

Short description of the double articulated pocket wagon T3000e (Sdggmrss)

DESCRIPTION AND TECHNICAL SPECIFICATION

of the double articulated pocket wagon

type T3000e (Sdggmrss)

with three Y25 bogies

Type drawing according to FC drawing no.01.12330-3

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Pocket wagon T 3000e

Description and technical specification

**Double articulated pocket wagon
with 3 bogies Y25 Lssi(K)-low – Y25 Lssif(K) – Y25Lssi(K)-low
according to the FC drawing 01.12330-3**

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Short description of the double articulated pocket wagon T3000e (Sdggmrss)

1. General concept of the wagon

The double pocket wagon T 3000e, described in this document, is a further development of the pocket wagon T 3000 and the EU Project called "SAIL", both projects of Ferriere Cattaneo. Tatravagonka Poprad is the exclusive partner for the manufacturing of T3000e wagons, that take place in Switzerland and in Slovak republic. The hitches and the pockets are put so that the front sides of semitrailers are heading the end sides of the wagon.

This wagon represents a further development of the wagons no. 33 80 4956 930-8 up to 33 80 4956 979-5, which were approved in Germany according to the EBO 32 rules as wagons complying with RIV regulation, with the following differences / improvements:

- Certification according to TSI WAG
- The new wagon is 2 x 85 mm = 170 mm longer
- Improvement of compatibility with megatrailers Schmitz
- Brake valves located under the frame, as for the wagon 33 80 4956 979-5
- Improvement of the hitch (2 or 3 adjustable heights) on the basis of experience from operation¹
- Possibility to load 30' containers and all removable swap bodies from class A (with side support) – such possibility is marked as MSP.B.

Fundamental loading characteristics of the new double pocket wagon T 3000:

- improved pocket wagon for megatrailers and all other conventional codified liftable trailers
- **semitrailers are fixed and secured to the wagon hitch, only by means of their kingpin.** Consequently **no wheel securing blocks in the pocket are needed.** This exclusive solution of F.C. company is patented.
- Transport of the mega-trailers (internal loading height 3 m) with lower grapple interfaces for lifting
- Consequently the pocket wagons are equipped with lowered outer longitudinal beams
- More space and ease for transshipping of trailers without problems up to a width of 2.6 m
- Optimized length and width of loading pocket in comparison with double pocket wagon T2000
- Optimized loading length for containers / swap bodies in comparison with double pocket wagon T3000

¹ Note: The mechanical interface of the wagon is standardised, enabling the installation of different hitches.

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- Cross beams into the loading pocket lowered from 270 mm to less than 200 mm, in order to obtain more space for lower parts of the semitrailer
- Conceived for 14.9 m long conventional saddle semitrailers (e.g. Big MAXX with saddle height of 98 cm).

Why do we need such a solution? (i.e., pocket without wheel blocks):

1. a fixed position of the hitch to the wagon pocket permits a better use of the loading space for semitrailer;
2. the adjustment of the hitch during the semitrailer transshipment with crane is no more necessary;
3. the absence of wheel blocks permits to create more space into the loading pocket for semitrailer components among the tyres (e.g. mud-flaps). The conventional geometry of the wheel blocks doesn't permit to cover all differences in semitrailer tyre diameters.

Improvements for the loading space for semitrailers:

- The biggest loading space of the wagon according to UIC Leaflet 596-5;
- More space for the lower components of semitrailers;
- Possibility to foresee firm rear and lateral protection devices for raiders;
- Possibility to load Mega-trailers with water fog minimisation device, according to the EU norms;
- No more special requirements for semitrailer components (i.e. foldable protections) for railway transport;
- 3 different heights of the hitch: 880 mm for mega-trailers, 980 and 1130 mm for conventional semitrailers.

