

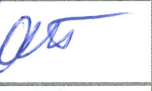
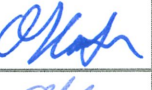
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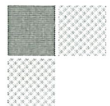
[Rev. D 4923]

National Commuter Train Project Pantograph Technical Specification

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III. LIST OF ACRONYMS & ABBREVIATIONS

ADD	Automatic Dropping Device
DeBo	Designated Body
EMU	Electrical Multiple Unit
FAI	First Article Inspection
HV	High Voltage
LRU	Line Replaceable Unit
LV	Low Voltage
MV	Medium Voltage
MVB	Multifunctional Vehicle Bus
N/A	Not Applicable
NoBo	Notified Body
TBC	To Be Confirmed
TBD	To Be Defined
TCMS	Train Control Monitoring System
TOR	Top of Rail

1 INTRODUCTION

1.1 SUBJECT

This document describes the technical requirements for the procurement of the pantograph to be installed on the Electrical Multiple Units (hereafter called EMU) produced by Turkish Railway Vehicles Industry Inc. (hereafter called TÜRASAŞ).

The bidder shall offer a solution totally compliant with the requirements of this specification.

After signing the contract, possible deviations from this specification or from other specifications and norms mentioned in this document, shall be validated by written agreements between TÜRASAŞ and the Supplier.

The Bidder shall make clause by clause comment into present technical specification together with their offer.

IMPORTANT NOTE:

The present document shall be examined by the bidder, together with following document:

TŞ-01.139–General Technical Specification

in order to know general applicable requirements established at train level.

This Technical specification and its annexes already prepared in Turkish and English language. The Turkish language shall be prevailing in case of any discrepancy among them.

1.2 DEFINITIONS

Within this Technical System Specification, the following definitions are applied to the words reported below:

- “the End Client” means the TCDD Transportation Inc. Comp.
- “the Administration” means the Turkish Railway Vehicles Industry Inc. (hereafter called TÜRASAŞ)
- “the Designer” means BLUE Engineering that is the company responsible for the design EMU set
- “the Supplier” means the company who wins the tender to supply the good object of this specification
- “documentation” means all or any specifications, drawings, reports, networks, operating and maintenance manuals and all other information whether on paper or on magnetic or other format which is prepared by the Supplier in the course of the contract
- “the Bidder” means the company who want to join to the tender to supply the good object of this specification

1.3 DOCUMENTS AND STANDARDS

The EMU shall be designed, assembled and tested according to the following international reference standards:

European Standards: TSI, EN;
International standards: UIC; ISO; IEC;
System of units shall be SI.

Table 1 reports the Applicable Standards for the Scope of Supply.

Standard	Year	Title
EN 17050	2010	Conformity assessment - Supplier's declaration of conformity
EN 45545	1,3,4,5,6-2013 2-2020	Railway applications - Fire protection on railway vehicles
EN 50121	1,2,3.1,5-2017 3.2,4-2016	Railway applications. Electromagnetic compatibility
EN 50124	2017	Railway applications. Insulation coordination.
EN 50126	2017	Railway applications. The specification and demonstration of reliability, availability, maintainability and safety (RAMS).
EN 50153	2014	Railway applications. Rolling stock. Protective provisions relating to electrical hazards
EN 50155	2017	Railway applications - Electric equipment used on rolling stock
EN 50163	2004	Railway applications. Supply voltages of traction systems
EN 50206	2010	Railway applications. Rolling stock. Pantographs: characteristics and tests.
EN 50317	2012	Railway applications. Current collection systems. Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line
EN 50367	2020	Railway applications. Current collection systems. Technical criteria for the interaction between pantograph and overhead line
EN 61373	2010	Railway applications. Rolling stock equipment. Shock and vibration tests
IEC 60529	1991	Degrees of protection provided by enclosures (IP Code)
TSI LOC&PAS 1302	2014 +AR 2019/776 and 2020/387	Technical Specification of Interoperability: Rolling Stock - locomotives and passenger rolling stock subsystem of the rail system in the European Union
UIC 608	2003	Conditions to be complied with for the pantographs of tractive units used in international services
UIC 611	2001	Regulations governing acceptance of electric locomotives, power cars and multiple units sets for running on international services

Table 1 – Applicable Standards

If it is not differently specified, the applicable version of the standards mentioned in the text of the document is the one specified in Annex 1 of "TS-01.139 –General Technical Specification" or in the above table.

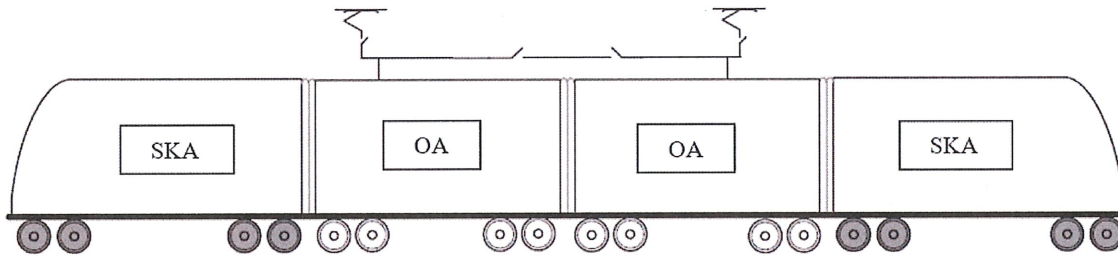
The Bidder shall review and confirm compliancy to the above list of applicable norms, any deviation shall be submitted to TÜRASAŞ for approval.

