TÜRASAŞ

SAKARYA REGIONAL DIRECTORATE

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Brake System Technical Specification for Sleeping Coaches

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Revision History

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00	First Issue	20.01.2011
D 3696	The specification has been completely updated.	20.12.2021
D 3877	Table 1, Item 2.3, Item 3.2, Item 3.3, Item 3.4, Item 5.1 have been revised. Table 6 has been updated. Changed Supplier/Tenderer to Supplier.	14.03.2022
D 3983	Table 1, Table 5, Clause 3.1.2, Clause 3.2, Clause 3.4, Clause 3.6.5, Clause 3.9, Clause 3.10 have been revised.	03.06.2022

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1. INTRODUCTION

1.1. Subject

This document defines the minimum technical and general specifications for the Pneumatic Brake System to be supplied for the Sleeping Coaches Project manufactured by Turkey Rail System Vehicles Industry Inc. (TURASAS).

The bidder shall submit a solution fully compliant with the requirements of this specification.

After the signing of the contract, possible changes that may arise from this specification or other specifications and the standards mentioned in this document will be validated by a written agreement between the TURASAS and the Supplier.

Bidders shall declare their acceptance by replying to all specification items clause by clause with the same sequence number.

This Technical Specification and its annexes have been prepared in Turkish and English. In case of any incompatibility between the two, the Turkish language is valid.

2. DEFINITIONS AND PROJECT MANAGEMENT

TÜRASAŞ	:	Turkish Railway Vehicles Industry Inc.
TCDD-T	:	TCDD Transport Inc.
The Supplier	:	The firm that will win the tender and supply the brake system within the scope of this specification
The Bidder	:	The firm that will participate in the tender to supply the products within the scope of this technical specification
OTIF	:	Intergovernmental Organisation for International Carriage by Rail
UTP	:	Uniform Technical Prescriptions defined by OTIF
Assessing Entity	:	Third body for UTP compliance
De-Bo	:	They are the institutions that evaluate and certify whether the railway vehicles meet the national qualifications and are authorized by the Ministry.

2.1. Operatin Conditions

2.1.1. Vehicle Characteristics

Maximum Speed	:	160 km/h
Mass in Working Order	:	Roughly 50000 kg
Mass under Normal Payload	:	Roughly 51600 kg
Mass under Exceptional payload	:	Roughly 55600 kg
Bogie Type	:	Y32
Passenger Capacity	:	20
Number of Compartments	:	10+1 (for staff)

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Basic Dimensions		
Distance between bumpers	:	26.400 mm
Distance between chassis headers	:	25.100 mm
Coach outer width	:	2.825 mm
Wagon height above top of rail	:	4050 mm
Distance between bogie axles	:	2560 mm
wheel diameter	:	920 (for new wheel)

2.1.2. Climate Conditions and Operating Environment

EN 50125-1 (Railroad applications - Environmental conditions for equipment - Equipment on railway vehicles) has been taken as reference for the concept of all equipment mounted on the vehicle. T3 is taken as the climate class. The equipment used in the coaches will operate in the following ambient conditions.

Track Gauge	:	1.435 mm
Platform Height	:	580 mm - 760 mm - 1050 mm
Loading Gauge	:	UIC 505-1
Atmospheric Temperature	:	-25 °C ~ +45 °C
İnterior Temperature	:	-25 °C ~ +55 °C
Relative humidity	:	20 °C'de %98
Atmosphere	:	Tozlu

2.2 Documents and Standards

The Supplier shall carry out the assembly and testing stages of the products within the scope of this technical specification in accordance with the international reference standards specified below. Table 1 specifies the applicable standards within the scope of supply.

Table 1: Applicable Standards

Standard	Title
UTP	Uniform Technical Instructions set by OTIF
EN 45545	Railway applications - Fire protection on railway vehicles
EN 286-3	Simple Unfired Pressure Vessels Designed to Contain Air or Nitrogen-Part 3: Steel Pressure Vessels Designed for Air Braking Equipment and Auxiliary Pneumatic Equipment for Railway Rolling Stock
EN 13452-1	Railway applications - Braking - Mass transit brake systems - Part 1: Performance requirements
EN 14531-1	Railway applications - Methods for calculation of stopping and slowing distances and immobilization braking - Part 1: General algorithms utilizing mean value calculation for train sets or single vehicles
EN 14531-2	Railway applications - Methods for calculation of stopping and slowing distances and immobilization braking - Part 2: Step by step calculations for train sets or single vehicles

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Standard	Title
EN 14601+A1	Railway applications - Straight and angled end cocks for brake pipe and main reservoir pipe
EN 15220	Railway applications - Brake indicators
EN 16334	Railway applications - Passenger Alarm System - System requirements
EN 15595	Railway applications - Braking - Wheel slide protection
EN 50125-1	Railway applications- Environmental conditions for equipment- Part 1: Rolling stock and on-board equipment
EN 50126 (series)	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)
EN 50128	Railway applications - Communication, signalling and processing systems - Software for railway control and protection systems
EN 50129	Railway applications - Communication, signalling and processing systems - Safety related electronic systems for signalling
EN 50155	Railway applications - Rolling stock - Electronic equipment
EN 50215	Railway applications - Rolling stock - Testing of rolling stock on completion of construction and before entry into service
EN 50343	Railway applications - Rolling stock - Rules for installation of cabling
EN 61373	Railway applications - Rolling stock equipment - Shock and vibration tests
EN 60529	Degrees of protection provided by enclosures (IP code)
IEC 61375-2-1	Electronic railway equipment - Train communication network (TCN) - Part 2-1: Wire Train Bus (WTB)
IEC 61375-3-1	Electronic railway equipment - Train communication network (TCN) - Part 3-1: Multifunction Vehicle Bus (MVB)
IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
ISO 8573-1	Compressed air-Part 1:Contaminants and purity classes
EN ISO 3744	Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane
02006R1907-20211001 EC	Toxic substances – Material safety data sheets
UIC 540	Brakes - Air Brakes for freight trains and passenger trains
UIC 541-1	Brakes – Provisions for the manufacture of brake components
UIC 541-05	Brakes - Specifications for the construction of various brake parts - Wheel Slide Protection device (WSP)
UIC 541-5	Brakes - Electropneumatic Brake (Ep Brake) - Electropneumatic Emergency Brake Override (Ebo)
UIC 541-6	Brakes - Electropneumatic brake (ep brake) and Passenger alarm signal (PAS) for vehicles used in hauled consists
UNI EN 10126-5	Cold rolled electrical non-alloyed steel sheet and strip delivered in the semi-processed state
UIC 543	Brake - Regulations governing the equipment of trailing stock