Main characteristics of the double pocket wagon T3000:

- Lowered bogies **Y25Ls(s)i1** with wheel diameter 920 mm under the hitches at the wagon fronts.
- Standardized bogie **Y25Ls(s)i1(f)** with wheel diameter 920 mm in the middle of the wagon.
- Admissible transportation forces for the semitrailer at impact speed up to 7 km/h are assured by means of high-performance buffer 1g.².

² The wagons belong to the category F-II according to the standard EN 12663-2:2010 (impact speed up to 7 km/h), and, in loaded condition, shall not impact another wagon or be impacted by other wagon.

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- Safety concept of the hitch with Crash-elements for the semitrailer king pin protection.

Aim of this solution: the king pin shall not be damaged without being detected (i.e. during improper shunting,...), to avoid accidents during the road transport phase,

- The force applied to the kingpin due to rail transport is not exceeding the so called D-Value [kN].
- Brake safety valve in case of crash-element deformation: the main brake pipe is vented (emergency braking).
- The wagon is equipped with ISO supporting plates for containers and swap bodies. If not used (i.e. transport of semitrailer), the supporting plates are tilted down into their housings by the longitudinal beams
- In the area of the loading pocket, 2 ISO container/swap body supporting plates are placed by each outer longitudinal beam, so that no collision occurs during semitrailer transshipment.

Advantages of the double pocket wagon T3000e respect to single pocket wagons:

- Lower tare per loading pocket.
- Lower purchasing and maintenance costs per loading pocket
- Optimized wagon length

2. Operational profile

The wagons are designed for transport of liftable codified semitrailers and standardized swap bodies / containers overall European railway network with normal track gauge.

The wagon is conceived for a year mileage up to 200,000 km per year.
The lifetime of the wagon is 20 years.

The wagons are conceived according the applicable codification requirements, so that the codes C and P can be used according to UIC rules without limitations.

The wagons are designed for speed up to **120 km/h** at axle load of **20 t** according to UIC Leaflet 543 Par.1.3.5 $\lambda = 90\%$ (Wagon equipped only with block braking).

Remark: As alternative the brake performance according to UIC 571-4:2011 may be reduced to:

Axle load of **22,5 t** $\lambda = 65\%$ according to UIC Leaflet 543.

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Loading capacity of the double pocket wagon T3000e:

For the main version T3000e MSP.A – following loading combinations are possible:

- It is possible to load 2 semi-trailers on one wagon up to nominal operational loading 40 t per semitrailer, 3 x 9 t for the axles of 3-axle semi-trailers. Semitrailer with 1 or 2 or 3 axles, with simple or double tyres, with air or with mechanical suspension
- 4 swap bodies of class C (max. length 4 x 7.82) or 4 2X containers with the weight combination **32 t + 17 t** per each half of the wagon. Position of container supporting plates is modified in comparison with the first series of T3000wagon, in order to improve the compatibility for transport of Schmitz megatrailer.
- 2 swap bodies of class a, type “2R” or 2 4X ISO-containers, **36 t + 34 t** (or 2 x 35 t) without intermediate supporting (analogue to T3000).

Version T3000e MSP.B includes also following main transport combinations:

- 2 30' containers up to maximal weight **2 x 36 t**.
- 2 removable swap bodies from class A 4X ISO up to maximal weight 36 t + 33 t (or 2 x 34,5 t) with support beam.

3. Basic parameters

Length over buffers	34,200 mm
Loading length	2 x 16,185 mm
Distance between bogies pivots	2 x 14,200 mm
Bogie Y25 of standard type in the middle of the wagon with wheel diameter	920 mm
Bogie Y25(low) lowered at the wagon ends with wheel diameter	920 mm
Bogie wheel-base	1,800 mm
Height of the pocket above top of rail (nominal dimension)	270 mm
Height of loading plane for containers	1,135 – 1,155 mm
Usable length of loading space between	