The Bidder shall declare if its system/equipment is compliant with other national/international or railroad administration standards not mentioned in the above list.

1.4 EMU TRAIN-SET CONFIGURATION

EMU is composed by:

- 4 cars: SKA car, OA car, OA car: SKA car



The types of car are hereafter:

- SKA = Leading car with driver cab
OA = Intermediate car

The SKA vehicles will be interchangeable and the OA vehicles will be interchangeable.

The EMU will be fixed configuration Unit: the orientation of the different type of vehicles within a Unit is fixed.

The Unit wheel arrangement will be the following: Bo'Bo'+2'2'+2'2'+Bo'Bo'

1.5 EMU TRAIN-SET MULTIPLE CONFIGURATION

The configurations foreseen for the multiple unit operation are the following:

- 4 cars + 4 cars
4 cars + 4 cars + 4 cars

2 SCOPE OF SUPPLY

2.1 HARDWARE

The Supplier shall provide all relevant components related to manufacturing and assembly of the listed components as following:

- Single arm complete pantograph with pan/heads of 1600mm, insulators and relevant pneumatic equipment
- All necessary connectors/connection, if any, relevant to the equipment above and counter connectors to be mounted on the vehicle side
- Grounding points with relevant items (screw, nuts,.....) for grounding terminal fixation
- Installation materials (Screw, bolt, brackets, pneumatic connections etc.) for mechanical, pneumatical and electrical fixations and connection
- If any, all other equipment and material which is necessary for functionality and installation of Pantograph
- Mechanical fixation items, such as screws, nuts, bolts, ...

The quantity of Pantograph Equipment is reported in the following table;

Part Name	Per Car				Per 4 Car Train Set
	SKA	OA	OA	SKA	
Pantograph System Equipment	-	1	1	-	2

Table 2 – Material Quantity

The supplier shall deliver 2 female and 2 male connectors for each type of connector that interfaces with the vehicle to TÜRASAŞ once under the contract.

The supplier shall include in the offer a separate price list for the spare parts listed in the below table.

The contractor shall accept and guarantee to deliver the pieces /parts in this list to TÜRASAŞ if it is so required by the administration for a period of 10 (ten) years in return of due unit prices that are escalated according to the escalation formula given below:

$$P1 = P_o \times (C1 / C_o) \times (0,10 + 0,35 \times (M1/M_o) + 0,55 \times (L1/L_o))$$

Where:

P1: Escalation unit price (in the currency of Turkish Lira or Euro or USD)

Po: unit price specified in the final lists (in the currency of Turkish Lira or Euro or USD)

Mo, Lo: material (Mo) and labour (lo) indexes applicable in the industry in the country of the contractor at the date 30 (thirty) days prior to signature date of the contract.

M1,L1: material (M1) and labour (L1) indexes applicable in the industry in the country of the contractor at the date 30 (thirty) days prior to placement of the purchase order.

If the currency indicated by Po is different than the currency of the country of origin where labour, and material indexes belonged, correction factor shall be used in calculation of escalated unit prices. Cor-rection factor shall correspond to the foreign currency exchange rate applied by the Central Bank of the Republic of Turkey at the date indexes are applied.

Co: the rate of exchange of foreign currency applied by the Central Bank of Turkey at the date 30 (thirty) days prior to the signing of the contract.

C1: the rate of exchange of foreign currency applied by the Central Bank of Turkey at the date 30 (thirty) days prior to placement of purchase order.

Name of the part	Unit	Qty
Pantograph	Piece	2
Pantograph coal	Piece	25

Table 3 – Spare Parts

2.2 SOFTWARE

NA

2.3 SPECIAL TOOLS AND EQUIPMENT

The Bidder shall comply special tools and equipment according to TD-GZ.26.0020 (relevant section in RAMS Analysis) which is given in Annex.

2.4 CONFORMITY TO THE PROJECT REQUIREMENTS

The EMU train set shall be certified according to current version TSI PAS/LOC, TSI NOI, TSI PRM, TSI SRT and TSI CCS by Notified Body (NoBo) / Designated Body (DeBo). The Supplier shall provide whole calculations, drawings, analysis, test reports and other kind of documentation which is requested by TSIs for the present Scope of Supply.

The Supplier/Bidder shall provide the declaration of conformity of its Scope of Supply to the relevant technical specifications and applicable norms.

The declaration of conformity shall be in accordance to the EN17050 Norm and shall include also the following documents:

- Conformity declaration (The bidder shall submit it at Stage 1)
- Conformity report with all conformity evidence (The supplier shall submit it at Stage 3)
- Type test reports (The supplier shall submit them at Stage 3)

The documentation presented by the Supplier/Bidder relevant to the Conformity report with all conformity evidences and test reports will be examined for approval by the NoBo/DeBo in charge of certification of the EMU.

2.5 EC CERTIFICATION OF CONFORMITY AS INTEROPERABILITY CONSTITUENT

The component (panto and contact strips) object of present Technical Specification are Interoperability Constituent.

The Bidder can join the tender with or without EC Certification of Conformity.

In any case the pantograph and contact strip equipment shall be supplied with its own EC certification of conformity according to the applicable and valid TSI regulation by the Supplier. The documentation related to the EC Certification of Conformity as per previous paragraph shall be accessible for examination by the Notified Body / Designated Body (DeBo) in charge of TSI certification of the EMU nominated by TÜRASAŞ.