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Standard	Title
UIC 544-1	Brakes - Braking performance
UIC 545	Brakes - inscriptions, marks and signs
UIC 546	Brakes - specifications for the construction of various brake parts - High power brakes for passenger trains
UIC 547	Brakes - Air brake - Standard programme of tests
UIC 612	Driver machines interfaces for emu/dmu, locomotives and driving coaches - Functional and system requirements associated with harmonised driver machine interfaces
UIC 541-3	Brakes – Disc brakes and their applications - General conditions for the certification of brake parts
EN 15328	Railway applications - Braking - Brake pads
EN 14535 (series)	Railway applications - Brake discs for railway rolling stock
EN 15273-1+A1	Railway applications - Gauges - Part 1: General - Common rules for infrastructure and rolling stock
EN 50121-3-1	Railway applications - Electromagnetic compatibility - Part 3-1: Rolling stock - Train and complete vehicle
EN 50121-3-2	Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus
EN ISO 14040	Environmental Management-Life Cycle Assestment-Principles and Framework
UIC 345	Environmental Specifications For New Rolling Stock
EN ISO/IEC 17050	Conformity assessment - Supplier's declaration of conformity
REACH RG 1907/2006	Regulation of Europian Union

Bidders shall declare this separately if their system/equipment complies with another national/international or railway administration standard other than the ones mentioned in the table above.

2.3. Conformity to the Project Requirements

Sleeping Coaches will be certified by the assessment entity determined by the administration according to the relevant versions of UTP (UTP LOC&PASS, UTP NOI, UTP SRT, UTP PRM). The Supplier shall provide TURASAS with the necessary documents (all calculations, drawings, analyses, test reports and similar documents) requested by UTP for the current scope of supply. The Bidder/Supplier shall provide the declaration of conformity of the scope of supply with the relevant technical specifications and the applicable standards in Table 1.

The general design and specifications will basically comply with UIC 540, UIC 541-1, UIC 541-5, UIC 541-6, UIC 543 and UIC 567-2 and UTP requirements.

Brake System, system responsibility will belong to the supplier company. The declaration of conformity shall comply with the TS EN ISO/IEC 17050-1 standard and shall contain the following documents:

- Declaration of conformity (bidders will submit with their bids)
- Compliance report with proofs (Supplier will give before product delivery).
- Type test reports (to be given by the Supplier before product delivery.)

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The conformity report (test reports and all proofs of conformity) submitted by the Supplier will be subject to the approval of De-Bo and the assessment body appointed by TÜRASAŞ and responsible for UTP certification of coaches.
The supplier and their subcontractor are responsible for the delivered components and systems. TÜRASAŞ reserves the right to request modifications and/or different solutions for the system or components if it deems necessary due to installation, operation, interface or other similar reasons. Such requests will be mutually agreed upon at the meetings to be held with the supplier.

This technical specification is a part of the contract between the supplier and TÜRASAŞ. The supplier is not authorized to distribute this document or any part of it to third parties. If an official document is requested and mutual communication causes any action; All possible information requests and responses will be made in written format or via e-mail.

2.4. EC Certification of Conformity as Interoperability Constituent

The WSP system object of present Technical Specification is an Interoperability Constituent. The Bidder can join the tender with or without EC Certification of Conformity. In any case the WSP system/equipment/component shall be supplied with its own EC certification of conformity according to the current UTP by the Supplier.

The Bidder can propose the Interoperability Constituent with the EC certification of conformity according to the previous version of the UTP LOC&PAS. In this case the bidder shall also submit evidence that the proposed EC certification of conformity is valid and demonstrates the conformity to the current UTP.

The documentation related to the EC Certification of Conformity according to the UTP shall be accessible for examination by the Notified Body in charge of UTP certification of the coaches nominated by the Company.

The Supplier shall enable an assessment by the Assessing Entity at the suppliers location. The required audit to reach the conformity declaration of the WSP system shall be passed at least one (not only initial audit). If requested the supplier shall inform about the number of field proven WSP system with EC declaration of conformity. Besides the EC declaration of conformity the offered WSP systems shall be UIC approved and listed in Annex KLM of UIC541-05.

2.5. Project Management and Planning

The Supplier shall submit a Project Plan within one month of contract award.

This Project Plan reports the schedule for all main activities and key events, including submission of all information identified in this specification and delivery of all parts and documentation. The Plan shall be subject to approval of the Company, every time it is issued.

The Supplier shall attend regularly to the Project Progress Meetings according the established schedule proposed by the Company. The Project Plan shall be updated by the Supplier for each of these meetings.

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3. TECHNICAL REQUIREMENT

3.1. Scope Of Supply

3.1.1. Hardware

The Supplier shall be responsible for providing all equipment required for the braking system and system performance. All braking system shall be under the Supplier's warranty. If TURASAS deems it necessary, the brake discs will be sent to the Wheelset supplier instead of TÜRASAŞ. In case the brake discs are sent to the Wheel Set Contractor, the transportation costs of the brake discs will be paid by TÜRASAŞ.

The Supplier shall meet all the component requirements for the Brake System specified in the list below and shall be able to make additions if necessary. The supply list required for a wagon is given in Table 2.