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protection beams	10,490 mm
Width of space between longitudinal beams	min. 2,700 mm
Distance from the centre of the bogie pivot up to the loading space	1,875 mm
Position and length of usable pocket, measured from the bogie pivot on the side of the hitch	from 5,250 mm to 10,060 mm
Effective height of the longitudinal beams and cross beams into the pocket	max. 150 mm
Height of the longitudinal beams above loading surface by the loading pocket where the grapple arms for semitrailer will be used	630 mm
Adjustable height of the hitch	
• Lower position	880 mm
• Central position	980 mm
• Upper position	1.130 mm

above the loading surface of the pocket

Loading limits:

	A	B	C	D
s	61 t	73 t	85 t	100 t
ss	61 t	73 t	85 t	

Tare	34.3 t
Max. axle load	22.5 t
Max. speed	120 km/h
Brake	Dako 2 x D - GP - A (K)
1 g high-performance buffer	according to UIC 526-3 – group L – stroke 150 mm
Min. track curve	75 m
Max. ferry-boat angle	1°30'

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Bogies

2 x **Y25Ls(s)i1-K** at the wagon ends
1 x **Y25Ls(s)i1(f)** at the wagon centre

4. Specification of subassemblies

4.1 Running gear – bogies at the wagon ends

- 2-axle bogie for freight wagons of type **Y25Ls(s)i1-K**
- This bogie is an “interoperable constituent” according to TSI-WAG
- Track gauge 1.435 mm
- Wheel-base 1,800 mm
- Axle load 22.5 t at the maximum speed of 100 km/h
- Axle load 20.0 t at the maximum speed of 120 km/h (UIC 543, $\lambda = 90\%$)
- The end bogies are modified respect to the central one in order to transport huge-capacity semitrailers (mega-trailers), which are characterized by a lowered height of semi-trailer coupling: it is therefore necessary to use bogies with the lowered height of the bogie pivot above the top of rail. Because of that, the bogie **Y25Ls(s)i1-K** requires a lowered main cross beam and two brake cylinders 10” equipped with internal slack adjusters (or an equivalent solution).
- Type of wheelsets LL306, according to EN 13262;
Wheels with low internal constraints (deeply cambered) ER 7 according to UIC 510-5 and EN 13979-1; according to TSI-Wag with axle load 23.5 t
Approved manufacturers: Lucchini
- Wheel tread diameter new/worn 920 / 860 mm
(up to 890 mm without backing)
- Axle box DB – BA 182 – in UIC execution or equivalent
- Axle bearings roller bearings NJ/NJP 130x240
Manufacturer: FAG, SKF or ZVL
- Wheelset clearance Lateral 10 mm
Longitudinal 0 mm

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- Wheel tread profile UIC S 1002 – 28/30 with 2 mm reduction of wheel flanges
- Distance between centres of Axle bearings 2,000 mm
- Max. axle load of the frame 22.5 t
- Max speed of running dynamical behaviour 120 km/h
Braking 120 km/h up to 20 t
100 km/h up to 22.5 t
- Height of the bogie pivot centre Above top of rail 790 mm
- Height of the side bearers above the top of rail 905 mm
- Number of side bearers 2, elastic side bearers according to UIC standards
- Distance between side bearers centres 1,700 mm
- Vertical clearance of the side bearers 12^{+2} mm
- Bogie pivot upper body according to UIC 510-1, Annex 9
- Suspension ratio up to axle load 6.62 t 2.5 mm/t for bogie loading in [t]
over 6.62 t 0.96 mm/t for bogie loading in [t]
- Static stroke of the spring 38 mm up to axle load 22.5 t
Max. spring stroke 60 mm
- Damping friction damping according to Lenoir principle acting on each axle bearing
- The bogie frame is derived from the UIC type bogie Y25L (welded construction made of steel S355J2+N according to the standard EN 10025) and it is conceived in accordance with the UIC Leaflet 510-3 and TSI WAG. For obtaining the TSI WAG certification, static tests on the test frame and validated calculations for fatigue strength will be made, taking into account the specific Swiss conditions (number of cycles for the lateral force reduced from 20 to 10).