The Supplier/Bidder shall enable an assessment by the NoBo/DeBo at the suppliers location.

2.6 SCOPE OF SUPPLY PROJECT MANAGEMENT

2.6.1 INTRODUCTION TO PROJECT MANAGEMENT

The Suppliers and their Sub-suppliers shall be responsible for the components and systems delivered. TÜRASAŞ reserves itself a right to request different solutions and/or modifications of a system or components in case they are necessary for reasons related to installation, operation, interfacing or other equivalent reasons. Such written requests shall be transmitted in direct contact with suppliers.

In case of direct contacts the minutes shall be drawn up and countersigned by the representatives of the parts participating the meeting.

Present document, is a part of the contract between the Supplier and TÜRASAŞ. The Supplier is not entitled to deal this document or part of it to a third party.

All generic information requests and answers shall be communicated in written form or through e-mail, if an official form is required, and in the case the exchanged communication preludes to any kind of action.

2.6.2 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 TÜRASAŞ, every time it is issued.

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

2.6.3 MODIFICATIONS

All engineering changes made prior to FAI (First Article Inspection) shall be controlled by the Supplier's Quality Management System.

Any engineering change made after FAI shall be supported by all relevant documentation and subject to written approval by TÜRASAŞ.

Engineering changes shall be subject to all requirements of this specification and any supporting specifications.

The Supplier shall agree with TÜRASAŞ a Modification Implementation Plan detailing timescales and locations where the work shall be carried out. This shall include modifications to any relevant spare parts.

The Supplier shall, on the day of completing any modification, provide TÜRASAŞ with the date of modification, serial number of component modified, new modification level of component

and location of component. In addition, the status of the modification level on the component shall be updated.

Modifications made to improve the product or production without any effect on performance or spare part exchange can be decided by the Supplier. Traceability of modifications shall be given by the Supplier to TÜRASAS.

In case of modifications due to Supplier design inaccuracy or whatever cause under its responsibility, the subsequent recovering modifications and whatever consequent actions shall be done by the Supplier free of charge.

2.6.4 Authorisation to start manufacturing

TÜRASAS will release to the Supplier the authorisation to start the manufacturing according to the following steps.

2.6.4.1 Design Freezing

After signing the contract, a dedicated meeting shall be held for freezing the design of the scope of supply between the End Client, the Administration, the Designer and the Supplier. The date and place of the meetings shall be agreed mutually.

2.6.4.2 Authorisation to start manufacturing for Prototype Train Sets

According to final design criterias which have been already decided in design freezing, TÜRASAS will issue the authorization to manufacture products/system/equipment. These products shall be used for type tests (according to item 4.4.1.1).

2.6.4.3 Authorisation to start serial production

After successful completion of tests in accordance with clause 4.4.1.1 and 4.4.1.3, TÜRASAS will release to the Supplier the authorization to start the serial production.

3 TECHNICAL REQUIREMENTS

3.1 INTRODUCTION

This document defines the requirement for the design and test of the pantograph for the Electrical Multiple Unit project, to supply power for HV car systems.

3.2 PANTOGRAPH REQUIREMENT

Each OA car has installed a HV 25kV pantograph on the roof, to transfer energy from catenary line to HV services to the trainset.

The trainset is provided with two pantographs. Only one pantograph is working during service, while the second one is lowered; in case of multiple train-sets, each trainset has its pantograph working.

For each pantograph the minimum supply is composed by the following main components:

- Pantograph complete frame (base, lower frame, upper frame)
- Electrical equipment (cables, terminals)
- Pneumatic equipment (Control, actuator, bellow, damper, valves, pressurestat,...)
- Pan head (1600mm)
- Insulators
- Insulating hoses
- Pressure safeguard (including ADD)
- Contact strip
- All the other elements listed in section 2.1

3.2.1 Line characteristics

Table below reports the line Power Supply System characteristics.

Type of Power Supply System	25.000 V AC 50Hz
Nominal voltage	25.000 V (EN 50163)
Minimum working voltage	19.000 V
Maximum working voltage	27.500 V
Minimum abnormal voltage	17.500 V
Maximum abnormal voltage (10s)	30.000 V

Table 4 – Line Power Supply System Characteristics

3.2.2 Pantograph Main Characteristics

The applicable width is 1600 mm.

The train speed to be considered for pantograph definition is 140km/h.

The pantograph lifting system shall be pneumatic and the contact force shall be regulated by mean of specific pressure device.

The pantographs are placed on the axis of one bogie in the OA cars.

The pantographs shall have an automatic drop device in case of bow damages or for excessive wear of the carbon collector strip. It can be singularly deactivated for each pantograph, in order to avoid, in case of malfunctions, train speed performances loss.

Disactivation status shall be available on a electric free contact (microswitch) to let system be interfaced with TCMS for proper diagnostic.

The automatic drop device functionality shall be properly tested by the supplier.

The carbon strip shall allow an easy substitution without dismounting the whole pantograph.

All necessary pantograph tests on the line with the appropriate modification shall be realized with the participation of the supplier.

To achieve a high quality of current collection it is necessary that the mass of the moving components of the pantograph shall be as low as possible, given the other structural constraints on the pantograph.

Particular attention shall be paid to minimising aerodynamic influences by the use of proper shaped arms and linkages hidden within these arms.