Table 2: Supply List per Coache

No.	Açıklama	Vagon Başına Miktar
1	Brake Control Equipments	1 set
2	Wheel Slide Protection Equipments	1 set
3	Electronic Control Panel with connection cables for Brake System	1 set
4	Vacuum toilet compressed air supply Equipment	1 set
5	Emergency Brake Equipment	1 set
6	Other components required to install (including air tanks and fittings)	As needed in each wagon
7	Special tools and test equipment	1 set

3.1.2. Software

The Supplier shall supply the software required for the operation and maintenance of the brake system, providing at least the following:

1) Operating software

2) Diagnostics & Test software

3) Full documentation including software operation, user and maintenance manual as well as including user manual for all development & test software and diagnostic software.

4) Two back-up copies.

All software supplied for the system designed structurally and logically, fully documented, thoroughly tested in a systematic manner such that they can achieve high quality in terms of safety,

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reliability, testability, traceability and maintainability. Also all software supplied for the system shall be developed in line with ISO 90003 or EN 50657.

In order for ISO 90003 to be effective, the Supplier will conduct internal software quality audits in accordance with ISO 90003. Compliance with ISO 90003 will be proven.

The bidder shall notify the Safety Integrity Level of the proposed system together with its proposal. The SIL certificate of the system containing the software and hardware (issued by an independent authorized organization according to the relevant railway standards) will be delivered by the supplier. Provisional acceptance may be made without delivery of SIL certification, but final acceptance is subject to delivery of SIL certification. The safety integrity level of the brake system shall be minimum SIL2.

The Supplier shall make these changes, in case of a software correction request by TURASAS during the start-up tests or during the warranty period.

The Supplier shall submit the system startup test reports applied in its own workshop or the test reports of the trial tests of the software before the official release of the updated software to TÜRASAŞ or the evaluation body.

The Supplier shall provide diagnostic software tools (programs, special connecting cables, etc.), if any, with a total amount of 10 sets for the contract.

3.2. Technical Requirements

The braking system will basically meet the current UIC standards and UTP requirements for rail. However, the basic technical requirements are as follows:

(a) The sleeping coaches will be equipped with a pneumatic brake system using a UIC approved distributor valve.

(b) The braking system will generally comply with UIC 540 0, UIC 541-1 OR, UIC 541-3, UIC 541-05, UIC 541-5, UIC 541-6, UIC 543, UIC 544-1 O, UIC 545 and UIC 546 OR.

(c) The braking system in wagons will be double-pipe conforming to UIC.

(d) There will be two 10" brake cylinders on each axle on the bogie.

(e) There will be a total of two brake cylinder handbrake installations on a wagon.

(f) The master control valve will meet current UIC and UTP applications.

(g) The emergency braking system shall be equipped with an electropneumatic device (NBU), type DB, conforming to UIC 541-5 and UIC 541-6.

(h) There will be a manometer showing the brake application. (suitable for TCDD Transportation)

(i) Brake Pads shall be type 4.2 according to UIC 541-3, Annex-I.

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(j) The wheel shall have an anti-appliance system that prevents it from slipping and locking. The anti-applet system must be integrated with the brake control system. The applet prevention system must meet the requirements of UIC 541-05 and UTP in conjunction with EN 15595+A1:2011.

(k) Paint and markings: The paint color and style approved by TÜRASAŞ will be applied upon the implementation of the proposed contract.

(l) All trade names, logos, symbols, markings and inscriptions on wagons must comply with UIC regulations.

3.3 Passenger Emergency Alarm

Sleeping coaches shall be equipped with an emergency alarm system according to UTP LOC&PAS.

A total of 16 emergency handles in each coach will be mounted in appropriate positions of the landing, corridor, personnel compartment and passenger compartments in order to give an emergency alarm signal.

When the alarm is activated, special lamps and chimes (not included in the supply) will alert the mechanic.

When the train is stopped on or leaving a platform, activating a passenger alarm will cause the service brake or emergency brake to be applied directly and thus to a complete stop.

In this case, only after the train has come to a complete stop will the system allow the driver to cancel the automatic braking action initiated by the passenger alarm.

In other cases, 10 +/- 1 second after the (initial) passenger alarm is activated, at least one automatic service brake will be initiated, unless the passenger alarm has been acknowledged by the driver within this time.

The driver shall have the possibility of canceling the emergency command given by the passenger alarm (Emergency brake override) to delay the stopping of the train if necessary.

Devices used for this function will be constantly monitored to avoid dangerous situations in case of failure.

Cancellation is managed by a dedicated push button (not included in the supply) in the driver's cab.

A passenger emergency intercom will be provided in close proximity to the emergency arms to allow communication between the passenger and wagon personnel when the arm is activated. (not covered by this specification). In addition, a 2-way emergency communication system will be active between the wagon personnel and the driver when the lever is activated.

The contractor-supplied passenger alarm pull box must contain 2 switches that can be read by the VCU (TCMS).

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The emergency arm shall have interfaces to provide the necessary functionality with the emergency intercom.

3.4. Diagnostic

The brake system itself (hardware) as well as the software of the brake control unit and WSP system shall be developed, tested and commissioned by the same supplier.

Brake Control Unit shall be equipped with a diagnostic system, continuously running and able to verify the status of the main components and send diagnostic data via CANOpen to TCMS.

There are two types of diagnostic data: one for the train staff (personnel), the other for maintenance staff. TCMS is responsible to inform the train staff and the maintenance staff accordingly.

Diagnostic information will be stored in an appropriate memory within the brake control unit. These data will be available for download by maintenance personnel using a standard PC with specific (included in supply) diagnostic software and TCMS interface (not included in supply).

Every fault record; will also include ambient data such as temperature, time, pressures, velocity. Most of this data is available from the vehicle logic on the CANOpen bus.

Diagnostic data will be available on an ethernet type connection, also all data will be available on the CANOpen vehicle bus to be managed in the local TCMS diagnostic system.