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- Brake rigging 60 kN, 8 pieces of composite brake blocks (2 x Bg Jurid 816M or Cosid 810), able to operate in ss regime up to the axle load 20.0 t (UIC 543, $\lambda = 90\%$).
- Bogies with weighing valves DAKO, type SL2 (UIC type 1)
- For interchangeability of the brake blocks downwards spring latches with eye are used
- The bogies will be equipped with dynamically optimised brake blocks holders for composite braking blocks
- Bogie pivot as well as all other joints are secured with two-segment elastic split pins
- Friction bearing of the bogie pivot, as well as friction plates of the lateral side bearers are made of composite material (Railko company)
- The side bearer clearance is 12^{+2} mm
- Conditions for bogie operation: the smallest negotiable track curve is 75 m. By a track curve of 120 m radius, the inclination angle of $1^{\circ}30'$ is granted.

4.2 Running gear – bogie in the wagon centre

- 2-axle bogie for freight wagons of type **Y25Ls(s)i1(f)**
- This bogie is an “interoperable constituent” according to TSI-WAG
- Track gauge 1.435 mm
- Wheel-base 1,800 mm
- Axle load 22.5 t at the maximum speed of 100 km/h
- Axle load 20.0 t at the maximum speed of 120 km/h (UIC 543, $\lambda = 90\%$)
- Type of wheelsets LL306, according to EN 13262;
Wheels with low internal constraints (deeply cambered) ER 7 according to UIC 510-5 and EN 13979-1; according to TSI-Wag with axle load 23.5 t
Approved manufacturers: Lucchini
- Wheel tread diameter new/worn 920 / 860 mm

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(up to 890 mm without backing)

- Axle box DB – BA 182 – in UIC execution or equivalent
- Axle bearings roller bearings NJ/NJP 130x240
Manufacturer: FAG, SKF or ZVL
- Wheelset clearance Lateral 10 mm
Longitudinal 0 mm
- Wheel tread profile UIC S 1002 – 28/30 with 2 mm reduction of wheel flanges
- Distance between centres of Axle bearings 2,000 mm
- Max. axle load of the frame 22.5 t
- Max speed of running dynamical behaviour 120 km/h
braking 120 km/h up to 20 t
100 km/h up to 22.5 t
- Height of the bogie pivot centre Above top of rail 925 mm
- Height of the side bearers above the top of rail 905 mm
- Number of side bearers 2, elastic side bearers according to UIC standards
- Distance between side bearers centres 1,700 mm
- Vertical clearance of the side bearers 12^{+2} mm
- Bogie pivot upper body according to UIC 510-1, Annex 9
- Suspension ratio up to axle load 6.62 t 2.5 mm/t
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- Static stroke of the spring 38 mm up to axle load 22.5 t
Max. spring stroke 60 mm
- Damping friction damping according to Lenoir

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principle acting on each axle bearing

- The bogie frame is conform to the UIC type bogie Y25L (welded construction made of steel S355J2+N according to the standard EN 10025) and it is conceived in accordance with the UIC Leaflet 510-3 and TSI WAG.
- Brake rigging 60 kN, 8 pieces of composite brake blocks (2 x Bg Jurid 816M or Cosid 810), able to operate in ss regime up to the axle load 20.0 t (UIC 543, $\lambda = 90\%$).
- Bogies with weighing valves DAKO, type SL2 (UIC type 1)
- For interchangeability of the brake blocks downwards spring latches with eye are used
- The bogies will be equipped with dynamically optimised brake blocks holders for composite braking blocks
- Bogie pivot as well as all other joints are secured with two-segment elastic split pins
- Friction bearing of the bogie pivot, as well as friction plates of the lateral side bearers are made of composite material (Railko company)
- The side bearer clearance is 12^{+2} mm
- Conditions for bogie operation: the smallest negotiable track curve is 75 m. By a track curve of 120 m radius, the inclination angle of $1^{\circ}30'$ is granted.
- All the double pocket wagons homologated in Switzerland and in Luxemburg are equipped with parking brake acting on the central bogie. 20% of the wagons homologated in Germany are equipped with park braking.

