can be assumed for additional batches delivered up to an overall total of 250 wheels in a tweive-month period, provided that the results of previous fracture toughness tests were within specification.

d Only category 1 wheels

The rejection of one wheel in a batch will require verification of the whole batch

f Clause 5 for qualification and E.5.3 for delivery

g In accordance with the technical specification, visual inspection as defined in E.5.4 may replace magnetic particle inspection.

^h Tread diameter, bore diameter, tread run out, rim profile, conformity to permitted deviation from circularity on at least one wheel from a production batch.

Balancing of wheels

Wheel sub assembly (with brake disc)



4 Product definition

4.1 Assembly of components

4.1.1 General

Before assembly, the various components of the wheelset must fulfil the geometric requirements of the specific documents that define them. In particular, the axle and wheels must be in the "ready to assemble" state defined in EN 13262 for wheels and EN 13261 for axles.

The components of the wheelset can be shrink-fitted or press-fitted to the axle.

The wheels should be fitted with an oil injection hole.

The interference fits to be used must be defined by the technical specification, depending on the characteristics of the material used for this element and the forces and moments to be transmitted through the fit. This interference must be defined according to the geometric tolerances of the wheel seats whose interference values are given in 4.1.2.

In the case of shrink-fitting, the whole wheel should be heated and its temperature should not exceed 250°C. If a different heating method is used, proof must be provided that it has had no influence on the characteristics of the wheel, as defined in EN 13262.

If another fitting method is used, it must be defined in the technical specification. It must at least demonstrate that the characteristics of the axle and wheel as defined in EN 13261 and EN 13262 are not affected by the fitting. Then the mechanical resistance of the assembly (see 4.2.1) must be demonstrated and the traceability documents for each fitting must be defined to give the same type of information as that defined in E.6.

The static imbalance of the two wheels on each wheelset must be within the same diametric plane and on the same side of the axle. The static imbalance of the brake discs must be in the same plane as the wheels but on the opposite side of the axle.

Instruction in specification EN 13260 clause 4.1.1for assembly of brake disc with wheel.

balanced by suppliers to 16 gm maximum.

Wheel sub assembly (with brake disc) – contd.



- 1. případná kuželovitost díry v náboji v rámci tolerance s tím, že větší průměr bude na vnitřní straně náboje.
- VÝKRES PLATÍ TAKÉ PRO DODÁVKU VOLNÝCH KOL S HRUBOVANÝM PRŮMĚREM DÍRY NÁBOJE #212-2, DRSNOST Ra 12,5 µm, HMOTNOST 502 kg.
 MAXIMÁLNÍ STATICKÁ NEVÝVAŽENOST 75gm. POLOHU ZNAČIT RAŽENÍM "E2" A RADIÁLNÍM BÍLÝM PRUHEM NA VNITŘNÍ STRANĚ VĚNCE.
- 4. ----- OZNAČENÝ POVRCH NATŘÍT DLE NÁTĚROVÉ SPECIFIKACE
- NEOZNAČENÉ POVRCHY (KROMĚ DOSEDACÍ PLOCHY POD BRZDOVÝ KOTOUČ) CHRÁNIT DOČASNÝM ANTIKOROZIVNÍM NÁTĚREM TECTYL 506. PLATÍ V PŘÍPADĚ DODÁVKY KOLA S BRZDOVÝM KOTUČEM.
- 6. UTAHOVACÍ MOMENT ZÁVITOVÉ ZÁTKY JE 45±5 Nm.
- 7. ZOBRAŻENI BRZDOVÝCH KOTOUČÚ JE POUZE INFORMATIVNÍ. MONTÁŽ A ANTIKOROZNÍ OCHRANA DOSEDACÍ PLOCHY DLE SPECIFIKACE VÝROBCE BRZDOVÉHO KOTOUČE.
- 1. ANY SLICHT TAPER WITHIN THE PERMITTED TOLERANCE MAY BE ON THE CONDITION THAT THE LARGER DIAMETER IS AT THE INBOARD SIDE OF THE HUB.
- 2. THE DRAWING IS ALSO VALID FOR DELIVERY OF SEPARATE SOLID WHEELS WITH ROUGH BORE #212-2, ROUGHNESS Ra 12,5 µm, WEIGHT 502 kg.
- MAXIMUM STATIC IMBALANCE 75gm, POSITION OF IMBALANCE OF SOLID WHEEL MARK BY PERFORATION ON INNER FACE OF THE RIM "E2" AND AND BY RADIAL STRIPE OF WHITE COLOUR.
- 4. ----- MARKED SURFACE COAT ACC. TO PAINTING SPECIFICATION.
- 5. NOT MARKED FACES (EXCEPT MATING SURFACES FOR THE BRAKE DISC) PROTECTED BY TEMPREARY ANTICORROSIVE COATING TECTYL 506. VALID IN CASE OF DELIVERY OF WHEEL INCLUDING THE BRAKE DISC.
- 6. THE THIGTENING TORQUE OF SCREW PLUG IS 45±5 Nm.
- VISUALISATION OF BRAKE DISC IS INFORMATIVE ONLY. ASSEMBLY AND ANTICOROSSION PROTECTION OF MATING SURFACES ACCORDING TO SPECIFICATION OF THE BRAKE DISC SUPPLIER.