The supplier is responsible for ensuring that diagnostic information and control commands are received/transmitted correctly between TCMS and the relevant system.

The TCMS contractor is the manager of communication protocols (WTB, CANOpen). The Supplier will provide the requested documents according to the parameters defined by the TCMS contractor and the administration.

In addition to the diagnostic data transmitted via bus, the vehicle wiring will provide an additional independent hardware signal for general brake failure. These signals will be sent by the brake control unit and can be monitored by personnel.

The supplier; will deliver a fault code stating the cause of the fault and a document itemizing the fault name, as well as maintenance / personnel and relevant LRU instructions according to the relevant communication protocol.

The minimum information to be managed by the diagnostic will consist of:

- Status of WSP
- Emergency brake lever pulled/not pulled information
- Speed information

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3.5. Weight

The supplier shall submit the estimated weight information of the brake system to TÜRASAŞ within two weeks after the signing of the contract, in files or explanations.

The deviation from the actual weight should not be more than ±4% of the estimated weight.

3.6. System Interface

The design and assembly points of the equipment included in the Brake System will be defined by the Supplier and approved by TÜRASAŞ. Thus, mechanical interference of other equipment in the wagon with this unit will be avoided. The supplier is responsible for the assembly method and the supply of all equipment required for assembly as defined in the drawings.

The Supplier will be responsible for the design of the brake system, providing design information, testing and inspections.

In case of any change in the parts covered by the Brake System, the Supplier shall indicate this change and submit it to TÜRASAŞ for approval. Thus, mechanical interference of other equipment in the coach with the modified parts of this unit will be prevented.

The following interface specifications shall be considered valid for all components of this technical specification within the scope of the brake system.

3.6.1. Mechanical Interface

The mechanical interfaces for the components of the brake system shall be provided in accordance with EN 12663 and UTP. All hardware of the organs of the brake shall be done with self-locking nuts.

3.6.2. Pneumatic Interface

The pneumatic interfaces between the cars shall comply with the UTP.

Every equipment having air inlet and outlet shall comply with ISO 228.

3.6.3. Electrical Interface

All electronic and electrical units will be connected to the wagon power lines using the corresponding connectors. All mutual female and male connectors will be included in the scope of supply.

3.6.4. Digital and/or Analog Inputs/Outputs

It will be defined at the design stage.

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3.6.5. Grounding

EN 50153 standard is valid for protective provisions against electrical hazards in railway vehicles and this standard will be followed.

All equipment that may cause electric shock shall be protected against direct contact.

All conductive surfaces in electrical equipment in vehicles will be connected to a grounding point to balance the electrical potential. This includes conductive surfaces of cabinets, doors and covers.

Small interior cladding elements connected directly to the vehicle body and/or protected by insulation are excluded. (e.g. handle, hanger, etc.)

All equipment operating at voltages greater than 25 V-AC and 60 V-DC shall be grounded for safety.

Each grounding point in equipment shall have good electrical conductivity and large contact surface to ensure low contact voltage and shall be protected against short circuits.

The Supplier shall supply grounding diagrams for its equipment, including grounding connections and protections. The supplier shall indicate which of the system cables will be shielded.

Cable shields should only be used for protection; should not be used as signaling, grounding or reference cables.

Unless the supplier requests differential connection, cable shields must be grounded at both ends to achieve high shielding efficiency against electric and magnetic fields.

This requires equipotential bonding of both earthing points (eg with chassis or suitable structural components). The cable shield will be grounded with low impedance (large contact surface, preferably all).

Grounding through connection pins or cable sheaths is not permitted.

The low voltage 0V level in the vehicles will be isolated from the vehicle body. Therefore, an internal connection between the metallic chassis and the 0V voltage in the equipment will be avoided; The ground connections at the equipment shall not be connected to the vehicle's low voltage DC power supply.

3.7. Painting

The Bidder shall submit its own painting specification to the Company. The supplier shall paint all necessary surfaces of brake equipment.

Concerning resistance to corrosion, design and processes shall take in account the effect of potential galvanic corrosion.

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The Supplier is responsible for painting (including primer and top coat paints) the air reservoirs and all components in the scope of supply. The colour of the equipment will be defined by the Company after signing the contract.

3.8. Noise, Vibration and Impact

The system will comply with EN 61373.

3.9. Protection Class (IP)

The design will provide adequate IP level for equipment/components depending on their function.

If enclosures for junction boxes, speed sensors, connectors, terminal boards or electrical/electronic components are located in the bogie, the protection level shall be IP 65 or IP 66 OR IP 67.

3.10. Electromagnetic Compatibility (EMC)

The EMC requirements of the supplied systems and components will be in compliance with the following list of relevant norms and standards:

- EN 50121-1 Railway applications – Electromagnetic compatibility – Part 1: General
- EN 50121-3-2 Railway applications – Electromagnetic compatibility – Part 3-2: Railway vehicles – Devices

4. TEST

The test procedure will be prepared by the Supplier and submitted to TÜRASAŞ and/or the Assessing Entity for approval. The Supplier shall perform tests and inspections in accordance with the Approved Test Procedure and the Approved Inspection Procedure.

TÜRASAŞ and/or the Assessing Entity have the right to observe these tests and inspections at any stage of the test and inspection procedures.

The requirements (dimensional, waterproof, mechanical strength, etc.) specified in this Technical Specification will be proved together with the tests (type tests on the component or the vehicle) and calculation reports by the Supplier.

Each component will be subjected to "type testing" and "routine testing". While type tests are applied to any sample selected by TÜRASAS among the products to be supplied, routine tests will be applied to each product. According to the results of these tests, the administration reserves the right to have the other components in that batch retested.

If the system and components have been proven and approved before, TÜRASAŞ may waive the type tests. In this case, the supplier will submit the existing test reports and certificates to TÜRASAŞ and/or the Assessing Entity for approval. If the test reports or certificates are not found appropriate, the supplier has to repeat the tests.