4.3 Pneumatic braking system

The double pocket wagons is equipped with a DAKO pneumatic brake having 3 load-proportional braking devices, each of them acts upon 8 composite brake blocks of a bogie. The composite brake blocks Jurid 816M or Cosid 810 are used in the configuration 2 x Bg.

The braking device in the central bogie consists of No. 1 weighing valve, No. 1 9" brake cylinder and No. 1 DRV10-450H1 slack adjuster.

The braking device in the end bogies consists of No. 1 weighing valve and No. 2 10" brake cylinder equipped with internal slag adjuster.

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Each load-proportional braking device:

- Is controlled by a distributor and its braking performance is determined independently for each bogie.
- Is installed in the chassis frame and it consists also on one or two relay valves, one or two limit valves with universal test points for brake testing.

Both distributors are equipped with ON-OFF and G-P change over devices. The three brake devices require an auxiliary air reservoir volume of 120 l plus 75 l. The auxiliary air reservoirs attain the requirements of the standard EN 286-3. Distributors, relay and limit valves, air reservoirs are installed in the wagon frame to be better accessible as possible.

There is a sufficient number of test points for brake tests.

The double pocket wagon is equipped with a 1 ¼" continuous main brake pipe with isolation cocks and brake-hose couplings. The pipes are connected through VEBEO-connections.

The brake force of each bogie is adjusted to loading, through the weighing valve.

4.4 Parking brake

20% of the pocket wagons homologated in Germany and 100% of the pocket wagons homologated in Switzerland or Luxemburg are equipped with a parking brake.

The parking brake on central bogie, acting through teeth wheels, braking spindle,... may be operated from both wagon sides by hand wheels.

4.5 Draw and buffing gears

The draw and buffing gears of the double pocket wagon are dimensioned to grant permissible constraints of the semitrailer at the impact speed of 7 km/h (value for shuttle trains); they consist of:

- No. 1 draw hook according to UIC 520 – EN 15566:2009 – TSI Wag – a=575 mm
- No. 2 draw gear 1500 kN according to UIC 520 with MINER or DUREL elastic elements, manufacturer Schwab or SMW/ETQ - EN 15566 – TSI Wag
- No. 2 thread couplings 850 kN according to UIC 520 – EN 15566:2009 – TSI WAG – Mark U St
- No. 4 high performance 1g buffers according to UIC 526-3, cat. L – EN15551:2009 – TSI Wag, stroke 150 mm, length 665 mm, manufacturer Schwab

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or SMW/ETQ. Non-rotating buffer plates with dimensions 340 mm x 450 mm, R = 2,750 mm according to UIC 527-1 – EN 15551:2009 – Mark (U)

4.6 Articulated joint

The two wagon frames are mutually connected through an articulation system above the central bogie. This articulated joint transfer between the wagon modules only the longitudinal and transverse forces. The vertical forces are introduced to the central bogie through two lateral upper bearers and through the cross beam to the UIC bogie pivot. The articulation is corresponding to the Talbot solution.

4.7 Wagon frame

Both wagon frames are mutually connected by means of an articulation through the central bogie.

The wagon frame is equipped with integrated pocket to carry the axle assembly of the semitrailer. The pocket is welded to the longitudinal beams.

The nominal operating pocket loading of the 3-axle assembly is $3 \times 9 \text{ t} = 27 \text{ t}$ for normal wheel base 1,310 mm. Other combinations comply with EN 12663-2.

The pocket on the wagon can withstand higher axle loads of the second and third axle of the semitrailer, which are caused by longitudinal tilting of the semitrailer typical of air suspensions.

The underframe design avoids deposit of water, to prevent corrosion.