Furthermore the pan-head design, carbon carrier section and variable incidence elbow vanes also shall ensure that the force limits applied to the overhead infrastructure are not exceeded and that true bi-directional optimal performance is achieved with this single arm asymmetric arrangement.

Maintenance and overhaul intervals shall be kept to a minimum but with a high reliability by the use of externally lubricated precision sealed needle roller bearings.

3.2.3 Pneumatic Control Unit

The pneumatic control unit function will feed the air pressure in the pantograph pneumatic line. The air pressure shall be used by the pantograph pneumatic equipment for:

- Guarantee the pantograph extension when EMU is stationary or running (pantograph operating)
- Guarantee the movement speed when pantograph is raising or lowering (pantograph not operating).

The supplier shall declare in proposal phase the following data:

- Pressure Operating Range: [Minimum Pressure, Maximum Pressure]
- Raising Pressure: [Minimum Pressure]

The Maximum Operating pressure shall be < 10 bar.

3.2.4 Static Force

The necessary pressure to deliver the required force shall be provided by a pressure device and properly adjusted before conducting the test.

The curves representing the static force obtained shall be in accordance with the EN 50206 standard.

3.2.5 Extensions

The pantograph shall cover the entire range from minimum to maximum catenary height from top of rail; for this purpose, the following measures shall be considered

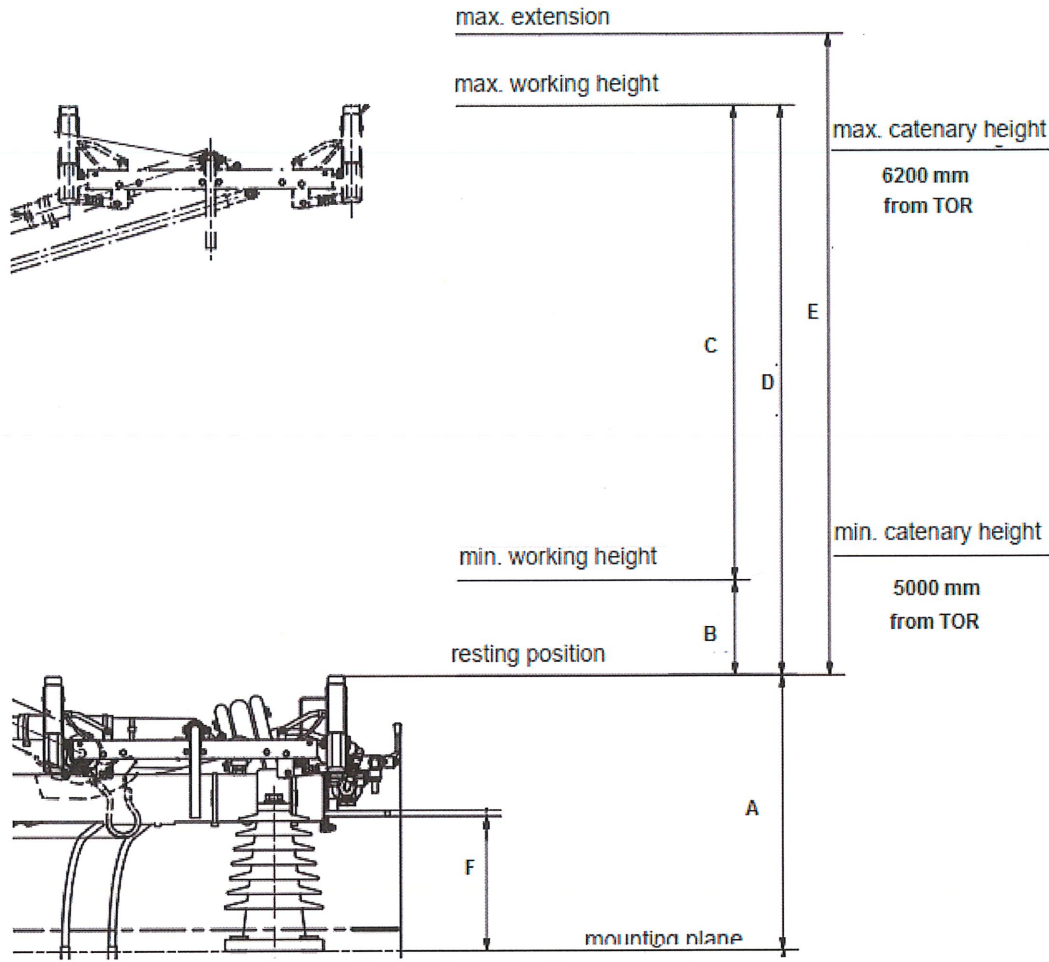


Figure 1 – Working extensions

Max. and Min. Height Catenary Line are reported below:

Max Height: 6200mm

Min. Height: 5000mm

The Height of Catenary Line in depot is 5750mm.

The working range shall be so as minimum 1200 mm.

Refer to document GZ90.03.00.00001 for other quotas.

Bidder shall indicate the values of the measures A, B, C, D, E and F in the offer.

3.3 WEIGHT

The Supplier shall be committed to the process of weight management required in order to meet target weights as the train design develops.

Below the target allowed weight:

item	Target weight
Pantograph with	180 kg

insulators and pneumatic group	
-----------------------------------	--

Table 5 – target weight

3.4 MANUFACTURING

NA

3.5 PAINTING

The bidder can propose its own painting specification to TÜRASAŞ.

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

The colour of products is TBD by the Administration.