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The Bidder shall submit the tests list in the offer. The absence of the tests list means that a test shall be run for each single requirement.

List of calculation and test shall be agreed in the detail design phase.

The Brake System shall be subjected, preventively, to the functional and experimental tests which shall be made on the first coach in the conditions much similar at the normal working conditions. The Supplier shall make the following type test :

- Functional test at normal and low temperature
- Water tightness test
- Visual and dimensional inspection
- Operational test at test bench
- Performance tests
- Endurance test
- Shock and vibration test
- Noise test
- Dynamometer test

Brake pads shall be approved according to UIC 541-3 and EN 15328. Approval testing of the brake disc shall be in accordance with standard UIC 541-3, EN14535-1 and EN14535-3.

The Company approval of the test specification does not imply that the Supplier is released by the responsibility regarding the correct behaviour and the compliance of the supplied product.

The Supplier is responsible for submitting any reports of the tests mentioned above in case of request by the Company. All test costs belong to Supplier.

Test and inspection procedures and reports containing all repair activities and checklists will be submitted to TÜRASAŞ for approval.

4.1. Type Tests

Type tests are required to verify that the components of the system object of the scope of supply, operate in accordance with the Approved Design Data.

The Supplier shall perform Type Tests, in accordance with a test procedure issued by the Supplier with the Company and/or end Client participation. The Supplier is responsible for the success of the aforementioned Type Tests.

During testing, the criteria shall be observed and recorded in a logbook and necessary alterations, adjustments and maintenance works shall be carried out.

In the case components are already being used in similar projects or more severe conditions the supplier shall submit to the Company for approval a report explaining in detail the reasons for which it believes the tests need not be carried out, providing evidence of that.

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4.1.1 Static Commissioning

The static test (plant test) of the coach shall be carried out by the Supplier at the Company. All necessary equipment for the test shall be provided by the supplier. This test shall be compliant with the test procedure prepared by the Supplier with the participation of the Company.

The Supplier shall provide the Company the relevant static test results of the brake system on the coach and shall be responsible from the correction of all kinds of problems.

4.1.2. Dynamic Commissioning

The dynamic track tests of the coach under all load and speed conditions shall be carried out on the TCDD lines with the participation of the Company.

The brake distances and air consumption quantities shall be tested in the dynamic tests. The correction of any malfunction / error shall be within the responsibility of the Supplier.

4.2. Routine Tests

Routine Tests, as with type tests, are required to demonstrate compliance with the Approved Design Criteria of system components included in the supply.

The Supplier shall perform the routine tests under his own responsibility in accordance with the test procedure approved by TÜRASAŞ. TÜRASAŞ reserves the right not to participate in routine tests.

During the test, the criteria will be observed and recorded in the Logbook. Necessary changes, adjustments and maintenance work will be carried out.

Routine test records kept by the Supplier will be kept ready for inspection by TÜRASAŞ and/or TCDD-T.
All copies of approved routine test results will be delivered with the relevant Logbook.

Backup copies of all test/inspection records will be kept at the supplier's facilities and will be submitted to TÜRASAŞ or its representative upon request.

This test; will include at least functional testing, visual inspection and dimensional inspection. Test details will be confirmed.

4.2.1. Static Commissioning

The static test (plant test) of the coach shall be carried out by the Supplier at the Company. All necessary equipment for the test shall be provided by the supplier. This test shall be compliant with the test procedure prepared by the Supplier with the participation of the Company.

The Supplier shall provide the Company the relevant static test results of the brake system on the coach and shall be responsible from the correction of all kinds of problems.

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4.2.2. Dynamic Commissioning

Dynamic track tests of the coach will be carried out by the Company on TCDD lines, with software, hardware and equipment provided by the Supplier, in accordance with the procedure determined by the Supplier.

Braking distances and air consumption values will be checked in dynamic tests. Correction of any malfunction/error will be the responsibility of the Supplier. In case of a possible problem, the Supplier will detect and solve this problem and commission the system.

4.3. First Article Inspection (FAI)

The Supplier will carry out First Article Inspection (FAI) at its own facilities, with the participation of TÜRASAŞ, to verify full compliance of the equipment with the design and production processes before proceeding to mass production, in accordance with the inspection procedures approved by TÜRASAŞ

In the First Article Inspection (FAI), the supplier must submit all documents related to the design and manufacturing process, test records, material certifications, etc. will have it ready. If all requirements are not met in the FAI, a Hardware Review will be requested.

With the acceptance of FAI by TÜRASAŞ, the supplier obtains permission to manufacture the necessary equipment. The equipment will meet the quality standards set in the FAI.

4.4. Quality Control Requirements

The supplier will develop the Quality Assurance Plan (QAP) based on the current and valid ISO 9001 standard and submit it to TÜRASAŞ Quality Control team for review and approval. The delivery of the QAP will be made within 60 days after the signing of the agreement between TÜRASAŞ and the Supplier.

Inspection and Test Plan (Hereinafter referred to as ITP.)
The ITP will include and define the following items:

- Sequence of review/test activities.
- Review/test requirements of activities or materials.
- Acceptance criterion or relevant specification.
- The level of observation/test required, including the requirement for monitoring by TÜRASAŞ and/or TÜRASAŞ's customer.
- Any certification requirements or records to be retained or made available.

5. GENERAL REQUIREMENT

5.1. Fire Safety

Coaches are classified as Category A according to UTP LOC&PAS in terms of fire safety.

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The system/equipment/components supplied, including all its elements, shall comply with the relevant parts of EN 45545-1, EN 45545-2, EN 45545-3, EN 45545-4, EN 45545-5 and EN 45545-6 norms. The fire performance requirements for materials are specified by the R(n) content given in EN 45545-2 Table 5.

These performance requirements of materials and components do not depend only on their natural structure; its location, shape and layout are also related to surface radiation, relative mass and material thickness considered. In EN 45545-2, Table 2, different products and their positions in the coach listed to identify the relevant R(x) properties.