The pocket cross section is optimized for semitrailers with single and twin tyres.

The longitudinal beams are lowered in the area of the pocket, to achieve a good access of the crane grapple arms to the lateral grabbing points of high volume semitrailers, in combination with the lower heights of the hitch.

To transport 4 containers/ swap bodies of class C (up to 7.82 m) and 2 containers of class A (13.6 m and longer), 2 x 10 container supporting plates according to UIC leaflets are installed on the double wagon. The pins arrangement is suitable for 2.60m wide containers/ swap bodies.

To transport another 2 30' containers and 2 another transport containers with side support beam – another 2x2 pieces of container pins and 2x2 support plates are for disposal in version T3000e MSP.B.

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The container supporting plates that comply with UIC requirements are located on the outer longitudinal beams, can be turned inside their cast housing by a pin until fixing position and are reinforced, in order to avoid any damage due to improper transshipment by the crane. The dimensioning of the supporting plates was based on the EN 12663-2 standard and the ERRI B 12/RP17 report.

The outer sides of the wagon consist as much as possible of smooth surfaces. Fixed components and turnable supporting plates are as much as possible against damages due to contact with mobile cranes or components.

The loading space for semitrailer is separated to the bogies by mean of so called protective beams in order to avoid collisions of semitrailers to bogies during transshipment or marshalling.

The transverse beam by the end bogies are fit with fixed hitch, having three adjustable heights. The hitch is connected to the wagon frame through strong guides so that, in case of accident, it can be exchanged by two persons in 30 minutes. The free spaces of the semitrailer between the kingpin and semitrailer frame according to ISO 1726 standard are preserved.

The wagon frame is able to withstand impacts from another vehicle with total weight of 80 t without exceeding the permissible stress:

- a) empty wagon up to 12 km/h according to EN 12663-2
- b) full loaded wagon up to 7 km/h according to EN 12663-2.

4.8 Safety system to preserve the semitrailer

The safety concept is necessary since the semitrailer is fastened to the wagon exclusively through its kingpin. The hitch is a subsystem of the wagon and is equipped with crash elements that prevent the relative longitudinal movement to the wagon (1 Crash-Element for bumping direction).

The crash element, that is conceived to avoid any over solicitation – or internal damaging - of the kingpin, will be activated by a longitudinal dynamical force greater as 0,8 g.

The crash elements permit to obtain a homogenous force up to the total stroke of 140 mm.

The safety concept to protect the semitrailer on the pocket wagon is consisting in following items:

- 1-g hig performance buffers (by Schwab or SMW/ETQ) with a static end force of 600 kN corresponding to a stroke of 150 mm;
- dimensioning of the semitrailer kingpin according to EU-Guidelines and UIC 596-5 to cope with typical solicitations of the railways operation;

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- The crash elements and their configuration on the saddle, in matter of safety components.
- The emergency braking of the double articulated wagon or of the train, in case of permanent deformation of a crash element, due to longitudinal forces overcoming the limits.

4.9 Hitch

The mechanical interface between the hitch and the wagon frame is conceived to avoid any damage of the guide assembled on the wagon frame, in case of sudden improper lifting of the hitch during loading or unloading.

In case of accident, the hitch may be changed completely in 30 min. in an intermodal terminal by two persons using simple tools (with crane available).

All movable parts for operation of the supporting beam (locking of the king pin, adjusting of height) are independent and not part of the wagon frame.

The hitch is designed for three heights – upper position 1,130 mm, central position 980 mm, lower position 880 mm – so that no further lateral clearances, which could worsen the coefficient of the inclination of the semitrailer, are present.

The hitch can be operated simply, intuitively and permanently from both wagon sides.

The hitch has an automatic locking of the kingpin complying to UIC leaflet 571-4.

The supporting beam is suitable also for semitrailers with control wedges according to DIN 47085.

The hitch has a wide supporting base in the transverse direction.