4	TĚSNÍCÍ KROUŽEK A14x20	SEAUNG	RING	A14x20						1	0,0
	D11-4-	01410			Cu					ks	kg
3	závitová zátka din910 –	G1/4 x12	SCR	EW PLUG						1	0.02
	D11-4-	-00213		0CEL 5,8	STEEL 5,8				ks	kg	
2	Brzdový kotouč -	WHEEL BRAKE DISC							1	116	
	KNORR C	130198/1						750/460-228	2	ks	kg
1	CELISTVÉ KOLO Ø952	CELISTVÉ KOLO Ø952 - SOLID WHEEL Ø952		ø952						1	379
	455.0.164	.000.30			ER8	KAT.2				ks	kg
ODKAZ	OZNAČENÍ/D	ESCRIPTION			POLOTOVAR/BLANK		ČÍSLO	ZÁSOBNÍKU/CONTZ	UNER No.	MR025Fel GEARTEY	HVOTN.
TTEN	VÝKRES/D	RAWING			MATERIAL/WATERIAL			POZNÁMKA/NOT	E	EDECISA	MASS
			e)		PRESNOST/General T	a. ISO 276	8 – cK	Materiäl/Materi	al		-
			d)		TOLEROVÁNÍ/Telerana	ing ISO	8015	Polotovar/Blan	k		
			c)		PRONITANI/Projection	, ()		Hmotnost/Mas	s		495 kg
			b)			-					
						[[]]	BO	NATR	AN	5	
	Zmēna/Modification	Datum/Date	Index	Podpis/Signature		S 2				-	
Heritk	0	Kine all Circles	SZTME	RINA V.	Název/Name	k	0.0	SEGTAVA	#052)	
Scale		Datan Data	17.8	3.2017				ACCENDIN	¥3JZ		
1:5	5	Predoutel Operand				W	1EEL	LEL ASSEMBLY Ø952			
1.0	,	Technolog Technologiet			Typ/Type HIGH SP	EED EMU Skup	ina/Group	INDIA		ICF	
C. senting of American Street	da.	Normalization Normalizing			Č. výkresu/Drw. N	lumber					
Stary vya Gid dav.	r.	Schwäll Appgroved	WIL(CZEK	Linta/Sets	455.8	3.16	4.000	.30		lbi/Sit
Havy yes		Datam	17.8	3 2017	1 1						

- During assembly of brake discs on wheel, imbalances on wheel & brake disc shall be on diametrically opposite side – vide clause 4.1.1 of EN 13260. This shall be suitably ensured by railway workshops / PUs.
- After assembly of brake disc, further marking by a radial strip of white colour vide note-3 in Bonatrans drawing – for ease of assembly with axle.

Wheel set assembly (assembly with axle for MC)

5. PROSTOR VYPLNÉN TĚSNÍCÍM PROSTŘEDKÉM.
 6. VÝROBA A DODÁVKA DLE EN13260, KATEGORIE 2b.
 7. NÁPRAVOVÉ ZATÍŽENÍ 21,0 t.
 8. MAXIMÁLNÍ PROVOZNÍ RYCHLOST 160 km/h.
 1. DIFFERENCE BETWEEN TREAD DIAMETERS OF WHEELS ON THE SAME AXLE TO BE MAX. 0,5 mm.
 2. DIFFERENCE BETWEEN "c" AND "c1" MAX. 1 mm.
 3. IMBALANCES OF BOTH WHEELS OF WHEELSET ARE ON THE SAME PLANE WHICH PASSES THROUGH AXIS OF THE AXLE AND IMBALANCES ARE POSITIONED AT SAME SIDE OF THE AXLE.
 4. THE MAXIMUM FORCE REACHED DURING THE PRESS-FITTING OPERATION SHALL BE: MOLYKOTE PASTE MOS2 ACC. TO EN13260 Fmin 755kN (79t) , Fmdx 1290kN (131t).
 5. SPACE WILL BE FILED WITH SEALING COMPOUND.

- MANUFACTURE AND DELIVERY ACCORDING EN13260, KATEGORY 2b..
- 7. AXLE LOAD 21,0 t.
- 8. MAXIMUM OPERATING SPEED 160 km/h.