3.6 INTERFACE SPECIFICATION

3.6.1 MECHANICAL INTERFACE

It shall be foreseen 3 points for attachment to the insulators on roof according to EN 50124-1, with insulators.

The mechanical interface shall be supplied complete with all the necessary elements to have a fixation with the relevant points and brackets available on the roof of the vehicle.

The pantograph system will be mounted on the frame shown in drawing number GZ11.07.22.00000. In case of any incompatibility between the frame and the pantograph, the contractor is obliged to perform the necessary revisions, design, production, and assembly work on the frame free of charge for all train sets.

3.6.2 ELECTRICAL INTERFACE

The high voltage shall be on the base frame, the relevant screws, nuts, bolts and washers necessary for the fixation of the HV cable to the pantograph shall be included in the scope of supply.

Supplier shall indicate the proposed fixing points for the HV cables, at least 2 fixing points for each side of the pantograph shall be available.

The pneumatic items necessary for the correct functions of the pantograph shall be supplied with the relevant mating connectors; it is preferable to have grouped all the elements in a single box/plate and to have a single connection point (single connector) for all the pneumatic elements which are necessary for the panto control.

As summary, shall be included in the scope of supplier:

- Screws, nuts and washers used for the connection of the HV cables
- All connectors (fixed and mating) used for external elements, such as valves and pressurestat; if these elements are in a single board/box, supplier shall route all the cables of these elements to a single connector which will be the only interface to vehicle lines; in this case supplier shall include in the scope of supply the mating and the fixed part of this connector. Independently, Supplier shall supply all the mating connectors of the elements.

3.6.3 PNEUMATIC INTERFACE

The pneumatic equipment of the pantograph is reported as an example in the following scheme.

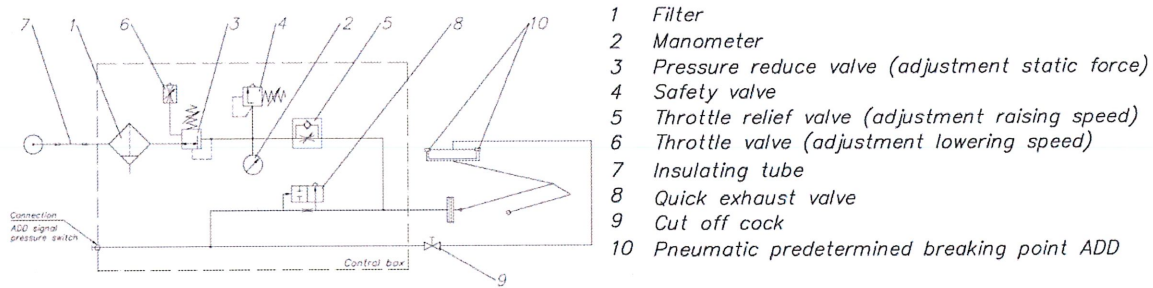


Figure 2 – Pneumatic Concept Scheme

Equivalent pneumatic equipment above shall be in the pantograph scope of supply, which includes the devices to adjust force, raising speed, lowering speed and also the pressure safeguard fed through the “Connection ADD (automatic dropping device) signal pressure switch”.

A dedicated electro valve (not visible in the schema above) shall be included and supplied to guarantee the ADD function in case of coupled trains (in case of a pantograph starts the ADD procedure, the correspondent pantograph in the other train shall also activate the procedure).

As defined in the previous section, a single box/plate which collect all the pneumatic elements is preferable.

Supplier shall define the dimensions and the characteristics of the pneumatic interfaces to connect the pneumatic lines with the pneumatic system available in the vehicle. All the connections of the elements shall be included in to the scope of supply, length of relevant piping and tubes will be given in design phase.

3.6.4 Digital and/or Analogue Inputs/Outputs

TBD

3.6.5 Earthing

For protective provisions relating to electrical hazards on railway vehicles EN 50153 - standard is valid and shall be obeyed.

All equipment causing an electric shock shall be protected against direct contact.

All conductive surfaces of electrical equipment on the vehicle shall be connected to an earthing point for equalization of the electrical potential.

This includes conductive surfaces of cubicles, doors and covers.

Exceptions are small items of interior trim in an environment otherwise protected by bonding to car body and/or insulation (e.g. grips, coat hooks, etc.).

All equipment operating at AC-voltage >25V or at DC-voltage >60V shall be earthed for safety. Each earthing point of the equipment shall be designed as follows: the earthing points shall be of good electrical conduction to ensure low touch voltage, the earthing points shall have large contact surface and shall be able to carry a possible short circuit current.

A design according to EN 60529, min IP20 (>12,5mm) is required for cubicles containing Band III voltages.

The min IP20 shall be achieved when there are situations when the cubicle is open and Band III voltage is live.

Each earthing point shall be easily accessible for assembly.

The Supplier shall provide an earthing diagram of its equipment including earthing bonds and shields.

The Supplier shall indicate which cables of his system will be shielded.

Cable shielding may only be used for shielding purposes and NOT as signal, ground or reference wires.

If supplier does not request different connection, cable shields shall be grounded on both ends in order to obtain high shielding efficiency against electric and magnetic fields.

This requires potential equalisation between both grounding points, e.g. through chassis or appropriate structural components.

Grounding of cable shields shall be made with low impedance (large contact surface, preferably over 360 deg. circumference).

Grounding by means of sheath wires (pig tails) or connector pins is NOT permitted.

The Low Voltage 0V level in the cars is floating, so shall be avoided an internal connection in the equipment between metallic chassis and the 0V connection; grounding connections in the equipment shall not be connected to car Low Voltage DC power supply.