The upper plate of the hitch is movable around the lateral axis of about 3°. The rotation axis lies in the same vertical plane as the interface of the kingpin of the road saddle.

The hitch is robust and it is resistant to improper operation.

The hitch was submitted to tests at the maximal static loading of the saddle with weight of 26 t. The fatigue loading of the saddle is 13 t.

The upper plate of the hitch is characterised by great bending strength, mainly in transverse direction, and it corresponds to the loadings common for a 50 kingpin, complying with the standard DIN 74081.

Centring of the hitch to the kingpin of the semitrailer in the transverse direction is max. +10 mm.

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Vertical movement of the hitch is almost linear.

4.10 Accessories, boards, handles, holders

The double pocket wagon is equipped at each front with a left footboard with an handle for shunter according to applicable regulations. At each wagon end, there are 2 hooks for rope and holders of the signal light.

The wagon frame is equipped with lifting points positioned by the cross beam of each bogie by each side.

Each bogie is equipped with earthing cable, connecting the bogie to the wagon frame.

4.11 Coatings and inscriptions

Before cutting, shaping, machining, assembling and welding, the surface of raw material – steel sheets with the thickness over 4 mm and the surface of steel profiles, cleaned by a method of dry abrasive cleaning by centrifugal force, grade Sa 2 in the accordance with the standard ISO 8501-1.

Surfaces of carbon steel to be coated have to be shot-blasted prior to the application of the coating according to the standardized cleanliness level Sa 2 1/2 (Sa 2 for the interior of the tank) DIN EN ISO 12944. The complete painting system must be done directly afterwards. Partial coatings and welding and assembly work are not permitted in the meantime.

Raw material surface which is impossible to prepare by the method of dry abrasive cleaning, is cleaned manually respectively mechanically in the accordance with the standard ISO 8504-3 to the surface quality preparation, defined by St 2 according to ISO 8501-1.

Coating materials are elaborated in accordance with the data sheets of the paint manufacturer.

For shade paints, data stated in coating and inscription drawings are decisive.

Underframe with all installed parts – from all sides = 2K – PUR; „Wet to wet“; 120 micr.

Bogie with installed parts (without wheelsets):

Priming anticorrosive coating = water-thinnable epoxy cathodic electrocoating; 20 micr.

Topcoat = 2K – EP; 140 micr.

4.12 Approval of the wagon and its putting into operation

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The present T3000e wagons, which was approved in Germany by EBA in 2006 according to EBO 32 rules, will be certified according to TSI WAG, and it will be put into operation in the required country of registration. (At the moment the wagon is homologated in Switzerland, Luxemburg and Germany).

4.13 Wagon maintenance

Due to high kilometrage of the wagon and due to very short stay periods of the train in terminal, very quick and low-cost maintenance and repair is important. The wagons are designed so that as much repairs as possible can be performed during a short period directly on the terminal track.

For instance, exchange of the brake blocks on the assembly track, as well as simple and quick access to the individual brake components and assembly parts.

The wagon maintenance is based upon the principle of simple exchange of lowest replaceable units (LRU), which minimizes wagon transfers to the repair shops.

5. Equipped components

6. Component	Type
Wheelsets	LL306
Axel Boxes	BA182
Bearings	Kinex
Brake blocks	Jurid 816M
Steureventil	DAKO CV1ND23-GP
Lastbremsventil	DAKO DSS
Wiegeventil	DAKO SL-2 typ1
Knickventil	DLV3HL
Bremsgestangesteller	DRV10-450H2
Buffers	SCHWAB
Draw gear	TREVA DGL 1,5/20
Gleiteinlage	RAILKO N-860-00-15-00-0 Pos. 7
Stützbock	FAHO 80800-Z
Crashelement	ETQ 080-08-0200 170 kN

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6. LIST OF ANNEXES

Annex 1 –Loading Scheme

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Chief Technical Officer (CTO)
Ferriere Cattaneo S.A.

Dott. Ing. E. Moro