									_
2	cel,kolo s brzdowim kotoučem	SOLD WHE	EL MT	h Brake disc				2	495
	455.8.16	455.8.164.000.30						ks	kg
1	HNACÍ NÁPRAVA	HNACÍ NÁPRAVA MOTOR AXLE						1	555
	455.0.000.227.28			EA1N, kot. 2			ks	kg	
ODKAZ	OZNAČENÍ/O	02NAČENÍ/DESCRIPTION			POLOTOWAR/BLANK	ĆSL0	ZÁSOBNÍKU/CONTAINER NO	NINCESTVI OSCANITY	HMOTH.
ПЕМ	VÝKRES/U	VYKRES/DRAWING			MATERIAL/MATERIAL		POZNÁMKA/NOTE	JEROBA UNIS	MASS
<u> </u>			e)		PRESNOST/Senarol Tol.		Material/Naterial		
			d)		TOLEROVAM/Tolerancing		Palatavar/Blank		
			c)		PROMITANI/Projection 🖯 🕀		Hmothost/Wass		1545 kg
			b)		44				
			a)		1 (5)	S			
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Warns	lico	See.	SZTNE	ETNIA V.	Název/Nome LINI	٨cí	DVO IZOLÍ #05	52	
5cg		Dotum Deb	27.5	0.2017			DAOOKOFI AGO	12	
01	0	Presidential Checked			MO	OR	WHEELSET Ø9	52	
		Little.			Typ/Type HIGH SPEED EMU Souphing	/iro.p	INDIA	ICF	
Cateria	E	Normalized			Č. v@resu/Drv. Number				
20 9 V	ke.	Schubil	WIL(CZEK	una/910 455 9 164	12	27 00-30) 28	Let/94
		2.44	0.12		1, 100.0.101	с• <u>с</u> .		1. <u>_</u> u	1

Instruction in specification EN 13260 clause 4.1.1 for assembly of wheels - confirmed in note 3 of Bonatrans drawing also.

BS EN 13260:2020 EN 13260:2020 (E)

For a powered wheelset, balancing is achieved after the proper placement and balancing of each component (wheels, brake discs and other components such as couplings and gears). Therefore, dynamic imbalance measurement is not necessary.

For motor coach wheel sets (powered wheel sets), dynamic imbalance measurement is not necessary, as per clause 4.2.4.1 of EN 13260.

Wheel set assembly (assembly with axle for TC)

5. PROSTOR VYPLNEN TESNICIM PROSTREDKEM.

- VÝROBA A DODÁVKA DLE EN13260, KATEGORIE 2b.
- 7. NÁPRAVOVÉ ZATÍŽENÍ 21,0 t.
- 8. MAXIMÁLNÍ PROVOZNÍ RYCHLOST 160 km/h.
- 1. DIFFERENCE BETWEEN TREAD DIAMETERS OF WHEELS ON THE SAME AXLE TO BE MAX. 0,5 mm.
- 2. DIFFERENCE BETWEEN "c" AND "c1" MAX. 1 mm.
- IMBALANCES OF BOTH WHEELS OF WHEELSET ARE ON THE SAME PLANE WHICH PASSES THROUGH AXIS OF THE AXLE AND IMBALANCES ARE POSITIONED AT SAME SIDE OF THE AXLE.
- 4. THE MAXIMUM FORCE REACHED DURING THE PRESS-FITTING OPERATION SHALL BE:
- MOLYKOTE PASTE MoS2 ACC. TO EN13260 Fmin 755kN (79t), Fmdx 1290kN (131t)." 5. SPACE WILL BE FILLED WITH SEALING COMPOUND.
- MANUFACTURE AND DELIVERY ACCORDING EN13260, KATEGORY 2b.,
- 7. AXLE LOAD 21.0 t.
- 8. MAXIMUM OPERATING SPEED 160 km/h.

2	celikolo s brzdowim kotoućem	SOLD WHE	EL WIT	h brake disc	2	495				
	455.8.164.000.30				ks	kg				
1	HNACI NÁPRAVA MOTOR AXLE				1	515				
	455.0.000.227.35				EA1N, kot. 2 ks	kg				
ODKAZ	OCKAZ OZNAČENÍ/DESCRIPTION				POLOTOWAR/BLANK ČÍSLO ZÁSOBNÍKU/CONTAINER No.	HINOTN.				
TEM	Vfikres/drawing				MATERIAL/MATERIAL POZNÁMKA/NOTE acia	MASS MASS				
			e)		PRESNOST/General Tol. Waterial/Naterial					
			d)		TOLEROWAM/Tolerancing Polotovor/Blank					
			c)		PROMITAN/Projection 🖯 🕀 Himotrost/Wass	1505 kg				
b)			b)		40					
a)			a)		I (",) BONATRANS					
	Datum/Date	Index	Podpis/Signati							
HALL	iko	Street Dream	STIE	EDMA V.	Nazev/Name UNANÉ DVO IZOLÍ #052					
1.1		Dotum Dotu	27.9	.2017						
1 13	0	Presidentel			IRAILER WHEELSET Ø952					
		COST			Typ/Type HIGH SPEED EMU Skuping/Group INDIA IC					
Casety	E.	Normalized			Č. v@resu/Drv. Number					
20.7 1	fe.	School	WILC	ZEK	1 univer 455 9 164 227 00-30 3	16/96				
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Instruction in specification EN 13260 clause 4.1.1 for assembly of wheels - confirmed in note 3 of Bonatrans drawing also.