3.7 ENVIRONMENTAL CONDITIONS

3.7.1 Climatic condition

The system object of the present document specification shall work properly in the specified climatic conditions (temperature, rain, snow, ice, sand, dust, wind and so on) in particular sand, ice and snow shall not be cause of malfunction.

General climatic conditions are reported in the mentioned TŞ-01.139 General Technical Specification

3.7.2 Noise, Vibration and Shock

To be respected in accordance to the relevant norms (EN61373).

3.7.3 Protection (IP)

In case of external pneumatic box, IP level of this box shall be min IP65.

3.7.4 Electromagnetic Compatibility (EMC)

The supplied system and components shall be compliant to EMC requirements established by relevant norms and standards listed below:

- EN 50121-1 Railway Applications – Electromagnetic Compatibility – Part 1: General;
- EN 50121-3-1 Railway Applications – Electromagnetic Compatibility – Part 3: Rolling stock – Train and complete vehicle;
- EN 50121-3-2 Railway Applications – Electromagnetic Compatibility – Part 3: Rolling stock - Apparatus

3.8 SYSTEM AND COMPONENTS LIFE

The required life shall be equal or greater than 30 years.

3.9 MATERIAL REQUIREMENT

3.9.1 General Requirements

Materials shall be suitable to allow the normal maintenance activities without need to adopt special protections including welding, cuts and so one. They shall be suitable for the waste disposal without need of particular care.

All information about safety and health shall be provided, even for consumables like lubricants and cleaning agents.

The choice of materials shall be done to prevent corrosion in every usage condition.

The bidder shall give the list of every material used together with their offer.

3.9.2 Fire Resistance Behaviour

According to TSI LOC&PAS materials requirements for fire resistance behaviour are expressed through the index R(n) described in the standard EN 45545-2, "Table 5". To correctly define the requirements it is necessary to know the hazard level of the train that, in this case, is HL2.

These requirements for materials depend not only on the component intrinsic nature, but also on the position, shape and layout, surface exposure, relative mass and thickness of the material considered.

To identify the relevant R (n) requirements, in "Table 2" of the standard EN 45545-2 several products and their position on the train are listed.

In the table below the material requirements for the components of the cars are reported.

Name	Applicable Product type (No)	Definition	Details	Requirement
Refer to EN45545-2	Non listed product	Non listed product	R7	Refer to EN45545-2

Table 6 – Materials Fire Behaviour

Any material used, even if not included in Table above, must meet the requirements specified in chapter 4 of the EN 45545-2 standard.

The Bidder/Supplier shall give the list of the inflammable materials used with material type, quantity and fire resistance behaviour tests.

The documentation presented by the Bidder or the Supplier relevant fire performance will be examined for approval by the Notified Body / Designated Body in charge of certification of the Gaziray Project nominated by the TÜRASAŞ. The Supplier/Bidder shall be responsible to perform all necessary activities which are required by Notified Body / Designated Body.

3.9.3 Smoke opacity and toxicity

All the materials used do not emit toxic gases in such quantities as to be harmful.

The parameters taken as reference for the selection of materials, and the requirements they must meet, are described in "Table 5" of the EN 45545-2 standard with reference to the classification

of the hazard level of the train and the set of requirements R(n) to which the material is associated.

4 GENERAL REQUIREMENT

4.1 RELIABILITY, AVAILABILITY, MAINTENABILITY & SAFETY (RAMS)

The Supplier shall make RAMS analysis according to TD-GZ.26.0020 as mentioned in Annexes.

4.2 MAINTENANCE MANUAL

4.2.1 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).

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

4.2.2 Contents of the Manual

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

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.

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.

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
 - 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.

Corrective Maintenance card/instruction

Each maintenance instruction shall include:

- 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.

Special tools

The use of special tools shall be avoided, nevertheless if they are essential for maintenance (upon Supplier and TÜRASAŞ 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

4.2.3 Format of the Manual

The format of the Maintenance Manual can vary according to the Company and the Final User requirements, therefore here following are reported some rules generally applicable.

Specific requests shall be communicated when available.

- The Manual shall report/contain the same references, drawings, schemes, component codes, Part Numbers, definitions, descriptions, terminology and so on used in the system/equipment configuration and design documentation to guarantee a perfect correspondence and to avoid mismatching during tasks performance.
- It is highlight the importance for a correct identification of LRUs/components by utilizing the same identification name reported by the technical drawings.
- The PDF format can be used as formal delivery of the documentation (in order to be used as official delivery towards Final User)
- Pictures and photos shall be inserted and not simply linked.
- Photos should be only JPEG format.
- Pictures should be only TIFF format.

Derogations from above listed issues can be discussed and agreed between TÜRASAŞ and the Suppliers pending the respect of Final User requirements.

4.3 TRAINING

Comprehensive training courses, covering the system/equipment supplied, therefore shall be provided by the Supplier to TÜRASAŞ or Costumer/Train Operator 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. Additionally the Supplier shall give detailed training about assembly/disassembly of system/equipment.

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.

The Supplier shall give minimum 3 days training for 6 TÜRASAŞ/the End Client in TÜRASAŞ facility. The training documentation shall be prepared by the supplier in English languages according to the number of participants. The training shall be done in English language.

The bidder shall propose and detail in the tender phase the training activity to be carried out. Then TÜRASAŞ and the Suppliers will discuss and agreed details pending on End Client requirements.