The bidder shall follow the instructions of EN 45545-2, paragraph 4.2 General and paragraph 4.3 Grouping Rules, and the flowchart Evaluation Process - Grouping Rules of Figure 1. Thus, it will both identify all materials not mentioned hereafter or not included in EN 45545-2 Table 2 at all, and verify whether the specifications can be applied (in case of small quantity, light weight, narrow open space, etc.).

To complete the punctual requirements identification in table 5, the Hazard Level "HL2" shall be used. This hazard level has been determined on the basis train-set classification 2S and it identifies the relevant tests pass-no-pass condition.

Concerning the materials used for the Scope of Supply of present Technical Specification following requirements have been identified.

Table 3: Material Fire Properties

Product type	Definition	Details	Requirement
M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
M2	Hoses - Interior	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R22
M3	Hoses - Exteriors	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R23
EL1B	Cables for exterior	Cables not compliant with one of the standards referenced in 4.2c	R16
EL10	Small electro technical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signalling switches, terminals, fuses	R26
EL9	Printed circuit boards	Printed circuit boards without any attached technical equipment	R24 or R25 or R26

The Supplier shall adopt materials with required characteristic and also identify other materials not mentioned above. The above R(x) list is not definitive; the Bidder/Supplier shall complete it according the materials used in the Scope of Supply.

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The Supplier shall give the list of the inflammable materials used with material type, quantity and fire resistance behaviour tests. The Supplier shall prepare a fire safety analysis report and submit to the Company for approval.
The documentation presented by the Supplier relevant fire performance will be examined for approval by the Assessing Entity in charge of UTP certification of the coach nominated by the the Company.

The Supplier shall be responsible to perform all necessary activities which are required by Assessing Entity.

The Supplier will be responsible for performing all necessary activities requested by the "Evaluation Body".

5.2. Material Compatibility and Recycling

The manufactured equipment shall not affect either the safety or health of crews and maintainers either/or the environment.

Reference Norms are the following:

- REACH RG 1907/2006: The European regulation
- UIC leaflet 345: Environmental specifications for new rolling stocks
- EN ISO 14040: Environmental management - Life cycle assessment - - Principles and framework

5.3. Reliability, Availability, Maintenability &Safety

The RAMS Specification and Demonstration will be carried out by the supplier from the preliminary design stage to the production, testing, compliance process and commissioning stage and up to the specified lifetimes.

RAMS guarantee will be checked and provided according to TS EN 50126 standard. This standard will be used as a guide in the development of all analyzes using the reported methodological approach.

5.3.1. Reliability Targets

Although reliability targets are not specified in this supply, the Supplier will be responsible for the quality and reliability of the product.

Corrective actions and / or design changes will be carried out by the supplier's own expense.

5.3.2. Maintenance Targets

Bidders; In order to keep the maintenance costs at reasonable levels, the best calculated values, including cost analyzes for the 2-year short period and the long-term 30-year period, will be submitted to TÜRASAŞ together with its offers at the time of the tender, by filling in Table 9 separately for both 2 years and 30 years.

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Tablo 4: Maintenance Targets

Tanım	Hedef (bir vagon için)	Açıklamalar
Total cost of preventive maintenance per 1000 km (€/1000 km)	to be defined	Labor cost: TBD €/hour
Corrective maintenance total cost per 1000 km (€/1000 km)	to be defined	Labor cost: TBD €/hour
Total maintenance cost per 1000 km (€/1000 km)	to be defined	Labor cost: TBD €/hour

5.3.3. Commitment to RAMS Targets

The achievement of the above mentioned RAMS objectives will be verified with data from the vehicle in service during the relevant Verification Period (see next section).

Reported RAMS objectives will be demonstrated and evaluated during the project development process by providing a RAMS analysis according to the tables in this document.

In particular, the supplier will demonstrate that all serviceability requirements and repair levels have been considered and processed in accordance with the design.

Maintainability analysis and maintenance target will be observed, evaluated and controlled through official processes recommended by TÜRASAŞ.

TCDD-T will verify the reported maintenance times through certain indications.

The Maintenance Plan derived from the preventive maintenance analyzes and related tasks will be consistent with the maintenance manuals (see relevant sections).

Regarding the missing points of the supplier:

For the realization of all RAMS targets, TÜRASAŞ has to make all necessary changes free of charge in line with its demands.
It will pay the fines to TÜRASAŞ, as defined in the supply contract, for situations arising from incompatibility between TCDD-T and the supplier system.

5.3.4 RAMS Performance Verification Period

Verification of RAMS targets by keeping records of field data for each system/sub-system/component; It will be done during the Verification Period during the operation phase of the system/subsystem/components.

The RAMS performance verification process is assumed to be 2 years today.

Note: The final definition of the verification period will be derived from the requirements of TCDD-T and this information will be confirmed when available.

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5.3.5. LRU Plan

Revisions (preventive maintenance) or basic repairs (corrective maintenance) of the Periodic Replacement Parts (LRU) of the products in the scope of supply are strongly recommended when the wagon is out of service. Thus, the Periodic Replacement Parts (LRU) in the maintenance task will be replaced with the spares already in the warehouse, and both time and cost will be saved.

In order to follow this method, a list of ready-to-use Periodically Replaced Parts (LRUs) must be provided as part of the maintenance documentation. Similarly, the supplier; so-called spare parts, which have a serious importance in terms of functionality within the scope of supply; will often supply a list of parts that are large, expensive, and have long lead times or are in critical condition (see next item).

5.3.6. Spare Parts

The Supplier shall supply a spare parts list, including stock calculation information, used for preventive and corrective maintenance analyses.