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 This is necessary to achieve max dynamic imbalance of 75 gm as per clause 4.2.4.1 of EN 13260.
 4.2.4 Dynamic imbalance

2.4 Dynamic mibalance

4.2.4.1 Maximum permissible values

For the wheelset of a vehicle that can travel at speeds greater than 120 km/h, the maximum dynamic imbalance values are shown in Table 2. They are measured in the wheel plane.

For category 1 wheelsets, the dynamic imbalance must be measured individually.

For category 2 wheelsets (speed greater than 120 km/h), the dynamic imbalance must be measured individually, unless otherwise specified in the technical specification.

Speed km/h	Imbalance g∙m			
$120 < S \le 200$	▶ 75			
<i>S</i> > 200	50			

					-
Table 2 —	Mavimum	dynamic	imhal	ance	values
	Mannum	uynamic	muua	lance	values

Dynamic balancing of wheel set for TC



Brake caliper arm extends to brake disc. Very less clearance with wheel rim.
 Hence, counter weights shall be pasted 5mm inside (towards web) from wheel rim face. This is necessary to avoid any infringement during brake application in worn brake pad & worn brake disc condition.

Dynamic balancing of wheel set for TC - contd

	Wheel dia	in mm		RPM		Speed in k	mph		
	New	Worn out	Average			New	Worn out	Average	
Fiat	915	845	880	320		55.1915	50.9692	53.08035	
T-18	952	877	914.5	320		57.42329	52.89939	55.16134	
					/				
1									

- As per MDTS-168, wheel RPM is 320. This corresponds to 55.2 kmph for new wheel dia 915mm for Fiat bogies.
- For the same 320 RPM, with trainset wheel dia 952mm speed will be 57.4 kmph.
- Since, the difference in speed is marginal, same 320 RPM shall be adopted for trainset TC wheel sets also. This will enable use of same settings in the machine.
- Counter weight's profile shall be suitably matched to rim profile. This is necessary to achieve surface contact and proper seating.
- > All other instructions as per MDTS-168 shall be followed.
- It may be noted that, if static balancing instructions as per M/s Bonatrans drawings & clause 4.1.1 of EN 13260 for 1) sub assembly of brake disc with wheel and 2) wheel & axle assembly is followed strictly, counter weights for dynamic balancing will be minimal only.

Loco with wheel mounted brake disc



> WAP-5 loco is provided with wheel mounted brake disc. This loco is fit for 160 kmph hauling speed.

RDSO is already aware of the balancing requirements of the wheel sets for this locos.

> Hence, for confirmation of balancing procedure and further clarity, RDSO may please be approached.

Load transfer in train set bogies



Vertical load transfer

Car body directly seated on air springs.

- Hence vertical load transer as follows:
- ➢ Air springs bogie frame primary springs – control arm top – bush - bearings – axle – wheel.



Tractive forces in train set bogies - MC



Traction motor (fully suspended – fitted to bogie frame) propels gear drive mounted over axle through a flexible coupling.

Hence flow of tractive forces as follows :

For Motor coaches: Traction motor – flexible coupling – pinion - gear wheel – axle – bearings – bush - control arm – control arm (rubber) bush – bogie frame – traction rods – traction centre – traction centre bush – CP pin - car body – coupler.

Tractive forces in train set bogies - TC



Motor coaches push / pulls the trailer coaches in formation through couplers.

For trailer coaches: Coupler - car body - CP pin – Traction centre bush – traction centre – traction rods – bogie frame – control arm (rubber) bush – control arm – bush – bearing – axle - wheel

Braking forces in train set bogies - MC



Regenerative braking – momentum of formation is utilised to generate current through motor and fed back.

<u>Friction braking on all coaches</u>: Brake caliper units applies brake force on brake discs fitted to wheel.

<u>Flow of brake forces</u>: Brake disc - Wheel – axle – bearing – bush - control arm control arm (rubber) bush – bogie frame – traction rods – traction centre – traction centre bush – CP pin - car body Thank you !