4.4 TEST

The supplier shall be responsible for TSI /1302/EU certification of Pantograph and contact-strips.

4.4.1 INTRODUCTION TO TEST AND INSPECTION

The Supplier shall perform the tests and the inspection in accordance with the Approved Test Procedure and the Approved Inspection Specification.

TÜRASAŞ and/or end Client have the right to witness any of these tests and inspections at any stage of test and inspection procedure.

Type test can be waived if system or components are already proven and confirmed to waive by end Final User. In that case, the Supplier shall provide old test report or certificate to submit for approval.

All test and inspection specifications and reports including all repair activities and check-lists shall be submitted and approved by TÜRASAŞ.

4.4.1.1 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 approved by TÜRASAŞ with TÜRASAŞ and/or End Client participation.

During testing, the criteria shall be observed and recorded. All alterations, adjustments and maintenance works required by TÜRASAŞ shall be carried out by the Supplier.

The Supplier has the responsibility for the success of mentioned Type Tests.

4.4.1.2 Routine tests

Routine tests are required to verify that the components of the system object of the scope of supply have been built in such a way that it satisfies the requirements of the Approved Design Data as verified by the Type Test.

The Supplier shall perform routine tests in accordance with a test procedure approved by TÜRASAŞ under his responsibility, and, if necessary, with TÜRASAŞ participation.

During tests, the criteria shall be observed and recorded and necessary alterations, adjustments and maintenance works shall be carried out.

Records from Routine tests shall be kept by the Supplier and made available timely for TÜRASAŞ and/or end Client's inspection.

All copies of the approved routine test results shall be submitted. Additional copies of records of all tests/inspections results shall also be kept at the Supplier's work to be made available to TÜRASAŞ or their representative on demand.

This test shall include functional test, visual inspection and dimensional inspection, as a minimum. The test details shall be approved.

4.4.1.3 First Article Inspection

The Supplier shall perform a First Article Inspection (FAI) of the components of the system object of the scope of supply at the Supplier/Producer's factory with TÜRASAŞ and/or end Client participation in accordance with an inspection specification issued by TÜRASAŞ and/or end Client, prior to serial production in order to confirm that the hardware & software fully complies with the Supplier's scope of supply design and manufacturing process. Supplier shall submit FAI test procedure to TÜRASAŞ at least 4 weeks before FAI. If any changes are requested by TÜRASAŞ, supplier shall comply with these requests.

At the FAI, the Supplier shall make available all pertinent design and manufacturing process documentation, test records, material certifications, etc. Should all the requirements of the FAI not be met, then the inspection shall be considered at a Hardware Review.

Upon acceptance of the FAI by TÜRASAŞ and/or end client, the supplier is then free to proceed to manufacture all pertinent hardware. The hardware shall meet or exceed the quality standards set at the FAI, and must incorporate any comments made by TÜRASAŞ and/or end client at the FAI.

4.4.2 Supplier Technical Assistance

The Supplier shall provide all the technical assistance necessary for the first installation of the system(s) at TÜRASAŞ.

Installation procedures and check lists shall be provided during this operation in order to be verified and validated. Details will be discussed during evolution of the project.

The Supplier shall attend to installation of equipment on the first train set, to commissioning in TÜRASAŞ and also to track test on Turkish Railway Network.

4.4.3 Commissioning

4.4.3.1 Type Commissioning Test

For the first prototype train set, the Supplier shall perform static (factory test on TÜRASAŞ workshop) and dynamic commissioning (on track) tests for the system to adequately demonstrate the requirements of TS, in accordance with a test procedure to be prepared by the Supplier and approved by TÜRASAŞ, under TÜRASAŞ participation.

4.4.3.2 Routine Commissioning Test

On the serial train sets, routine commissioning test for pantograph system will be performed by TÜRASAŞ in workshop and service track under the Supplier's responsibility.

4.5 WARRANTY

4.5.1 Warranty Condition

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 30 months starting with the date of delivery of the products to TÜRASAŞ, it is 24 months starting with the commercial commissioning of the EMU set.

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 TÜRASAŞ.

Throughout the warranty period, following the notification by TÜRASAŞ 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 pantograph set within this time period.

4.5.2 Systematic Fault / Epidemic failure

If a failure covered by guarantee occurs during the guarantee period in more than 25% of the same parts/components, such failure shall be assumed as "epidemic failure".

In addition, if mean time between failures (general average failure time) for the failures occurring in main components/parts used in all sets within annual periods during the guarantee term is shorter than guaranteed MDBF or MTBF value, such failure shall be deemed as an epidemic failure.

In case of confirmed systematic faults, proper investigations shall be done in order to define a proper technical solution or modification including Spare Parts modification or replacement.

4.6 ACCEPTANCE

4.6.1 Temporary Acceptance

Temporary acceptance report shall be issued by TÜRASAŞ after followings have been covered:

- All required components have been delivered.
- All documents have been delivered.
- If required, Routine tests in TÜRASAŞ have been performed successfully

4.6.2 Final Acceptance

Final acceptance report shall be issued by TÜRASAŞ after Track tests of system for first two train sets have been performed successfully.

4.7 PACKAGING, LABELLING AND STORAGE

4.7.1 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 foreseen by the TŞ-01.139 General Technical Specification.

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 TÜRASAŞ. Lists of the boxes shall be finalized after approval of the lists by TÜRASAŞ. A copy of each list shall be sent to TÜRASAŞ at the beginning of the shipment.