• Fault structure
• Spare part definition
• The number of equipment in an upper complex; number based on large main systems without considering smaller components of subsystems
• Series price [1]
• Ex-factory price
• On-site delivery time
• Number of economical purchases
• Lifetime
• Minimum number of purchases
• Aging time

[1]: Serial price: It is the new fee configuration applied to spare parts to build up the maintenance stock at the beginning of the business enterprise. TÜRASAŞ will select the equipment and quantity to be purchased within the framework of this list.

All references used by the supplier to identify spare parts will be the same as in any other documentation provided (design documentation, primary and secondary maintenance manuals, spare parts catalog, miscellaneous instructions for personnel, etc.).

5.4. Maintenance Manual

5.4.1. Main Features of the Manual

The Supplier shall prepare integrated manual for the operation and maintenance of its scope of supply equipment. The manuals shall contain:

- supplied system/equipment description;
- preventive maintenance tasks description;
- corrective maintenance tasks description (repair instructions included).
- information in order to carry out the overhaul of the system/equipment and the heavy repair (if it is repairable and off Train).

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The manual will be used as the basis for Train operation and maintenance by the End Client staff. The manual shall be prepared in electronic editable format and the language UK English; and Turkish.

5.4.2. Contents of the Manual

The manual shall contain as minimum the following information/instructions:

5.4.2.1. Description and Operation

- General description and operation of system/equipment
- Functional description and operation of all LRU's and components
- Mechanical and electrical data sheets for all LRU's and components.

5.4.2.2. Maintenance Activities

- Preventive Maintenance Plan including the maintenance periodicity (frequency) table for system/equipment.
- Reported information shall be the same of those described by the Preventive Maintenance analysis and be linked with detailed Maintenance Instructions.
- Preventive Maintenance Plan shall report reference to specific/special tools needed for the maintenance works (if used).
- Maintenance Instructions shall report step by step detailed description of each task of the maintenance plan in order to include all information necessary for carrying out the relevant work.
- The Preventive Maintenance Plan shall include all activities foreseen for the system/equipment from daily inspection up to major repair/overhaul.

5.4.2.3. Preventive Maintenance Card/Instruction

Each maintenance instruction shall include:

- task periodicity
- safety warnings
- cleaning materials
- recommended lubricants
- torque values
- special tools (if any): as special tool is intended either a tool (hardware and/or software) that is exclusively produced by the Supplier and is essential for system/equipment maintenance, either a tool available on market but expensive, sophisticated, with long lead time and so on
- step by step activity description with necessary schemes, drawings and illustrations, including:
  - scheduled activities (greasing, topping up, visual check, etc.)
  - removal and refitting

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- off-Train overhaul
- final functional check

The Supplier is responsible to update the maintenance instructions until the end of the general warranty period of the last supplied equipment.

5.4.2.4. Corrective Maintenance Card/Instruction

Each maintenance instruction will contain the following:

- trouble shooting
- safety warnings
- torque values
- special tools (if any).
- step by step activity description with necessary schemes, drawings and illustrations, including:
  - removal and refitting
  - off-Train repair
  - failure diagnosis
  - final functional check.

The Supplier is responsible to update the maintenance instructions until the end of the general warranty period of the last supplied equipment.

5.4.2.5. Specials Tools and Test Equipment

The use of special tools shall be avoided, nevertheless if they are essential for maintenance (upon Supplier and the Company agreement), following information shall be supplied in a dedicated section of the Maintenance Manual:

- descriptions and technical data (including SW if present)
- drawings
- use instructions
- list of tasks where the tools usage is mandatory (and of course Maintenance Cards shall refer to the relevant special tools when is needed).
- all the information for purchasing it correctly (technical data, builder, price, and so on) if the special tool is available on the market.

The supplier will provide the special tools and test equipment required for maintenance and repairs. The Supplier shall submit a detailed list of special tools and test equipment to TÜRASAŞ during the design phase.

5.5. Training

The Company consider of paramount importance to have a good level training to maintainers/operators in order to increase the skills and experience for carry out maintenance activities of the supplied system/equipment. Comprehensive training courses, covering the

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system/equipment supplied, therefore shall be provided by the Supplier to the Company/TCDD personnel.

The level of training shall be congruent with the complexity and criticality of the system/equipment in object, therefore training performed by the Supplier shall be properly prepared in order to be efficient and effective. This training shall give to the trainees a general overview of the system/equipment, of its performance, as well as sufficient knowledge for carrying out periodic maintenance of the system/equipment and its components, fault finding and repair and carrying out works both of preventive and of corrective maintenance.

Generally the training activities are divided in two steps; the first concerning a general description of the system/equipment and depth training for carrying out scheduled maintenance needed during the first 2 years of operation.

The second step completes the knowledge about all maintenance aspects with particular care to overhaul activities. Supplier shall provide the Company/TCDD personnel the training according to following table.

Table 5: Scoop of Training

Training Subject	Trainee Duration	Trainees Number	Training Place
Brake system description (pneumatic and electronic)	5 days	6 people	At Supplier facilities
Brake system description on car level (pneumatic and electronic)	5 days	10 people	At the Company facilities
Overhaul training of the brake system components	6 days	6 people	At Supplier facilities
Overhaul training of the brake system components	6 days	10 people	At the Company facilities

The training documentation shall be prepared by the supplier in English and Turkish languages according to the number of participants. The training shall be done in Turkish language. The Bidder shall propose and detail in the tender phase the training activity to be carried out. The Supplier shall submit the training cost separately at the offer phase.

5.6. Warranty

Supplier shall guarantee the quality of products within the scope of this specification against malfunctions, failures and assembly and workmanship defects.

While the warranty period is limited to 42 months starting with the date of delivery of the products to the Company, it is 30 months starting with the commercial commissioning of the coach. The responsibility of performing preventive maintenance on the normally used parts and the protective maintenance in cases where it is evidently clear that the root cause is not the own malfunctions of the unit, shall belong to the Company.

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Throughout the warranty period, following the notification by the Company of any malfunction, the Supplier shall respond to that malfunction within three (3) working days and replace the malfunctioning parts and equipment or repair and fix the malfunction.

The Supplier shall make available in Turkey throughout the warranty period the required service facilities in order to respond to the possible malfunctions and a sufficient number of spare parts or fully complete air supply and brake systems of at least one electrical set within this time period. The Supplier shall provide a spare part supply warranty for a period of 10 years.

5.7. Acceptance

5.7.1. Temporary Acceptance

Temporary acceptance report shall be issued by the Company after the brake system and all documentation are sent by the Supplier.

5.7.2. Final Acceptance

Final acceptance report shall be issued by the Company after the commissioning tests of each coach.

5.8. Packing, Labelling, and Storage

5.8.1. Packaging

System/equipment/components shall be delivered in suitable packages with adequate strength to be resistant against shocks and transportation damages including effects of dust, rain, snow, solar, wind etc. in the climatic conditions.

Packing boxes shall be convenient for stacking one on another and shall allow easy lifting by fork-lift truck (where reasonably applicable) or travelling bridge-crane.
Following information shall be reported on the package (in a legible, non-erasable and non-removable mean).

- Name, address and registered logo of the manufacturer.
- Assembly Part Number and applicable Tech. Specification reference
- Date of manufacturing and serial number (if applicable)
- Date and number of the contract.

Furthermore, if the content of a box consists of more than one component, a components list shall be added inside and outside of the box and each individual component shall be labelled.

Determination of the content of these boxes shall be performed with the participations of the Company. Lists of the boxes shall be finalized after approval of the lists by the Company. A copy of each list shall be sent to the Company at the beginning of the shipment.

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5.8.2. Labels

The system/equipment/components supplied shall be provided with technical markings, in order to fulfil requirements of electrical safety, and provide information to maintenance personnel.

Wherever required for health and safety purposes, including where necessary to comply with legislation, parts shall be fitted with suitable safety and warning signs.

In particular the parts supplied, including all replaceable parts, shall be identified by a label showing:

- Serial number
- Date of manufacture
- Supplier's part number (if any)
- Revision level.
- Company's part number (if any)
- Technical data (if any)

Format and positioning of all labels shall be subject to approval by the Company. Wherever possible, the position shall be such that labels can be viewed when the relevant part is installed within the vehicle.

Any information belongs to Supplier, Logo and brand etc. so located to products shall not be visible by passengers. All labels shall be permanent and indelible.

5.8.3. Storage Conditions

The Supplier shall provide any useful information it is deemed necessary for the correct storage of the goods delivered.

5.8.4. Mounting and Handling

All the components shall be supplied ready for installation and possibly already mounted and pre-regulated. Special care is requested to the Supplier to list all the necessary tools for mounting and maintenance.

5.9. Documents to be Submitted to TÜRASAŞ

In the table below, there is a list of documents requested by the administration together with the timelines.

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Table 6: Documentation to be Supplied

No	Stage 1: Concept Phase	Time Schedule	Language
1.1	Clause by Clause commentary CBC (this document)	Concept Phase	English
1.2	Preliminary system description		
	Stage 2: Offer Phase	**Time Schedule**	**Language**
2.1	General system information	Within 1 Month After Signing the Contract	English
2.2	3D drawings for mounting locations of bogie equipment		
2.3	Bogie equipment drawings created according to the axle		
2.4	Project descriptive drawing and component information		
2.5	Thermal report based on the agreed profiles		
2.6	Pneumatic piping diagrams for each car type		
2.7	Parts list for each car type		
2.8	Brake calculation		
2.10	Air consumption estimation		
2.11	Equipment Scheme:		
2.12	Installation drawing electronic		
2.13	Electronic wiring diagrams		
2.14	Service instruction electronic		
2.15	Electronic scope of supply		
2.16	System requirements specification		
2.17	Configuration diagram		
2.18	Updated pneumatic piping diagrams for each car type		
2.19	Updated parts list for each car type (after system design review)		
	Stage 3: Design Freeze	**Time Schedule**	**Language**
3.1	Final version: Pneumatic piping diagrams for each car type	Design Freeze	English
3.2	Final version: Parts list for each car type		
3.3	Complete set of component installation drawings		
3.4	Arrangement drawing bogie equipment		
3.5	Final installation drawings electronic		
3.6	Final electronic wiring diagrams		
3.7	Final system requirements specification		
	Stage 4: Delivery Phase	**Time Schedule**	**Language**
4.1	Documentation CD including: • component description (complete component documentation) • installation drawing (complete component documentation) • spare part catalogue (complete component documentation)	Delivery Phase	English
4.2	Final version: System description		
4.3	Static commissioning protocol (pneumatic / mechanic)		
4.4	Static commissioning protocol (electronic)		
4.5	Results from test protocol for determination of anti-skid chokes		
4.6	Dynamic commissioning protocol (after test of first train)		
4.7	List of special tools for commissioning (to be provided at tests)		
4.8	EC declaration of conformity for WSP device and horns		
	Stage 5: Additional Documents	**Time Schedule**	**Language**
5.1	Fire safety analysis with test certificates	Delivery Phase	English
5.2	RAMS and LCC analysis (see chapter RAMS LCC /PM/CM Analysis)		
5.3	Material declaration (REACH)		

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5.4	System maintenance instruction		
5.5	Software assessment report by independent third party assessor		

Notes:

- 3D models shall be provided in .step format.
- 2D drawings shall be provided in .tiff and .pdf format.
- Electrical schemes shall be provided in pdf and .tiff format.
- Other documents shall be provided in an editable format and in .pdf format.
- In the documentation, the Turkish version shall prevail in case of utilisation both Turkish and English languages.
- All documents in stage 1 shall be provided as hardcopy and softcopy in CD.
- All test procedures will be prepared in accordance with EN 50215.

6. LIST OF ATTACHED FILES

Annex-1: Principle Picture of BS50.01.00.0001 Sleeping Coaches

In case of updating the attached technical drawings, the Supplier must update the design and documents in accordance with the updated drawing.

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