4.7.2 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;
- Data of manufacturer
- Date of manufacture
- Supplier's part number (if any)
- Revision level;
- Company's part number (if any)

Format and positioning of all labels/markings shall be subject to approval by TÜRASAS. Wherever possible, the position shall be such that any company information (Logo and brand etc.) cannot be viewed when the relevant part is installed within the vehicle. All labels shall be permanent and indelible

4.7.3 Storage Conditions

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

4.7.4 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.

4.8 DOCUMENTATION TO BE SUPPLIED TO TÜRASAS

The following tables report the list of requested documents (with schedule) to be supplied to TÜRASAS.

Table 7 shows the documentation which shall be given by the Bidders in the offer phase.

Table 8 and Table 9 show the documentation which shall be provided by the Supplier for the Preliminary Technical Review and the Detail Technical Review respectively.

Id.	Stage 1 -OFFER Phase	Time Schedule	Language
1.1	Clause by Clause commentary of present Tech. Specification	With offer	Turkish and English
1.2	Scope of supply list		Turkish and English
1.3	General description of the proposed system, including all the characteristics and functionalities and technical documentation and information requested in this specification as preliminary		English
1.4	Preliminary 3D models or installation drawings showing the main external space envelope (draft)		English
1.5	Preliminary applicable schemes (draft)		English
1.6	Preliminary definition of main I/F characteristics with the other train systems		English
1.7	List of tests (FAI, routine, type, commissioning and homologation) that shall be performed on components and systems		English

Id.	Stage 1 -OFFER Phase	Time Schedule	Language
1.8	Declaration of Conformity to applicable standards According to EN17050		English
1.9	EC Declaration of Conformity according to the TSI LOC&PAS 1302 if the scope of Supply is considered "Interoperability Constituent"		English
1.10	IRIS or ISO 9001 Certification of the Bidder (If the Bidder is an agency of the manufacturer, the Bidder shall show the manufacturer's certificate)		English
1.11	List of special tools and test equipment		English
1.12	Design schedule, in line with project milestones		English
1.13	Sub Supplier List		English
1.14	Detailed part list with price information of each part		English
1.15	Delivery time from order		English
1.16	Working range of pantograph (Point 3.2.5 in Technical Spec.)		English
1.17	Spare part price list which is requested chapter 2.1		Turkish and English
1.18	Proposed training activity (refer to clause 4.3)		Turkish and English

Table 7 – Stage 1 Offer Phase: list of requested documents and due date

Id.	Stage 2 - PRELIMINARY Review	Time Schedule	Language
2.1	First level drawings with weight and centre of gravity indications in 3D and 2D formats	Within three month after signing the contract	English
2.2	Technical description of the system, with system characteristics and performance		English
2.3	Functional description (normal and degraded mode) of the system, included diagnostic description		English
2.4	Design justification analysis reports		English
2.5	Definition and specification of applicable I/F's characteristic (mechanical, pneumatics, electrical, signals, I/O data, etc.)		English
2.6	Certificates of the fire smoke behaviour of non-metal materials and electric cables		English
2.7	Certificates of behaviour versus applicable emissions requirements		English
2.8	Preliminary applicable analysis reports (performance, consumptions, structural strength, etc.)		English

Table 8 – Stage 2 list of requested documents and due date

Id.	Stage 3 - DETAIL Review	Time Schedule	Language
3.1	Definitive drawings with weight and centre of gravity indications in 3D and 2D format.	Within one month After FAI	English
3.2	Definitive schemes		English
3.3	Installation drawings		English
3.4	Installation instruction		Turkish and English
3.5	Detailed description of the supplied components or systems		Turkish and English
3.6	All the technical documentation and information requested during the project (including final version of documents of previous stages)		English

Id.	Stage 3 - DETAIL Review	Time Schedule	Language
3.7	Procedures of tests (FAI, routine, type, commissioning and homologation) performed on components and systems		English
3.8	Reports of tests (FAI, routine, type, commissioning and homologation) performed on components and systems		English
3.9	List of special tools and test equipment		English
3.10	LRU list		Turkish and English
3.11	Servicing and lubricating table		Turkish and English
3.12	Final documentation for Certification		English
3.13	EC Certification according to the TSI LOC&PAS 1302 if the scope of Supply is considered "Interoperability Constituent"		English
3.14	RAMS and LCC documentation: see dedicated paragraphs		Turkish and English
3.15	User Manuals		Turkish and English
3.16	Maintenance Manuals		Turkish and English
3.17	Calculations, tests and analysis report requested by TSI for Pantograph System		English

Table 9 – Stage 3 list of requested documents and due date

The Bidder shall review and confirm the above lists of documents for all the phases of the project. Any deviation shall be submitted to TÜRASAŞ for approval.

Notes:

- 3D models of all components shall be provided, shall be in ".step" format and shall be complete with all elements, connectors included. In the 3D model connectors can be separated from the model to be used for the harnessing design
- 2D drawings shall be provided in pdf format.
- Electrical schemes shall be provided in pdf 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" or "USB"

5 ANNEX

Annexed documents

TŞ-01.139	General Technical Specification
GZ90.03.00.00001	Equipment gauge
GZ90.00.00.00101	General layout
TD-GZ.26.0020	RAMS Analysis
TD-GZ.44.0152	Fire Classification Of The Unit
GZ11.07.22.00000	Pantograph Integrameter Surge Arrester Installation